



Lake Macquarie City Council

Awaba Waste Management Facility
Landfill Environmental Management Plan

July 2021

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This LEMP was originally prepared for LMCC by GHD Pty Ltd (GHD). The LEMP was handed over to LMCC on 10 October 2019. GHD has no control over the document and takes no responsibility for changes made to the LEMP after this date.

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Definitions

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. Leachate may contain high levels of dissolved solids, ammonia, organic matter, and sometimes metals and other pollutants.

Cell – A discrete unit of a landfill that is physically separated from other waste emplacements at the site.

The site – The 32.5 hectares of land off Wilton Road Awaba, known as Lot 372 DP 723259, H/N 367 Wilton Road Awaba on which the Facility is located.

The facility - The Awaba Waste Management Facility.

Putrescible waste – A type of waste that is characterised by materials that readily decay under standard conditions, emit offensive odours, and attract vermin or other vectors (such as flies, birds and rodents). It includes household waste containing putrescible organics, and food and animal waste.

EMP – Environmental Management Plan

Grab Sample – A single sample collected in a manner that ensures that it is a representative sample.

Landfill gas – Gaseous emissions from the anaerobic decomposition of organic waste materials placed in a landfill. About 90% of landfill gas is methane and carbon dioxide, in roughly equal amounts depending on the phase of the waste decomposition and other factors, such as oxygen levels.

Monitoring bore – Means a bore excavated into the ground for the purpose of intercepting and collecting groundwater and or subsurface gas.

Monitoring site map – Means the monitoring sites defined by a survey map.

EA – Environmental Assessment

HDPE – High-Density Polyethylene

GCL – Geosynthetic Clay Liner

LEMP – Landfill Environmental Management Plan

HWC – Hunter Water Corporation

EPA – NSW Environment Protection Authority

EPL – Environment Protection Licence

POEO Act – *Protection of the Environment Operations Act 1997 (NSW)*

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- Appendix D – Fill-Out Plan
- Appendix E – Soil, Water & Leachate Management Plan
- Appendix F – Awaba Waste Pollution Incident & Emergency Response Plan
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- Appendix I – Biodiversity Management Plan
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- Appendix K – Greenhouse Gas Management Plan
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- Appendix N – Cultural Heritage Management Plan
- Appendix O – Drawing 22-16920-C1601 EPL Requirements: Site Detail Plan
- Appendix P – QA Plans
- Appendix Q – Work Health and Safety Policy
- Appendix R - Management Structure and Position Descriptions
- Appendix S - Awaba Waste Facility Site Induction
- Appendix T – Trade Waste Agreement

1. Introduction

1.1 Overview

Lake Macquarie City Council (LMCC) operates the Awaba Waste Management Facility (the facility) located off Wilton Road, Awaba. The facility has a 32.5 hectare (ha) site area and operates as a General Solid Waste (putrescible) landfill. It accepts municipal and commercial waste from the Lake Macquarie local government area.

The landfill is located in a broad, deep, south-facing amphitheatre between two spurs of a north-westerly trending ridgeline. Prior to filling, the base of the amphitheatre contained a gully that drained towards the south. The surrounding land acts as a buffer zone and it contains approximately 10 ha of native bushland.

The facility commenced operation in 1986 and has undergone several phases of development including upgrading and improvement since that time.

This Landfill Environmental Management Plan (LEMP) is one of a suite of plans that govern the operation of the facility.

1.2 Purpose

This LEMP has been developed to address and manage the environmental aspects and potential impacts related to the operation of the facility. The key principles of the LEMP are to provide:

- An environmental management tool for the operation of the facility
- A means of identifying baselines for monitoring the impact of the facility
- An outline of reporting requirements associated with the facility
- The processes for interaction between LMCC and the relevant Government Authorities
- The means by which compliance with the Secretary of the Department of Planning and Environment's (DPE) (the Secretary) requirements and the requirements of the Environmental Protection Licence (EPL) will be achieved

The LEMP provides an overall framework for environmental management during operation and forms the basis for managing specific environmental aspects such as waste, leachate, water, noise, odour etc.

The LEMP has been developed to satisfy the requirements of:

- Condition 2 of the *Project Approval (Application No. 10_0139, dated 8 May 2013)* (Appendix A)
- The commitments made in Cardno (2012). '*Additions to Awaba Waste Management Facility: Environmental Assessment*', dated 29 August 2012 (the 'EA')
- Environment Protection Licence 5873
- Applicable legislation and regulatory requirements (Section 2.2)
- Requirements of relevant government agencies including the NSW EPA (2016) *Environmental Guidelines: Solid Waste Landfill, Second Edition* (hereafter called the 'revised landfill guidelines')

In the event of any inconsistency in the above documents, the Project Approval prevails.

1.3 Environmental management overview

1.3.1 Lake Macquarie Local Environment Plan

The Lake Macquarie Local Environment Plan (LEP) was published in 2014 under the *Environmental Planning and Assessment Act 1979* to implement a framework for the sustainable local environmental planning provisions for land in Lake Macquarie City.

The LEP defines the land use zones with permitted and prohibited development and the extent of that development in relation to consent and permit requirements. Principal development standards are implemented with the objective of promoting efficient use of land, ensuring that the intensity of the development is appropriate and development is in an orderly fashion.

Further information provided in the LEP highlights the relevant policies and guidelines to be addressed when encountering various aspects of the planning process including acid sulfate soils, airspace operations and the development on certain land in various land zones.

1.3.2 Awaba Waste Management Facility Landfill Environmental Management Plan

This LEMP outlines LMCC's approach to environmental management through the operation of the facility.

The LEMP includes a summary of the relevant environmental policies, legislation, regulations and guidelines relevant to operation of the facility. The plan identifies the key operational activities that are likely to have an environmental impact and develops processes for managing these impacts, via monitoring, inspections and auditing. Also included in the LEMP is a set of objectives and targets for the environmental performance of the facility during operation. The LEMP documents the management responsibilities of key staff in relation to environmental management.

The LEMP is intended as an over-arching environmental management document that forms the basis for development of detailed sub plans and procedures for managing specific environmental aspects and impacts.

The LEMP includes a number of subordinate environmental planning and management instruments (e.g. sub plans, procedures, instructions, forms etc.) that will be implemented during operation of the facility. The scope and interaction of these documents are described throughout this LEMP and illustrated in Figure 1-1.

The implementation of the LEMP will involve the execution of key stages listed in Table 1-1. These stages are designed to ensure continual improvement and allow lessons learnt to be incorporated into the environmental strategies and performance.

Table 1-1 LEMP stages

Stage	Broad description of each stage
1. Plan	Identify regulatory and other environmental requirements Identify and assess environmental aspects for their potential risks Establish and document strategies and procedures to manage those risks Consult and/or seek approval from relevant stakeholders Establish incident reporting and emergency management procedures
2. Do	Induct, train and conduct ongoing awareness programs for employees and subcontractors Implement management strategies Manage community and other stakeholder relations through effective complaints management
3. Check	Periodic site inspections, incident investigation and auditing, and review of the LEMP and supporting documents

Stage	Broad description of each stage
	Implement corrective actions
4. Act	Continuous improvement through review of processes, risks and legislative requirements

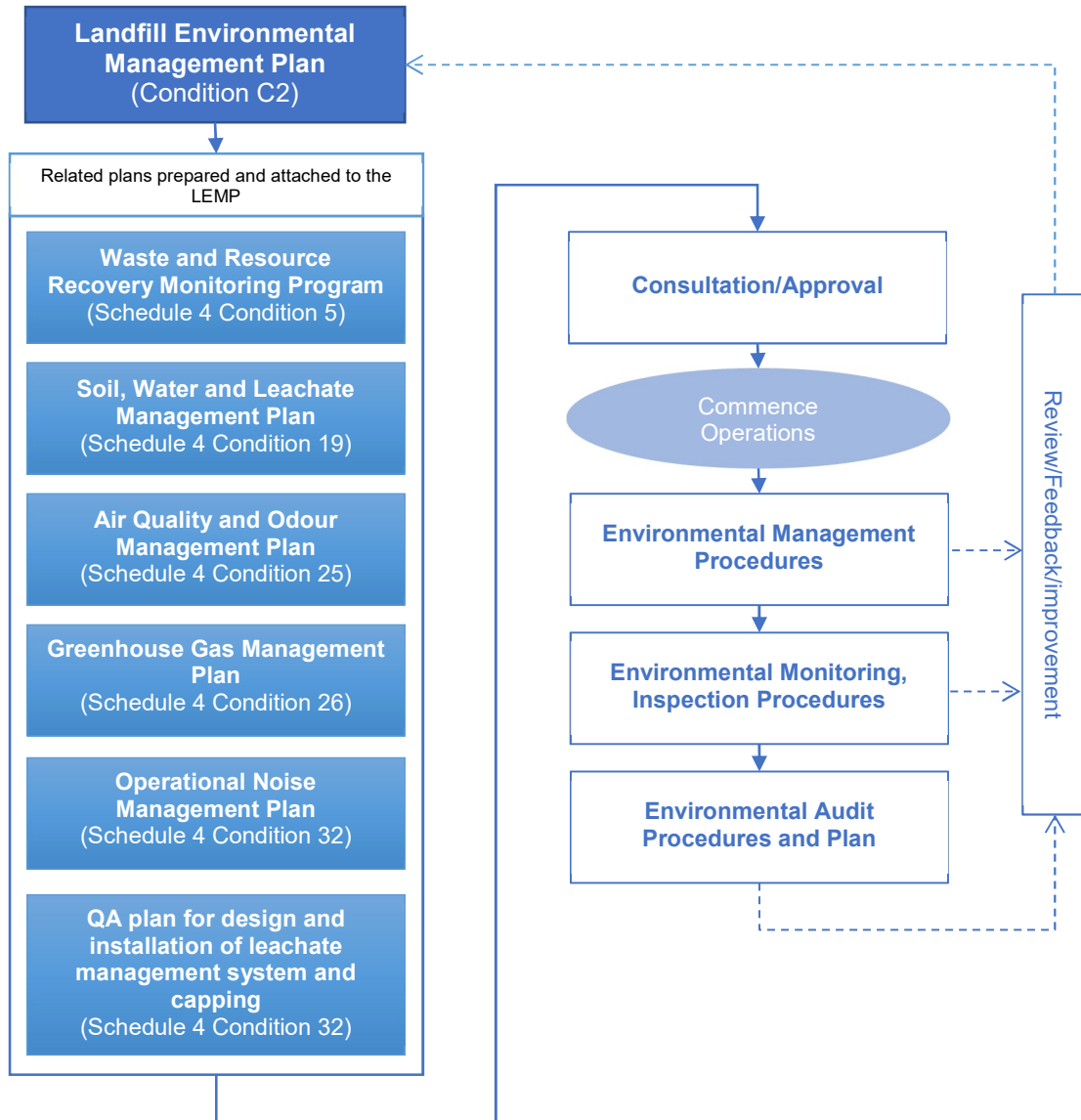


Figure 1-1 Landfill environmental management document structure

1.3.3 Sub plans and related plans

In accordance with the Conditions of Approval, a number of sub plans are required to document LMCCs management approach to identified risks (e.g. soil, water, leachate, air quality, noise etc.). These sub plans identify potential impacts as they relate to the operation of the facility (as defined in the EA) and outline the physical and management safeguards, mitigation measures, responsibilities and monitoring requirements to be implemented to minimise potential impacts on the environment.

The sub plans required according to the Conditions of Approval are shown in Figure 1-1. Additionally, this shows the sub plans that are also required under the Conditions of Approval.

1.4 Consultation and approval process

1.4.1 LEMP compliance with the Conditions of Approval

Table 1-2 lists the key requirements of Condition 2 of Schedule 5 and indicates where these requirements are addressed within this LEMP or other documents.

Table 1-2 Conditions of Approval requirements

Ref	Condition requirements	Response/reference
Schedule 5 Condition 2	Prior to the commencement of operations, the Proponent shall update the draft Landfill Environmental Management Plan for the Site to the satisfaction of the Director-General and in consultation with NOW. Following approval, the Proponent shall implement the Plan to the satisfaction of the Director-General. The Plan shall:	This Plan
a)	Be prepared in consultation with the EPA and NOW.	Section 1.4
b)	Be prepared by suitably qualified and experienced experts.	Prepared by GHD
c)	Describe in detail the management measures that would be implemented to address: <ul style="list-style-type: none"> The relevant matters referred to in the Environmental Guidelines for Solid Waste Landfills The conditions of this approval Requirements of the EPL 	Sections 6 to 10
d)	Include a copy of: <ul style="list-style-type: none"> The relevant plans and programs required under this approval A quality assurance plan for the design and installation of the leachate management system and any capping of the landfill cells that covers the relevant issues outlined in sections 1 – 2 of Appendix A of the Environmental Guidelines for Solid Waste Landfills 	Appendices
e)	Describe the procedures that would be implemented to: <ul style="list-style-type: none"> Keep the local community and relevant agencies informed about the operation and environmental performance of the Project Receive, handle, respond to, and record complaints Resolve any disputes that may arise during the course of the Project Respond to emergencies 	Section 6.12-14, Section 7.1-2

Ref	Condition requirements	Response/ reference
f)	Describe the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the Project; and	Section 4
g)	Be placed on Council's website within 2 weeks of its approval.	Section 1.4

2. Planning

2.1 Environmental risks (aspects)

2.1.1 Key potential environmental impacts

The key potential environmental impacts associated with the facility include:

- Generation and/or spreading of waste material through inadequate storage and disposal
- Contamination of air, soil, surface water and/or groundwater through the inappropriate storage, on-site transport and disposal of waste
- Excess waste quantities being disposed of in the landfill
- Inappropriate disposal of waste through incorrect classification

2.1.2 Ongoing identification of environmental risks

The process of identifying environmental risks will be achieved through:

- Review of the key potential environmental impacts as part of the LEMP review to ensure the identified potential impacts remain current.
- For new or non-routine works, or sub-contractor works, environmental risks will be determined through implementation of the risk assessment and health and safety procedures. Where necessary, these will identify the need to amend or develop standard procedures.
- Other processes, including informal site meetings, site inspections, audits and toolbox talks.

The ongoing review of environmental risks will consider the following elements:

- Do the identified environmental aspects still pose the risk of environmental impact? Do these need to be reviewed?
- Are there any new environmental aspects that need to be considered?
- Are there any changes to legislative requirements or facility operations which have an impact on the environmental aspects?

2.2 Legislative and other statutory requirements

The following is a summary of the key legislative and statutory requirements that apply or may impact on the operation of the facility:

- Development Application (10_0139)
- The EA (Cardno 2012)
- *The Project Approval (10_0139)* (Appendix A)
- Environment Protection Licence (5873)
- Environmental Guidelines: Solid Waste Landfills (EPA 2016)
- Key NSW and Commonwealth legislation

If there is any inconsistency between the above documents, the most recent document shall prevail to the extent of the inconsistency. However, the conditions of the Project Approval shall prevail to the extent of any inconsistency.

In addition, LMCC will comply with any reasonable requirement(s) of the Secretary arising from DPE's assessment of:

- a. Any reports, plans, strategies, programs or correspondence that are submitted in accordance with the Project Approval
- b. The implementation of any actions or measures contained within these reports, plans, strategies, programs or correspondence

A review of the legislative and statutory requirements will be conducted at least once every 12 months in accordance with Schedule 5 Part 4-b in the *Project Approval (10_0139)* (Appendix A) and/or within 3 months of release of any significant change in environmental regulatory requirements. For changes assessed as having significant impact on the operations, the process of review, development of actions and communication will be undertaken in sufficient time to ensure compliance with the relevant requirements.

The review of legislative and other statutory requirements will consider:

- The currency of legislation and regulations
- The identification of new legislative and regulatory requirements
- The review of non-conformances as a result of legislative non-compliance

Where required, LMCC will seek expert legal advice on legal compliance issues.

2.2.1 Environmental Assessment

The facility will be operated in accordance with the EA (Cardno 2012).

2.2.2 Project approval

The operation of the facility will be carried out in accordance with the *Project Approval (10_0139)* (Appendix A). This includes:

- The conditions of approval specified in *Project Approval (10_0139)* (Appendix A)
- The management and mitigation measures as identified in the Statement of Commitments in Appendix 1 of the *Project Approval (10_0139)* (Appendix A)

2.2.3 Commitments

The Statement of Commitments describes the management measures which LMCC has committed to implement with regard to environmental management of the site and the mitigation and monitoring of potential environmental impacts associated with the operation of the facility. A copy of the Statement of Commitments is provided in Appendix 1 of the *Project Approval (10_0139)* (Appendix A). The commitments have been incorporated into the site operation (Section 6) and environmental management in (Section 9) of this LEMP.

2.2.4 Environment protection licence

The facility has been licensed by the NSW EPA under the POEO Act (Licence number 5873). A copy of the EPL is attached in Appendix B. The conditions of the EPL are addressed in this LEMP.

The EPL anniversary date is 13 October.

2.2.5 Environmental Guidelines: Solid Waste Landfills

The EPA (2016) '*Environmental Guidelines: Solid waste landfills*' combine and replace the EPA (1996) '*Environmental Guidelines: Solid waste landfills*' and the EPA (1998) '*Draft Environmental Guidelines for Industrial Waste Landfilling*'.

The EPA (2016) '*Environmental Guidelines: Solid waste landfills*' provides guidance for the environmental management of landfills in NSW by specifying a series of 'Minimum Standards'. The minimum standards in these guidelines reflect the following broad goals for landfilling in NSW:

- Landfills should be sited, designed, constructed and operated to cause minimum impacts to the environment, human health and amenity.
- The waste mass should be stabilised, the site progressively rehabilitated, and the land returned to productive use as soon as practicable.
- Wherever feasible, resources should be extracted from the waste and beneficially reused.
- Adequate data and other information should be available about any impacts from the site, and remedial strategies should be put in place when necessary.
- All stakeholders should have confidence that appropriately qualified and experienced personnel are involved in the planning, design and construction of landfills to high standards.

The facility will be operated in accordance with the minimum standards set out in EPA (2016) '*Environmental Guidelines: Solid waste landfills*'.

2.2.6 Legislation

The following provides a list of primary environmental legislation applicable to the operation of the facility:

- Environmental Planning and Assessment Act 1979 (EP&A Act)
- Protection of the Environment Operations Act 1997 (POEO Act)
- Environmentally Hazardous Chemicals Act 1985
- Protection of the Environment Operations (Noise Control) Regulation 2000
- Protection of the Environment Operations (General) Regulation 2009
- Protection of the Environment Operations (Clean Air) Regulation 2010
- Protection of the Environment Operations (Waste) Regulation 2005
- Protection of the Environment Administration Regulation 2012
- Heritage Act 1977
- National Parks and Wildlife Act 1974
- Waste Avoidance and Resource Recovery Act 2001
- Waste Recycling and Processing Corporation Act 2010
- Water Management Act 2000
- Work Health and Safety Act 2011

2.2.7 Other requirements

In addition to the requirements discussed above, the following publications, standards, guidelines and codes will be implemented, considered or referenced by LMCC during operation of the facility.

Table 2-1 Publications, standards, guidelines and codes

Organisation	Document title
Australian Standard	AS 1055 Acoustics – Description and measurement of environmental noise
EPA publications	Waste Classification Guidelines – Part 1: Classification of Waste
	NSW EPA Noise Policy for Industry 2017
	Approved Methods for the Sampling and Analysis of Air Pollutants in NSW 2007
	Environmental Guidelines: Solid Waste Landfill, Second Edition
National Association of Testing Authorities (NATA)	NATA Accreditation Requirement Guidelines

3. Site description

3.1 Location and property description

The facility is located on the property known as Lot 372 DP 723259 and covers an area of 32.5 ha.

The address is 367 Wilton Road, Awaba, approximately 1.2 km south east of the township of Awaba and 4 km west of the suburb of Toronto. Access to the site is via Wilton Road.

The site is within the Lake Macquarie local government area.

3.2 Ownership

The site is Crown Land controlled by LMCC as the appointed Corporate Manager of the Awaba Waste Management Reserve Trust (R170042).

3.3 Site history

Consent for the facility was originally granted by the Department of Health NSW on 7 October 1986 which included a series of conditions. Then on 8 October 1986 consent was given by LMCC for a Solid Waste Disposal Depot & Associated Works (DA No 86/0170). There were 10 conditions under the LMCC consent.

With the closure of LMCCs Redhead landfill in 1994, LMCC commissioned a study on the waste disposal alternatives available to the City at the time (Patterson Britton, 1991). The study recommended the expansion of the Awaba Waste Disposal Site, allowing it to cater for the waste disposal needs of the City until 2010.

Subsequently, a development application for the expansion of the Awaba landfill site was lodged in 1994 with consent for the expansion granted in February 1995.

Approximately 20 ha of the site was allocated for the landfill and supporting infrastructure as part of the original project approval. This expanded to the current 23.5 ha in 1995 to allow for the expansion of the facility as per the 1995 consent. The majority of the remaining 9 ha comprises natural bushland.

A lined cell was established in an existing quarry on the eastern portion of the site in 2006-07 and has been subsequently filled.

Approval was granted on 8 May 2013 (Project Approval No. 10_0139) for expansion of the facility including:

- Staged excavation of two new areas on-site to create additional landfill space
- Additional waste emplacement over the existing landfill
- Expansion of the on-site leachate management system
- Installation of a package pumping station on-site and a rising main to transfer excess leachate and sewage to the No. 6 Waste Water Pump Station at Rathmines
- Installation of additional sediment management basins
- Expansion of the landfill gas management system
- Construction of a permanent transfer station
- Construction of a wheel wash facility

- Replacement of the existing weighbridges
- Construction of a new reuse centre with amenities.

3.4 Previous use

Prior to development as a waste disposal facility, the site was previously unoccupied and consisted of undisturbed natural bushland.

3.5 Zoning

The site is zoned 'SP2 – Infrastructure' under the LMCC Local Environment Plan 2014.

The land in the surrounding area is predominantly zoned E2 – Environmental Conservation.

3.6 Easements

The only easement over the site is for the electricity supply line that feeds the weighbridge and gas extraction system.

3.7 Site infrastructure

Existing site facilities and infrastructure include:

- Gatehouse with two weighbridges, entry and exit lanes, security compound and security monitoring system
- Amenities Building
- Community Reuse Centre
- Heavy vehicle wheel wash
- Waste Transfer Station
- Leachate collection ponds (2), and sewer discharge point for leachate
- Leachate Pre-Treatment System (Sequence Batch Reactor) (to be constructed)
- Three sediment collection ponds
- Roads and access, drains and berms, fences, gates and signs
- General waste processing area
- Garden waste receiving and processing area
- Pumps
- Landfill gas collection infrastructure, flare and combustion engines.

3.8 Environmental characteristics

3.8.1 Topography

The facility is situated on undulating terrain, and slopes from the north-west to south-east. The site is generally cleared, with tall open woodland forest to the north, south, east and west limiting the visibility of the facility from local areas. Regional landscape features include Lake Macquarie to the east and distant views of relatively intact vegetated hills.

3.8.2 Soils

Topsoil/fill materials at the site are predominantly sandy and comprise fine to coarse grained clayey silty sand, silty sand, gravelly clayey sand and gravelly silty sand with some low to medium plasticity sandy silt and sandy silty clay.

Residual soils are also predominantly sandy and comprise fine to coarse grained and medium dense to dense clayey sand, silty sand, clayey gravelly sand, gravelly silty sand and gravelly sand with bands of low to medium plasticity and stiff to hard silty clay and sandy clay, with cobbles at places.

Borehole and test pit logs at the site show that the combined thickness of topsoil/fill and residual soils across the site varies from approximately 0.2 m to 1.5 m (Geotechnique, 2011).

3.8.3 Geology

According to Geotechnique (2011), bedrock at the site is anticipated to be Newcastle Coal Measures (Pn) comprising shale, sandstone, conglomerate, tuff, chert and coal seams and varies across the site.

NSW Mine Subsidence Board advised that the site is underlain by coal seams, which are likely to be mined sometime in the future by Centennial Coal Company Limited, who owns the mining lease.

3.8.4 Hydrogeology

An investigation undertaken by Geotechnique (2011) concluded that groundwater is unlikely to be encountered at less than 3 m below the existing ground surface except in close proximity to existing dams.

Under the existing EPL, LMCC is required to monitor five groundwater monitoring wells (refer Section 10.2). These wells are monitored in accordance with the conditions set out in Clause M2 of the EPL, which includes a number of parameters and analytes. Monitoring frequency varies depending on the parameter but is generally quarterly or yearly. Monitoring has shown that overall, groundwater in the area has variable quality.

3.8.5 Surface water

A natural watercourse runs along the south eastern boundary of the site. The unnamed watercourse flows southerly through the site and topographically below the landfill emplacement, and eventually flows into Lake Macquarie at Kilaben Bay. A number of other watercourses join this watercourse downstream of the site prior to entering the lake.

Under the existing EPL, LMCC is required to monitor four stormwater sites (refer Section 10.2). Two of the monitoring points are on-site sediment ponds and the remaining two points monitor the upstream and downstream conditions of an unnamed natural water course running along the south-eastern edge of the site.

The sites are monitored in accordance with the conditions set out in Clause M2 of the EPL, which includes the measurement of a number parameters. Similarly to groundwater quality, monitoring frequency varies depending on the parameter but is generally quarterly or yearly. Annual reports which detail the results of the monitoring are issued to EPA. These reports show that stormwater in the area is of varying quality.

3.8.6 Local meteorology

Lake Macquarie's climate is best described as warm temperate with a coastal aspect.

The mean annual rainfall is 1,250 millimetres (mm) most of which falls between March and June. The driest months are from July to October.

Daytime temperatures in summer are warm to very warm and night time temperatures are mild. February is the warmest month with an average maximum of 25.5°C and an average minimum of 19.6°C.

Temperatures in winter are cold. July is the coldest month with an average maximum of 17°C during the day and average minimum of 9°C overnight.

Predominant winds for the Awaba area are from the southeast and northeast during summer and from the west and north-west during winter.

3.8.7 Biodiversity

The Biodiversity Management Plan (Appendix I) and the Biodiversity Conservation Area Plan of Management (Appendix J) detail the required provisions to mitigate impacts on native flora and fauna for the site and the greater area.

The threatened flora species *Tetratheca juncea* (Black-eyed Susan) is located within the direct footprint of the landfill. *Tetratheca juncea* is listed as vulnerable under both the *Threatened Species Conservation Act 1995* and the EPBC Act. It was determined that 2,302 *Tetratheca juncea* plants would need to be removed to facilitate the filling of the site.

Due to the location of *Tetratheca juncea* over the site, it is not possible to avoid or minimise impacts on this species.

No Endangered Ecological Communities have been identified at the site.

4. Site management structure, roles and responsibilities

This section outlines the roles, responsibilities, authority and accountability of all key personnel involved in environmental management of the site.

Table 4-1 Site management roles and responsibilities

Site role	Responsibilities
Waste Site Supervisor	Manage the operational performance of the site to ensure compliance.
Waste Site Leading Hand	Oversee all site works to ensure work is completed.
Awaba Waste Site Attendant - Gatekeeper	Screen waste. Record all data entry accurately against the correct waste characterisation.
Plant Operator	Landfilling activities including filling and compaction.
Awaba Waste Site Attendant	Waste Screening and supervision of customer access.
Labourers	Various Duties.
Waste Transfer Station Attendant	Supervise customers at WTS. Waste screening.
Waste Transfer Truck Driver	Transport waste bins from WTS to tip face.
Environmental Health Officer	Manage the environmental performance of the site to ensure compliance.

The organisation chart and detailed position descriptions are set out in *Management Structure and Position Descriptions* (Appendix R).

5. Staffing and training requirements

LMCC is responsible for providing sufficient and appropriately qualified and trained staff to meet all the requirements described in this LEMP. It is also LMCC's responsibility to provide adequate training to all staff performing critical operational tasks such as inspections, waste classification/identification, directing incoming wastes, operation of landfill equipment or site vehicles and environmental and health and safety management on site.

LMCC has a strong culture of training and developing its staff and will train personnel to fulfil the requirements in accordance with the specific requirements of this LEMP. This training will include, but not be limited to:

- Inductions
- Toolbox sessions
- Environmental awareness
- Emergency response
- Role specific training

All training will be recorded and training records kept in relevant files, together with certificates and other relevant training documentation. Employees will be assessed for competency for the position and or role they have been chosen to fulfil.

5.1 Inductions

All staff and sub-contractors are to be required to attend induction prior to commencing work. The induction covers health, safety and environmental requirements and is set out in Appendix S.

A record of induction will be kept on file.

5.2 Toolbox sessions

Toolbox meetings are to be held on a regular basis and cover health, safety and environmental topics. A schedule of topics will be developed and may be sourced from:

- Hazards register
- Legislation/regulation changes
- Inspection findings
- Audit finding
- Incidents or near miss investigations
- Suggestions from staff or sub-contractors

The meetings are to be held at a time suitable to allow maximum participation by operational staff and will be used to encourage two-way communication and participation. Attendance will be recorded in the minutes of the meetings.

5.3 Environmental awareness

Environmental awareness training is aimed at increasing environmental awareness and promoting familiarity with environmental issues and aspects. It reinforces and builds on the basic principles covered in the induction and can also be given as refresher training. It covers issues such as:

- LMCC's environmental policy

- Relevant environmental legislation
- Risk Assessment process
- Auditing and workplace inspections
- Incident reporting and investigation
- Environmental issues
- Spills, leaks, contamination management
- Resource management

Environmental awareness training may be delivered through:

- Formal and informal training sessions
- Health and safety meetings
- Online training modules

Attendance at awareness training sessions is to be recorded and kept on file.

5.4 Emergency response

Staff will be trained in the Awaba Waste Pollution Incident and Emergency Response Plan. Training will include:

- Identification of various types of emergencies
- Awaba Waste Pollution Incident & Emergency Response Plan
- Fire Management Plan
- Emergency response procedures
- Control of incidents
- Liaising with NSW Fire and Rescue, EPA, SES, police and other emergency response groups
- Reporting procedures relating to emergency response

Attendance at emergency response training sessions is to be recorded and kept on file.

5.5 Role specific training

In addition to the above, staff will be trained as required to meet their role description and responsibilities for their role. This may include training in record/reporting systems, visual inspections (e.g. to recognise wastes not permitted to be accepted), acceptance criteria, waste handling, quality control etc.

6. Site operations

6.1 Operational conditions

6.1.1 Limit of approval

The facility is approved to accept no more than 150,000 tonnes of waste per annum. This limit may be exceeded only in accordance with extraordinary conditions outlined in the site EPL (e.g. significant storm events).

6.1.2 Operating hours

The public access operating hours for the facility are:

- Monday to Friday 8:00 am – 4:00 pm
- Weekend & Public Holidays 8:00 am – 4:00 pm
- Christmas Day Closed

Plant operating hours on the site are:

- Monday to Friday 7:30 am – 4:30 pm
- Weekend & Public Holidays 8:00 am – 4:00 pm
- Christmas Day Closed

6.1.3 Landfill operations

The facility includes a landfilling operation, which is the main function of the site. The landfill is licensed to accept the following wastes for waste disposal by application to land:

- Asbestos waste
- General solid waste (non-putrescible)
- General solid waste (putrescible)

6.1.4 Waste transfer station

A newly built waste transfer station will form part of the waste handling operations. It will be located to the east of the main internal site road, and will allow members of the public to drop off their mixed residual waste for landfilling, as well as specific materials for recovery, such as timber, concrete or metals.

6.1.5 Community Recycling Centre operations

The facility will include a Community Recycling Centre (CRC). The CRC provides the community with a safe way to dispose of problem household waste, free of charge.

Problem household waste is accepted and disposed of via the NSW EPA's contractor (Toxfree). These wastes include:

- Paint - oil and water based (in liquid form only)
- Gas cylinders
- Fire extinguishers
- Fluorescent light globes and tubes
- Household batteries

- Motor oils
- Other oils
- Smoke detectors

Council also receives the following waste items at the CRC:

- Co-mingled household recyclables
- Electronic waste
- Polystyrene
- Vehicle batteries
- Non-ferrous metals

Vehicle batteries are collected by Council which are sold for scrap metal content (lead).

Other items consisting of non-ferrous metals may be processed by the Waste Site Attendant to ensure maximum value is achieved for scrap e.g.: removal of ferrous fasteners and sorting of metal categories.

The CRC may also include the operation of a buy-back centre for the recovery of reusable items including furniture, appliances, kitchen, bathroom, laundry fittings and bric-a-brac.

Recyclable materials will be sold to local markets while reusable items will be sold through the on-site buy-back centre.

6.1.6 Garden organics processing operations

A contractor-built and operated Alternate Waste Treatment Facility for Food Organics and Garden Organics (FOGO) processing has been constructed on a site adjacent to the facility. Source separated FOGO waste entering the facility will be directed to the organic waste processing facility.

6.2 Waste control

6.2.1 Permitted wastes

The facility is licensed by the NSW EPA to accept:

- General solid waste (putrescible)
- General solid waste (non-putrescible)
- Asbestos waste

as defined by Schedule 1 Part 3 of the POEO Act.

Only wastes and quantities of waste expressly permitted by the EPL are to be accepted. Refer Clause L3 of EPL 5873.

Permitted wastes include:

- Municipal waste
 - Household domestic waste
 - Residential garden waste/green waste
 - Local council generated solid waste
 - Kerbside collection waste

- Putrescible waste
 - Food
 - Dead animals
 - Animal parts
- Biosolids e.g. 'sewage sludge' organic products from sewage treatments that is spadeable and has an angle of repose of greater than five degrees (5°)
- Inert wastes
- Building and demolition wastes
 - Bricks
 - Concrete
 - Paper
 - Glass
 - Metal and timber
 - Soils
- Asbestos waste that is safely secured under the relevant guidelines:
 - Bonded matrix
 - Asbestos fibre
 - Asbestos dust waste
- Containers that are entirely emptied and free of liquid chemical waste and have been cleaned as good as or better than the triple rinsing method developed by AVCARE

Any waste generated on the site during construction will be classified in accordance with the EPA (2014) *'Waste Classification Guidelines: Part 1 Classifying Waste'* and disposed of to a facility that may lawfully accept the waste.

6.2.2 Excluded wastes

Specific waste types not permitted to be accepted at the facility include the following:

- Industrial waste
- Hazardous waste
- Liquid waste
- Tyres

6.2.3 Waste screening and acceptance

Acceptance of waste

Signs at the entrance clearly indicate the types of wastes that are and are not accepted at the facility.

Waste arrives at the site from a variety of sources, including LMCC collection vehicles, waste collection contractors, and waste self-hauled by businesses and residents. Upon entering the site, the waste is classified and charged in accordance with a number of categories.

Acceptance of special waste

The facility has additional acceptance requirements in relation to wastes classified by the facility as "special waste." Waste is classified "special waste" if the site supervisor considers that the waste requires special handling by the operators at the tip face, and immediate covering to prevent possible environmental or occupational impacts (e.g. from dust or odour), or for confidential reasons.

These special wastes generally refer to asbestos, dead animals, sewerage sludge, and confidential documents.

The procedure for acceptance of these special wastes is as follows:

- The site supervisor will be notified of the type and quantity of special waste. A date and time will be scheduled for the disposal of the special waste. The special waste has to arrive onsite before 12.00 pm Monday to Friday.
- The special waste will be brought to the facility and then screened. The special waste will be weighed and the special fee will be charged.
- The special waste will then be disposed of in a safe manner usually in a designated area away from the tip face and covered immediately after disposal.

6.2.4 Waste monitoring program

Monitoring of waste will be in accordance with the *Waste Screening, Acceptance and Resource Monitoring Programme* (Appendix C). The Waste Screening, Acceptance and Resource Monitoring Programme details the screening and acceptance procedures and the monitoring requirements for waste and resource recovery.

6.3 Landfill operations and filling

The landfill operations and filling will be in accordance with the *Fill-Out Plan* (dated September 2019) (Appendix D).

LMCC will:

- Minimise the exposed or cleared areas at the landfill
- Progressively revegetate all completed areas of the landfill and stabilise any exposed areas that are not required for operational purposes for a period greater than 90 days
- Minimise the tracking of mud and waste from the site on public roads
- Fill the landfill cells in a systematic manner as detailed in the *Fill-Out Plan* (Appendix D)
- Maximise landfill compaction rates ($\geq 0.75 \text{ t/m}^3$ required, goal of achieving 0.85 t/m^3)
- Cover the active landfill area at the end of daily waste disposal and compaction activities with either:
 - Minimum 150 mm of VENM soil
 - A DECCW approved synthetic cover
 - Biodegradable plastic sheeting
- Progressively cap the landfill cells with a capping layer approved by the EPA
- Revegetate the covered landfill cells following the capping of each cell once they reach their final design height

Landfill operations will also be in accordance with Conditions O6 and O7 of EPL 5873.

6.3.1 Daily cover

All putrescible waste will be compacted as it is tipped in the landfill. The working face will be covered with alternative daily cover (spray cover) on a daily basis, as approved by the NSW EPA.

6.3.2 Intermediate cover

Intermediate cover will be used to provide a more effective barrier between refuse and the environment during extended periods of time. VENM soil will be applied to a minimum depth of 250

mm (inclusive of any daily cover already in place) over all surfaces of the landfill that will be exposed for more than 90 days.

Intermediate cover includes a top layer of dredging materials which readily self-seeds providing vegetation protection from wind and water erosion.

6.3.3 Topsoil

Any top soil won on site will be set aside for future revegetation and rehabilitation of the site. Topsoil stockpiles will be suitably managed to ensure that the topsoil in these stockpiles can be beneficially used in the revegetation and rehabilitation of the site.

6.3.4 Site capping and revegetation

Landfill cells must be progressively capped during operations, and specifically when the level of waste reaches final heights within each landfill cell.

Final capping is to comprise five layers, including:

- Seal bearing surface
- Gas drainage layer
- Sealing layer
- Infiltration layer
- Revegetation layer

The cap will be graded to a degree to facilitate appropriate stormwater flow off site or to a sedimentation pond, reducing the potential for ponding onsite.

The vegetation layer will be maintained at all times to ensure the cap remains in a working condition and stormwater is draining from the affected area.

6.3.5 Landfill closure and post closure monitoring and maintenance

The EPL requires Council to submit a closure plan three months prior to ceasing receipt of waste at the facility, however Schedule 4 Condition 57-58 of the *Project Approval (10_0139)* (Appendix A) requires closure and rehabilitation management plans to be prepared within 12 months of commencement of the approval.

Section 76 of the Protection of the Environment Operations Act 1997 stipulates that the closure plan must:

- Specify the steps taken (or to be taken) in closing, stabilising or rehabilitating the premises and the time-frame for doing so
- Provide for a post-closure monitoring and maintenance program
- Identify any proposed future uses of the premises
- Comply with any other specified requirements relating to the plan

A comprehensive Closure Management Plan and Rehabilitation Management Plan will be prepared within 12 months of commencement of filling in landfill Cells 1 & 2.

6.4 Water supply

All water supplies will be sourced from an authorised and reliable supply.

Any taking of water for purposes other than water supply must be appropriately authorised.

6.5 Site supervision and control

The facility and site will be supervised by suitably experienced and qualified staff at all times during operational hours. Details of the management structure as well as staff responsibilities and training are described further in Sections 4 and 5 above.

6.6 Equipment

Sufficient and appropriate plant, equipment and machinery will be provided and maintained to meet the requirements of this LEMP. This will include, but is not limited to equipment for:

- Dust suppression (i.e. water cart)
- Fire control and fire-fighting
- Waste inspection
- Waste handling
- Environmental monitoring
- Any other operation/task/activity required for the proper and efficient operation of the facility such as:
 - Landfill compactor
 - Traxcavator loader
 - Pumps
 - Alternative Daily Cover applicator
 - Waste Transfer Station haul trucks and bins

Council will ensure that all plant and equipment used for operation of the facility is:

- Maintained in a proper and efficient condition
- Operated in a proper and efficient manner

6.7 Security

Security of the facility will include the following controls:

- A 1.8 metre high cyclone steel mesh fence surrounding major site infrastructure will be checked and maintained on a regular basis. Major site infrastructure includes:
 - Sewer pump station
 - Leachate ponds
 - Reuse centre
 - Amenities building
 - Weighbridge and gatehouse
 - Leachate pre-treatment plan
 - Transfer station
 - Wheel wash
- Major site infrastructure and all site gates will be locked outside normal operating hours.
- Major site infrastructure and main entrances will have security monitoring and video surveillance cameras.
- Unauthorised vehicle access to landfill cells will be prevented by a combination of cyclone steel mesh and cable fencing (at high risk areas), and strategically placed boulders and earth mounding.

- Manned security will patrol the facility outside of operational hours on an at request basis.

6.8 Health and safety

The site will be operated in accordance with Council's *Work Health and Safety Policy* (Appendix Q) and associated risk assessments and work method statements.

The *Work Health and Safety Policy* (Appendix Q) outlines Council's commitment to the risk management process, health and safety legislation and sets measurable targets and objectives to eliminate workplace injury.

The *Work Health and Safety Policy* (Appendix Q) defines Council's commitment to providing appropriate training, staff consultation and to disseminate safety information to employees, contractors, labour hire employees and visitors to the facility.

6.9 Hazards and risk management

6.9.1 Fire

Fires will be managed in accordance with the *Fire Management Plan* and *Emergency Response Plan* (currently under development).

6.9.2 Chemicals, fuels and oils

All chemicals, fuels and oils used on site will be stored in appropriately banded areas in accordance with the requirements of all relevant Australia Standards, and/or EPA's Storing and Handling Liquids: Environmental Protection – Participants Handbook.

6.10 Incidents and emergency response

Incidents and emergency response will be in accordance with the *Awaba Waste Pollution Incident & Emergency Response Plan* (Appendix F).

6.11 Complaints handling and investigation

Complaints handling and management will be in accordance with the *Complaints Handling and Investigation Procedure* (Appendix H).

6.12 Dispute resolution

In the event that a dispute arises between the LMCC and a public authority, other than the DPE, in relation to the reasonableness of any requirements proposed by a public authority arising from the conditions of the Project Approval, the matter can be referred by either party to the Secretary for resolution.

6.13 Community education

Community education will be carried out in accordance with the *Community Education Program* (Appendix G).

7. Records and reporting

7.1 Record keeping

7.1.1 Waste monitoring data

LMCC will keep waste and resource recovery records in accordance with the *Waste Screening, Acceptance and Resource Monitoring Programme* (Appendix C).

7.1.2 Fires

LMCC will maintain a daily log and record the following data of any fires at the site:

- a. Time and date when the fire was deliberately started or reported
- b. Whether the fire was authorised by the licensee, and, if not, the circumstances which ignited the fire
- c. The time and date that the fire ceased and whether it burnt out or was extinguished
- d. The location of fire (e.g. clean timber stockpile, putrescible garbage cell, etc.)
- e. Prevailing weather conditions
- f. Observations made in regard to smoke direction and dispersion
- g. The amount of waste that was combusted by the fire
- h. Action taken to extinguish the fire

7.1.3 Complaints

LMCC will keep a legible record of all complaints. The record will include details of the following:

- a. The date and time of the complaint
- b. The method by which the complaint was made
- c. Any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect
- d. The nature of the complaint
- e. The action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant
- f. If no action was taken by the licensee, the reasons why no action was taken

The record of a complaint will be kept for at least 4 years after the complaint was made.

Upon request, the record will be produced to any authorised EPA officer.

7.1.4 Monitoring records

LMCC will maintain the results of any monitoring required under EPL 5873 in accordance with Clause M1 of the EPL.

7.2 Reporting

7.2.1 Regular reporting

LMCC will provide regular reporting on the environmental performance of the facility on its website, in accordance with the reporting arrangements in any plans or programs approved under the Project Approval, and to the satisfaction of the Secretary.

Particular reference is made to the Annual Return, which is to be supplied to the EPA annually at the end of each reporting period. The Annual Return is to be prepared in the approved form, in accordance with the details outlined in Condition 6 R1 of EPL 5873.

7.2.2 Incident reporting

Notification of environmental harm

LMCC or its employees/contractors will notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after becoming aware of the incident.

Notifications to the EPA will be made by telephoning the Environment Line service on 131 555.

LMCC will provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.

Discharge of leachate to surface waters

In the event that leachate is discharged to surface waters from the facility, LMCC will provide written details of any leachate discharge(s) to the EPA within 7 days of the date on which the incident occurred in accordance with conditions R2 and R3 of EPL 5873.

The report will include the following information:

- a. The volume of the leachate discharged and over what time period the discharge occurred
- b. The date and time of the commencement of the overflow
- c. The weather conditions at the time of the discharge, specifying the amount of rainfall on a daily basis that had fallen:
 - On the day(s) of the discharge
 - For the one week period prior to the discharge
- d. The most recent monitoring results of the chemical composition of the leachate
- e. An explanation as to why the discharge occurred
- f. The location(s) of the discharge
- g. A plan of action to prevent a similar discharge in the future
- h. Was the discharge permitted by this licence

Methane exceeding 1.25% (v/v)

LMCC will notify the EPA within 24 hours if subsurface monitoring detects methane above 1.25% (v/v), and increase the frequency of monitoring to daily, until the EPA determines otherwise.

Fire incidents

In accordance with condition R4 of EPL 5873, fires need to be reported in the format and with the detail described in Section 7.1.2 above.

Other incidents

LMCC will notify the Secretary and any other relevant agencies of any incident associated with the facility as soon as practicable after it becomes aware of the incident. Within 7 days of the date of the incident, LMCC will provide the Secretary and any relevant agencies with a detailed report on the incident.

7.2.3 Access to information

LMCC will make the following information publicly available on its website:

- a. A copy of all current statutory approvals
- b. A copy of the current plans and programs required under the project approval
- c. A summary of the monitoring results, which have been reported in accordance with the various plans and programs approved under the project approval
- d. A complaints register, which will be updated on a monthly basis
- e. A copy of the annual reviews (over the last five years)
- f. A copy of any independent environmental audit, and LMCC's response to the recommendations in any audit
- g. Any other matter required by the secretary

8. Environmental auditing and review

8.1 Annual review

One year after the commencement of operations, and annually thereafter, LMCC will review the environmental performance of the facility to the satisfaction of the Secretary. The review will:

- a. Describe the operations that were carried out in the past year
- b. Analyse the monitoring results and complaints records of the facility over the past year, which includes a comparison of these results against the
 - Relevant statutory requirements, limits or performance measures/criteria
 - monitoring results of previous years
 - relevant predictions in the EA
- c. Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance
- d. Identify any trends in the monitoring data over the life of the facility
- e. Describe what measures will be implemented over the next year to improve the environmental performance of the facility

8.2 Management system audits

8.2.1 LMCC corporate audit

The LMCC corporate Environment Manager or delegate will carry out a corporate audit annually, which covers environmental risk and compliance. The audit will include a site visit to the facility, a tour of the facility and workspaces and interviews with site personnel. Planning for the audit will include familiarisation with relevant site practices, site-specific issues and the LEMP, prior to conducting the audit.

8.3 Independent environmental audit

Within a year of the commencement of operations of the facility, and every three (3) years thereafter, unless the Secretary directs otherwise. The audit will:

- a. Be conducted by suitably qualified, experienced and independent team of expert/s whose appointment has been endorsed by the Secretary
- b. Include consultation with the relevant agencies
- c. Assess the environmental performance of the facility and assess whether it is complying with the relevant requirements in the Project Approval and any relevant EPL (including any plan or program required under these approvals)
- d. Review the adequacy of any plans or programs required under the Project Approval, and, if appropriate
- e. Recommend measures or actions to improve the environmental performance of the Project, and/or any plan or program required under these approvals

Note: This Audit team must be led by a suitably qualified auditor and include experts in any fields specified by the Secretary

Within six (6) weeks of the completing of this audit, or as otherwise agreed by the Secretary, LMCC will submit a copy of the audit report to the Secretary, together with its response to any recommendations contained in the audit report

8.4 Revision of plans and programs

The LEMP will be reviewed on a regular basis to ensure that it conforms to applicable legislative and other requirements and continues to be a practical tool for environmental management. The LEMP, other plans and programs required under the Project Approval will be reviewed within 3 months of the submission of an:

- a. Independent environmental audit (refer Section 8.3)
- b. Incident report (refer Section 6.10)
- c. Annual review (refer Section 8.1)

Based on the outcomes of the reviews, LMCC will revise the plan(s) and/or program(s) if necessary, and to the satisfaction of the Secretary.

9. Environmental management

9.1 Erosion and sediment control

9.1.1 Environmental goals and principles

Erosion and sediment control aims to:

- Prevent soil erosion
- Minimise generation of sediment and prevent sediment laden runoff from discharge off site
- Prevent surface water contamination by sediment

9.1.2 Management strategy

The approach to erosion and sediment control will be to:

- Operate the facility in accordance with the *Erosion and Sediment Control Plan* (Appendix B of Appendix E)
- Minimise stormwater (volume and velocity) from running onto downstream works by appropriate staging of the work and, where necessary, utilising existing site or temporary stormwater diversion drains and bunds
- Minimise erosion of disturbed areas by utilising erosion control measures:
 - Steel shaker grate
 - Water carts
 - Sediment fencing
- Maximise the potential for stormwater runoff from disturbed areas of the site to be treated to an acceptable standard prior to reuse or discharge offsite, by utilising the indicated sediment control measures:
 - Diversion drains and rock check dams
 - Sediment ponds
 - Outlet energy dissipaters/level spreaders
- Minimise the amount of stormwater runoff discharged from the site by maximising reuse on-site
- Manage all erosion and sediment controls so that they are properly maintained by implementing an inspection and monitoring schedule
- Manage stockpiles so that they are appropriately constructed and managed to maximise reuse of topsoil
- Provide stormwater devices in the trafficked areas

9.1.3 Activities/frequency

- Inspections – as per *Erosion and Sediment Control Plan* (Appendix B of Appendix E)
- Maintenance of erosion and sediment control devices – as per *Erosion and Sediment Control Plan* (Appendix B of Appendix E)

9.1.4 Performance indicators/targets

Compliance with EPL limits.

9.1.5 Reporting and review

Reporting – in accordance with the *Erosion and Sediment Control Plan* (Appendix B of Appendix E) and *EPL* (Appendix B).

9.2 Stormwater management

9.2.1 Environmental goals and principles

Stormwater management aims to:

- Minimise erosion and sediment generation at the source
- Maintain discharge levels to pre-development values
- Divert runoff from disturbed areas through sediment basins prior to discharge offsite

9.2.2 Management strategy

The approach to the management of stormwater on the site will be to:

- Operate the facility in accordance with the *Surface Water Management Plan* (Appendix D of Appendix E)
- Minimise the volume of clean surface water running onto the site from off site
- Minimise the extent of disturbed areas
- Minimise surface water from running onto disturbed areas of the site by staging operations and, where necessary, utilising surface water diversion drains and bunds for disposal and processing areas
- The perimeter of landfilled areas must be contoured to mitigate stormwater running onto these surfaces in all rainfall events less than or equal to the 1 in 10 year 24 hour duration event
- Minimise erosion of disturbed areas by utilising at source control measures
- Ensure all surface water runoff from disturbed areas of the site is managed prior to reuse or discharge offsite
- Ensure all erosion and sediment controls are properly maintained by implementing an inspection and monitoring schedule
- Separate 'clean' and 'dirty' water, where possible
- Fast-track rehabilitation of capped areas to expedite diversion off-site
- Install retarding features for discharge offsite to control peak flow discharge
- Provide surface water drainage in the trafficked impervious areas
- Provide staff education and adopting strategies for early identification of potential surface water issues

9.2.3 Activities/frequency

- Inspections – as per *Surface Water Management Plan* (Appendix D of Appendix E)
- Maintenance of surface water management measures – as per *Surface Water Management Plan* (Appendix D of Appendix E)

9.2.4 Performance indicators/targets

Compliance with EPL limits.

9.2.5 Reporting and review

Reporting – in accordance with the *Surface Water Management Plan* (Appendix D of Appendix E) and *EPL* (Appendix B).

9.3 Leachate management

9.3.1 Environmental goals and principles

Leachate management aims to:

- Prevent groundwater pollution by leachate
- Prevent surface water pollution by leachate
- Prevent amenity impacts to nearby waterways

9.3.2 Management strategy

The approach to the management of leachate on the site will be to:

- Operate the facility in accordance with the *Leachate Management Plan* (Appendix C of Appendix E). This plan was published prior to the release of the 2016 EPA Environmental Guidelines for Solid Waste landfills, and as such is currently being reviewed to assess compliance with the new guidelines.
- Minimise leachate generation through a number of strategies as described in the *Leachate Management Plan* (Appendix C of Appendix E)
- Effectively contain and collect leachate through a number of strategies as described in the *Leachate Management Plan* (Appendix C of Appendix E)
- Dispose of leachate via the sewer connection as per the Trade Waste Agreement with HWC (Appendix T)
- Monitor leachate quantities and qualities

9.3.3 Activities/frequency

Leachate monitoring will be undertaken in accordance with conditions of EPL 5873.

9.3.4 Performance indicators/targets

Compliance with EPL limits.

9.3.5 Reporting and review

Reporting – in accordance with the *Leachate Management Plan* (Appendix C of Appendix E) and *EPL* (Appendix B).

9.4 Greenhouse gas management including landfill gas

9.4.1 Environmental goals and principles

Greenhouse gas management aims to:

- Reduce potential greenhouse gas emissions from the operation of the facility
- Continue to progressively apply existing landfill gas management measures across the existing and future landfill areas

9.4.2 Management strategy

The approach to the management of greenhouse gas on the site will be to:

- Operate the facility in accordance with the *Greenhouse Gas Management Plan* (Appendix K) including application of the landfill gas management measures. This plan was published prior to the release of the 2016 EPA Environmental Guidelines for Solid Waste landfills, and as such is currently being reviewed to assess compliance with the new guidelines.
- Conduct a Landfill Gas Risk Assessment within 12 months after commencement of filling in landfill Cells 1 & 2.
- Routine surface gas monitoring onsite, on both building sites and waste areas on a monthly basis to establish if landfill gases are present onsite and identify areas which may require addressing

9.4.3 Activities/frequency

Monitoring – in accordance with the *Greenhouse Gas Management Plan* (Appendix K) and *EPL* (Appendix B).

9.4.4 Performance indicators/targets

Implementation of energy saving measures per the *Greenhouse Gas Management Plan* (Appendix K).

9.4.5 Reporting and review

Reporting – in accordance with the *Greenhouse Gas Management Plan* (Appendix K) and *EPL* (Appendix B).

9.5 Air quality management

9.5.1 Environmental goals and principles

Air quality management aims to:

- Prevent air pollution
- Prevent amenity impacts from odour and dust

9.5.2 Management strategy

The approach to air quality management will be to:

- Operate the facility in accordance with the *Air Quality and Odour Management Plan* (Appendix L)
- Construct internal access roads of well-compressed gravel/soil and wetted down during dry weather
- Maintain internal access roads in good order
- Make a water cart available for operation at all times
- Ensure that all exposed areas and cover material stockpiles that will remain exposed for more than 90 days will be grassed to reduce erosion by wind and water
- Ensure that all dusty loads identified prior to tipping will be deposited carefully and wetted down if appropriate
- Maintain open communications between customers, the gatekeeper and the tipping Attendant concerning wastes that requires wetting down

9.5.3 Activities/frequency

Monitoring – as per *Air Quality and Odour Management Plan* (Appendix L) and *EPL* (Appendix B).

9.5.4 Performance indicators/targets

- Total suspended particulate (TSP) – annual average: 90 µg/m³
- Particulate matter < 10 µg (PM₁₀) – 24 hour average: 50 µg/m³
- Deposited dust – annual average maximum increase in deposited dust level: 2 g/m²/month
- Deposited dust – annual average maximum total deposited dust level: 4 g/m²/month

9.5.5 Reporting and review

Reporting – in accordance with the *Air Quality and Odour Management Plan* (Appendix L) and *EPL* (Appendix B).

9.6 Noise management

Environmental goals and principles

Noise management aims to:

- Prevent noise pollution offsite
- Prevent amenity impacts from noise
- To ensure operation noise complies with the *Project Approval (10_0139)* (Appendix A) and *EPL* (Appendix B) requirements

9.6.1 Management strategy

The approach to the management of noise on site will be to:

- Operate the facility in accordance with the *Operational Noise Management Plan* (Appendix M)
- Maintain effectiveness of any noise suppression equipment on plant at all times
- Regularly assess noise monitoring data and relocate, modify and/or stop operations to ensure compliance with the noise limits.

9.6.2 Activities/frequency

Monitoring – as per *Operational Noise Management Plan* (Appendix M) and *EPL* (Appendix B).

9.6.3 Performance indicators/targets

The performance indicators/targets are:

- No exceedance of the noise limits set out below
- No noise complaints

Noise from the facility must not exceed:

- a. An LA₁₀ (15 minute) noise emission criterion of 45 dB(A) (7:00 am to 6:00 pm) Monday to Sunday
- b. An LA₁₀ (15 minute) noise emission criterion of 45 dB(A) during the evening (6:00 pm to 10:00 pm) Monday to Friday
- c. At all other times, an LA₁₀ (15 minutes) noise emission criterion of 35 dB(A),

except as expressly provided by the EPL.

9.6.4 Reporting and review

- Reporting – in accordance with the *Operational Noise Management Plan* (Appendix M) and *EPL* (Appendix B)
- Operational noise validation – in accordance with Schedule 4 Condition 28 of the *Project Approval* (10_0139) (Appendix A). Operational noise validation will occur within 12 months of commencement of filling in landfill Cells 1 & 2.

9.7 Litter control

9.7.1 Environmental goals and principles

Litter management aims to:

- Prevent spread of litter off site to the environment
- Prevent amenity impacts from litter
- Maintain site visual appeal

9.7.2 Management strategy

The approach to the management of litter on the site will be to:

- Cover and compact waste daily
- Litter fences around part of the perimeter of the active landfill area
- Signs to advise drivers of their responsibility to ensure material does not fall from their vehicles and litter public roads
- Daily inspection and clearance of the site (and if necessary, surrounding area) of litter resulting from the landfilling operations

9.7.3 Activities/frequency

- Cover and compact waste – daily
- Inspect and clear the site of litter (and if necessary, surrounding area) – daily

9.7.4 Performance indicators/targets

Site is clear of litter.

9.7.5 Reporting and review

Daily inspections and discussions at toolbox meetings.

9.8 Pests, vermin and noxious weed control

9.8.1 Environmental goals and principles

Pests, vermin and noxious weed management aims to:

- Minimise the sources of food and habitat for pests and vermin
- Use professional pest exterminators/controllers if an outbreak is detected
- Prevent spread of weeds off site to the surrounding areas

9.8.2 Management strategy

The approach to management of pests, vermin and noxious weeds will be to:

- Cover and compact waste daily
- Inspect the site on a regular basis to ensure that these measures are working effectively, and that pests, vermin or noxious weeds are not present on site in sufficient numbers to pose an environmental hazard, or cause the loss of amenity in surrounding area
- Control weeds by the use of chemical herbicides and pesticides on an as needs basis (determined by the LMCC Vegetation Control Office) on a monthly basis

9.8.3 Activities/frequency

- Cover and compact waste – daily
- Inspect the site for pests, vermin and noxious weeds – daily
- Control of weeds – as required

9.8.4 Performance indicators/targets

Site is clear of pests, vermin and noxious weeds.

9.8.5 Reporting and review

Daily inspections and discussions at toolbox meetings.

9.9 Heritage management

9.9.1 Environmental goals and principles

Heritage management aims to manage and protect Aboriginal cultural heritage values associated with the site.

9.9.2 Management strategy

The approach to heritage management will be to:

- Operate the facility in accordance with the *Cultural Heritage Management Plan* (Appendix N).
- Consult with and involve all the registered Aboriginal parties for the facility in the ongoing management of Aboriginal cultural heritage values. Evidence of this consultation will be collated and provided to the Secretary upon request.

9.9.3 Activities/frequency

Management in accordance with the *Cultural Heritage Management Plan* (Appendix N).

9.9.4 Performance indicators/targets

Compliance with requirements of the *Cultural Heritage Management Plan* (Appendix N).

9.9.5 Reporting and review

Reporting – In accordance with the *Cultural Heritage Management Plan* (Appendix N).

10. Environmental monitoring

Environmental monitoring will be in accordance with the requirements of the *EPL* (Appendix B) and any other management plan that applies to the site. This section summarises the requirements of the *EPL* with respect to environmental monitoring. Monitoring requirements of other management plans are set out within each plan.

10.1 Discharge and monitoring points

The locations of discharge and monitoring points are specified in Clause P1 of *EPL* 5873. These include five groundwater quality monitoring points, two wet weather discharge and surface water quality monitoring points, two other surface water quality monitoring points and one leachate quality monitoring. Refer to Table 10-1 below.

Table 10-1 Discharge and monitoring point locations

EPA Identification no.	Type of monitoring point/discharge point	Location
1 to 5	Groundwater quality monitoring	Sites 1 to 5 in <i>Drawing 22-16920-C1601</i> (Appendix O)
6 and 7	Wet weather discharge Surface water quality monitoring	Site 6 and 7 in <i>Drawing 22-16920-C1601</i> (Appendix O)
8 and 9	Surface water quality monitoring	Site 8 and 9 in <i>Drawing 22-16920-C1601</i> (Appendix O)
10	Leachate quality monitoring	Site 10 in <i>Drawing 22-16920-C1601</i> (Appendix O)

10.2 Groundwater, surface water and leachate quality monitoring requirements

10.2.1 General

Sampling and monitoring methods, frequencies, test methods, locations and pollutant types will be in accordance with Clause M2 of *EPL* 5873. The sampling and analysis methods used shall be in accordance with *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (NSW DEC, 2004), and other recognised guidelines for matters not covered by the *Approved Methods*.

Details for the individual monitoring types are provided in subsequent sections.

10.2.2 Groundwater monitoring

In accordance with the revised landfill guidelines, the design, number and location of groundwater monitoring wells enable the detection of pollution of soil and groundwater by the landfill by means of regular representative sampling of groundwater from the network. The network of groundwater boreholes will be maintained and repaired as necessary.

In accordance with the requirements of condition 5 of *EPL* 5873, quarterly and yearly groundwater monitoring will be undertaken by means of sampling and analysis of groundwater from the five boreholes specified in Section 10.1 above.

Groundwater monitoring data must be regularly assessed for trends in contaminant levels and any impacts on groundwater quality. In accordance with the revised guidelines, a groundwater assessment report should be prepared at least once every five years or if the groundwater monitoring program detects a possible failure of the leachate containment system. The assessment should be conducted by an appropriately qualified and experienced expert in groundwater contamination assessment.

10.2.3 Surface water monitoring

Surface water monitoring at the facility comprises both stormwater monitoring (monitoring points 6 and 7) and ambient surface water monitoring (monitoring points 8 and 9).

In accordance with the revised guidelines, the stormwater monitoring program has been established to detect excess sediment loads in stormwater leaving the site and/or cross-contamination of stormwater with landfill leachate. In addition, the ambient surface water monitoring program has been established to detect pollution of off-site surface water bodies by leachate or by sediment-laden stormwater from the landfill.

In accordance with the EPL requirements, monitoring is undertaken quarterly and yearly by sampling and analysis of surface water from the four monitoring points specified in Section 10.1.

10.2.4 Leachate monitoring

In accordance with the requirements of EPL 5873, quarterly monitoring of leachate is undertaken from the discharge point at the leachate dam.

10.3 Landfill gas monitoring requirements

In accordance with condition M4 of EPL 5873, landfill gas monitoring is undertaken monthly for detection of building gas accumulation as well as surface gas emissions.

Sub-surface gas monitoring is carried out by a contractor who is also responsible for management of gas capture, flaring and electricity generation infrastructure.

11. References

Cardno, 2012. '*Additions to Awaba Waste Management Facility: Environmental Assessment*', dated 29 August 2012, Reference: 600308/Rep2744v4

EPA, 2014. '*Waste Classification Guidelines: Part 1 Classifying Waste*', Sydney

Geotechnique, 2012. '*Extension of Awaba Landfill Facility, Wilton Road, Awaba – Geotechnical Services*'. Letter prepared for Cardno on behalf of LMCC, December 2011

Appendices

Appendix A – Development Consent (10_0139)

Project Approval **(Consolidated)**

Section 75J of the *Environmental Planning and Assessment Act 1979*

As delegate of the Minister for Planning and Infrastructure under delegation executed on 14 September 2011, the Planning Assessment Commission of New South Wales (the Commission) approves the application referred to in Schedule 1, subject to the conditions in Schedules 2 to 5.

These conditions are required to:

- prevent, minimise, and/or offset adverse environmental impacts;
- set standards and performance measures for acceptable environmental performance;
- require regular monitoring and reporting; and
- provide for the ongoing environmental management of the Project.

Member of the Commission	Member of the Commission	Member of the Commission
Sydney	2013	

SCHEDULE 1

Application No:	10_0139
Proponent:	Lake Macquarie City Council
Approval Authority:	Minister for Planning and Infrastructure
Land:	Lot 372 DP 723259; and the existing road reserves on Wilton, Wangi and Dorrington Roads along the sewer pipeline route.
Project:	Awaba Waste Management Facility Expansion Project

As modified by Land and Environment Court of NSW orders made on 23 October 2013

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SCHEDULE 2 - DEFINITIONS

AWMF	Awaba Waste Management Facility
AHD	Australian Height Datum
BCA	Building Code of Australia
Biodiversity offset strategy	The biodiversity offset approach and vegetation management plan described within the Environmental Assessment, Response to Submissions Report and Statement of Commitments
Construction	The demolition of buildings or works, carrying out of works and erection of buildings and other infrastructure covered by this approval
Council	Lake Macquarie City Council
Department	Department of Planning and Infrastructure
Director-General	Director-General of the Department (or nominee)
EA	Environmental assessment titled ' <i>Additions to Awaba Waste Management Facility</i> ' dated 29 August 2012 prepared by Cardno Pty Ltd
ENV	Excavated Natural Material
EPA	Environment Protection Authority
EP&A Act	<i>Environmental Planning & Assessment Act 1979</i>
EP&A Regulation	<i>Environmental Planning & Assessment Regulation 2000</i>
EPL	Environmental Protection Licence
Feasible	Feasible relates to engineering considerations and what is practical to build
General Solid Waste (Putrescible)	As defined in the <i>Waste Classification Guidelines</i> (DECCW)
General Solid Waste (Non-Putrescible)	As defined in the <i>Waste Classification Guidelines</i> (DECCW)
HWC	Hunter Water Corporation
Incident	An incident causing or threatening material harm to the environment, and/or an exceedance of the limits or performance criteria in this approval
Land	In general, the definition of land is consistent with the definition in the EP&A Act.
Landfill	Awaba Waste Management Facility Landfill
LEMP	Landfill Environmental Management Plan
LGA	Local Government Area
Material harm to the environment	Harm to the environment is material if it involves actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial
Minister	Minister for Planning and Infrastructure
Mitigation	Activities associated with reducing the impacts of the Project
NOW	Department of Primary Industries – NSW Office of Water
NPWS	National Parks and Wildlife Service
OEH	NSW Office of Environment and Heritage
Operations	Operations are triggered by the receipt of waste at the new landfill cells covered by this approval.
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
Privately-owned Land	Land not owned by the Proponent or where a private agreement does not exist between the Proponent and the land owner
Project	The development described in the EA
Proponent	Lake Macquarie City Council, or its successor
Reasonable	Reasonable relates to the application of judgment in arriving at a decision, taking into account: mitigation benefits, costs of mitigation versus benefits provided, community views, and the nature and extent of potential improvements
Rehabilitation	The treatment or management of land disturbed by the Project for the purpose of establishing a safe, stable and non-polluting environment
Response to Submissions Report	Response to Submissions Report prepared titled ' <i>Additions to Awaba Waste Management Facility Submissions Report and Revised Statement of Commitments</i> ' prepared by Cardno Pty Ltd dated 22 March 2013
RMS	Roads and Maritime Services
Site	The land referred to in Schedule 1
Special Waste	As defined in the <i>Waste Classification Guidelines</i> (DECCW)
Statement of Commitments	The Proponent's Statement of Commitments in Appendix 1
VENM	Virgin Excavated Natural Material
WAD	Works Authorisation Deed

SCHEDULE 3 - ADMINISTRATIVE CONDITIONS

OBLIGATION TO MINIMISE HARM TO THE ENVIRONMENT

1. The Proponent shall implement all reasonable and feasible measures to prevent and/or minimise any harm to the environment that may result from the construction, operation or decommissioning of the Project.

TERMS OF APPROVAL

2. The Proponent shall carry out the Project generally in accordance with the:
 - (a) EA and Response to Submissions Report;
 - (b) Statement of Commitments (see Appendix 1);
 - (c) site layout plans and drawings in the EA, (as shown in Appendix 2 to Appendix 8); and
 - (d) conditions of this approval.
3. If there is any inconsistency between the above, the conditions of this approval shall prevail to the extent of any inconsistency.
4. The Proponent shall comply with any reasonable requirement/s of the Director-General arising from the Department's assessment of:
 - (a) any reports, plans, strategies, programs or correspondence that are submitted in accordance with this approval; and
 - (b) the implementation of any actions or measures contained in these reports, plans, strategies, programs or correspondence.

LIMITS OF APPROVAL

5. The Proponent shall ensure that no more than 150,000 tonnes per annum of waste is accepted at the landfill in any one calendar year.

SURRENDER OF EXISTING DEVELOPMENT CONSENTS

6. Upon commencement of the development, or as otherwise agreed by the Director-General, the Proponent shall surrender the development consents identified in Table 1 in accordance with Sections 75YA and 104A of the EP&A Act.

Table 1: Existing development consents to be surrendered

DA No.	DA description	Date Consent Granted
DA 170/1986	Solid waste disposal depot and associated works (original consent)	7 October 1986
DA 976/1994	Recycling area and building	6 December 1994
DA 82/1994	Extension of waste disposal site (current working approval to filling levels)	13 February 1995
DA 2185/1999	Additions to consol window (additional window to weighbridge)	4 January 1999
DA 504/2004	Compactor shed storage	13 May 2009

Note: This requirement does not extend to the surrender of construction and occupation certificates for existing and proposed building works under Part 4A of the EP&A Act. Surrender of a consent or approval should not be understood as implying that works legally constructed under a valid consent or approval can no longer be legally maintained or used.

7. To the extent of any inconsistency between the DA's identified in Table 1 and this approval, this approval shall prevail.

TRANSITIONAL ARRANGEMENTS

8. All existing environmental management plans that apply to the site under those DAs listed in Table 1 of this Schedule shall continue to be fully applied until replaced under this approval.

ACQUISITION OF LAND

9. Prior to the commencement of construction or within 12 months from the date of this approval, whichever occurs first, the Proponent shall acquire Lot 372 DP 723259 from the Crown under the *Land Acquisition (Just Terms Compensation) Act 1991*.

STRUCTURAL ADEQUACY

10. The Proponent shall ensure that all new buildings and structures, and any alterations or additions to existing buildings and structures are constructed in accordance with the relevant requirements of the BCA.

Notes:

- *Under Part 4A of the EP&A Act, the Proponent is required to obtain construction and occupation certificates for the proposed building works.*
- *Part 8 of the EP&A Regulation sets out the requirements for the certification of the Project.*

UTILITIES

11. Prior to the construction of any utility works, the Proponent shall obtain the relevant approvals from service providers and Council.

DEMOLITION

12. The Proponent shall ensure that all demolition work is carried out in accordance with *Australian Standard AS 2601:2001: The Demolition of Structures*, or its latest version.

OPERATION OF PLANT AND EQUIPMENT

13. The Proponent shall ensure that all plant and equipment used for the Project is:
 - (a) maintained in a proper and efficient condition; and
 - (b) operated in a proper and efficient manner.

PROTECTION OF PUBLIC INFRASTRUCTURE

14. The Proponent shall:
 - (a) repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by the Project; and
 - (b) relocate, or pay the full costs associated with relocating, any public infrastructure that needs to be relocated as a result of the Project.

STAGED SUBMISSION OF PLANS OR PROGRAMS

15. With the approval of the Director-General, the Proponent may submit any plan or program required by this approval on a progressive basis.

DISPUTE RESOLUTION

16. In the event that a dispute arises between the Proponent and a public authority, other than the Department, in relation to the reasonableness of any requirements proposed by a public authority arising from the conditions of this approval, the matter can be referred by either party to the Director-General for resolution.
-

SCHEDULE 4 SPECIFIC ENVIRONMENTAL CONDITIONS

WASTE

Restrictions on Receipt, Storage & Handling of Waste

1. The Proponent shall only receive waste on Site that is authorised for receipt by an EPL.
2. The Proponent shall ensure that any waste generated on the Site during construction is classified in accordance with the EPA's *Waste Classification Guidelines* and disposed of to a facility that may lawfully accept the waste.

Resource Recovery

3. The Proponent shall implement all reasonable and feasible measures to recover resources from the waste stream to the satisfaction of the Director-General.

Screening and Acceptance

4. The Proponent shall:
 - (a) implement auditable procedures to:
 - ensure that the Site does not accept wastes that are prohibited;
 - screen incoming waste loads; and
 - (b) ensure that:
 - all waste types that are controlled under a tracking system have the appropriate documentation prior to acceptance at the Site;
 - staff receive adequate training in order to be able to recognise and handle any hazardous or other prohibited waste.

Monitoring

5. The Proponent shall prepare and implement a Waste and Resource Recovery Monitoring Program for the Site to the satisfaction of the Director-General. The Program shall:
 - (a) be prepared in consultation with the EPA, and submitted to the Director-General for approval prior to the commencement of operations on Site;
 - (b) detail the screening and acceptance procedures required by Condition 4 above; and
 - (c) monitor:
 - the quantity, type and source of waste received on Site; and
 - the effectiveness of the resource recovery measures (see condition 3 above).

This Program shall be documented in the landfill EMP (see Condition 2 of Schedule 4)

Trade Waste Agreement

6. Prior to commencement of operation, the Proponent shall ensure that a Trade Waste Agreement is in place with Hunter Water Corporation for the life of the Project.

Landfill Operations

7. Unless the Director-General agrees otherwise, the Proponent shall:
 - (a) minimise the exposed or cleared areas at the landfill;
 - (b) progressively revegetate all completed areas of the landfill and stabilise any exposed areas that are not required for operational purposes for a period greater than 90 days;
 - (c) minimise the tracking of mud and waste from the Site on public roads;
 - (d) fill the landfill cells in a systematic manner as detailed in the Staging Plan at Appendix 3;
 - (e) maximise landfill compaction rates;
 - (f) cover the active landfill area with at least 0.15 m of VENM soil (or a suitable alternative material approved by the EPA) at the end of daily waste disposal and compaction activities;
 - (g) progressively cap the landfill cells with a capping layer approved by the EPA; and
 - (h) revegetate the covered landfill cells following the capping of each cell once they reach their final design height.

Cover Material

8. The Proponent shall ensure that all waste cover material used on Site is approved in writing by the EPA.

Litter Control

9. The Proponent shall:
- (a) implement suitable measures to prevent the unnecessary proliferation of litter both on and off Site resulting from the landfilling operations; and
 - (b) inspect daily and clear the Site (and if necessary, surrounding area) of litter resulting from the landfilling operations, on a daily basis.

Pest, Vermin & Noxious Weed Management

10. The Proponent shall:
- (a) implement suitable measures to manage pests, vermin and declared noxious weeds on Site; and
 - (b) inspect the Site on a regular basis to ensure that these measures are working effectively, and that pests, vermin or noxious weeds are not present on Site in sufficient numbers to pose an environmental hazard, or cause the loss of amenity in surrounding area.

Note: For the purposes of this condition, noxious weeds are those species subject to an order declared under the Noxious Weed Act 1993.

Cell Design and Lining System

11. Prior to the commencement of any cell construction work under this approval, the Proponent shall submit comprehensive cell design details to the EPA for the Sidewall, Base and Piggyback components of the landfill. The design details shall be prepared to the satisfaction of the EPA and should include, but are not necessarily limited to:
- (a) plans with cross sections at a suitable scale depicting the dimensions of the proposed landfill cell extensions ie. length, width and depth, as well as details of the floor and wall gradients. The floors of the cells should have transverse gradients of greater than three percent and longitude gradients greater than one percent. All levels should be relative to AHD. A plan shall also be provided that depicts the boundary of the premises subject to the development application and the lot and DP numbers of this land;
 - (b) engineering design detail of the proposed cell extension lining and proposed anchoring;
 - (c) engineering design detail of the proposed cell extension capping;
 - (d) plans and design specifications and arrangements of leachate collections and disposal systems;
 - (e) plans indicating the design specifications and arrangement of landfill gas collection systems; and
 - (f) the details required on items 11(a) to 11(e) above are to be prepared or overseen by a suitable qualified engineer who has considerable experience in the design and construction of medium to large scale municipal waste landfills. The engineer shall have qualifications acceptable to the Institution of Engineers Australia (IAE).
12. The Proponent shall ensure that the cell design details meet all the recommendations and requirements of the Mine Subsidence Board and are prepared to the satisfaction of the EPA. Confirmation shall be provided to both the Director-General and the EPA at Licence Variation Application Stage that the Mine Subsidence Board has reviewed and approved the final cell design details.

SOIL & WATER

Erosion and Sediment Control

13. During the construction of the Project, the Proponent shall implement suitable erosion and sediment control measures on Site, in accordance with the relevant requirements in the latest version of the *Managing Urban Stormwater: Soils and Construction* guideline. These measures shall be documented in the Construction Environmental Management Plan (see Condition 1 of Schedule 5).

Soil

14. The Proponent shall:
- (a) minimise any soil loss through erosion on Site;
 - (b) set aside any topsoil won on Site for the proposed revegetation and rehabilitation of the Site; and
 - (c) ensure that any topsoil stockpiles on Site are suitably managed to ensure that the topsoil in these stockpiles can be beneficially used in the proposed revegetation and rehabilitation of the Site.

Water Supply

15. The Proponent shall ensure that:
- (a) all water supplies for construction and operation are sourced from an authorised and reliable supply; and
 - (b) the taking of water for purposes other than water supply, such as dewatering during construction, is appropriately authorised.

Surface Water Discharge Limits

16. The Proponent shall ensure that all licensed surface water discharges from the Site comply with discharge limits (volume and quality) set for the Project in any EPL or relevant provisions of the POEO Act.

Stormwater Management

17. The Proponent shall:
- (a) design and install the stormwater management and collection system generally in accordance with the conceptual design in the EA (as shown in Appendix 5), applicable Australian Standards and industry standard best practice guidelines;
 - (b) ensure that the system capacity has been designed in accordance with the Blue Book Volumes 1 and 2B;
 - (c) divert existing clean surface water around operational areas of the Site;
 - (d) direct all sediment laden water in overland flow away from the leachate management system;
 - (e) ensure peak stormwater discharge rates from the site at each stage of the project do not exceed predevelopment values; and
 - (f) prevent cross contamination of clean and sediment or leachate laden water,

to the satisfaction of the Director-General.

Leachate Management

18. The Proponent shall:
- (a) design and install the leachate management and collection system generally in accordance with the conceptual design in the EA (as shown in Appendix 5), applicable Australian Standards and industry standard best practice guidelines, or otherwise approved by the EPA;
 - (b) ensure that leachate generated by the Project is minimised and appropriately contained, collected and disposed of;
 - (c) as required, leachate generated by the Project shall be transferred for disposal to the Rathmines No. 6 WWPS in accordance with HWC's requirements;
 - (d) install a leachate barrier system to be used for the direct impoundment of leachate (see conditions 11 and 12 of this Schedule);
 - (e) design and operate the leachate management system to prevent leachate from escaping to surface water, groundwater or the surrounding subsoils;
 - (f) direct all surface water from areas not subject to waste disposal or leachate disposal away from the leachate management system; and
 - (g) treat all water that has entered areas filled with waste, or been contaminated by leachate, as leachate.

to the satisfaction of the Director-General.

Soil, Water and Leachate Management Plan

19. The Proponent shall prepare and implement a Soil, Water and Leachate Management Plan for the Project. The Plan shall be prepared by a suitably qualified and experienced expert in consultation with LMCC, the NOW and the EPA and be submitted to the Director-General for approval prior to the commencement of Operations. The Plan shall include:
- (a) a Site water balance for the Project, that details:
 - sources and security of water supply;
 - water use on Site;
 - water management on Site;
 - (b) an erosion and sediment control plan that:
 - is consistent with the requirements of the latest version of the Blue Book Volume 1 and Volume 2B;
 - identifies activities on Site that could cause soil erosion and generate sediment; and
 - describes the measures that will be implemented to:

- i. minimise soil erosion and the transport of sediment to downstream waters, including the location, function and capacity of any erosion and sediment control structures and maintain these structures over time;
 - ii. ensure that any topsoil stockpiles on Site are suitably managed to ensure that the topsoil in these stockpiles can be beneficially used in the proposed revegetation and rehabilitation of the Site.
- (c) a leachate management plan that:
 - includes final detailed design specifications of the leachate management and collection system on Site; and
 - demonstrates how the requirements of Condition 18 of Schedule 4 have been addressed;
- (d) a stormwater management plan that:
 - is consistent with the guidance in the latest version of the Blue Book Volume 1 and Volume 2B;
 - includes final detailed design specifications for the stormwater management and collection system; and
 - demonstrates how the requirements of Condition 17 of Schedule 4 have been addressed;
- (e) a surface water, groundwater and leachate monitoring program that includes:
 - baseline data (including water flow and quality);
 - details of the proposed monitoring network; and
 - the parameters for testing and respective impact assessment criteria and trigger levels for action under the surface water, groundwater and leachate response plan.
- (f) a surface water, groundwater and leachate response plan that:
 - includes a protocol for the investigation, notification and mitigation of any exceedances of the respective trigger levels; and
 - describes the measures that could be implemented to respond to any surface or groundwater contamination that may be caused by any development.

The Plan shall be documented in the Landfill Environmental Management Plan (see Condition 3 in Schedule 5).

Contamination Management Plan

- 20. The Proponent shall prepare and implement a Contamination Management Plan for the Project to the satisfaction of the Director-General. The Plan shall:
 - (a) be prepared by a suitably qualified and experienced expert;
 - (b) be submitted to the Director-General for approval prior to commencement of construction;
 - (c) detail the protocols to be put in place and followed in the event that contaminated soil (including Acid Sulphate Soils) or water is encountered during construction;
 - (d) be prepared in accordance with the relevant best practice industry guidelines such as the NSW State Government’s *Acid Sulphate Soil Manual* (ASSMAC, 1998);
 - (e) detail how excavated soil will be tested, handled and stockpiled;
 - (f) detail the measures that will be employed to prevent erosion and sedimentation of contaminated soil; and if necessary;
 - (g) outline how contaminated soil and water will be disposed of off Site (eg. at a licenced facility).

The Plan shall be documented in the Construction Environmental Management Plan (see Condition 2 in Schedule 5).

AIR QUALITY

Odour

- 21. The Proponent shall ensure the development does not cause or permit the emission of any offensive odour (as defined by the POEO Act).

Dust Criteria

- 22. The Proponent shall ensure that dust generated by the Project does not exceed the criteria listed in Tables 2 to 4 at any private residential receiver, or on more than 25 percent of any privately owned land surrounding the Site.

Table 2: Long term criteria for particulate matter

Pollutant	Averaging period	^dCriterion
Total suspended particulate (TSP) matter	Annual	^a 90 µg/m ³

Particulate matter < 10 µm (PM ₁₀)	Annual	^a 30 µg/m ³
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Table 3: Short term criterion for particulate matter

Pollutant	Averaging period	^d Criterion
Particulate matter < 10 µm (PM ₁₀)	24 hour	^a 50 µg/m ³

Table 4: Long term criteria for deposited dust

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total ¹ deposited dust level
^c Deposited dust	Annual	^b 2 g/m ² /month	^a 4 g/m ² /month

Notes for Tables 2 -4:

- ^aTotal impact (i.e. incremental increase in concentrations due to the Project plus background concentrations due to other sources);
- ^b Incremental impact (i.e. incremental increase in concentrations due to the Project on its own);
- ^c Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method; and
- ^d Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agree to by the Director-General in consultation with the EPA.

Dust and Odour Minimisation

23. The Proponent shall:
- implement best management practice, including all reasonable and feasible dust and odour mitigation measures to prevent and minimise dust and odour emissions from operations;
 - prevent and minimise air quality impacts from the development during adverse meteorological conditions and extraordinary events; and
 - minimise surface disturbance of the Site, other than as permitted under this consent.
24. During construction, the Proponent shall ensure that:
- all vehicles on Site do not exceed a speed limit of 25 kilometres per hour;
 - all loaded vehicles entering or leaving the Site have their loads covered; and
 - all loaded vehicles leaving the Site are clean of dirt, sand and other materials before they leave the Site, to avoid tracking these materials on public roads.

Air Quality Management Plan

25. The Proponent shall prepare and implement an Air Quality and Odour Management Plan for the Project in consultation with the EPA. The Plan shall:
- be prepared and implemented by a suitably qualified and experienced expert;
 - be submitted to the Director-General for approval prior to commencement of operations;
 - identify all potential odour sources at the Site;
 - describe the measures that will be implemented to ensure:
 - best management practice is employed;
 - the air quality and odour impacts from landfilling are minimised during adverse meteorological conditions and extraordinary events; and
 - compliance with the relevant conditions of this approval; and
 - describes the air quality and odour management system.

The Plan shall be documented in the Landfill Environmental Management Plan (see Condition 3 in Schedule 5).

Greenhouse Gas Management Plan

26. The Proponent shall develop and implement a Greenhouse Gas Management Plan prior to the commencement of operations of the new landfill cells. The Plan shall include, as a minimum:
- proposed active landfill gas management system including flaring and / or combustion to reduce potential greenhouse gas emissions from the landfill;
 - energy saving measures to be implemented ;
 - detail greenhouse gas monitoring program;
 - a program to monitor the effectiveness of these measures; and
 - a protocol to periodically review the Plan.

The Plan shall be documented in the Landfill Environmental Management Plan (see Condition 3 in Schedule 5).

NOISE

Noise Limits

27. Noise from the premises shall not exceed:
- an LA10(15 minute) noise emission criterion of 45dB(A) (7am to 6pm) Monday to Sunday;
 - an LA10 (15 minute) noise emission criterion of 45 dB(A) during the evening (6pm to 10pm) Monday to Friday; and
 - at all other times, an LA10 (15 minutes) noise emission criterion of 35dB(A), except as expressly provided by the EPL.

Noise from the Site is to be measured at any point within six (6) metres of the nearest effected residential receiver or other noise sensitive areas in the vicinity to determine compliance with this condition.

Operational Noise Validation

28. By 21 January 2016 or at a date approved by the Director-General, the Proponent shall undertake a Noise Validation of activities at the Site. The Validation shall be performed in accordance with the *NSW Industrial Noise Policy* (EPA, 2000) or the relevant policy adopted by the EPA at the time of the Validation and submitted to both the Director-General and EPA. The Validation shall include, but not be limited to, the following information:
- identification of any noise sensitive locations ('sensitive receivers') likely to be affected by activities at the Site, such as residential properties, schools, hospitals and passive recreation areas. The location of any noise sensitive locations in relation to the Site shall be mapped;
 - existing background (L_{A90}) and ambient (L_{Aeq}) noise levels determined for each sensitive receiver in accordance with the *NSW Industrial Noise Policy* (EPA, 2000) or the relevant policy adopted by the EPA at the time of the validation;
 - derivation and identification of the Project specific noise levels for each sensitive receiver in accordance with the *NSW Industrial Noise Policy* (EPA, 2000) or the relevant policy adopted by the EPA at the time of the validation;
 - the expected noise level and noise character (for example tonality, impulsiveness, vibration(etc) likely to be generated from noise sources during Operation. Include noise source data for each source in 1/1 or 1/3 octave band frequencies including methods or references used to determine noise source levels;
 - the noise levels likely to be received at the most sensitive receivers, including potential impacts for any identified significant adverse meteorological conditions, including:
 - a plan showing the assumed location of each noise source for each prediction scenario;
 - a list of the number and type of noise sources used in each prediction or direct monitoring scenario to simulate all potential significant operating conditions on the Site;
 - any assumptions made in the predictions such as source heights, directivity effects, shielding from topography, buildings or barriers;
 - methods used to predict noise impacts including identification of any noise models used. Where modelling approaches other than the ENM or SoundPlan computer models are adopted, the approach should be appropriately justified and validated;
 - an assessment of appropriate weather conditions for the noise predictions, including reference to any weather data used to justify the assumed conditions;
 - the predicted noise impacts for each noise source as well as the combined noise level for each prediction scenario under any identified significant adverse weather conditions as well as calm conditions where appropriate;
 - an assessment of the need to including modification factors as detailed in Section 4 of the *NSW Industrial Noise Policy* (EPA 2000) or the relevant policy adopted by the EPA at the time of the Validation.
 - discuss the findings of the predictive modelling and direct monitoring and, where relevant noise criteria have not been met, recommend additional mitigation measures;
 - include details of any mitigation proposed including the attenuation that will be achieved and the revised noise impact predictions following mitigation;
 - after application of all feasible and reasonable mitigation measures, quantify the residual level of noise impact by identifying:
 - locations (if any) where the noise level exceeds the criteria and the extent of exceedance;
 - numbers of people (or areas) affected;
 - times when criteria will be exceeded;
 - likely impact on activities (speech, sleep, relaxation, listening etc);

- change in ambient conditions; and
- the result of any community consultation or negotiated agreement.

Operating Conditions

29. The Proponent shall:
- implement best management practice, including all reasonable and feasible noise management and mitigation measures to prevent and minimise operational, low frequency and traffic noise generated by the Project;
 - minimise the noise impacts of the Project during adverse meteorological conditions when noise criteria do not apply;
 - maintain the effectiveness of any noise suppression equipment on plant at all times and ensure defective plant is not used operationally until fully repaired; and
 - regularly assess noise monitoring data and relocate, modify and/or stop operations to ensure compliance with the relevant conditions of this consent.

Operating Hours

30. The Proponent shall comply with the construction and operation hours detailed in Table 2 for the Site, unless otherwise agreed in writing by the Director-General.

Table 2: Construction and Operation Hours

Activity	Day	Time
Construction	Monday - Friday	7.00am – 6.00pm
	Saturday	8.00am – 1.00pm
	Sunday and Public Holidays	Nil
Operation	Monday to Friday	7.30am – 4.30pm
	Saturdays, Sundays and Public Holidays	8.00am – 4.00pm

Noise Management Plans

31. The Proponent shall prepare and implement a Construction Noise Management Plan in consultation with the EPA and to the satisfaction of the Director-General. The Plan shall:
- be prepared and implemented by a suitably qualified and experienced person;
 - be submitted for approval by the Director-General prior to commencement of construction;
 - identify each work area, Site compound and access route (both private and public);
 - identify the specific activities that will be carried out and associated noise sources at the Site and access routes;
 - identify all potentially affected sensitive receivers;
 - include the construction noise and vibration objectives identified in accordance with the *NSW Interim Construction Noise Guideline and Assessing Vibration: A Technical Guideline*;
 - assess potential noise and vibration from the proposed construction methods (including noise from construction traffic) against the objectives identified in (f);
 - where the objectives are predicted to be exceeded, include an analysis of feasible and reasonable noise mitigation measures that can be implemented to reduce construction noise impacts;
 - describe management methods and procedures and specific noise mitigation treatments that will be implemented to control noise and vibration during construction, including the early erection of operational noise barriers;
 - detail procedures for notifying residents of construction activities that are likely to affect their noise and vibration amenity; and
 - detail measures to monitor noise performance and respond to complaints.

The Plan shall be documented in the Construction Environmental Management Plan (see Condition 2 in Schedule 5).

32. The Proponent shall prepare and implement an Operational Noise Management Plan for the Project in consultation with the EPA and to the satisfaction of the Director-General. The Plan shall:
- be prepared and implemented by a suitably qualified and experienced person;
 - be submitted for approval by the Director-General prior to commencement of operations;
 - describe the measures that will be implemented to ensure:
 - best management practice is being employed on site;
 - traffic management noise is effectively managed; and

- the noise impacts of the Project are minimised during any meteorological conditions when the noise criteria in this consent do not apply;
 - compliance with the relevant conditions of this consent.
- (d) describe the noise management system;
- (e) includes a noise monitoring program that:
- is capable of evaluating the performance of the Project;
 - includes a protocol for determining exceedances of the relevant conditions of this consent and responding to complaints; and
 - adequately supports the noise management system; and
 - evaluates and reports on the effectiveness of the noise management system.

The Plan shall be documented in the Landfill Environmental Management Plan (see Condition 3 in Schedule 5).

TRANSPORT

33. Prior to the commencement of operations, a Seagull Type intersection with raised kerbs and street lighting shall be provided at the intersection of Wangi Road (MR217) and Wilton Road. The intersection shall be designed and constructed in accordance with the Austroads *Guide to Road Design 2009* (with RTA supplements) to the satisfaction of the RMS.
34. Prior to the commencement of any works on a State road, the proponent shall enter into a Works Authorisation Deed (WAD) with the RMS.
- Note: Further advice regarding the WAD process is provided in Appendix 8.*
35. Prior to the commencement of operations, the Proponent shall complete all road works under the WAD to practical completion, to the satisfaction of the RMS.
36. All works shall be undertaken at full cost to the Proponent, to the satisfaction of RMS.
37. The Proponent shall ensure that:
- (a) the internal roads and parking associated with the Project are constructed and maintained in accordance with the latest versions of AS 2890.1 and AS 2890.2; and
 - (b) vehicles associated with the Project do not park or queue on the public road network.
38. The Proponent shall prepare and implement a Construction Traffic Management Plan (CTMP), including a Vehicle Movement Plan for the Project in consultation with the RMS and to the satisfaction of the Director-General. The Plan shall:
- (a) be prepared and implemented by a suitably qualified and experienced person;
 - (b) be submitted for approval by the Director-General prior to commencement of construction; and
 - (c) be prepared with the intention of having minimal impact to the operation of the road network.

VISUAL AMENITY

Lighting

39. The Proponent shall ensure that the lighting associated with the Project:
- (a) complies with the latest version of AS 4282(INT) - *Control of Obtrusive Effects of Outdoor Lighting*; and
 - (b) is mounted, screened and directed in such a manner that it does not create a nuisance to surrounding properties or the public road network.

Signage

40. The Proponent shall not install any advertising signs on Site without the written approval of the Director-General.

HAZARDS & RISKS

Bunding

41. The Proponent shall store all chemicals, fuels and oils used on Site in appropriately bunded areas in accordance with the requirements of all relevant Australia Standards, and/or EPA's *Storing and Handling Liquids: Environmental Protection – Participants Handbook*.

Fire Management

42. The Proponent shall:
- (a) ensure that all new buildings and structures, and any alterations or additions to existing buildings and structures are constructed in accordance with Section 3 and Section 7 (BAL 29) Australian Standard AS3959-2009 c of buildings in bush fire-prone areas;
 - (b) prior to the commencement of operations, prepare a Fire Management Plan for the Site;
 - (c) implement suitable measures to minimise the risk of fire on Site, including in the landfill area;
 - (d) extinguish any fires on Site promptly; and
 - (e) maintain adequate fire-fighting capacity on Site.

Emergency Response

43. The Proponent shall prepare and implement an Emergency Response Plan for the Project to the satisfaction of the Director-General. The Plan shall:
- (a) be prepared and implemented by a suitably qualified and experienced person whose appointment has been approved by the Director-General;
 - (b) be submitted for approval by the Director-General prior to commencement of operations; and
 - (c) include a Bush Fire Emergency Evacuation Plan in accordance with the NSW Rural Fire Service document *Guide for Developing a Bush Fire Emergency Evacuation Plan*.

CONSERVATION

Heritage Management

44. The Proponent shall consult with and involve all the registered Aboriginal parties for the Project in the ongoing management of the Aboriginal cultural heritage values. Evidence of this consultation shall be collated and provided to the Director-General upon request.
45. The Proponent shall prepare and implement a Cultural Heritage Management Plan (CHMP) to the satisfaction of the Director-General. The Plan shall:
- (a) be prepared in consultation with the OEH by a suitably qualified and experienced expert;
 - (b) be approved by the Director-General prior to the commencement of any ground disturbance or development works;
 - (c) be implemented in consultation with the registered Aboriginal parties;
 - (d) detail:
 - procedures for managing the Aboriginal cultural heritage values associated with the Project;
 - the involvement and responsibilities of the Aboriginal stakeholders in the implementation of all cultural heritage management actions;
 - the responsibilities of all other stakeholders;
 - all mitigation and management strategies (including monitoring program, further investigations etc);
 - procedures for the identification and management of previously unrecorded sites (including human remains);
 - an appropriate keeping place agreement with local Aboriginal community representatives for any Aboriginal objects salvaged through the development process;
 - the Aboriginal Cultural Heritage Education Induction Program for all contractors and personnel associated with construction activities; and
 - compliance procedures in the unlikely event that non-compliance with the CHMP is identified.
46. The Proponent is to provide fair and reasonable opportunities for the registered Aboriginal parties to monitor any initial ground disturbance activities associated with the Project. In the event that additional Aboriginal objects are uncovered during the monitoring program, the objects are to be recorded and managed in accordance with the requirements of Sections 85A and 89A of the *National Parks and Wildlife Act 1974*.
47. All Aboriginal sites impacts by the Project shall have an Aboriginal Site Impact Recording (ASIR) form completed and be submitted to the AHIMS Registrar within three (3) months of being impacted.
48. If human remains are located in the event that surface disturbance occurs, all works shall halt in the immediate area to prevent any further impacts to the remains. The NSW Police are to be contacted immediately. No action is to be undertaken until the NSW Police provide written notification to the Proponent. If the skeletal remains are identified as Aboriginal, the Proponent

shall contact the Environment Line on 131 555 and representatives of the local Aboriginal community. No works are to continue until the NSW OEH provides written notification to the Proponent.

49. An Aboriginal Cultural Education Induction Program shall be developed for the induction of all personnel and contactors involved in the construction activities on Site. Records are to be kept of which staff / contractors were inducted and when for the duration of the Project. The program should be developed and implemented in collaboration with the registered Aboriginal parties.

Threatened Biodiversity

Biodiversity Offset Strategy

50. The Proponent shall implement the biodiversity offset strategy summarised in Table 3 and shown in Appendix 2 in accordance with the Biobanking Assessment Report prepared by Niche dated September 2013 to the satisfaction of the Director-General.

Table 3: Biodiversity Offset Strategy

Offset Area	Offset Type	Ecosystem credits	Species credits
Lot 463 DP 1138964 (121.19 hectares)	Vegetation to be enhanced and retained including Smooth-barked Apple-Red Bloodwood open Forest and Scribbly Gum-Red bloodwood heath woodland communities and <i>Tetratheca juncea</i> (Black-eyed Susan)	392	33,853

Note: to see the areas referred to in Table 3, see the applicable figures in Appendix 2.

51. Prior to construction, the Proponent shall prepare a Biodiversity Offset Management Plan for Lot 463 DP 1138964 in consultation with OEH and to the satisfaction of the Director-General.

51A.

- (a) Within 60 days of the commencement of vegetation clearance (other than for survey or conservation management purposes) under this Approval, a restriction on user burdening Lot 463 DP 1138964 retained to implement the Biodiversity Offset Strategy in Condition 50 shall be registered and inure in favour of the Minister for Planning and Infrastructure.
- (b) The instrument shall be in or to the effect of the Restrictive Covenant annexed to these conditions as Appendix 9 and will affect the area of land referred to in that Appendix.
- (c) It is a requirement that the restriction on user instrument not restrict or constrain the holder of an authority granted or renewed under the *Mining Act 1992* or any Act consolidating or replacing that Act from carrying out on the subject land prospecting, mining operations, mining purposes and related improvements and activities authorised by or under any such authority.

52. Deleted.

Pre-Clearance Surveys

53. Prior to construction, the Proponent shall carry out pre-clearing surveys by a suitably qualified and experienced ecologist in accordance with *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004), to the satisfaction of the Director-General.

Biodiversity Management

54. The Proponent shall prepare and implement a Translocation Plan for the Project to the satisfaction of the Director-General. The Plan shall:
- (a) be prepared by a suitably qualified and experienced expert in consultation with the OEH;
 - (b) be reviewed by an independent agency that oversees land management outcomes in the region;
 - (c) be submitted to the Director-General for approval prior to the commencement of construction;
 - (d) describe the measures that will be implemented to:
 - translocate and manage fauna species;
 - monitor and report on the success of the translocation; and
 - ensure suitable contingency measures are implemented if the monitoring suggests the translocation is not working as well as intended.

The Plan shall be documented in the Construction Environmental Management Plan (see Condition 2 in Schedule 5).

55. The Proponent shall prepare and implement a Vegetation and Fauna Management Plan for the Project to the satisfaction of the Director-General. The Plan shall:
- (a) be prepared by a suitably qualified and experienced expert in consultation with the OEH;
 - (b) be reviewed by an independent agency that oversees land management outcomes in the region;
 - (c) be approved by the Director-General prior to the commencement of construction;
 - (d) map all identified vegetation cover and types;
 - (e) describe methods for monitoring and controlling vegetation, including prevention of litter and weed invasion into the Offset Areas during construction and operation;
 - (f) include a Vegetation Clearing Protocol;
 - (g) identify measures to manage edge effects along the interface of the Offset Areas and landfill sites;
 - (h) detail management of pest species; and
 - (i) detail ecological monitoring programs to be implemented.
56. The Vegetation Clearing Protocol shall:
- (a) clearly identify the location and type of vegetation to be retained and to be removed from the Site;
 - (b) detail measures that would be implemented for vegetation clearing;
 - (c) ensure vegetation, including trees would not be pushed or felled into any retained bushland areas during the vegetation removal process; and
 - (d) detail the staging of construction to avoid breeding times for key species on Site.

LANDFILL CLOSURE AND REHABILITATION

Closure Management Plan

57. The Proponent shall prepare and implement a Landfill Closure and Rehabilitation Management Plan for the Site to the satisfaction of the Director-General. The Plan shall:
- (a) be prepared in consultation with the EPA and other relevant agencies by suitably qualified and experienced expert;
 - (b) be submitted to the Director-General for approval within 12 months upon commencement of this approval;
 - (c) ensure that the final landform of the Site is consistent with the EA and Appendix 5 of this Consent; and

Rehabilitation Management Plan

58. The Proponent shall prepare and implement a Landfill Closure and Rehabilitation Management Plan for the Site to the satisfaction of the Director-General. The Plan shall:
- (a) be prepared in consultation with the EPA by a suitably qualified and experienced expert;
 - (b) be submitted to the Director-General for approval within 12 months upon commencement of this approval;
 - (c) define the objectives and criteria for rehabilitation and closure;
 - (d) ensure that the final landform of the Site is consistent with the EA and Appendix 5 of this approval;
 - (e) describe the measures that would be implemented to achieve the specified objectives and criteria for rehabilitation and closure;
 - (f) calculate the cost of implementing these measures;
 - (g) describe how the performance of these measures would be monitored over time; and
 - (h) include details of the post closure management measures for all aspects of the Project.
-

**SCHEDULE 5
ENVIRONMENTAL MANAGEMENT, REPORTING & AUDITING**

ENVIRONMENTAL MANAGEMENT

Construction Environmental Management Plan

1. The Proponent shall prepare and implement a Construction Environmental Management Plan for the Project to the satisfaction of the Director-General. The Plan shall:
 - (a) be approved by the Director-General prior to the commencement of construction;
 - (b) identify the statutory consents and approvals that apply to the Development;
 - (c) consolidate all relevant management plans and monitoring programs required in the conditions of this approval;
 - (d) outline all environmental management practices and procedures to be followed during construction and demolition works associated with the Project;
 - (e) describe all activities to be undertaken on the Site during construction of the Project, including a clear indication of construction stages;
 - (f) detail how the environmental performance of the construction works will be monitored, and what actions will be taken to address identified adverse environmental impacts;
 - (g) describe the roles and responsibilities for all relevant employees involved in construction and demolition works associated with the Project; and
 - (h) include arrangements for community consultation and complaints handling procedures during construction and demolition.

Note: Construction of the Project shall not commence until written approval of the Plan has been received from the Director-General.

Landfill Environmental Management Plan

2. Prior to the commencement of operations, the Proponent shall update the draft Landfill Environmental Management Plan for the Site to the satisfaction of the Director-General and in consultation with NOW. Following approval, the Proponent shall implement the Plan to the satisfaction of the Director-General. The Plan shall:
 - (a) be prepared in consultation with the EPA and NOW;
 - (b) be prepared by suitably qualified and experienced experts;
 - (c) describe in detail the management measures that would be implemented to address:
 - the relevant matters referred to in the *Environmental Guidelines for Solid Waste Landfills*;
 - the conditions of this approval; and
 - requirements of the EPL;
 - (d) include a copy of:
 - the relevant plans and programs required under this approval;
 - a quality assurance plan for the design and installation of the leachate management system and any capping of the landfill cells that covers the relevant issues outlined in sections 1 – 2 of Appendix A of the *Environmental Guidelines for Solid Waste Landfills*;
 - (e) describe the procedures that would be implemented to:
 - keep the local community and relevant agencies informed about the operation and environmental performance of the Project;
 - receive, handle, respond to, and record complaints;
 - resolve any disputes that may arise during the course of the Project; and
 - respond to emergencies;
 - (f) describe the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the Project; and
 - (g) be placed on Council's website within 2 weeks of its approval.

Management Plan Requirements

3. The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:
 - (a) detailed baseline data;
 - (b) a description of:
 - the relevant statutory requirements (including any relevant approvals, licences or lease conditions);
 - any relevant limits or performance measures/criteria; and
 - the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the Project or any management measures;
 - (c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;

- (d) a program to monitor and report on the:
 - impacts and environmental performance of the Project;
 - effectiveness of any management measures (see c above);
- (e) a contingency plan to manage any unpredicted impacts and their consequences;
- (f) a program to investigate and implement ways to improve the environmental performance of the Project over time;
- (g) a protocol for managing and reporting any:
 - incidents;
 - complaints;
 - non-compliances with statutory requirements; and
 - exceedances of the relevant limits and/or performance measures / criteria; and
- (h) a protocol for periodic review of the plan.

Annual Review

4. One year after the commencement of operations, and annually thereafter, the Proponent shall review the environmental performance of the Project to the satisfaction of the Director-General. The review shall:
 - a) describe the operations that were carried out in the past year;
 - b) analyse the monitoring results and complaints records of the Project over the past year, which includes a comparison of these results against the
 - relevant statutory requirements, limits or performance measures/criteria;
 - monitoring results of previous years; and
 - relevant predictions in the EA;
 - c) identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
 - d) identify any trends in the monitoring data over the life of the Project; and
 - e) describe what measures will be implemented over the next year to improve the environmental performance of the Project.

Revision of Plans & Programs

5. Within 3 months of the submission of an:
 - a) audit under condition 9 of schedule 5;
 - b) incident report under condition 7 of schedule 5; and
 - c) annual review under condition 5 of schedule 5,
 the Proponent shall review, and if necessary revise the plans and programs required under this approval to the satisfaction of the Director-General.

Note: This is to ensure the plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the Project.

REPORTING

Incident

6. The Proponent shall notify the Director-General and any other relevant agencies of any incident associated with the Project as soon as practicable after the Proponent becomes aware of the incident. Within 7 days of the date of the incident, the Proponent shall provide the Director-General and any relevant agencies with a detailed report on the incident.

Regular

7. The Proponent shall provide regular reporting on the environmental performance of the Project on its website, in accordance with the reporting arrangements in any plans or programs approved under the conditions of this approval, and to the satisfaction of the Director-General.

INDEPENDENT ENVIRONMENTAL AUDIT

8. Within a year of the commencement of operations of the Project, and every three (3) years thereafter, unless the Director-General directs otherwise, the Proponent shall commission and pay the full cost of an Independent Environmental Audit of the Project. The Audit shall:
 - a) be conducted by suitably qualified, experienced and independent team of expert/s whose appointment has been endorsed by the Director-General;
 - b) include consultation with the relevant agencies;
 - c) assess the environmental performance of the Project and assess whether it is complying with the relevant requirements in this approval and any relevant EPL (including any plan or program required under these approvals);
 - d) review the adequacy of any plans or programs required under these approvals; and, if appropriate;

- e) recommend measures or actions to improve the environmental performance of the Project, and/or any plan or program required under these approvals.

Note: This Audit team shall be led by a suitably qualified auditor and include experts in any fields specified by the Director-General.

- 9. Within 6 weeks of the completing of this audit, or as otherwise agreed by the Director-General, the Proponent shall submit a copy of the audit report to the Director-General, together with its response to any recommendations contained in the audit report.

ACCESS TO INFORMATION

- 10. From the commencement of the construction of the Project, the Proponent shall make the following information publicly available on its website as it is progressively required by the approval:
 - a) a copy of all current statutory approvals;
 - b) a copy of the current plans and programs required under this approval;
 - c) a summary of the monitoring results of the Project, which have been reported in accordance with the various plans and programs approved under the conditions of this approval;
 - d) a complaints register, which is to be updated on a monthly basis;
 - e) a copy of the Annual Reviews (over the last 5 years);
 - f) a copy of any Independent Environmental Audit, and the Proponent's response to the recommendations in any audit; and
 - g) any other matter required by the Director-General.

COMMUNITY EDUCATION PROGRAM

- 11. The Proponent shall prepare and implement a Community Education Program for the Project to the satisfaction of the Director-General. The Program shall be submitted to the Director-General for approval prior to the commencement of operations, and shall at a minimum focus on promoting resource recovery activities provided at the Site.
-

APPENDIX 1 PROPONENT'S STATEMENT OF COMMITMENTS

Statement of Commitments

Issue	Commitments
<ul style="list-style-type: none"> • General 	<ul style="list-style-type: none"> • LMCC will undertake the proposed works as described in this EA in accordance with the mitigation and management measures identified in this EA. • LMCC will ensure that a Construction Environmental Management Plan (CEMP) is prepared and implemented for the proposed works. The CEMP will detail appropriate mitigation measures for a range of construction activities and will address soil erosion and sediment control, slope stability, uncovering of contaminated, saline and/or acid sulfate soil, spill management, dust suppression, construction noise and vibration (as a minimum). • LMCC will gain all necessary approvals and permits supporting both the construction and operational phases, including: <ul style="list-style-type: none"> - Updating and obtaining a reissue of the existing EPL (Licence No. 5873) for the site, or obtaining a new EPL for the site; and - Obtaining approval under Section 15 of the <i>Mine Subsidence Compensation Act 1961</i>. • LMCC will update and continue to apply the existing LEMP for the AWMF to incorporate any new management/mitigation measures and monitoring requirements considered necessary for the proposed works. • LMCC will undertake community consultation as identified in Section 4.4 during the exhibition period of this EA Report, including holding information sessions for the community and stakeholders. • LMCC will ensure that site monitoring is undertaken in accordance with the existing and future Environmental Protection Licence (EPL) for the site.
<p>Waste Management</p>	<ul style="list-style-type: none"> • LMCC will ensure that during construction the site will be kept clear of unnecessary construction waste. Waste materials generated during the construction phase on both the AWMF site and along the sewer pipeline route will be recycled or reused wherever possible in the first instance. • LMCC will stockpile and reuse soil and vegetation required to be excavated/cleared for the new landfill cells and either reuse these resources as daily cover material for the active tipping face (soil) or process as green waste and use as mulch (vegetation). • LMCC will, wherever practical, place any felled trees or tree limbs in nearby surrounding bushland to act as potential habitat for fauna and reduce the volume of green waste. • LMCC will extend the gas extraction infrastructure into the proposed new landfill Areas A, B and C on a progressive basis into the future so that the capacity for gas capture and energy generation will be enhanced. • LMCC will continue to apply cover material to the active tip face to suppress any litter from becoming airborne during strong winds and escaping into the surrounding environment. LMCC will also continue to undertake litter patrols to manage stray litter. • LMCC will construct the additional facilities at the AWMF out of recycled materials, wherever possible. • LMCC will adopt a phased “three-bin source separated organics” processing system as its preferred waste processing technology for targeting domestic waste, which includes the implementation of a three bin system for domestic use (general rubbish, recycling and organic waste).
<p>Soil and Contamination</p>	<ul style="list-style-type: none"> • LMCC will ensure that an <i>Erosion and Sediment Control Plan (ESCP)</i> will be prepared and implemented in accordance with the <i>Managing</i>

Issue**Commitments**

Urban Stormwater: Soils and Construction Volume 2 series (DECC, 2008a, 2008b and 2008c) prior to works commencing. The ESCP should include a range of measures in accordance with best practice, including but not limited to progressive/staged vegetation clearing, implementation of sediment fences and flow diversion structures, covering or wetting of stockpiles, usage of excavation materials as future daily cover, ceasing of works and checking the integrity of erosion and sediment controls during heavy rainfall, stabilisation of access points and the installation of rumble grids at access points, and rapid backfilling of excavated pipeline trenches.

- LMCC will ensure that an *Acid Sulfate Soils Management Plan* must be prepared for the proposed works in accordance with the *Acid Sulfate Soils Manual* (Stone et al., 1998) that will focus on the trenching works for the installation of the sewer pipeline.
- LMCC will ensure that a *Salinity Management Plan* will be prepared for the proposed works that will focus on the trenching works for the installation of the sewer pipeline.
- LMCC will ensure that a *Contamination Management Plan* is prepared and implemented in the event that contaminated land is encountered during excavation. In such an event, works would cease immediately and OEH would be notified. Emergency measures (such as diversion of surface runoff away from contaminated areas) would also be implemented in a timely fashion.
- Prior to construction, LMCC will consider the existing Geotechnique Report (Appendix F) and the results of the subsidence risk assessment currently being undertaken by Centennial Coal to support an application being prepared to support future mine-workings. (This report is currently being prepared in partnership with LMCC, the Mine Subsidence Board, Centennial Coal, GSS Environmental, GHD and MSEC). LMCC will undertake a design review to ensure that the final design considers the worst case mine subsidence parameters, and will accommodate the worst case ground movement identified in either document without suffering structural failure or compromising environmental protection.
- LMCC will facilitate the management of erosion and sediment in the operational phase through stability control measures, utilisation of the proposed wheel wash facility, progressive revegetation of capped landfill area and utilisation of the proposed road to minimise surface and vegetation disturbance.

Water Quality and Hydrology

- LMCC will ensure that a Site Water Management Plan is prepared and implemented. This Plan will be developed in consultation with the Office of Water and shall include:
 - Site Water Balance, which will include:
 - Sources and security of water supply,
 - Water use on site, and
 - Water management on site.
 - Surface Water Management Plan which will include:
 - Detailed baseline data on surface water flows and quality,
 - Surface water impact assessment criteria, including trigger levels for investigating any potentially adverse surface water impacts,
 - A program to monitor surface water flows and quality, and
 - A protocol for the investigation and mitigation of identified exceedences of the surface water impact assessment criteria.
 - Groundwater Management Plan which will include:
 - Detailed baseline data on groundwater levels and quality,

Issue**Commitments**

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- Groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts,
 - A program to monitor groundwater levels and quality, and
 - A protocol for the investigation and mitigation of identified exceedences of the groundwater impact assessment criteria.
-
- In accordance with the site's EPL, LMCC currently undertakes groundwater quality monitoring using annual or quarterly grab samples at five sites. Parameters monitored include alkalinity (as calcium carbonate), aluminium, ammonia, arsenic, biochemical oxygen demand (BOD), barium, benzene, cadmium, calcium, chloride, chlorinated volatile compounds, chromium (hexavalent), chromium (total), cobalt, conductivity, copper, ethyl benzene, fluoride, iron, lead, magnesium, manganese, mercury, nitrate, organochlorine pesticides, organophosphate pesticides, PCBs, phosphate, polycyclic aromatic hydrocarbons, potassium, sodium, sulfate, toluene, total phenolics, total dissolved solids, total organic carbon, total petroleum hydrocarbons, zinc, pH. It is expected that the EPL will be amended for the site to account for the proposed site changes, and LMCC will continue to undertake monitoring according to the amended licence conditions. In addition, LMCC propose to install additional groundwater monitoring wells as shown in **Figure 5.5** to enable improved monitoring of groundwater quality.
 - LMCC will ensure that, should dewatering of groundwater be required as part of any excavation works, a licence is sought under the *Water Management Act 2000*.
 - LMCC will ensure that a *Stormwater Management Plan* is prepared and implemented for the construction phase of the proposed works to mitigate the impacts on water quality.
 - LMCC will ensure that temporary stormwater quantity and quality management measures are implemented during the construction phase, including the installation of silt curtains, hay bale filters and stormwater diversions.
 - In accordance with the site's EPL, LMCC currently undertakes stormwater quality monitoring using annual or quarterly grab samples at four sites. Parameters monitored include alkalinity (as calcium carbonate), aluminium, ammonia, arsenic, biochemical oxygen demand (BOD), barium, benzene, cadmium, calcium, chloride, chlorinated volatile compounds, chromium (hexavalent), chromium (total), cobalt, conductivity, copper, ethyl benzene, fluoride, iron, lead, magnesium, manganese, mercury, nitrate, organochlorine pesticides, organophosphate pesticides, PCBs, phosphate, polycyclic aromatic hydrocarbons, potassium, sodium, sulfate, toluene, total phenolics, total dissolved solids, total organic carbon, total petroleum hydrocarbons, total suspended solids, zinc and pH.

LMCC will ensure that the quality of stormwater leaving the site will be in accordance with the limits outlined by ANZECC (2000) and the existing EPL.
 - LMCC will ensure that a 30m buffer zone will be established from the watercourse centre-line and that all water management measures, both temporary construction phase measures and permanent measures, are located outside of this buffer.
 - LMCC will ensure that the proposed expansion will incorporate appropriate design principles for leachate basins, including ensuring that basin liners are utilised, active storage depths in the proposed basins are 0.75m from the permanent water level to the level of the primary spillway, and overflows from the basins are conveyed to the outfall(s) via 0.5m deep rock lined channel with base widths of 2m and side slopes of 1(V):2(H).
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Issue	Commitments
Leachate	<ul style="list-style-type: none"> • With regards to Hunter Water Corporation assets, LMCC will ensure that no sludge will be discharged to the receiving access chamber, if required. <hr/> <ul style="list-style-type: none"> • Leachate will be managed in accordance with best practice: <ul style="list-style-type: none"> - The entire new landfill area will be lined (implementing a 'piggyback' liner over the existing waste using a LLDPE liner; - Leachate will be collected, treated and managed/disposed of appropriately for the operational lifetime of the landfill; and - The landfilling operations will be carefully staged, with care taken at all times to minimise the inflow of water into active landfill areas. • LMCC will incorporate aeration in the proposed 8ML leachate pond, as discussed in Section 6.4.4 and determined in consultation with HWC, such that surplus leachate disposed of to the sewer network (via the proposed sewer pipeline) meets HWC's quality requirements. The existing 6ML leachate pond will be retained, and operated in series to provide additional physical treatment. • LMCC will ensure that engineering cell design drawings that meet EPA specifications (including the provision of cross sections, cell extension lining, anchoring and capping, leachate collection and disposal system and gas collection system) will be developed as part of the detailed design. LMCC note that this information is also required as part of the required application to vary the existing EPL (Licence No. 5873) to permit the construction of the cell extension. • LMCC will seek to establish a Trade Wastewater Agreement with HWC for the discharge of leachate from the AWMF site to the HWC sewer system. • LMCC will ensure that a sewer flowmeter is installed, and a sampling point established, at the AWMF package pumping station so that volumes and quality of leachate discharged to the HWC sewer network can be monitored. • LMCC currently undertakes leachate quality monitoring via quarterly grab samples at one location, and this includes testing for alkalinity (as calcium carbonate), ammonia, biochemical oxygen demand (BOD), calcium, chloride, fluoride, iron, magnesium, manganese, nitrate, organochlorine pesticides, potassium, sodium, sulfate, total phenolics, total organic carbon, total petroleum hydrocarbons, total suspended solids and pH. LMCC will ensure that leachate quality monitoring continues in accordance with the conditions of the new EPL to be issued for the site.
Flora and Fauna	<ul style="list-style-type: none"> • LMCC will within 60 days of the commencement of vegetation clearance (other than for survey or conservation management purposes), ensure that a restrictive covenant burdening Lot 463 DP 1138964 be registered in favour of the Minister for Planning and Infrastructure, to implement LMCC's Biodiversity Offset Strategy. • LMCC's Biodiversity Offset Strategy includes: <ul style="list-style-type: none"> - the offsetting of 33,853 <i>Tetratheca juncea</i> credits, calculated under the NSW Biobanking calculator, to offset the removal of 2,302 <i>Tetratheca juncea</i> plants at the site; and, - the offsetting of 392 Ecosystem credits, calculated under the NSW Biobanking calculator, to offset the removal of 7.2ha of native vegetation communities at the site (a total of 8.55ha of vegetation is to be impacted). • LMCC will provide DP&I with a <i>Biodiversity Offset Management Plan</i> that commits the proposed Awaba Offset Site as shown on Figure 2 of the "Biobanking Assessment Report Awaba Biobank Site – Lot 463, Wilton Road, Awaba NSW" prepared by Niche September 2013. The

Issue	Commitments
	<p>required management actions will be determined in consultation with OEH.</p> <ul style="list-style-type: none"> <li>• LMCC will ensure that a <i>Vegetation Management Plan</i> is prepared and implemented prior to commencement of the proposed works that will include details pertaining to procedures for clearing, landscaping and revegetation/rehabilitation works that are planned for the AWMF site during the construction, operational and post-closure phases and also immediately following completion of the installation of the sewer pipeline. The plan will include a <i>Vegetation Clearing Protocol</i> and a <i>Weed Management Sub-Plan</i>. <li>• LMCC will ensure that a <i>Fauna Management Plan</i> is prepared and implemented prior to commencement of the proposed works that will provide a protocol for responding to the detection and relocation of native fauna present in trees, hollows and logs that lie within the proposed areas for clearing. LMCC will ensure that details regarding the most appropriate season(s) to undertake clearing with regard to reducing disturbance to fauna (especially nestlings) are included in addition to details regarding the proposed management of pest species during the proposed works. Where they have been prepared and where applicable, LMCC will consider the details set out in <i>Recovery Plans</i>, <i>Threat Abatement Plans</i> or <i>Priority Action Statements</i> for listed threatened species and incorporate relevant mitigation measures into the <i>Fauna Management Plan</i>. <li>• Suitably experienced wildlife handlers will be present during pre-clearance surveys to relocate any fauna located during the works.
Air Quality and Odour	<ul style="list-style-type: none"> <li>• LMCC will ensure that a <i>Construction Environmental Management Plan</i> is prepared and implemented prior to commencement of the proposed works, and that this plan will include management/mitigation procedures for air quality, odour and dust, including minimising the number of stockpiles on site, limiting unnecessary vegetation clearing, and reducing/controlling the number of trips and trip distances where possible. <li>• LMCC will ensure that standard odour management practices for landfill sites will be utilised in the operational phase of the works, including the continuation of current practices such as daily covering/capping of the active tip face, gas monitoring programs and an odour complaints register. <li>• LMCC will ensure that standard air quality management practices for landfill sites will be utilised in the operational phase of the works, including the maintenance of gas collection infrastructure, power generation unit, flare stack, and plant and equipment on site, and a flare stack emission monitoring program. <li>• LMCC will ensure that air quality, odour and dust mitigation measures are implemented during the operational phase of the works, including covering/capping of waste, gas emission monitoring programs, and maintenance of gas infrastructure and site plant/equipment. <li>• LMCC currently undertakes environmental monitoring of methane which includes monthly, in-situ monitoring of %(v/v) methane inside buildings at the site and also on the surface of the landfill. LMCC will ensure that this monitoring continues. Additional gas monitoring locations are proposed as part of the works as shown in Figure 5.4 of the EA. <li>• LMCC will prepare an Odour Control Plan and provide it to Hunter Water in support of the development application.
Aboriginal Heritage	<ul style="list-style-type: none"> <li>• LMCC will ensure that a <i>Cultural Heritage Management Plan</i> is prepared in partnership with the registered Aboriginal stakeholders and implemented for the construction phase of the proposed works. The CHMP will demonstrate that effective community consultation with local Aboriginal communities has been undertaken during the preparation of the Plan. The CHMP will include procedures for ongoing Aboriginal consultation and involvement, management of all Aboriginal cultural

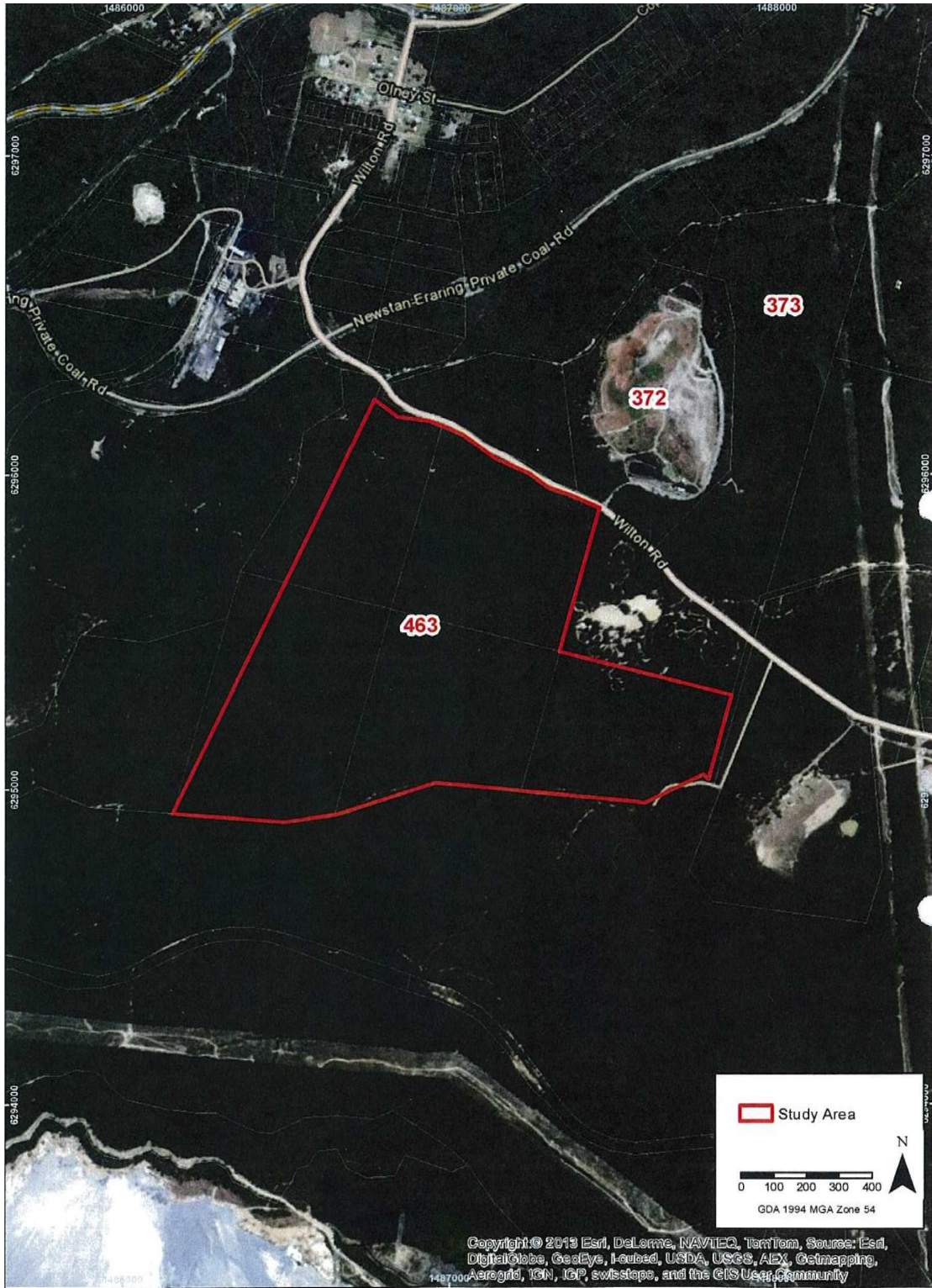
Issue	Commitments
	<p>heritage values associated with the project area, the responsibilities of all stakeholders, details of proposed mitigation and management strategies of all sites; including any additional investigation processes, salvage activities, monitoring, etc.; procedures for the identification and management of previously unrecorded sites (excluding human remains), and compliance procedures in the unlikely event that non-compliance with the CHMP is identified.</p> <ul style="list-style-type: none"> <li>• LMCC will ensure that further archaeological survey around the creek lines at the AWMF site and sub-surface testing of the midden site identified along the pipeline route is undertaken prior to the commencement of construction works to determine the full nature and extent of these archaeologically sensitive areas. These investigations will initially comprise a series of 1m² probes spaced evenly over the area of impact along the creek line, but may be expanded if artefact densities warrant further investigation or salvage. A monitoring and collection program will then be undertaken by the registered Aboriginal stakeholders during all proposed sub-surface excavations to allow collection of any artefacts that may be disturbed in this area (with subsequent relocation and reburial “in country” and in a location that will not be subject to any future impacts). <li>• LMCC will ensure that a minimum buffer of 5m around culturally modified trees to be retained will be delineated and enforced to reduce the impacts on these sites. LMCC will conduct further investigations during the detailed design phase as to whether an increase in the size of the buffer distance around culturally modified trees of the project is achievable given site constraints. <li>• LMCC will provide an opportunity for the Registered Aboriginal Parties (RAPs) to monitor the initial ground disturbance works associated with all sections of the excavations (ground surface impacts) so that any potentially impacted artefacts may be collected by the RAPs. <li>• LMCC will develop and implement an Aboriginal Cultural Heritage Induction Program for all personnel associated with the project, to make them aware of the site’s Aboriginal heritage values and artefacts that are to be conserved at the site. <li>• LMCC will ensure that any new Aboriginal artefacts located uncovered due to the development and/or sub-surface excavation or monitoring activities will be recorded and registered with the EPA as part of the assessment process in accordance with the requirements of Section 89A of the NPW Act. <li>• LMCC will ensure that work is ceased immediately in the event that any bone or stone artefacts, discrete distributions of shell or any other objects of potential cultural association are uncovered during earthmoving or other activities, in accordance with the <i>National Parks and Wildlife Act 1974</i>, “stop work” provisions. <li>• LMCC will ensure that strategies for the management of Aboriginal sites will be developed in collaboration with the Registered Aboriginal Parties and documented in an Aboriginal Cultural Heritage Management Plan, as recommended by the two Aboriginal Cultural Heritage Assessment Reports (ACHAR). <li>• LMCC will ensure that archaeological excavations of known or Potential Archaeological Deposit/archaeological sensitivity will be conducted (as recommended by the ACHAR) where impacts may result from construction works. The objective of any such excavations will be to confirm whether there is a likelihood of any objects being present (and therefore impacted by the works), and where this is the case to develop appropriate management strategies in collaboration with the Registered Aboriginal Parties and to formalise these in an Aboriginal Cultural Heritage Management Plan.
Non-Aboriginal heritage	<ul style="list-style-type: none"> <li>• LMCC will ensure that none of the non-Aboriginal heritage items identified in the vicinity of the proposed works will be impacted by the proposed works by making the Contractors aware of the items and

Issue	Commitments
Visual Landscape	<p>ensuring the Contractors avoid them.</p> <ul style="list-style-type: none"> <li>• LMCC will progressively excavate, fill and re-vegetate Areas A and B and subsequently fill and re-vegetate Area C (11 cell areas in total across Areas A, B and C) as shown in the Staging Plan in Figure 6.9, which has been developed to minimise the visual impacts of the proposed works. <li>• LMCC will ensure that the application of daily cover to the active tipping face is continued during the construction and operational phases of the works to ensure regular concealment of the landfill emplacement. <li>• LMCC will ensure that revegetation and rehabilitation will be undertaken at the site once the landfill has reached capacity, so that effective concealment of the emplacement will be achieved in the long term.
Greenhouse Gas	<ul style="list-style-type: none"> <li>• LMCC will continue to recover gases produced by the AWMF for energy generation and to minimise GHG emissions from the AWMF landfill. LMCC will increase the potential for landfill gas harvesting and electricity generation on site through the expansion of gas extraction infrastructure at the site. <li>• Prior to the commencement of the proposed works, LMCC will review the design of the final landfill gas management infrastructure to ensure that it meets the objective of capturing the majority of the gases from the landfill emplacement. <li>• LMCC will continue to monitor landfill gases generated for reporting purposes.
Traffic and Transport	<ul style="list-style-type: none"> <li>• LMCC will ensure that a <i>Construction Traffic Management Plan</i> is prepared and implemented for the proposed works. <li>• LMCC will ensure that the intersection of Wilton/Wangi Roads is upgraded to appropriately provide for existing traffic volumes and to reduce average delays experienced at the intersection for vehicles turning right onto Wangi Road.
Hazards and Risks	<ul style="list-style-type: none"> <li>• LMCC will continue to undertake the procedures detailed in the <i>Awaba Landfill Environmental Management Plan</i> (LMCC, 2006) to achieve compliance with the EPL issued for the site. <li>• LMCC will undertake a detailed risk review during the detailed design of the proposed additions, and any additional mitigation measures identified as being required will be incorporated into the <i>Awaba Landfill Environmental Management Plan</i>. <li>• LMCC will revise the site-specific <i>Fire Management Plan</i> within the <i>Awaba Landfill Environmental Management Plan</i> to ensure it remains current considering the proposed works. <li>• LMCC will continue to implement OH&S practices and adhere to relevant OH&S standards to ensure employee and user safety at the AWMF site. <li>• LMCC will work with HWC, as required, to enable the AWMF, pipeline and WWPS risks to be managed in an integrated manner. <li>• The standards defined in Section 3 and Section 7 of the Australian Standard AS3959-2009 (Construction of buildings in bush fire-prone areas) will be adopted as minimum design standards during the detailed design phase.
Noise and Vibration	<ul style="list-style-type: none"> <li>• LMCC will ensure that a <i>Noise and Vibration Management Plan</i> is prepared in accordance with the <i>Interim Construction Noise Guideline</i> (DECC, 2009b) and implemented for the construction phase of the proposed works. <li>• LMCC will continue to undertake the procedures detailed in the <i>Awaba Landfill Environmental Management Plan</i> (LMCC, 2006) to mitigate operational noise at the site.

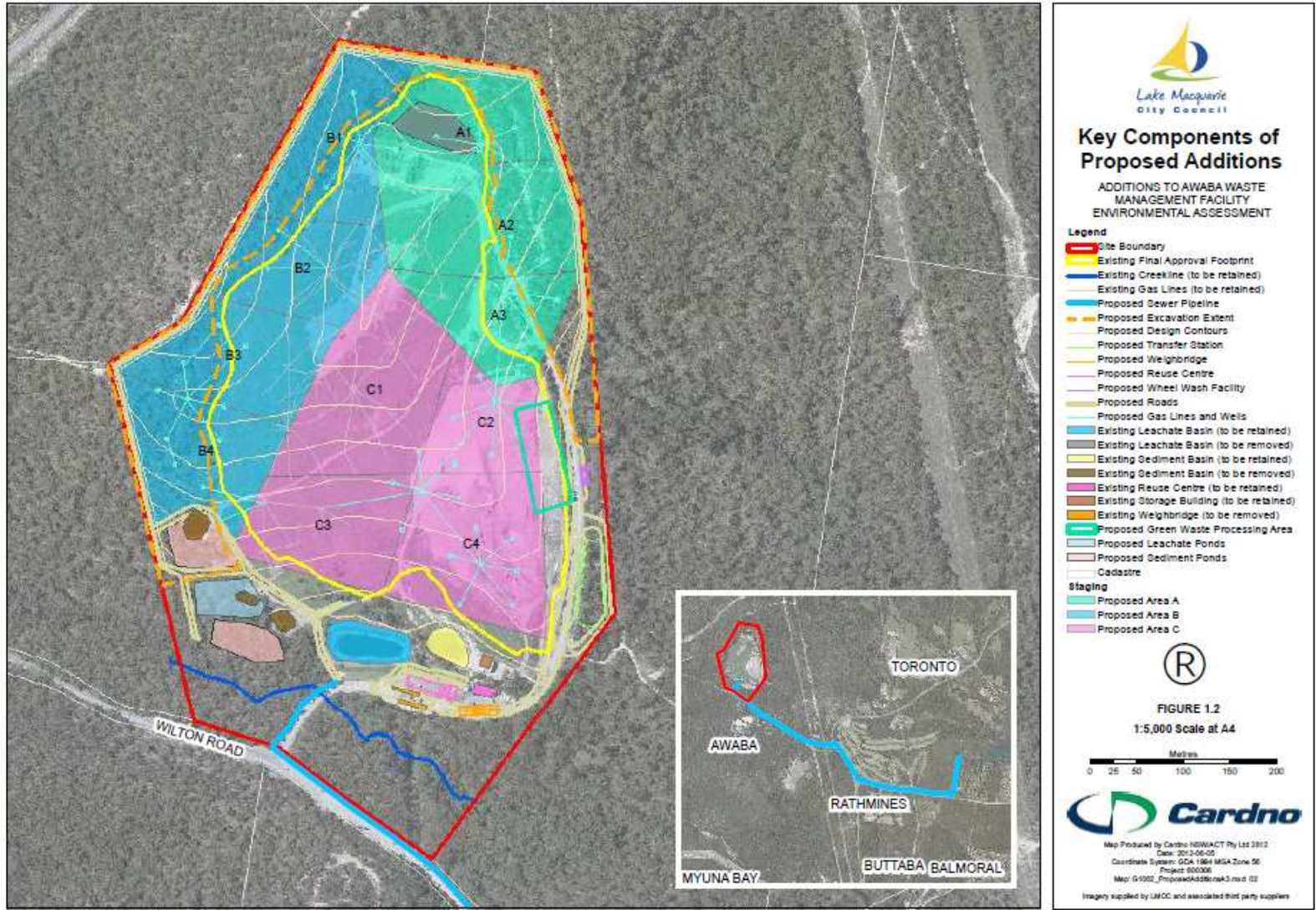
Issue**Commitments**

- LMCC will ensure that construction normally takes place only between the hours of 7am to 6pm Monday to Friday, and 8am to 1pm Saturday, with no construction on Sundays or Public Holidays. LMCC will obtain prior written permission from the EPA for any construction activities which are required outside these times.
 - LMCC will ensure that a Construction Noise Management Plan (CNMP) is prepared and implemented prior to commencement of construction activities. The Noise Assessment will be performed in accordance with the NSW Industrial Noise Policy (EPA 2000) or the relevant policy adopted by the EPA at the time of the Noise Assessment and is expected to include the following:
 - Identification of any noise sensitive locations (these will be mapped or described);
 - The existing background and ambient noise levels determined for each sensitive receiver;
 - Derivation and identification of the project-specific noise levels for each sensitive receiver;
 - The expected noise level and noise character (e.g. tonality, impulsiveness, vibration, etc.) likely to be generated from noise sources during operation. Noise source data will be included for each source in 1/1 or 1/3 octave band frequencies including methods or references used to determine noise source levels;
 - The noise levels likely to be received at the most sensitive receivers, including potential impacts for any identified significant meteorological conditions;
 - The findings of the predictive modelling and direct monitoring will be discussed and, where relevant noise criteria have not been met, additional mitigation measures will be recommended;
 - Details of any proposed mitigation will be provided, including the attenuation that will be achieved and the revised noise impact predictions following mitigation; and
 - After application of all feasible and reasonable mitigation measures, the residual level of noise impact will be quantified by identifying locations of where noise level exceeds the criteria and the extent of exceedance; numbers of people or areas affected; time when criteria will be exceeded; likely impact on activities; change in ambient conditions; and the result of any community consultation or negotiated agreement.
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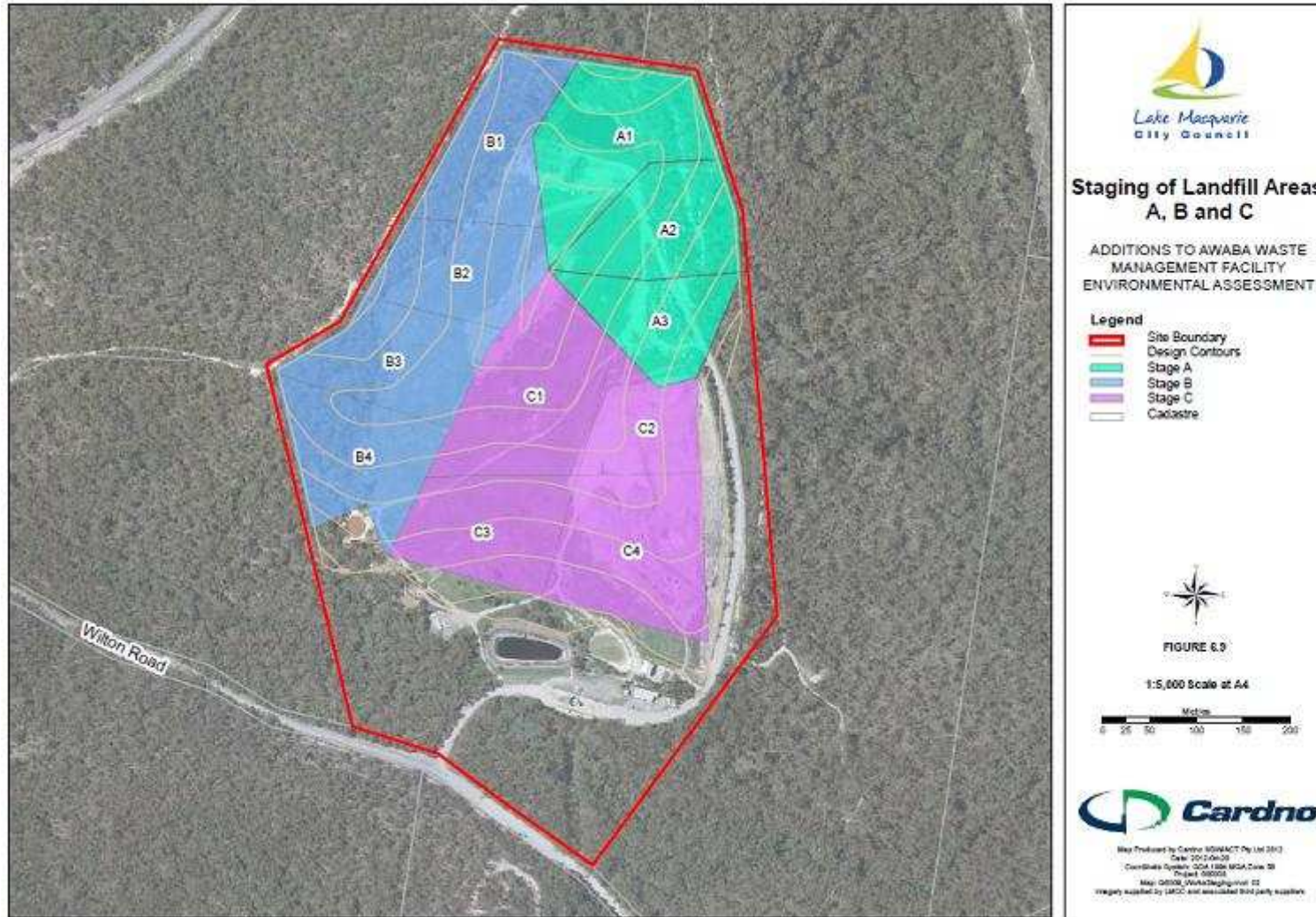
APPENDIX 2 – BIODIVERSITY OFFSET AREA



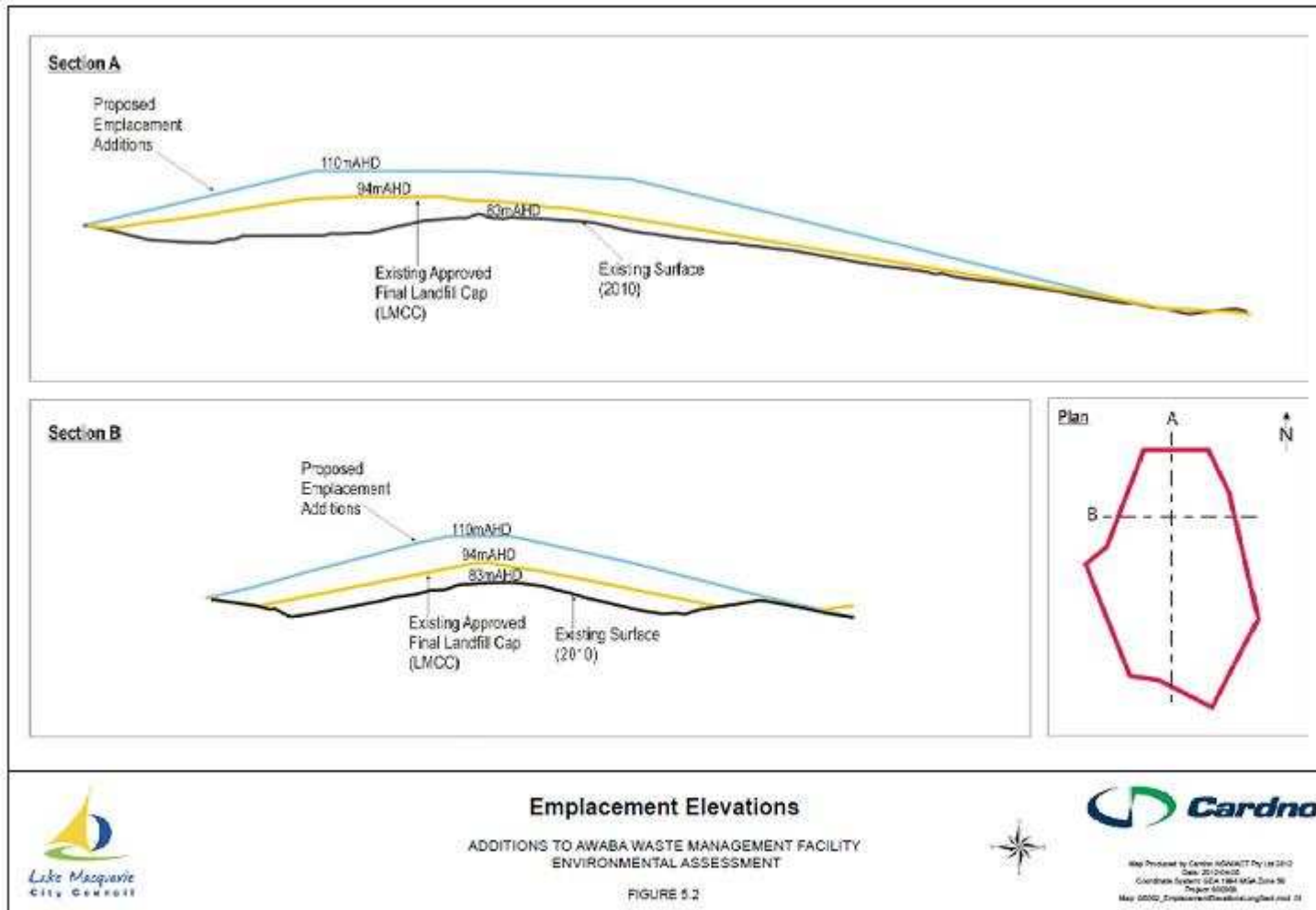
APPENDIX 3 - KEY COMPONENTS OF PROPOSED EXPANSION



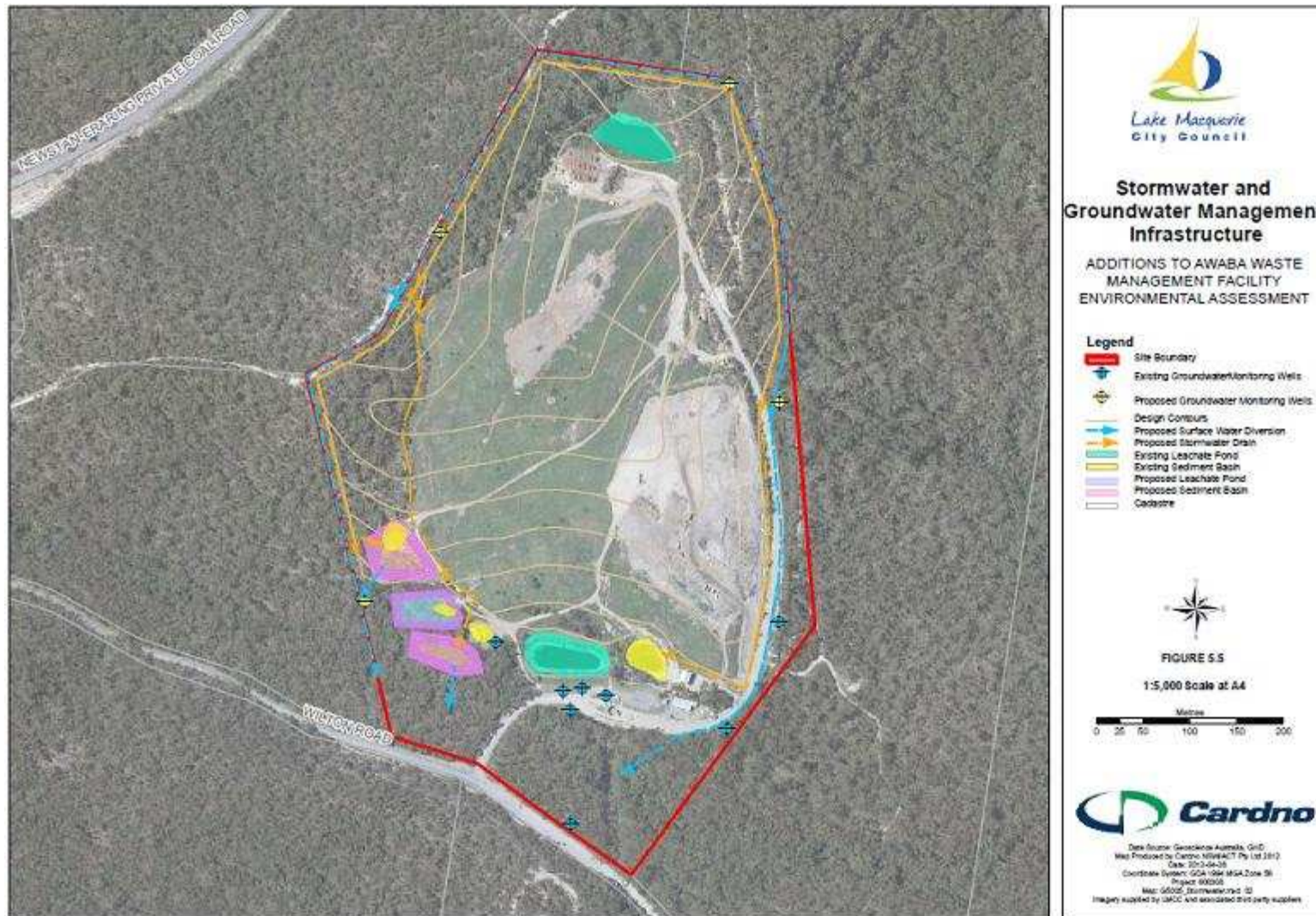
APPENDIX 4 - STAGING PLAN



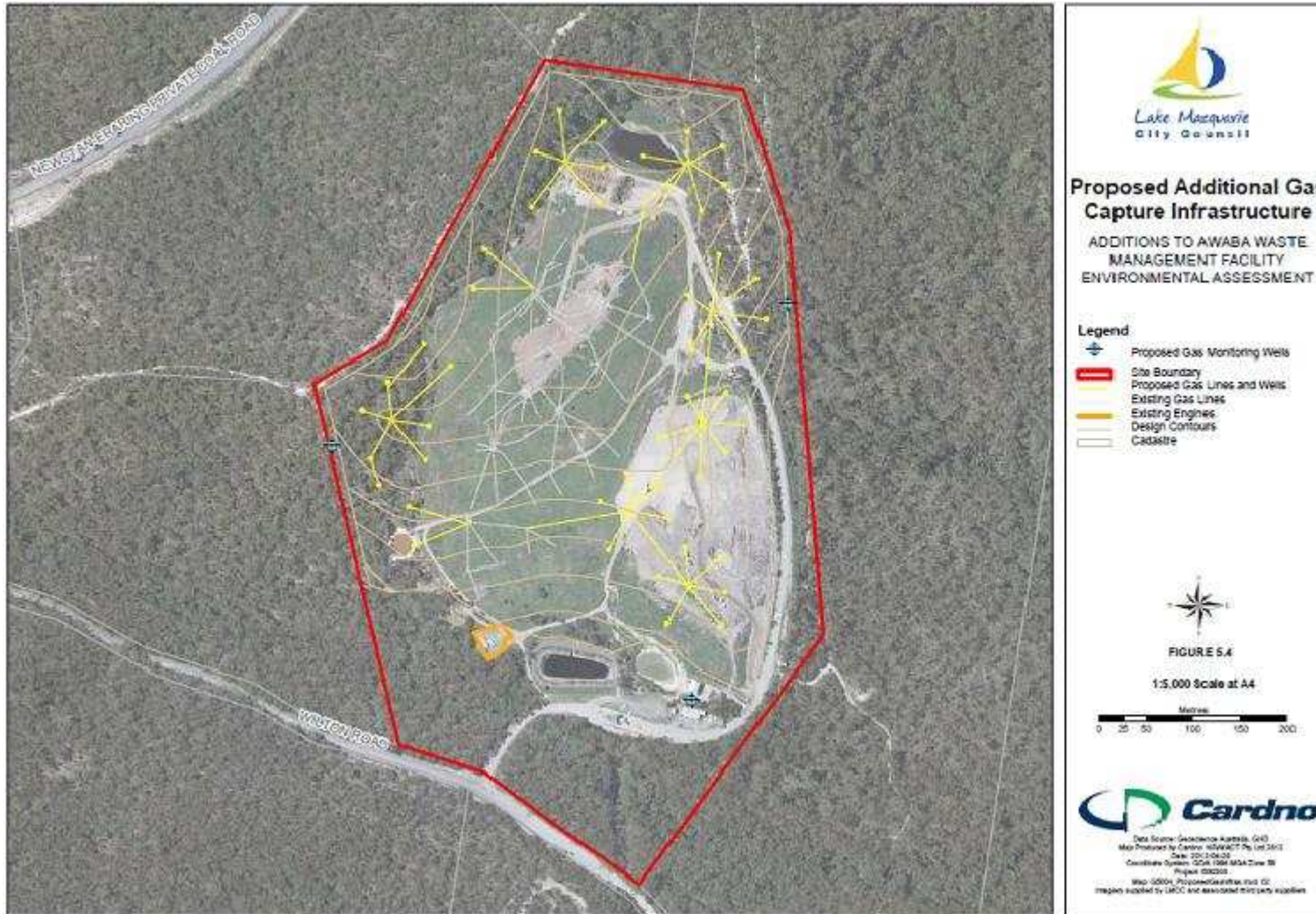
APPENDIX 5 - EMPLACEMENT ELEVATIONS



APPENDIX 6 - STORMWATER AND GROUNDWATER MANAGEMENT INFRASTRUCTURE



APPENDIX 7 - PROPOSED ADDITIONAL GAS CAPTURE INFRASTRUCTURE



Proposed Additional Gas Capture Infrastructure

ADDITIONS TO AWABA WASTE MANAGEMENT FACILITY
ENVIRONMENTAL ASSESSMENT

Legend

-  Proposed Gas Monitoring Wells
-  Site Boundary
-  Proposed Gas Lines and Wells
-  Existing Gas Lines
-  Existing Engines
-  Design Contours
-  Cadastre



FIGURE 5.4

1:5,000 Scale at A4



Data Source: Geoscience Australia, QGIS
Map Produced by Cardno NSWACT Pty Ltd 2013
Date: 22/10/2013
Coordinate System: GDA 1984 MGA Zone 56
Project: 000000
Map: 00001_ProposedGasCapture_EnvAss
Images supplied by URS, and associated third party suppliers.

APPENDIX 8

RMS PRELIMINARY WORKS AUTHORISATION ADVICE TO CONSENT AUTHORITY AND DEVELOPER

Advice to the Consent Authority

- On the Department's determination a copy of the Project Approval should be forwarded to RMS for advice / consideration and action where required.
- Conditions of development consent do not guarantee RMS' consent to the specific road works, traffic control signals and / or other structures or works for which it is responsible. The developer must obtain RMS' authorisation in writing prior to the commencement of any road works and traffic control signals, including traffic management, temporary or permanent road works associated with the proposed development.

Advice to the Developer

- Following development consent, early discussion with RMS' Project Manager is recommended. RMS will initiate the WAD process by sending out a letter and information pack on receipt of the Notice of Determination, including the name and contact details of the Project Manager.
- As the WAD process, including acceptance of design documentation and construction can take considerable time, you should allow sufficient lead time within the project development program to ensure that all documentation and works are completed in advance of occupation. RMS will not consider granting concurrence to occupation until it is satisfied all documentation and works under the WAD have been completed.
- Authorisation to commence construction will only be granted when RMS is satisfied that all requirements under the WAD have been met by the developer, including RMS' fees and charges, an unconditional bank guarantee for the full value of the works, detailed design documentation, environmental assessment, road occupancy license, among other matters. RMS will issue a letter to the developer advising of this authorisation.
- Any property acquisition / dedication required to accommodate the State road works / traffic control signals associated with the proposed development shall be at full cost to the developer, including all legal and survey costs. This land shall be dedicated by the developer as public road reserve in favour of the Council, as the owner.
- Part of the developers' timeline should make provision for RMS to satisfy its obligations under the *Environmental Planning and Assessment Act 1979* (EP&A Act) to assess the environmental impacts of the works within the road reserve. Further investigation and assessment to that undertaken for the development consent may be required to the satisfaction of RMS, under Part 5 of the EP&A Act.
- It is recommended that the developer use design consultants with the experience and knowledge of RMS' design requirements, in particular the Austroads *Guide to Road Design 2009* (with RMS supplements) and relevant Australian Standards.
- A factsheet providing further information on the WAD process can be obtained from the RMS Private Developments Website at:

http://www.rta.nsw.gov.au/roadprojects/community_environment/private_developments.html
- Construction on a State road and / or traffic control signals requires the engagement of an RMS pre-qualified contractor. A list of pre-qualified contractors can be found on the RMS website below.

<http://www.rta.nsw.gov.au/doingbusinesswithus/tenderscontracts/prequalifiedcontractors.html>

APPENDIX 9

TERMS OF RESTRICTIVE COVENANT REFERRED TO IN CONDITION 51A OF SCHEDULE 4

The land to which the restrictive covenant relates is Lot 463 DP 1138964 as shown on the plan annexed marked A subject to final survey.

Restrictive covenant to implement the Biodiversity Offset Strategy in Project Approval 10_0139 for the Awaba Waste Management Facility Expansion Project to be created under s 88D of the *Conveyancing Act 1919* for the benefit of the Minister for Planning and Infrastructure on the terms specified below.

Restrictive Covenant for conservation purposes

1. In this instrument, unless the contrary intention appears:

"animals" includes sheep, goats, horses, deer and cattle.

"clearing" and "cleared" in relation to the land, means the ringbarking, cutting, stripping, cutting down, felling, poisoning, lopping, topping, burning, injuring, removal or destruction in any manner whatsoever of vegetation or any part of vegetation growing on the land.

"development" in relation to land, means:

- a. the erection of a building or structure (other than a fence) on the land; or
- b. the carrying out of a work, in, on, over or under the land.

"land" means the area burdened by this instrument.

"Management Plan" means a plan for the management of the land (by whatever title it is called) approved under the *Environmental Planning and Assessment Act 1979* or any Act consolidating or replacing that Act, or the Project Approval, or as agreed between the registered proprietor and the Minister, and any amendment or replacement of the plan.

"Minister" means the Minister for Planning and Infrastructure and includes any successor in title.

"Project Approval" means the Part 3A Approval granted under s 75J of the *Environmental Planning and Assessment Act 1979* by the Land and Environment Court on 23 October 2013 for the Awaba Waste Management Facility Expansion Project (MP 10_0139), as may be modified from time to time.

"registered proprietor" means the registered proprietor for the time being of the land recorded in the Register under the *Real Property Act 1900*.

"substance" in relation to the land includes timber, turf, stone, clay, shells, earth, sand and gravel.

"vegetation" in relation to the land means plants indigenous to the State of New South Wales including trees, saplings and seedlings of trees, plants, shrubs, ferns, vines, herbs, grasses and other vegetable cover which are endemic to the land.

2. Without the prior written consent of the Minister:

- (a) no person shall reside on the land;
- (b) no animal shall be depastured or driven on the land;
- (c) no development shall be carried out on the land save for that which is listed in clause 3;
- (d) the land shall not be cleared, slashed or cultivated;

- (e) no substance, whether or not in or forming part of the land, shall be interfered with;
- (f) no fire shall be lit on the land;
- (g) no use shall be made of the land or activities on the land which would result in the clearing of vegetation on the land; and
- (h) no use shall be made of the land or activities undertaken on the land which would interfere with or prevent the nature growth or regeneration of vegetation on the land.

3. This covenant does not prevent or restrict in accordance with law:

- (a) the destruction or removal of vegetation declared to be noxious weed under the *Noxious Weeds Act 1993* or an Act consolidating or replacing that Act; or
- (b) the destruction or removal of vegetation which is a prohibited plant within the meaning of the *Drug Misuse and Trafficking Act 1985* or an Act consolidating or replacing that Act; or
- (c) the incidental destruction or removal of vegetation lying adjacent to any noxious weeds or prohibited plants where such incidental destruction or removal occurs unavoidably during the process of destroying or removing those noxious weeds or prohibited plants; or
- (d) the destruction or removal of vegetation within 1 metre of the external boundaries of the land for the purpose of erecting or maintaining a fence along those boundaries; or
- (e) the destruction or removal of vegetation within 0.5 metres of the land for the purpose of enabling a survey to be carried out along those boundaries by a surveyor registered under the *Surveyors Act 2001* or any Act consolidating or replacing that Act; or
- (f) the destruction or removal of vegetation or substance in compliance with the *Rural Fires Act 1997* or any Act consolidating or replacing that Act; or
- (g) the destruction or removal of vegetation or substance within 3 metres of the top bank of any drain on or adjoining the land for the purpose of maintaining the drain; or
- (h) the removal of refuse, garbage, rubbish or any other noisome, noxious, poisonous or unwholesome matter; or
- (i) the taking of reasonable precautions to keep the land free of noxious weeds, rodents or vermin; or
- (j) carrying out environmental protection works, being works associated with the rehabilitation or land towards its natural state or any work to protect land from environmental degradation and includes bush regeneration works, soil conservation and the like; or
- (k) erecting, carrying out or using the land for environmental facilities, being a building or place that provides for the recreational use or scientific study of natural systems, and includes walking tracks, seating, shelters, boardwalks, observation decks, bird hides, or the like, and associated display structures; or
- (l) carrying out any other work permitted by the Project Approval or Management Plan; or
- (m) prospecting, mining operations, mining purposes and related improvements and activities authorised by or under an authority granted or renewed under the *Mining Act 1992* or any Act consolidating or replacing that Act.

4. Nothing in this covenant shall be construed as avoiding the need to obtain any consent under any applicable legislation.
5. The prior written consent of the Minister is taken to have been given under cl 2 if an approval consent or authorisation of any kind is given for the activity by a public authority having power to do so (or a court or other person or body on appeal or review) under the *Environmental Planning and Assessment Act 1979* or any Act replacing it, including the Project Approval.
6. The restriction on use may be released with the consent of the Minister.

Appendix B – Environment Protection Licence

Environment Protection Licence

Licence - 5873

Licence Details

Number:	5873
Anniversary Date:	13-October

Licensee

LAKE MACQUARIE CITY COUNCIL
 PO BOX 1906
 HUNTER REGION MAIL CENTRE NSW 2310

Premises

AWABA WASTE DISPOSAL FACILITY
 367 WILTON ROAD
 AWABA NSW 2283

Scheduled Activity

Composting
 Waste disposal (application to land)

Fee Based Activity

Scale

Composting	> 5000-50000 T annual capacity to receive organics
Waste disposal by application to land	Any capacity

Region

Waste & Resource Recovery
 59-61 Goulburn Street
 SYDNEY NSW 2000
 Phone: (02) 9995 5000
 Fax: (02) 9995 5999
 PO Box A290
 SYDNEY SOUTH NSW 1232

Environment Protection Licence



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Information about this licence

Dictionary

A definition of terms used in the licence can be found in the dictionary at the end of this licence.

Responsibilities of licensee

Separate to the requirements of this licence, general obligations of licensees are set out in the Protection of the Environment Operations Act 1997 ("the Act") and the Regulations made under the Act. These include obligations to:

- ensure persons associated with you comply with this licence, as set out in section 64 of the Act;
- control the pollution of waters and the pollution of air (see for example sections 120 - 132 of the Act);
- report incidents causing or threatening material environmental harm to the environment, as set out in Part 5.7 of the Act.

Variation of licence conditions

The licence holder can apply to vary the conditions of this licence. An application form for this purpose is available from the EPA.

The EPA may also vary the conditions of the licence at any time by written notice without an application being made.

Where a licence has been granted in relation to development which was assessed under the Environmental Planning and Assessment Act 1979 in accordance with the procedures applying to integrated development, the EPA may not impose conditions which are inconsistent with the development consent conditions until the licence is first reviewed under Part 3.6 of the Act.

Duration of licence

This licence will remain in force until the licence is surrendered by the licence holder or until it is suspended or revoked by the EPA or the Minister. A licence may only be surrendered with the written approval of the EPA.

Licence review

The Act requires that the EPA review your licence at least every 5 years after the issue of the licence, as set out in Part 3.6 and Schedule 5 of the Act. You will receive advance notice of the licence review.

Fees and annual return to be sent to the EPA

For each licence fee period you must pay:

- an administrative fee; and
- a load-based fee (if applicable).

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The EPA publication “A Guide to Licensing” contains information about how to calculate your licence fees. The licence requires that an Annual Return, comprising a Statement of Compliance and a summary of any monitoring required by the licence (including the recording of complaints), be submitted to the EPA. The Annual Return must be submitted within 60 days after the end of each reporting period. See condition R1 regarding the Annual Return reporting requirements.

Usually the licence fee period is the same as the reporting period.

Transfer of licence

The licence holder can apply to transfer the licence to another person. An application form for this purpose is available from the EPA.

Public register and access to monitoring data

Part 9.5 of the Act requires the EPA to keep a public register of details and decisions of the EPA in relation to, for example:

- licence applications;
- licence conditions and variations;
- statements of compliance;
- load based licensing information; and
- load reduction agreements.

Under s320 of the Act application can be made to the EPA for access to monitoring data which has been submitted to the EPA by licensees.

This licence is issued to:

LAKE MACQUARIE CITY COUNCIL
PO BOX 1906
HUNTER REGION MAIL CENTRE NSW 2310

subject to the conditions which follow.

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1 Administrative Conditions

A1 What the licence authorises and regulates

A1.1 This licence authorises the carrying out of the scheduled activities listed below at the premises specified in A2. The activities are listed according to their scheduled activity classification, fee-based activity classification and the scale of the operation.

Unless otherwise further restricted by a condition of this licence, the scale at which the activity is carried out must not exceed the maximum scale specified in this condition.

Scheduled Activity	Fee Based Activity	Scale
Composting	Composting	> 5000 - 50000 T annual capacity to receive organics
Waste disposal (application to land)	Waste disposal by application to land	Any capacity

A1.2 This licence authorises the construction, maintenance and operation of a sewer pipeline which transports leachate from the licensed premises to the receiving manhole at Hunter Water Corporation's Rathmines No. 6 Wastewater Pump Station for disposal.

Any unauthorised discharges or leaks of the sewer reticulation pipeline or its infrastructure before disposal at Rathmines No. 6 Wastewater Pump Station is the responsibility of the licensee.

A2 Premises or plant to which this licence applies

A2.1 The licence applies to the following premises:

Premises Details
AWABA WASTE DISPOSAL FACILITY
367 WILTON ROAD
AWABA
NSW 2283
LOT 372 DP 723259
PREMISES BOUNDARY IS MARKED IN SURVEY DATED 7/4/2018 COUNCIL DOCUMENT NUMBER D08804852.

A3 Other activities

A3.1 This licence applies to all other activities carried on at the premises, including:

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Ancillary Activity

Waste storage

A4 Information supplied to the EPA

A4.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence.

In this condition the reference to "the licence application" includes a reference to:

- a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and
- b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.

A4.2 The "Awaba Waste Management Facility Landfill Environment Management Plan" (LEMP) dated April 2000 is not to be taken as part of the documentation in A4.1, other than those parts specifically referenced in this licence.

A4.3 The Awaba Waste Management Facility Expansion Project documents, including:

- a. "Awaba Waste Management Facility Cells 1 and Cells 2 Design Report" prepared by GHD and dated September 2014" (EPA reference DOC14/239898-02);
- b. "Awaba Waste Management Facility Surface Water Management Plan: Revision 1" prepared by GHD and dated July 2014 (DOC14/239898-03);
- c. "Awaba Waste Management Facility Leachate Management Plan: Revision 1" prepared by GHD and dated July 2014 (EPA reference DOC14/239898-07);
- d. "Drawing no. 22-16920-C1601, EPL Requirements Site Detail Plan; Revision B" prepared by GHD and dated 30 April 2015 (EPA reference DOC15/163922);
- e. "Drawing no. 22-16920-C7181 to 22-16920-C7188, Awaba Waste Management Facility Expansion, Leachate Pond 3 (LP3)", prepared by GHD 26 October 2017; and
- f. "Council document no. D08592010; Ground Water Test Locations, Awaba Waste Management Facility", prepared by City Projects - Survey, 27 October 2017.

are not to be taken as part of the documentation in A4.1, other than those parts specifically referenced in this licence.

2 Discharges to Air and Water and Applications to Land

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P1 Location of monitoring/discharge points and areas

P1.1 The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.

P1.2 The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.

Water and land

EPA Identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
1	Groundwater quality monitoring		Groundwater quality monitoring bore located north of landfill Cells 1&2, labelled as Site 1 on Council document number D08738800.
2	Groundwater quality monitoring		Groundwater quality monitoring bore located downstream & south of the leachate dam, labelled as Site 2 on Council document number D08738800.
3	Groundwater quality monitoring		Groundwater quality monitoring bore located downstream & south of the leachate dam, labelled as Site 3 on Council document number D08738800.
4	Groundwater quality monitoring		Groundwater quality monitoring bore located downstream & south of the leachate dam, labelled as Site 4 on Council document D08738800- coordinates to be confirmed after bore relocation.
5	Groundwater quality monitoring		Groundwater quality monitoring bore located downstream & south of the leachate dam, labelled as Site 5 on Council document number D08738800.
6	Wet weather discharge Surface water quality monitoring	Wet weather discharge Surface water quality monitoring	Surface water quality monitoring point located at the overflow point on sediment pond, labelled as Site 6 on Council document number D08738800.
7	Wet weather discharge Surface water quality monitoring	Wet weather discharge Surface water quality monitoring	Surface water quality monitoring point located at overflow point on sediment pond, labelled as Site 7 on Council document number D08738800.

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8	Surface water quality monitoring	Surface water quality monitoring point located in a natural watercourse downstream south east of the landfill weighbridge, labelled as Site 8 on Council document number D08738800.
9	Surface water quality monitoring	Surface water quality monitoring point located in a natural watercourse downstream south of sediment pond, and labelled as Site 9 on Council document number D08738800.
10	Leachate quality monitoring	Leachate quality monitoring point located at leachate pond 1, labelled as Site 10 on Council document number D08738800.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

L2.1 For each monitoring/discharge point or utilisation area specified in the table\&s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.

L2.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.

L2.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\&s.

L2.4 Water and/or Land Concentration Limits

POINT 6,7

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit

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Total suspended solids	milligrams per litre	50
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- L2.5 Exceedances of the concentration limits in condition L2.4 are permitted at Monitoring Points 6 and 7 for the duration of the overflow whenever a wet weather overflow is occurring due to stormwater events greater than or equal to a 90th percentile 5 day rainfall duration.

L3 Waste

- L3.1 The licensee must not cause, permit or allow any waste to be received at the premises, except the wastes expressly referred to in the column titled "Waste" and meeting the definition, if any, in the column titled "Description" in the table below.

Any waste received at the premises must only be used for the activities referred to in relation to that waste in the column titled "Activity" in the table below.

Any waste received at the premises is subject to those limits or conditions, if any, referred to in relation to that waste contained in the column titled "Other Limits" in the table below.

This condition does not limit any other conditions in this licence.

Code	Waste	Description	Activity	Other Limits
NA	Waste tyres	As defined in Schedule 1 of the POEO Act, as in force from time to time	Waste disposal (application to land)	Maximum of 150,000 tonnes in total of all waste types may be disposed per annum
NA	Asbestos waste	As defined in Schedule 1 of the POEO Act, as in force from time to time.	Waste disposal (application to land)	Maximum of 150,000 tonnes in total of all waste types may be disposed per annum
NA	General solid waste (non-putrescible)	As defined in Schedule 1 of the POEO Act, as in force from time to time	Waste disposal (application to land) Composting	Maximum of 150,000 tonnes in total of all waste types may be disposed per annum
NA	General solid waste (putrescible)	As defined in Schedule 1 of the POEO Act, as in force from time to time	Waste disposal (application to land)	Maximum of 150,000 tonnes in total of all waste types may be disposed per annum
NA	Waste	Any waste received on site that is below licensing thresholds in Schedule 1 of the POEO Act, as in force	Waste storage	NA

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from time to time

- L3.2 The licensee must not dispose of any tyre at the premises unless:
- the tyre has a diameter of 1.2 metres or more; or
 - the tyre has been shredded or had its walls removed as defined in condition L3.3 (a); or
 - the tyre was delivered to the premises as part of a domestic load as defined by condition L3.3 (b).
- L3.3 In condition L3.2:
- tyres are taken to be shredded only if the tyres are in pieces measuring no more than 250mm in any direction; and
 - domestic loads means a load containing no more than 5 tyres having a diameter of less than 1.2 metres.
- L3.4 Tyres stockpiled on the premises must:
- not exceed fifty (50) tonnes of tyres at any one time; and
 - be located in a clearly defined area away from the tipping face; and
 - be managed to control vermin; and
 - be managed to prevent any tyres from catching fire.

L4 Noise limits

- L4.1 Noise from the premises must not exceed:
- an LA_{10} (15 minute) noise emission criterion of 45 dB(A) (7am to 6pm) Monday to Sunday; and
 - an LA_{10} (15 minute) noise emission criterion of 45 dB(A) during the evening (6pm to 10pm) Monday to Friday; and
 - at all other times, an LA_{10} (15 minutes) noise emission criterion of 35 dB(A), except as expressly provided by this licence.
- L4.2 Noise from the premises is to be measured at any point within six metres of the nearest effected residential residence or other noise sensitive areas in the vicinity to determine compliance with this condition.

L5 Potentially offensive odour

- L5.1 No condition of this licence identifies a potentially offensive odour for the purposes of section 129 of the Protection of the Environment Operations Act 1997.

Note: Section 129 of the Protection of the Environment Operations Act 1997, provides that the licensee must not cause or permit the emission of any offensive odour from the premises but provides a defence if the emission is identified in the relevant environment protection licence as a potentially offensive odour and the odour was emitted in accordance with the conditions of a licence directed at minimising odour.

4 Operating Conditions

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O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.

This includes:

- a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and
- b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

O2 Maintenance of plant and equipment

O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity:

- a) must be maintained in a proper and efficient condition; and
- b) must be operated in a proper and efficient manner.

O3 Dust

O3.1 All operations and activities occurring at the premises must be carried out in a manner that will minimise the emission of dust from the premises.

O4 Emergency response

O4.1 The licensee must extinguish fires at the premises as soon as possible.

O4.2 The licensee must have adequate fire prevention measures in place, and ensure that facility personnel are able to access fire-fighting equipment and manage fire outbreaks at any part of the premises.

O5 Processes and management

O5.1 The sediment basins and leachate dams must be maintained to ensure that their design capacity is available for the storage of stormwater/leachate.

O5.2 The perimeter of the areas where waste has been 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 storm event.

O5.3 The drainage from all areas at the premises which will liberate suspended solids when stormwater runs over these areas must be diverted into the sediment ponds as indicated in Drawing 22-16920-C1601 of the Design Report and Figure 3.1 in the Surface Water Management Plan.

O5.4 The licensee must ensure that any waste for storage or transfer or recovery by way of separating at the premises is assessed and classified in accordance with the NSW EPA Waste Classification Guidelines as in force from time to time.

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O5.5 The licensee must ensure that each waste for recovery/recycling is stockpiled separately.

O6 Waste management

O6.1 The last licensee must prepare and submit to the EPA within three months prior to the last load of waste being landfilled a closure plan in accordance with section 76 of the Protection of the Environment Operations Act 1997.

O6.2 Surface drainage must be diverted away from any area where waste is being or has been landfilled.

O6.3 A leachate barrier system as detailed in Appendix D of the Leachate Management Plan must be installed at the premises for Cells 1 and 2.

O6.4 Leachate impounded in the surface leachate storage ponds and leachate collected by subsurface leachate collection systems may be irrigated on the following utilisation area(s):

a. any landfilled area within the facility.

O6.5 There must be no incineration or burning of any waste at the premises.

O6.6 The licensee must have in place and implement procedures to identify and prevent the disposal of any waste not permitted by this licence to be disposed of at the premises.

O6.7 The licensee must ensure that a compaction of 0.75 (with the goal of achieving 0.85) tonnes per cubic metre is achieved for each 1 tonnes of waste disposed of at the premises.

O6.8 The licensee must ensure that the achieved compaction rate of landfilled waste (excluding cover material) is stated in the annual report for the waste premises submitted to the EPA.

O6.9 The licensee must manage the disposal of waste at the premises in accordance with the progressive filling plan identified in Appendix 11 of the LEMP.

O6.10 The licensee must ensure that the landfill cells are capped progressively during operations and specifically at times when the level of waste reaches final heights within each landfill cell.

O6.11 Final capping must comprise five layers in the order of installation: a seal bearing surface, a gas drainage layer, a sealing layer, an infiltration layer and the revegetation layer as specified in Benchmark Technique No. 28.

O6.12 Cover material must be:

a) Daily Cover

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 and must be either:

i) virgin excavated natural material, or

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- ii) a DECCW approved synthetic cover, or
- iii) a biodegradable plastic sheeting.

b) Intermediate Cover

Virgin excavated natural material must be applied to a minimum depth of 25 centimetres over all surfaces of the land filled waste at the premises which are exposed for more than 90 days.

O6.13 The licensee must minimise the tracking of waste and mud by vehicles in accordance with Section 6 - Cleaning of Vehicles (BT 32) of the LEMP.

O6.14 Chemicals, fuels, oils and liquid waste must be;

- a) stored in an impervious bund able to contain at all times 110% of the largest container stored within that bund; and
- b) stored in a manner which prevents rain or water ingress into those containers; and
- c) must be clearly labelled to identify their contents.

O7 Other operating conditions

- O7.1 The licensee must only dispose of waste at the premises in the approved landfill cell unless the EPA amends this licence to expressly permit waste disposal elsewhere at the premises. The approved landfill cell is indicated in Figures 9 and 10 of the LEMP.
- O7.2 The licensee must obtain approval from the EPA prior to constructing any new landfill cells at the premises that are not contained within the licence.
- O7.3 The licensee must carry out the construction of Cells 1 and 2 of the landfill extension in accordance with the documents, plans and drawings associated with the Design Report.
- O7.4 Prior to disposing any waste in Cell 1 or 2, the licensee must submit to the EPA a report prepared in accordance with the QA/QC program, demonstrating that the cell constructed meets its design specifications.
- O7.5 The Licensee is permitted to construct a temporary leachate dam generally in accordance with the drawing numbers 22-16920-C7180 to 22-16920-C7188, Awaba Waste Management Facility Expansion, Leachate Pond 3 (LP3)", prepared by GHD 26 October 2017.
- O7.6 During construction of temporary Leachate Pond 3 (LP3) the Licensee must generally implement the construction quality assurance (CQA) measures: "Geosynthetic materials: a) Manufacturing quality control, (b) Independent conformance testing, and (c) Installation procedures " contained within Section 11.1 of the EPA's Environmental Guidelines Solid Waste Landfills, Second Edition, 2016.
- O7.7 Within three months of completion of construction of Leachate Pond 3 (LP3) and prior to using LP3 to store leachate, the Licensee must provide the EPA with a CQA report detailing the construction of LP3, as required by the condition above.

Environment Protection Licence

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5 Monitoring and Recording Conditions

M1 Monitoring records

M1.1 The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.

M1.2 All records required to be kept by this licence must be:

- in a legible form, or in a form that can readily be reduced to a legible form;
- kept for at least 4 years after the monitoring or event to which they relate took place; and
- produced in a legible form to any authorised officer of the EPA who asks to see them.

M1.3 The following records must be kept in respect of any samples required to be collected for the purposes of this licence:

- the date(s) on which the sample was taken;
- the time(s) at which the sample was collected;
- the point at which the sample was taken; and
- the name of the person who collected the sample.

M2 Requirement to monitor concentration of pollutants discharged

M2.1 For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:

M2.2 Water and/ or Land Monitoring Requirements

POINT 1,2,3,4,5

Pollutant	Units of measure	Frequency	Sampling Method
Alkalinity (as calcium carbonate)	milligrams of calcium carbonate per litre	Quarterly	Grab sample
Aluminium	milligrams per litre	Yearly	Grab sample
Ammonia	milligrams per litre	Quarterly	Grab sample
Arsenic	milligrams per litre	Yearly	Grab sample
Barium	milligrams per litre	Yearly	Grab sample
Benzene	milligrams per litre	Yearly	Grab sample
BOD	milligrams per litre	Yearly	Grab sample
Cadmium	milligrams per litre	Yearly	Grab sample
Calcium	milligrams per litre	Quarterly	Grab sample
Chloride	milligrams per litre	Quarterly	Grab sample
Chlorinated volatile compounds	milligrams per litre	Yearly	Grab sample
Chromium (hexavalent)	milligrams per litre	Yearly	Grab sample

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Chromium (total)	milligrams per litre	Yearly	Grab sample
Cobalt	milligrams per litre	Yearly	Grab sample
Conductivity	microsiemens per centimetre	Quarterly	Grab sample
Copper	milligrams per litre	Yearly	Grab sample
Ethyl benzene	milligrams per litre	Yearly	Grab sample
Fluoride	milligrams per litre	Quarterly	Grab sample
Iron	milligrams per litre	Quarterly	Grab sample
Lead	milligrams per litre	Yearly	Grab sample
Magnesium	milligrams per litre	Quarterly	Grab sample
Manganese	milligrams per litre	Quarterly	Grab sample
Mercury	milligrams per litre	Yearly	Grab sample
Nitrate	milligrams per litre	Quarterly	Grab sample
Organochlorine pesticides	milligrams per litre	Quarterly	Grab sample
Organophosphate pesticides	milligrams per litre	Yearly	Grab sample
PCBs	milligrams per litre	Yearly	Grab sample
pH	pH	Quarterly	Grab sample
Phosphate	milligrams per litre	Yearly	Grab sample
Polycyclic aromatic hydrocarbons	milligrams per litre	Yearly	Grab sample
Potassium	milligrams per litre	Quarterly	Grab sample
Sodium	milligrams per litre	Quarterly	Grab sample
Sulfate	milligrams per litre	Quarterly	Grab sample
Toluene	milligrams per litre	Yearly	Grab sample
Total dissolved solids	milligrams per litre	Yearly	Grab sample
Total organic carbon	milligrams per litre	Quarterly	Grab sample
Total petroleum hydrocarbons	milligrams per litre	Yearly	Grab sample
Total Phenolics	milligrams per litre	Quarterly	Grab sample
Zinc	milligrams per litre	Yearly	Grab sample

POINT 6,7,8,9

Pollutant	Units of measure	Frequency	Sampling Method
Alkalinity (as calcium carbonate)	milligrams of calcium carbonate per litre	Quarterly	Grab sample
Aluminium	milligrams per litre	Yearly	Grab sample
Ammonia	milligrams per litre	Quarterly	Grab sample
Arsenic	milligrams per litre	Yearly	Grab sample
Barium	milligrams per litre	Yearly	Grab sample
Benzene	milligrams per litre	Yearly	Grab sample
BOD	milligrams per litre	Yearly	Grab sample
Cadmium	milligrams per litre	Yearly	Grab sample
Calcium	milligrams per litre	Quarterly	Grab sample
Chloride	milligrams per litre	Quarterly	Grab sample

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Chlorinated volatile compounds	milligrams per litre	Yearly	Grab sample
Chromium (hexavalent)	milligrams per litre	Yearly	Grab sample
Chromium (total)	milligrams per litre	Yearly	Grab sample
Cobalt	milligrams per litre	Yearly	Grab sample
Conductivity	microsiemens per centimetre	Quarterly	Grab sample
Copper	milligrams per litre	Yearly	Grab sample
Ethyl benzene	milligrams per litre	Yearly	Grab sample
Fluoride	milligrams per litre	Quarterly	Grab sample
Iron	milligrams per litre	Quarterly	Grab sample
Lead	milligrams per litre	Yearly	Grab sample
Magnesium	milligrams per litre	Quarterly	Grab sample
Manganese	milligrams per litre	Quarterly	Grab sample
Mercury	milligrams per litre	Yearly	Grab sample
Nitrate	milligrams per litre	Quarterly	Grab sample
Organochlorine pesticides	milligrams per litre	Quarterly	Grab sample
Organophosphate pesticides	milligrams per litre	Yearly	Grab sample
PCBs	milligrams per litre	Yearly	Grab sample
pH	pH	Quarterly	Grab sample
Phosphate	milligrams per litre	Yearly	Grab sample
Polycyclic aromatic hydrocarbons	milligrams per litre	Yearly	Grab sample
Potassium	milligrams per litre	Quarterly	Grab sample
Sodium	milligrams per litre	Quarterly	Grab sample
Sulfate	milligrams per litre	Quarterly	Grab sample
Toluene	milligrams per litre	Yearly	Grab sample
Total dissolved solids	milligrams per litre	Yearly	Grab sample
Total organic carbon	milligrams per litre	Quarterly	Grab sample
Total petroleum hydrocarbons	milligrams per litre	Yearly	Grab sample
Total Phenolics	milligrams per litre	Quarterly	Grab sample
Total suspended solids	milligrams per litre	Quarterly	Grab sample
Zinc	milligrams per litre	Yearly	Grab sample

POINT 10

Pollutant	Units of measure	Frequency	Sampling Method
Alkalinity (as calcium carbonate)	milligrams per litre	Quarterly	Grab sample
Ammonia	milligrams per litre	Quarterly	Grab sample
BOD	milligrams per litre	Quarterly	Grab sample
Calcium	milligrams per litre	Quarterly	Grab sample

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Chloride	milligrams per litre	Quarterly	Grab sample
Fluoride	milligrams per litre	Quarterly	Grab sample
Iron	milligrams per litre	Quarterly	Grab sample
Magnesium	milligrams per litre	Quarterly	Grab sample
Manganese	milligrams per litre	Quarterly	Grab sample
Nitrate	milligrams per litre	Quarterly	Grab sample
Organochlorine pesticides	milligrams per litre	Quarterly	Grab sample
pH	pH	Quarterly	Grab sample
Potassium	milligrams per litre	Quarterly	Grab sample
Sodium	milligrams per litre	Quarterly	Grab sample
Sulfate	milligrams per litre	Quarterly	Grab sample
Total organic carbon	milligrams per litre	Quarterly	Grab sample
Total petroleum hydrocarbons	milligrams per litre	Quarterly	Grab sample
Total Phenolics	milligrams per litre	Quarterly	Grab sample
Total suspended solids	milligrams per litre	Quarterly	Grab sample

M3 Testing methods - concentration limits

M3.1 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

M4 Environmental monitoring

M4.1 The following environmental monitoring must be undertaken at the premise:

- Inside buildings at the premise, Methane must be measured as a %(v/v) on a monthly basis using an In situ sampling method;
- On the surface of the landfill, Methane must be measured as a %(v/v) on a monthly basis using an In situ sampling method.

For the purpose of this condition in situ means sampling in accordance with the methodology specified in Benchmark 17 of the EPA's publication titled "Environmental Guidelines: Solid Waste Landfills".

The results of all environmental monitoring undertaken in accordance with this condition must be attached and forwarded to the EPA with the annual return required by condition R1.

M5 Recording of pollution complaints

M5.1 The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.

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M5.2 The record must include details of the following:

- a) the date and time of the complaint;
- b) the method by which the complaint was made;
- c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
- d) the nature of the complaint;
- e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and
- f) if no action was taken by the licensee, the reasons why no action was taken.

M5.3 The record of a complaint must be kept for at least 4 years after the complaint was made.

M5.4 The record must be produced to any authorised officer of the EPA who asks to see them.

M6 Telephone complaints line

M6.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.

M6.2 The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.

M6.3 The preceding two conditions do not apply until 3 months after: the date of the issue of this licence.

M7 Other monitoring and recording conditions

M7.1 The licensee must monitor the remaining disposal capacity (in cubic metres) of the landfill.

6 Reporting Conditions

R1 Annual return documents

R1.1 The licensee must complete and supply to the EPA an Annual Return in the approved form comprising:

1. a Statement of Compliance,
2. a Monitoring and Complaints Summary,
3. a Statement of Compliance - Licence Conditions,
4. a Statement of Compliance - Load based Fee,
5. a Statement of Compliance - Requirement to Prepare Pollution Incident Response Management Plan,
6. a Statement of Compliance - Requirement to Publish Pollution Monitoring Data; and
7. a Statement of Compliance - Environmental Management Systems and Practices.

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At the end of each reporting period, the EPA will provide to the licensee a copy of the form that must be completed and returned to the EPA.

- R1.2 An Annual Return must be prepared in respect of each reporting period, except as provided below.
- R1.3 Where this licence is transferred from the licensee to a new licensee:
- a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and
 - b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.
- R1.4 Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on:
- a) in relation to the surrender of a licence - the date when notice in writing of approval of the surrender is given; or
 - b) in relation to the revocation of the licence - the date from which notice revoking the licence operates.
- R1.5 The Annual Return for the reporting period must be supplied to the EPA via eConnect *EPA* or by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').
- R1.6 The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.
- R1.7 Within the Annual Return, the Statements of Compliance must be certified and the Monitoring and Complaints Summary must be signed by:
- a) the licence holder; or
 - b) by a person approved in writing by the EPA to sign on behalf of the licence holder.

Note: The term "reporting period" is defined in the dictionary at the end of this licence. Do not complete the Annual Return until after the end of the reporting period.

Note: An application to transfer a licence must be made in the approved form for this purpose.

R2 Notification of environmental harm

- R2.1 Notifications must be made by telephoning the Environment Line service on 131 555.
- R2.2 The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.
- R2.3 Whenever leachate is discharged to surface waters from the premises the licensee must notify the event to the EPA in accordance with condition R2.1.
- R2.4 The licensee must provide written details of any leachate discharge(s) to the EPA within 7 days of the

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date on which the incident occurred in accordance with R2.5.

- R2.5 The written details referred to in the above condition must be provided as a report. The report must include the following information:
- the volume of the leachate discharged and over what time period the discharge occurred;
 - the date and time of the commencement of the overflow;
 - the weather conditions at the time of the discharge, specifying the amount of rainfall on a daily basis that had fallen:
 - on the day(s) of the discharge; and
 - for the one week period prior to the discharge.
 - the most recent monitoring results of the chemical composition of the leachate;
 - an explanation as to why the discharge occurred;
 - the location(s) of the discharge;
 - a plan of action to prevent a similar discharge in the future; and
 - was the discharge permitted by this licence.
- R2.6 The licensee must notify the EPA within 24 hours in accordance with condition R2.1 if subsurface monitoring detects methane above 1.25% (v/v), and increase the frequency of monitoring to daily, until the EPA determines otherwise.

Note: The licensee or its employees must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the Act.

R3 Written report

- R3.1 Where an authorised officer of the EPA suspects on reasonable grounds that:
- where this licence applies to premises, an event has occurred at the premises; or
 - where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying out of the activities authorised by this licence,
- and the event has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies), the authorised officer may request a written report of the event.
- R3.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.
- R3.3 The request may require a report which includes any or all of the following information:
- the cause, time and duration of the event;
 - the type, volume and concentration of every pollutant discharged as a result of the event;
 - the name, address and business hours telephone number of employees or agents of the licensee, or a specified class of them, who witnessed the event;
 - the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
 - action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
 - details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and

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g) any other relevant matters.

R3.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.

R4 Other reporting conditions

R4.1 The licensee must maintain a daily log and record the following data of fires at the site:

- a) Time and date when the fire was deliberately started or reported.
- b) Whether the fire was authorised by the licensee, and, if not, the circumstances which ignited the fire.
- c) The time and date that the fire ceased and whether it burnt out or was extinguished.
- d) The location of fire (eg. clean timber stockpile, putrescible garbage cell, etc).
- e) Prevailing weather conditions.
- f) Observations made in regard to smoke direction and dispersion.
- g) The amount of waste that was combusted by the fire.
- h) Action taken to extinguish the fire.

R4.2 The licensee or its employees or agents must notify the EPA in accordance with conditions R2.1 and R2.2 of all fires at the premises as soon as practical after becoming aware of the incident.

7 General Conditions

G1 Copy of licence kept at the premises or plant

G1.1 A copy of this licence must be kept at the premises to which the licence applies.

G1.2 The licence must be produced to any authorised officer of the EPA who asks to see it.

G1.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.

8 Special Conditions

E1 Exhuming Waste

E1.1 The Licensee is permitted to exhume waste for the construction of temporary leachate pond 3 on the southern batter of the landfill.

E1.2 No exhumed waste is to leave the premises

E1.3 Exhumed waste for the preparation of temporary leachate pond 3 is permitted to be reapplied to land for preparation of "piggy back" cells 1 and 2.

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E1.4 All exhumed and exposed waste as a result of exhuming, is to be covered in accordance with condition O6.12.

E1.5 The Licensee must notify the EPA of the commencement, duration and completion of the works to exhume waste.

E2 Temporary Extension to Construction Hours

E2.1 Hours of construction are extended in accordance with Appendix A of the Department of Planning and Environment's *Approval of Revised Construction Noise and Vibration Management Plan & Temporary Extension to Construction Hours* for the Awaba Waste Management Facility Extension Project (MP10_0139) dated 5 October 2018.

E2.2 From 2 December 2018 to 29 March 2019, inclusive, construction hours of the licence are extended between 7.00 p.m. and 5.00 a.m. on dates specified in Appendix A of the Department of Planning and Environment's approval (5 October 2018).

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Dictionary

General Dictionary

3DGM [in relation to a concentration limit]	Means the three day geometric mean, which is calculated by multiplying the results of the analysis of three samples collected on consecutive days and then taking the cubed root of that amount. Where one or more of the samples is zero or below the detection limit for the analysis, then 1 or the detection limit respectively should be used in place of those samples
Act	Means the Protection of the Environment Operations Act 1997
activity	Means a scheduled or non-scheduled activity within the meaning of the Protection of the Environment Operations Act 1997
actual load	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
AM	Together with a number, means an ambient air monitoring method of that number prescribed by the <i>Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales</i> .
AMG	Australian Map Grid
anniversary date	The anniversary date is the anniversary each year of the date of issue of the licence. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
annual return	Is defined in R1.1
Approved Methods Publication	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
assessable pollutants	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
BOD	Means biochemical oxygen demand
CEM	Together with a number, means a continuous emission monitoring method of that number prescribed by the <i>Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales</i> .
COD	Means chemical oxygen demand
composite sample	Unless otherwise specifically approved in writing by the EPA, a sample consisting of 24 individual samples collected at hourly intervals and each having an equivalent volume.
cond.	Means conductivity
environment	Has the same meaning as in the Protection of the Environment Operations Act 1997
environment protection legislation	Has the same meaning as in the Protection of the Environment Administration Act 1991
EPA	Means Environment Protection Authority of New South Wales.
fee-based activity classification	Means the numbered short descriptions in Schedule 1 of the Protection of the Environment Operations (General) Regulation 2009.
general solid waste (non-putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997

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flow weighted composite sample	Means a sample whose composites are sized in proportion to the flow at each composites time of collection.
general solid waste (putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
grab sample	Means a single sample taken at a point at a single time
hazardous waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
licensee	Means the licence holder described at the front of this licence
load calculation protocol	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
local authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
material harm	Has the same meaning as in section 147 Protection of the Environment Operations Act 1997
MBAS	Means methylene blue active substances
Minister	Means the Minister administering the Protection of the Environment Operations Act 1997
mobile plant	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
motor vehicle	Has the same meaning as in the Protection of the Environment Operations Act 1997
O&G	Means oil and grease
percentile [in relation to a concentration limit of a sample]	Means that percentage [eg.50%] of the number of samples taken that must meet the concentration limit specified in the licence for that pollutant over a specified period of time. In this licence, the specified period of time is the Reporting Period unless otherwise stated in this licence.
plant	Includes all plant within the meaning of the Protection of the Environment Operations Act 1997 as well as motor vehicles.
pollution of waters [or water pollution]	Has the same meaning as in the Protection of the Environment Operations Act 1997
premises	Means the premises described in condition A2.1
public authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
regional office	Means the relevant EPA office referred to in the Contacting the EPA document accompanying this licence
reporting period	For the purposes of this licence, the reporting period means the period of 12 months after the issue of the licence, and each subsequent period of 12 months. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
restricted solid waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
scheduled activity	Means an activity listed in Schedule 1 of the Protection of the Environment Operations Act 1997
special waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
TM	Together with a number, means a test method of that number prescribed by the <i>Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales</i> .

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TSP	Means total suspended particles
TSS	Means total suspended solids
Type 1 substance	Means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements
Type 2 substance	Means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements
utilisation area	Means any area shown as a utilisation area on a map submitted with the application for this licence
waste	Has the same meaning as in the Protection of the Environment Operations Act 1997
waste type	Means liquid, restricted solid waste, general solid waste (putrescible), general solid waste (non - putrescible), special waste or hazardous waste

Mr Grahame Clarke

Environment Protection Authority

(By Delegation)

Date of this edition: 02-August-2000

Environment Protection Licence



Licence - 5873

End Notes

- 1 Licence varied by notice 1011060, issued on 30-Oct-2001, which came into effect on 24-Nov-2001.
- 2 Licence varied by notice 1016496, issued on 29-Jul-2002, which came into effect on 23-Aug-2002.
- 3 Licence varied by notice 1022783, issued on 09-Feb-2003, which came into effect on 06-Mar-2003.
- 4 Licence varied by notice 1034492, issued on 22-Mar-2004, which came into effect on 16-Apr-2004.
- 5 Licence varied by notice 1042851, issued on 20-Dec-2004, which came into effect on 14-Jan-2005.
- 6 Licence varied by correction to DEC Region, issued on 18-Jan-2007, which came into effect on 18-Jan-2007.
- 7 Licence varied by notice 1074466, issued on 22-Aug-2007, which came into effect on 22-Aug-2007.
- 8 Condition A1.3 Not applicable varied by notice issued on <issue date> which came into effect on <effective date>
- 9 Licence varied by notice 1093624, issued on 14-Nov-2008, which came into effect on 14-Nov-2008.
- 10 Licence varied by notice 1101492, issued on 04-Jun-2009, which came into effect on 04-Jun-2009.
- 11 Licence varied by Correction to EPA Region data record., issued on 28-Jun-2010, which came into effect on 28-Jun-2010.
- 12 Licence varied by notice 1124008, issued on 25-Jan-2011, which came into effect on 25-Jan-2011.
- 13 Licence varied by notice 1519962 issued on 24-Feb-2014
- 14 Licence varied by notice 1530238 issued on 23-Jun-2015
- 15 Licence varied by notice 1558992 issued on 28-Nov-2017
- 16 Licence varied by notice 1563511 issued on 20-Jun-2018
- 17 Licence varied by notice 1571504 issued on 24-Oct-2018

Appendix C – Waste Screening, Acceptance and Resource Monitoring Program


 <p>Lake Macquarie City Council</p>	<p>Procedure</p> <p>AWMF - Waste Screening, Acceptance and Resource Monitoring Programme</p>	
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Procedure

1 Introduction

1.1 Programme Objective

This Programme represents an integrated waste screening, acceptance and resource recovery program for the Awaba Waste Management Facility (AWMF) located at Wilton Road, Awaba.

The AWMF is subject to an Environmental Protection Licence (EPL 5873) issued by the NSW Environmental Protection Authority which stipulates the type of waste that can be deposited at the facility.

The objective of the programme is to ensure waste entering the centre is

- classified to ensure appropriate disposal at the facility
- diverted from disposal at the facility when appropriate
- presented for disposal in an acceptable manner
- reclaimed or recycled where practical

1.2 Regulatory Framework

The Programme will guide the operation of the AWMF to ensure compliance with:

- Provisions of the Protection of the Environment Operations (POEO) Act 1997
- Protection of the Environment Operations (Waste) Regulation 2014
- Environmental Protection Licence (EPL) No. 5873 – specifically Section 5
- Major Project Approval number 10_0139 issued by the NSW Department of Planning and Infrastructure.
- Hunter Water Corporation Non-Standard Wastewater Service Agreement (WSA) 2014-1036

1.3 Permissible Waste Types

Condition L3 of the EPL defines what wastes are permitted to be received at the AWMF. Waste types are defined in Schedule 1 of the POEO Act. Waste types that can be received under the licence are:

- waste tyres
- asbestos waste
- general solid waste (putrescible and non-putrescible)

Special licence provisions apply to the receipt of waste tyres, however Council does not permit disposal of tyres at the AWMF. Customers presenting waste tyres for disposal at the AWMF are referred to commercial tyre recycler(s).

2 Waste Acceptance and Screening

2.1 Signage

Signage is installed at the AWMF entrance off Wilton Road, which lists wastes that are prohibited at the facility. These include:

- toxic waste
- flammable waste
- liquid waste
- car tyres

2.2 Waste Screening

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Systematic waste screening procedures are employed to ensure only permissible wastes are disposed of at the facility. Video surveillance is also installed at the weighbridge should follow-up investigation be required.

Screening of incoming waste will take place at three stages:

2.2.1 Inspection of Loads

Site Attendants at the weighbridge will question the customer and inspect each load, via the video cameras, entering the facility to ensure only permissible wastes are received and to classify the type of waste for reporting and charging purposes.

2.2.2 Unloading

Site Attendants at the waste transfer station and tip face will oversee unloading of waste and monitor for prohibited waste materials.

2.2.3 Pushing and Compacting

Plant Operators will observe waste during pushing and compaction to identify any prohibited waste items that may have been overlooked during prior screening.

2.3 Waste Auditing

Auditing of landfilled waste is undertaken on an as needs campaign basis, generally in response to specific data requirements to assist with strategic waste planning programs.

2.4 Rejection of Prohibited Waste

In the event that unacceptable waste is identified in an incoming vehicle, the vehicle will be refused entry. The Gatekeeper will advise the driver of the vehicle of appropriate waste management facilities, or to contact the EPA for advice on the appropriate management of the unacceptable waste.

In the event that unacceptable waste is identified during deposition by a vehicle, site staff will segregate and contain the waste away from the active tipping face or processing area. Site staff will advise the driver of the vehicle that the waste is not acceptable and to load the waste back onto the vehicle where practical and safe to do so. The vehicle is to then leave the site via the weighbridge and the driver advised of appropriate waste management facilities, or to contact the EPA for advice on the appropriate management of the unacceptable waste.

In the event that unacceptable waste is identified during the spreading and compaction of deposited waste, site staff will segregate and contain the waste away from the active tipping face or processing area. If practical and safe to do so, the source of the waste should be attempted to be identified for future investigations if required.

If appropriate waste management facilities are unknown for the waste type, the EPA is to be contacted for advice on the appropriate management of the unacceptable waste.

2.5 Waste Classification

Acceptable waste types for receipt at the AWMF are defined the EPL 5873 as being:

Code	Waste	Description	Activity	Other Limits
NA	Waste Tyres	As defined in Schedule 1 of the POEO Act, as in force from time to time	Waste disposal (application to land)	Maximum of 150,000 tonnes in total of all waste types may be disposed per annum

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NA	Asbestos Waste	As defined in Schedule 1 of the POEO Act, as in force from time to time	Waste disposal (application to land)	Maximum of 150,000 tonnes in total of all waste types may be disposed per annum
NA	General Solid Waste (non-putrescible)	As defined in Schedule 1 of the POEO Act, as in force from time to time	Waste disposal (application to land) Composting	Maximum of 150,000 tonnes in total of all waste types may be disposed per annum
NA	General Solid Waste (putrescible)	As defined in Schedule 1 of the POEO Act, as in force from time to time	Waste disposal (application to land)	Maximum of 150,000 tonnes in total of all waste types may be disposed per annum
NA	Waste	Any waste received on site that is below licensing thresholds in Schedule 1 of the POEO Act, as in force from time to time.	Waste storage	NA

On occasions, Council receives requests for the disposal of fill material, generally associated with a development project. Council will accept clean fill that can be used for operational purposes subject to the following criteria:

- Prior contact and approval from the AWMF Site Supervisor
- Council has an operational need for the clean fill
- Quantities over 50 tonnes
- Suitability of material for operational purposes
- Evidence that the material is free from contamination. A contamination report will be required in accordance with the EPA's Waste Classification Guidelines.

2.6 Special Wastes

The AWMF accepts special waste including:

- Asbestos
- Dead animals
- Quarantine waste
- Offensive waste
- Confidential documents

The Waste Site Supervisor may classify other wastes as special waste should they require special handling by operational staff during the landfilling process to control environmental and / or WHS impacts e.g. dust, odour.

The procedure for managing the acceptance and disposal of special waste (other than asbestos) is summarised below:

- The customer advises of the intended delivery of the special waste including the type and quantity of the waste.
- Through discussion with the Waste Site Supervisor, acceptance and disposal requirements are determined including date, time, waste presentation requirements etc
- The special waste is brought to the AWMF in accordance with agreed conditions
- The special waste is screened, weighed and the special waste charge applied
- The special waste is then landfilled in a manner to control the risks presented by the waste type. Generally, this is at a location removed from the general tipping face with the special waste covered immediately upon disposal.

Requirements for disposing of asbestos are detailed below.

2.7 Asbestos

2.7.1 WasteLocate

The NSW EPA administers the WasteLocate tracking system for loads of tyres and asbestos over 100kg or 10m² of bonded asbestos sheeting. The AWMF has a QR2id code plate available at the weighbridge for asbestos transporters to scan for confirmation of delivery under the WasteLocate system.

AWMF staff must report the registration number of any vehicles that deliver trackable volumes of asbestos without scanning the QR2id plate.

2.7.2 Disposal of Asbestos

The POEO Waste Regulation details how asbestos must be managed on receipt at the AWMF tip face. Section 80 of the regulation states:

The occupier of a landfill site must ensure that asbestos waste disposed of at the site is covered with virgin excavated natural material or (if expressly authorised by an environment protection licence held by the occupier) other material:

(a) initially (at the time of disposal), to a depth of at least 0.15 metre, and

(b) at the end of each day's operation, to a depth of at least 0.5 metre, and

(c) finally, to a depth of at least 1 metre (in the case of bonded asbestos material or asbestos-contaminated soils) or 3 metres (in the case of friable asbestos material) beneath the final land surface of the landfill site.

Requirements for disposing of asbestos are detailed below.

- A minimum of 24 hours notice must be given to the Awaba Waste Management Facility's Gatekeeper on 02 4921 0778 prior to the disposal of all quantities of asbestos. This is to allow Council's Landfill staff to manage the disposal of the asbestos at the facility.
- At the time of booking, the Gatekeeper will enter the details into the Awaba Waste Management Facility asbestos booking diary and will advise the customer of the EPA's WasteLocate program. Information on WasteLocate can be found on the [EPA's website](#).
- Material may be disposed at the Awaba Waste Management Facility between 8am-12pm, Monday to Friday.
- Asbestos will not be accepted during wet weather.

- Asbestos must be wet to avoid the creation of dust and must be wrapped in heavy-duty plastic or other NSW Environment Protection Authority (EPA), WorkCover or National Australia Testing Authority (NATA) approved wrapping system, such as Hazi Bags.
- It must be in manageable bundles that maintain their integrity during the unloading process. This is also a WorkCover NSW directive.
- Before transporting asbestos waste (greater than 10m² or 100kg), each load needs to have a unique EPA consignment ID generated by logging into [WasteLocate](#) and following the on-screen prompts.
- The Gatekeeper will inspect each load using CCTV located at the weighbridge. If a load does not visibly comply, it will be rejected.
- The customer is required to scan the WasteLocate QR2id plate located adjacent to the inbound Gatehouse window (for asbestos loads greater than 100kg).
- The Gatekeeper will check that the driver has scanned the QR2id plate. If the QR2id plate has not been scanned, the Gatekeeper will record this against the transaction and advise the driver of the EPA's WasteLocate program by providing an EPA brochure.
- It is the responsibility of the customer disposing of the asbestos to advise the Gatekeeper of their name and address and nature of the load to ensure correct charges apply.
- It is the responsibility of the customer to unload their own vehicle. It is not the responsibility of the Awaba Waste Management Facility staff to assist in the unloading of asbestos from any vehicle.
- If during the unloading, a load is deemed by the Facility's Tip Hand or Plant Operators to not comply with Council's requirements - for example has split or not appropriately covered - then:
 - The driver of the vehicle must wet down and cover the asbestos with plastic to a degree that complies with Council's requirements.
 - If the driver of the vehicle is unprepared or unable to fulfil these requirements, the Site Supervisor will decide on how to proceed with the asbestos disposal process. This may result in the customer being directed to remove the asbestos off-site.

2.8 Record Keeping

Protection of the Environment Operations (Waste) Regulation 2014 sets out requirements for measurement and recording of waste received at the facility, primarily for the purpose of calculating liability for the Waste Levy.

Council's weighbridge management software is used to record waste type and volume and report to the NSW EPA on a monthly basis in accordance with requirements of Section 22 of the POEO Waste Regulation.

2.9 Training

AWMF staff training is undertaken in accordance with Council's WHS Module 12 – Training.

Specific AWMF staff training includes:

- Site inductions
- Plant inductions

- Risk Assessments
- Work Method Statements
- Procedures
- Operational Plans
- Vehicle Recovery
- Confined spaces
- First aid
- Pollution Incident and Emergency Response Plan
- Code of Conduct
- Armed Holdup
- Professional development training
- etc

3 Resource Recovery

Council is committed to maximising recovery of green waste, household problem wastes, scrap metal, mattresses, and household recyclables entering the AWMF. Categorisation and collection of data pertaining to the receipt and recovery of these materials is recorded through Council's weighbridge software.

Effectiveness of the recovery of these resources is monitored through annual analysis and performance benchmarking against previous years' recovery rates, with outcomes publicly reported through the waste performance section of Council's annual State of the Environment report, accessible from Council's website at www.lakemac.com.au

<https://www.lakemac.com.au/page.aspx?=&pid=2528&vid=28>

3.1 Greenwaste

Source separated loads of green waste are accepted by the Remondis operated Lake Macquarie City Council Organics Resource Recovery Facility (ORRF), located adjacent to the AWMF.

Customers delivering organic garden waste in mixed loads to the AWMF have the opportunity to separate the organic waste component from the remainder of their load during the unloading process. Council will deliver this separated organic garden waste to the ORRF for processing.

3.2 Community Recycling Centre

The AWMF incorporates a Community Recycling Centre (CRC), which caters for problem household waste that cannot be placed in domestic recycling bins.

Waste disposal at the CRC is free of charge for "household quantities" and includes the following waste types:

- paint
- gas bottles
- fire extinguishers
- e-waste
- fluorescent light globes and tubes
- car and household batteries
- polystyrene
- motor and other oils

- smoke detectors
- expanded poly styrene (EPS)

3.3 Scrap Metal Diversion

Scrap metal is accepted at the AWMF as mixed waste.

AWMF Plant Operators and Site Attendants working at the tip face will recover scrap metal from mixed waste when practical. Ferrous metals are placed in scrap bins at the tip face for later transport to a metal recycling facility. Non-ferrous metals and composite materials are transported to the Reuse Centre for separation into various metal types for later transport to a metal recycling facility.

3.4 Mattresses

Mattresses are accepted at the AWMF and charged the mixed waste fee plus a surcharge fee per mattress.

Mattresses are separately stockpiled and periodically collected by a commercial mattress recycling company for processing.

3.5 Household Recyclables

Traditional household recyclables are accepted free of charge at the AWMF for household quantities.

Materials included as traditional household recyclables includes:

- Paper and cardboard
- Glass bottles and jars
- Aluminium cans
- Steel cans
- Rigid plastic containers

A full list of household recyclable items can be found on Hunter Resource Recovery's website at:

<https://hrr.com.au/>

Household recyclables are periodically collected and taken to Solo's Material Recovery Facility at Gateshead

Controlled Document Information

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Related Document Information, Standards & References

Related Legislation:	(Legislation Name) Protection of the Environment Operations Act 1997 Protection of the Environment Operations (Waste) Regulation 2014 Major Project Approval number 10_0139 Major Project Approval number 10_0139 under Water Corporation Non-Standard Wastewater Service Agreement (WSA) 2014-1036	(Relationship/Context)
Related Policies (Council & Internal):	(Policy Name)	(Relationship/Context)
Related Procedures, Guidelines, Forms, WHS Modules/PCD's, Risk Assessments, Work Method Statements:	(Document Name)	(Relationship/Context)
Standards COP's & Other References	(Standard, COP or Other References)	(Relationship/Context)

Definitions

Term / Abbreviation	Definition

Consultation (update for each version created)

Key Departments, Teams, Positions, Meetings:	
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Version History

Version No	Date Changed	Modified By	Details and Comments

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Appendix D – Fill-Out Plan



Lake Macquarie City Council
Awaba Waste Management Facility Expansion Project
Fill-Out Plan

February 2020

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- Appendix C – Safety in Design (SiD) risk register

1. Introduction

1.1 Purpose and objective

GHD Pty Ltd. (GHD) has been engaged by Lake Macquarie City Council (LMCC) to provide design and management services to the Awaba Waste Management Facility Expansion Project. This document provides the Fill-Out Plan (FOP) for proposed Cells 1 to 6 and Cell 9, as described in Section 3, and shown in drawings in Appendix A. The FOP provides a detailed methodology that will assist in correct operation of the landfill design features and maximising void capacity.

1.2 Relevant compliance documents

1.2.1 Environment protection licence

This section outlines relevant conditions listed in Environment Protection Licence (EPL) No. 5873 (licence version date 9 April 2019).

Items to note from the EPL include:

- Condition L3 – Waste
- Condition O5 – Processes and Management
- Condition O6 – Waste Management

1.2.2 Environmental Guidelines: Solid waste landfills, Second edition 2016 (NSW EPA, April 2016)

The NSW EPA's Environmental Guidelines: Solid waste landfills, Second edition 2016 (hereon referred to as the Landfill Guidelines) include required outcomes for covering of waste, which are relevant to this FOP.

1.2.3 Landfill Environmental Management Plan (LEMP)

The Awaba Waste Management Facility Landfill Environmental Management Plan (LEMP) includes details of site operations, and is the overarching document for environmental management of the site. The LEMP is a live document, and therefore LMCC shall ensure that the latest version is being relied upon for operation of the site.

1.3 Design basis and assumptions

The fill out plan is based on the following design intention and assumptions:

- Stable waste placement.
- Availability of suitable bund material to achieve the steepened bunds. The final grades will be achieved via cutting and filling between the bunds to produce a final slope.
- Final exterior slopes of approximately 1 Vertical: 4 Horizontal, as per the detailed design.
- Compaction rate for landfilled waste is at least 0.75 t/m³, with the goal of achieving 0.85 t/m³.
- Engineering materials for placement of intermediate cover will be sourced from excavations for the landfill extension and/or from suitable waste streams accepted at the site for disposal and/or purchase.

- The working face will be covered with daily cover (virgin excavated natural material, DECCW approved synthetic cover or biodegradable plastic sheeting) prior to ceasing operations at the end of each day, as approved by the NSW EPA.
- LMCC should develop a safe work method statement to identify all relevant safety risks and develop appropriate strategies to manage these risks.

1.4 Scope and limitations

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

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

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

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

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

2. Waste operations

2.1 Plant and equipment

2.1.1 Landfill compactor

A landfill compactor shall be employed for the placement and compaction of waste in the working face of the active landfill area. In order to achieve optimum compaction of waste, the type and size (weight) of the compactor shall be matched to the types and quantities of waste accepted for landfill disposal.

While the selection of the correct compactor type and equipment (wheels, blades etc.) can depend on variable factors such as the moisture content of the waste and the waste composition, the weight ranges listed in Table 2-1 below can be used as a guide, which considers economic factors such as fuel consumption, plant cost and compaction efficiency:

Table 2-1 Compactor sizes

Waste Quantities accepted for Disposal (t/day)	Optimum no. and weight-range of Landfill Compactor ¹
<100	1 x 25 t
100 – 250	1 x 25 - 40 t
250 – 500	1 x 40 – 55 t
500 – 750	2 x 35 – 50 t
>750	2 x 40 – 55 t

Based on the licence limit of 150,000 tonnes of waste for disposal per annum (EPL 5873, Condition L3.1), the maximum allowable tonnage of waste disposed of at the site each day is approximately 410 tonnes on average. Therefore, a single 40 to 55 tonne landfill compactor is recommended.

2.1.2 Bulldozer and/or Traxcavator

Tracked waste handling equipment (bulldozer, traxcavator or similar) shall be used for placement of the protective waste layer above the cell base, as well as in close proximity of sidewall and piggyback liner, as described in Section 2.3.

In comparison with a landfill compactor, the use of a tracked machine reduces the point loads and resulting forces impacting on the landfill liner, which could lead to puncture of the liner materials, in particular geomembranes.

During the initial stages of access and waste placement in new cell areas it is important that the use of tracked machines be assured where the depth of waste above the landfill liner is less than 2.5 m.

While the use of a tracked machine reduces the compaction efficiency, the protection of the landfill liner is paramount, and it is recommended to use track widths in excess of 600 mm in order to further reduce the load.

¹ The number and weight ranges listed are based on operational experience at Landfill Sites in Europe for disposal of municipal waste.

2.2 Active landfill cells

2.2.1 General

The active cell is the landfill cell, or cell area, where activities related to waste deposition and covering are undertaken. The active area changes constantly, as waste deposition progresses, but usually comprises the following:

- Access tracks/roads and temporary haul roads
- Manoeuvring areas
- Unloading area
- Working face
- Stockpiles

Figure 2-1 shows a typical scenario of an active landfill cell, which is centred around the working face.

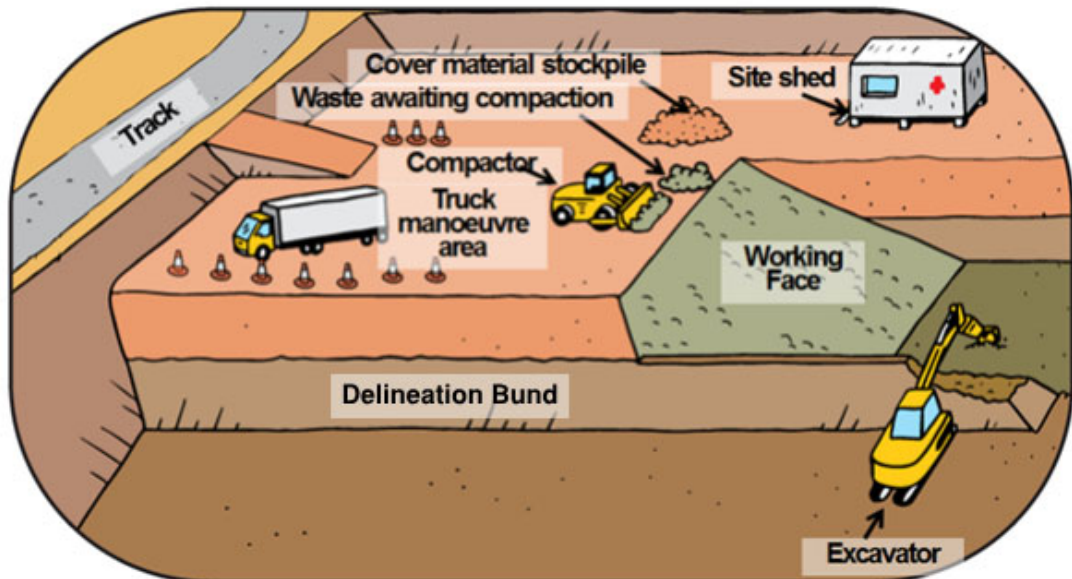


Figure 2-1 Typical active landfill cell

The key features include:

- Permanent haul track is sealed and runs along the edge of the landfill
- Access ramp into the cell to prevent damage to the liner
- Nearby transportable amenities and first aid shed
- Stockpile for cover material located adjacent to the working area
- Area for trucks to turn and unload
- Compactor pushing waste from the top down
- Excavator reclaiming previous cover to build the bund delineating the working face where used (refer to Section 2.3.5)

While the circumstances and available space for establishing and maintaining the individual areas of an active cell constantly change, it shall be prioritised to always consider health and safety of landfill staff, visitors, customers and contractors when setting up the active landfill area. In particular the potential interference between mobile plant and trucks delivering waste to the site shall be considered.

2.2.2 Roads and manoeuvring areas

Haul roads and manoeuvring areas for waste trucks shall be aligned and established at a sufficient distance from the operating area for mobile plant, which always includes the area where trucks unload their waste consignments. Depending on the available space, this distance may be in excess of 30 metres to allow for safe reversing of trucks into the unloading area.

In circumstances when the active area is constrained to a small size by surrounding waste and cell batters, it may be necessary to operate a temporary waiting area for trucks, which may allow only one truck at any time to unload the waste in the unloading area.

It is advisable to apply traffic cones on access and haul roads where the alignment or directional flows can otherwise not be clearly identified. The same applies to sections of haul roads that may be bordering banks on one or both sides.

Depending on the traffic volumes and possible times of peak traffic, it may be advisable to allocate a staff member to undertaking supervisory duties in the manoeuvring areas in order to minimise the risk of vehicle accidents, particularly when reversing.

2.2.3 Unloading area

The unloading area should be established in close proximity to the working face, ideally terminating at the higher level of the working face, in order to avoid pushing waste loads across the landfill surface over unnecessarily long distances into the working face. The closer the unloading area is located to the working face, the easier it usually is to maintain the area.

100 mm minus gravel should be placed on unloading access areas to provide all-weather access for vehicles.

In most cases trucks will have to be driven forward slowly and in very short increments during the unloading process, to provide for additional unloading space for waste. On soft surfaces in particular trucks with long, articulated trailers may get stuck during this unloading process when the majority of the waste load has been moved over the back axles, which in return reduces the weight and therefore the traction on the driven front axles.

2.2.4 Working face

The working face is the area where unloaded waste is placed and subsequently compacted. In order to ensure the effectiveness of the compaction equipment, the working face should be maintained at a slope with a gradient between 1 in 3 and 1 in 4. The vertical height of the working face can often depend on the waste types and quantities accepted at the site for disposal, but should ideally not exceed 3 metres. Based on the above gradients, the working face would therefore extend out horizontally by a maximum of 9 to 12 metres.

While the width of the working face can often vary, depending on the geometry of the cell area to be filled and the types and numbers of compaction equipment in operation, it should, as a rule of thumb, not be greater than ten times the height, i.e. a maximum of 30 metres.

The two main typical tipping and compaction methods are identified below.

Face tipping method

In this method the waste is tipped out and then compacted into a bench. The height of the bench will generally be a maximum of 3 meters, with the compactor working down the face, as well as along the surface of the bench. This method tends to find favour with machine operators, but supervision is needed to ensure that the compactor is operated sufficiently in the face. Otherwise, compaction may be poor in areas other than the horizontal surface of the bench itself. Bulky objects, which may be difficult to bury can be placed at the toe of the face and then covered with other waste from above. Besides the generally lower compaction efficiency, the disadvantages of this method are that waste can become windblown when tipped over the edge and that the landfill surface can become heavily compacted by the passage of vehicles, which can lead to perched leachate zones.

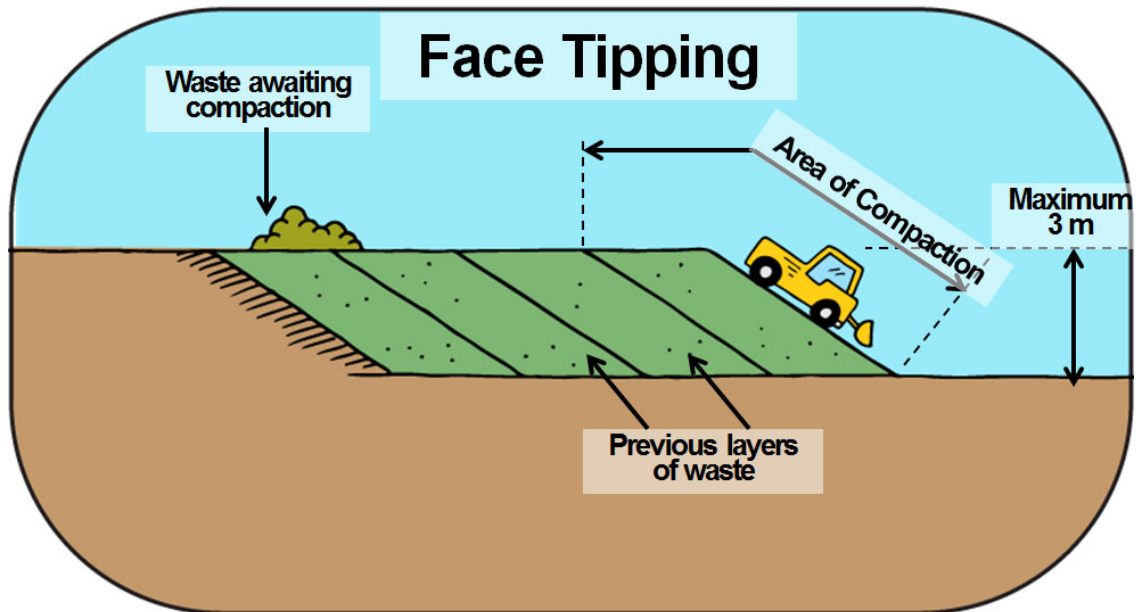


Figure 2-2 Face tipping

Onion Skin Method

This method has similarities to face tipping, but with the toe of the face extending at a much shallower gradient. The compactor operates solely on the gradient of the shallower face, pushing thinner layers of waste and applying compaction pressure to them. While it may be more difficult to bury bulky objects or other difficult wastes, this method has the advantage of having a lower probability of windblown litter, and perching may be lessened by less compaction of the horizontal surfaces.

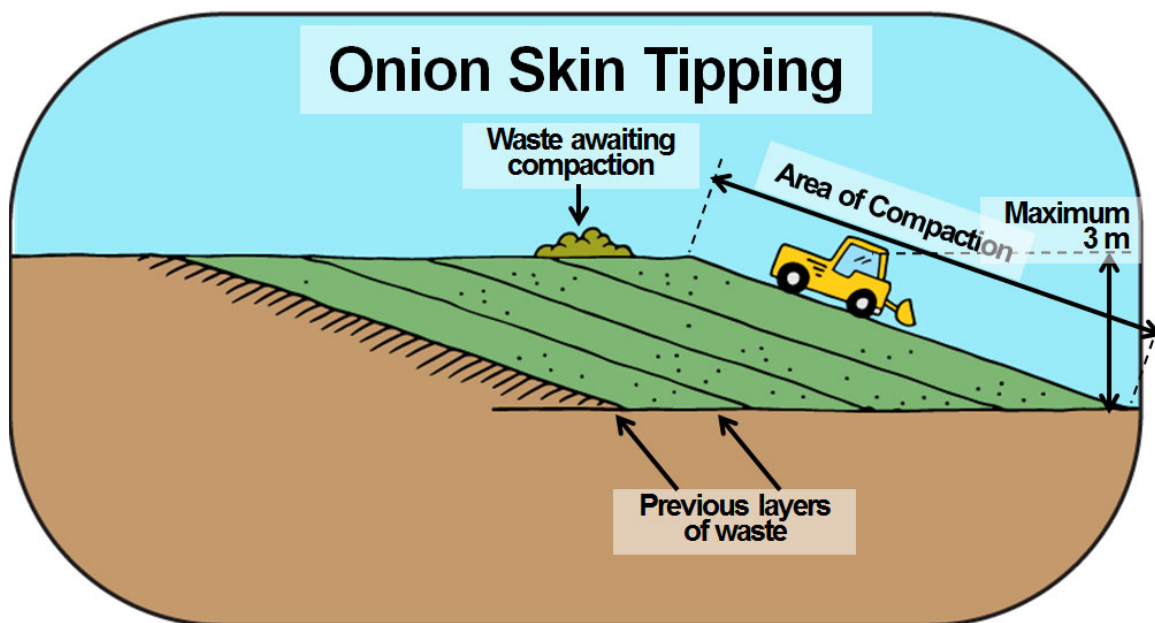


Figure 2-3 Onion skin tipping

2.2.5 Stockpiles

One or more stockpiles with cover material for daily and intermediate cover should be maintained in the vicinity of the working face, without interfering with manoeuvring areas for trucks and mobile plant. The stockpiles should not contain cover material for more than three to five days, as otherwise the stockpiles may have to be moved to remain sufficiently close to the working face.

2.3 Waste placement and compaction

2.3.1 General

As described in Section 2.2.4, the dimensions and geometry of the working face may vary, as may the tipping and compaction method.

However, irrespective of the geometry of the working face and the compaction method, several general aspects should be considered.

2.3.2 Access ramp

Access ramps shall be constructed when required to allow for vehicular access into the cell without damaging the underlying liner. The following criteria shall be adhered to for all access ramps:

- Gradient shall be suitable for all vehicles requiring access to the cell.
- The finished level of the access ramp shall provide for no less than 1.5 m cover depth above the landfill liner.
- The access ramp shall be constructed from a well-graded granular material in order to provide sufficient stability and to prevent erosion.
- Any deterioration of the ramp material, i.e. wear, erosion or cracks, shall be repaired and reinstated without undue delay, in order to maintain sufficient protection of the perimeter bund at the access point.
- Access ramps will be progressively removed as waste is placed within the cells.

2.3.3 Protective waste layer

A protective waste layer of no less than 0.5 to 1.0 metre compacted depth shall be placed on top of the leachate drainage layer. The protective waste layer shall be placed prior to the actual first lift of waste, in order to prevent potential damage to the basal liner caused by vehicles and waste handling and compaction equipment.

The protective waste layer shall comprise select waste, free of oversized particles (greater than 150 mm in any direction) or materials that may damage the cell liner. Any large or potentially protruding items, such as rebar, fence poles or other pointed items, are to be removed from the select waste prior to placement. A spotter should be present to observe placement of the protective waste layer and remove protruding items as required. A line of communication and clear visual sight line must exist between the spotter and machine operators at all times. The spotter must not proceed into the operating area of the machines without visual agreement with the operator.

The protective waste layer shall be placed by tracked waste handling equipment, i.e. bulldozer, to prevent damage to the basal liner. Wheeled compaction equipment shall not be utilised in landfill areas where a protective waste layer of no less than 0.5 – 1.0 meter (compacted depth) has not been achieved.

2.3.4 Waste filling against sidewall or piggy-back liner

When filling against the sidewall or piggy-back liner the following measures should be adopted to reduce the risk of damage to the liner and leachate collection infrastructure:

- Ensure that a protective waste layer is applied to the liner prior to placement of any unclassified waste (refer to Section 2.3.3 above).
- Only use a tracked dozer within 5 meters of the sidewall and piggy-back liner for waste placement and compaction. Refer to Figure 2-4.
- Push and compact waste in a perpendicular direction to the liner when within 5 meters of the liner. I.e. do not push waste along the liner as this may cause the liner to be dragged across the subgrade and damaged. Refer to Figure 2-4 for permitted movements.

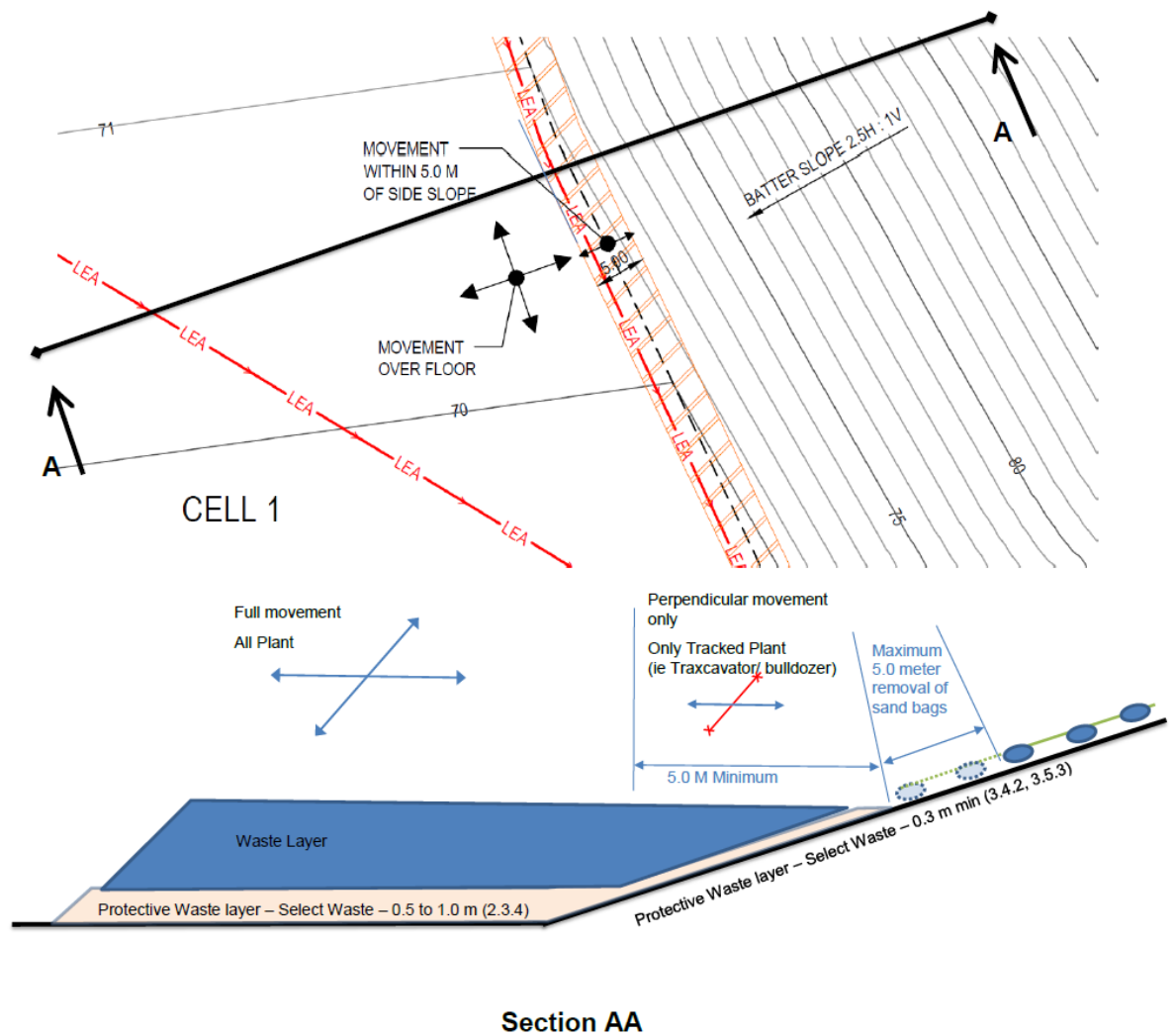


Figure 2-4 Permitted plant movements at base of sidewall and piggyback area interfaces

2.3.5 General waste filling

In all general fill areas, other than the first waste lift and against sidewall or piggy-back liner, waste should be filled as described in Section 2.2.4 above.

Where feasible and applicable, a small bund should be constructed to delineate the working face ahead of filling. This bund could be constructed from reclaimed cover material, which was placed on previous fill sections, as indicated in Figure 2-1, and is a supporting feature for machine operators. It can help ensuring that the width of the working face is not extending beyond suitable dimensions.

As described in Section 2.2.4, sufficient compaction of the deposited waste is important in order to ensure that voids cannot form in filled areas, and also to ascertain that filled areas provide for good bearing capacity for subsequent vehicle movement.

3. Cells 1 and 2 operation instructions

3.1 Preparation of Cell 1 for landfilling

3.1.1 Removal of sacrificial geotextile

A temporary UV-stabilised sacrificial geotextile (sacrificial geotextile) will be placed over the separation geotextile layer on the Cell 1 floor. This will mitigate premature deterioration of the separation geotextile caused by over-exposure to the natural elements (sun, rain and wind).

As the sacrificial geotextile does not meet the specified requirements for permittivity, it must be removed in order to facilitate movement of leachate into the underlying leachate collection layer. Removal of the sacrificial geotextile is outlined in the following points:

- The sacrificial geotextile layer is ballasted with sandbags to prevent wind uplift, which must be removed first to allow subsequent removal of the sacrificial geotextile.
- Removal of the sacrificial geotextile is to occur progressively in unison with placement of the initial protective waste layer.
- Care is to be taken during this removal process, as the underlying separation geotextile is to remain in place.
- Only a small area of sacrificial geotextile should be removed at any one time, with the underlying separation geotextile immediately covered by the initial protective waste layer to prevent wind uplift. The removed sacrificial geotextile can either be appropriately disposed of or reused on site (if suitable). The removed sandbags can be reused as desired by LMCC.

3.1.2 Placement of protective waste layer

A protective waste layer of no less than 0.5 to 1.0 m compacted depth shall be placed over the leachate drainage layer to protect it from damage caused by protruding objects. Refer to Section 2.3.3 for details of the protective waste layer. The protective waste layer will be placed across the whole Cell 1 floor and covered prior to the placement of the first lift of waste.

3.1.3 Direction of initial filling in Cell 1

Landfilling in Cell 1 is to progress as shown on drawing 22-16920-C7080 (Appendix A) until the cell has been filled to the height of the Cell 1/3 intercell bund wall and a 5% grade to the south has been achieved.

When landfilling has progressed above this height, such that stormwater can be shed over the bund wall, waste placement in Cell 2 can commence. Refer to Section 3.3 for commissioning details required for Cell 2 prior to commencement of waste placement.

3.2 Management of Cell 2 prior to landfilling

3.2.1 Management of water in Cell 2

To eliminate the need for two leachate pumpwells, a hydraulic connection exists between Cell's 1 and 2, enabling extraction of Cell 2 leachate from the Cell 1 sump. The Cell 1/2 intercell bund includes a temporary 'rainflap', which forms a hydraulic barrier between the leachate generated within Cell 1 (during waste placement) and the direct rainfall collected within Cell 2. This enables management of the rainwater captured in Cell 2 as clean or sediment-laden water.

The water level in Cell 2 is to be maintained so that it is always higher than the water/leachate level in Cell 1. This is required to limit backpressure of water/leachate on the rainflap (acting from Cell 1 towards Cell 2). The rainflap is designed to keep water in Cell 2 out of Cell 1, but is not intended to contain an elevated water/leachate level in Cell 1 while Cell 2 is empty.

In accordance with EPL 5873 Condition L2.4 (licence version date 9 April 2019), the 100 percentile concentration limit for water discharged from the site is 50 mg/L total suspended solids (TSS). If TSS \leq 50 mg/L, operators can pump water directly from Cell 2 into the clean water diversion drain.

If TSS > 50 mg/L, the water shall be managed as sediment-laden, and shall be pumped into the dirty water catch drain and directed to the sediment ponds for treatment. Stormwater captured within Cell 2 can be used for dust suppression around site (if desired). TSS must be less than 50 mg/L if used for dust suppression around the site.

Prior to waste placement in Cell 2, removal of the hydraulic barrier (rainflap) from the Cell 1/2 intercell bund is to occur, enabling leachate to move freely from Cell 2 into Cell 1. Refer to Section 3.3 below for details.

3.2.2 Maintenance of Cell 2 prior to filling

It is important that Cell 2 is maintained in a good condition prior to the commencement of waste placement, so that it is suitable for commencement of landfilling when required.

Refer below for potential maintenance activities:

- Any waste materials deposited in Cell 2 prior to formal commencement of landfilling (e.g. wind-blown litter, unintentional deposition of waste into Cell 2 over the Cell 1/2 intercell bund wall, etc.) shall be regularly removed and disposed of at the active tipping face.
- Sediment build-up within the exposed leachate drainage aggregate layer requires flushing out with water on an 'as-needed' basis. Flushing should be completed with a high-volume pump so that there is sufficient water to mobilise the sediment, thus preventing 'excessive clogging' of the leachate drainage aggregate. The source of the sediment causing the build-up should also be identified and eliminated if possible.
- Any weeds or vegetation growing within the exposed leachate drainage aggregate is a sign of significant sediment build-up. Weeds and vegetation are to be removed and sediment should be flushed out as outlined above.
- A regular inspection of all side slopes is to occur verifying the integrity of the panel joints of the sacrificial geotextile layer. Any open joints are to be ballasted immediately and re-joined (as per the manufacturer's installation guidelines) as soon as possible, mitigating uplift during high wind events.
- Check condition of ballast sandbags on sidewalls, piggyback area and intercell bunds, and replace if necessary. Sandbags are to be attached to the existing anchor rope to prevent them sliding down slope.

3.3 Commissioning of Cell 2 for landfilling

3.3.1 Removal of Cell 1/2 rainflap and preparation of Cell 2 leachate sump pipe

As noted in Section 3.2.1, a temporary 'rainflap' exists in the Cell 1/2 intercell bund to facilitate surface water management prior to waste placement. This 'rainflap' must be removed prior to

commencement of landfilling in Cell 2 to enable free flow of leachate from Cell 2 into the Cell 1 leachate sump for extraction.

The Cell 2 leachate sump pipe is connected to the Cell 1 leachate sump. It is currently blocked-off, preventing the movement of the clean or sediment laden water from Cell 2 into Cell 1. The Cell 2 leachate sump pipe must therefore be prepared (remove flange and flush) to facilitate the conveyance of future leachate from Cell 2 to Cell 1.

Refer to drawing 22-16920-C7103 (Appendix B) for the removal procedure of the rainflap and the preparation of the Cell 2 leachate sump pipe. More details follow:

1. Dewater Cell 2 completely of all surface water.
2. Extract leachate in Cell 1 ensuring leachate level is below the Cell 2 sump invert level.
3. Cut and remove top section of HDPE geomembrane (of rainflap) to allow any landfill gas build-up beneath the liner to evacuate and vent.
4. Cut and remove remaining HDPE geomembrane from rainflap.
5. Remove blank flanges from Cell 2 leachate sump pipe, again being mindful of landfill gas and leachate build-up within the pipe.
6. Drill Ø12 mm holes at 150 mm centres into exposed part of Cell 2 leachate sump pipe to enable leachate to move into leachate pipe.
7. Cover Cell 2 leachate sump pipe using leachate drainage aggregate.

In order to gain additional void space and recover potential cover soil material, the select fill used in the Cell 1/2 intercell bund beneath the rainflap shall be removed and recovered. This will increase the hydraulic connectivity between Cell 2 and Cell 1, therefore mitigating the risk of excessive clogging occurring in the leachate collection system.

Landfill gas is a specific hazard that is to be considered by LMCC and any contractors during removal of the rainflap. Landfill gas is predominantly composed of methane and carbon dioxide, but can also include small amounts of hydrogen sulphide and carbon monoxide. Methane is a flammable and explosive gas between concentrations of 4.4 to 17% v/v. Hydrogen sulphide is toxic, corrosive and flammable at certain concentrations, while carbon monoxide can be toxic at certain concentrations.

Works required for removal of the rainflap shall be cognisant of the risk caused by landfill gas, and the area should be considered a Hazardous Area as defined in AS/NZS 60079.10.1. All equipment and machinery used for removal of the rainflap shall be intrinsically safe. Hot works and other ignition sources shall not be allowed during the works. Gas monitoring for methane, carbon dioxide, carbon monoxide and hydrogen sulphide shall be undertaken during the works.

Prior to removal of the rainflap, LMCC should revisit the Safety in Design risk assessment (Appendix C) with any involved parties to ensure all safety risks are identified and appropriately managed. LMCC should develop a safe work method statement to identify all relevant safety risks and develop appropriate strategies to manage these risks.

A suitably qualified engineer shall verify that the rainflap has been appropriately removed and that the required hydraulic connection between Cells 1 and 2 has been achieved.

3.3.2 Placement of separation and sacrificial geotextiles

Following removal of the Cell 1/2 rainflap and preparation of the Cell 2 leachate sump pipe, the separation geotextile layer must be installed over the exposed leachate drainage aggregate. This will mitigate clogging of the leachate collection layer with fines. A temporary UV-stabilised sacrificial geotextile (sacrificial geotextile) shall be placed over the separation geotextile layer on

the Cell 2 floor (as has been in Cell 1) in order to mitigate premature deterioration of the separation geotextile.

Bidim A24 non-woven geotextile is to be used as the separation geotextile layer. This material has undergone the necessary conformance testing to ensure compliance with the requirements of the technical specification. TerraStop TS203V woven polypropylene geotextile is to be used as the sacrificial geotextile layer. Sufficient quantities of both of these materials was procured at construction stage and has been stored on site, ready for deployment in Cell 2 when required.

Placement and joining of the separation and sacrificial geotextiles is to be in accordance with the design drawings, the technical specification and the manufacturer's installation guidelines.

In unison with placement of the separation and sacrificial geotextiles, ballast sandbags are to be placed at 2.5 m by 2.5 m grid spacing to mitigate wind uplift.

A suitably qualified engineer shall verify that the separation and sacrificial geotextiles are placed in accordance with the design drawings, technical specification and manufacturer's installation guidelines.

3.3.3 Removal of sacrificial geotextile

As outlined in Section 3.3.2, a temporary sacrificial geotextile will be placed over the separation geotextile layer on the Cell 2 floor to mitigate premature deterioration.

As per Section 3.1.1, the sacrificial geotextile does not meet the specified requirements for permittivity, and it must therefore be removed in order to facilitate movement of leachate into the underlying leachate collection layer. The ballast sandbags must be removed to allow subsequent removal of the sacrificial geotextile. Removal of the sacrificial geotextile is to occur progressively in unison with placement of the initial protective waste layer. Care is to be taken during this removal process, as the underlying separation geotextile is to remain in place. Only a small area of sacrificial geotextile should be removed at any one time, with the underlying separation geotextile immediately covered by the initial protective waste layer to prevent wind uplift.

The removed sacrificial geotextile can either be appropriately disposed of or reused on site (if suitable). The removed sandbags can be reused as desired by LMCC.

3.3.4 Placement of protective waste layer

As outlined in Section 3.1.2, a protective waste layer shall be placed over the leachate drainage layer providing protection to underlying layers. Refer to Section 3.1.2 for details of the protective waste layer. The protective waste layer will be placed across the whole Cell 2 floor and covered prior to the placement of the first lift of waste.

3.3.5 Direction of initial filling in Cell 2

Landfilling in Cell 2 is to progress as shown on drawing 22-16920-C7081 (Appendix A) until the cell has been filled to the height of the Cell 2/4 intercell bund wall and a 5% grade to the south has been achieved.

When landfilling has progressed above this height, such that stormwater can be shed over the bund wall, Stage 2 filling of Cells 1 and 2 can occur as per drawings 22-16920-C082 (Appendix A).

3.4 Progressive filling against sidewalls and intercell bunds

3.4.1 Removal of sandbags

There is a risk that the interconnected sandbags placed on the sidewalls and intercell bunds could pull out from the anchor trench due to the downward force created by the placement, compaction and settlement of waste against the slope. To mitigate this risk, the sandbags and ropes are to be cut and removed as landfilling progresses up the slope so that tensile stresses do not develop in the vertical ropes. The removed sandbags can be reused as desired by LMCC.

3.4.2 Placement of slope protection layer

As outlined in Section 2.3.4, a slope protection layer is to be placed against the exposed sidewall and intercell bund liners. The slope protection layer shall have a compacted thickness of at least 300 mm. The slope protection layer shall be comprised of select waste, which is free of oversized particles or materials that may damage the liner. Any large or potentially protruding items, such as rebar, fence poles or other pointed items, are to be removed from the select waste prior to placement. A spotter should be present to observe placement of the protective waste layer and remove protruding items as required. A line of communication and clear visual sight line must exist between the spotter and machine operators at all times. The spotter must not proceed into the operating area of the machines without visual agreement with the operator.

As outlined in Section 2.3.4, a tracked dozer only shall be used within 5 metres of the sidewalls for waste placement and compaction. Waste shall be pushed and compacted in a direction perpendicular to the liner when within 5 m of the sidewall.

3.5 Progressive filling against piggyback slope

3.5.1 Removal of sandbags

As outlined in Section 3.4.1, there is a risk that the interconnected sandbags placed on the piggyback slope could pull out from the anchor trench due to the downward force created by the placement, compaction and settlement of waste against the slope. To mitigate this risk, the sandbags and ropes are to be cut and removed as landfilling progresses up the slope so that tensile stresses do not develop in the vertical ropes. Sandbags can be removed from the lower 5 m of the exposed slope. The removed sandbags can be reused as desired by LMCC.

3.5.2 Installation of drainage aggregate & separation geotextile around leachate collection pipes

The piggyback slope includes a series of slope breaks that include leachate collection pipes placed across the slope (as shown on drawing 22-16920-C7020 (Appendix B)). The leachate collection pipes are to be buried beneath a mound of leachate drainage aggregate that is subsequently covered by a layer of separation geotextile.

Installation of the leachate collection pipes and connection to the conveyance system occurred at construction stage. However, placement of the drainage aggregate and separation geotextile around the pipes can only occur along the piggyback slope when waste levels permit. The separation geotextile must be joined to the exposed sacrificial geotextile so that the mound of leachate drainage aggregate is fully encapsulated, mitigating clogging of the leachate collection system with fines.

Placement of the drainage aggregate is in accordance with the design drawings and the technical specification. Placement and joining of the separation geotextile is in accordance with the design drawings, the technical specification and the manufacturer's installation guidelines. In unison with geotextile placement, ballast (sandbags) is to be placed over the geotextile, mitigating wind uplift. Sufficient drainage aggregate and separation geotextile was procured at construction stage and has been stored on site, ready for installation when required.

3.5.3 Placement of slope protection layer

As outlined in Section 2.3.4, a slope protection layer is to be placed against the exposed piggyback liner. The slope protection layer shall have a compacted thickness of at least 300 mm. The slope protection layer shall be comprised of select waste, which is free of oversized particles or materials that may damage the liner. Any large or potentially protruding items, such as rebar, fence poles or other pointed items, are to be removed from the select waste prior to placement. A spotter should be present to observe placement of the protective waste layer and remove protruding items as required.

As outlined in Section 2.3.4, a tracked dozer only shall be used within 5 metres of the piggyback slope for waste placement and compaction. Waste shall be pushed and compacted in a direction perpendicular to the liner when within 5 m of the piggyback slope.

3.6 Leachate extraction and leachate pumpwell

3.6.1 Normal operation (horizontal leachate extraction)

Extraction of leachate from Cell 1 is via a submersible pump, which pumps leachate horizontally through a rising main located along the base of the cell. The rising main daylights at the east of the cell where it connects to an aboveground leachate transfer main as shown on drawing 22-16920-C7024 (Appendix B). This line then conveys the leachate to Leachate Pond 1 (LP1) at the southern end of the site.

To provide access and services (including power) to the submersible pump, a vertical pumpwell was required in the design. The pumpwell requires vertical extension as landfilling progresses, and will eventually be approx. 40 m deep upon completion of landfilling. Power is provided to the pump by a relocatable diesel generator. A level sensor is included to control operation of the pump, with a high water level to activate operation of the pump at RL 68.960 (1,100 mm above base of pumpwell) and a low water level to stop pumping at RL 68.660 (800 mm above base of pumpwell). It is noted that since the pump is on a level sensor, it may pump regardless of whether there is capacity in the downstream leachate pond. The pump must therefore be manually deactivated by LMCC staff if the downstream leachate pond does not have sufficient capacity to receive the leachate. A site-wide leachate management system should be developed and implemented by LMCC to reduce the need for manual intervention.

Normal operation of the leachate extraction system requires refuelling of the generator to ensure power to the pump can be maintained. The generator is not 'intrinsically safe', but is equipped with a gas monitor that will shut down the generator if methane is detected above certain limits in order to prevent ignition. LMCC may need to consider periodic calibration of the gas monitor to confirm its accuracy and ensure the shut down is working as intended.

Regular maintenance of the generator and pump should be undertaken in accordance with the manufacturer's recommendations. Maintenance of the pump requires the pump to be lifted from the pumpwell using a small crane or lifting machine. A lift plan should be developed prior to removal of the pump, noting the pump weight of approximately 160 kg. The pump guide rails are in place to guide the reinserted pump to the correct location and ensure that it lines up with the coupler.

Operators should manually check leachate levels at weekly intervals to ensure that the level sensor is accurate. Manual checks shall be done by dipping with a dipstick or chain (or similar). Calibration of the level sensor may be required at regular intervals.

3.6.2 Pumpwell riser extension

As filling progresses around the leachate pumpwell, additional HDPE risers must be added to the pumpwell. The process for installation of additional risers is outlined on drawing 22-16920-C7102 (Appendix B), and is repeated below:

1. Disengage generator to pump and remove grated lid off riser pump.
2. Install pump guide rail support to 3 m riser and extend both pump chain and electrical cable through riser. Extend stilling pipe riser.
3. Lift riser into place and install all bolts for flanges, install grated lid, relocate electrical cable support and pump chain support.
4. Install 4 m long GRE pump rail (mass 8 kg) into lower pump rail extender. Installer shall be harnessed and secured to anchor points.
5. Install stainless steel pump rail extender to rail support and cut GRE pump rail to suit length. GRE pump rail is to be cut by hand tools only. No hot works shall be undertaken on riser grate.
6. Install extensions for stilling pipe. N16 pipe and future vertical bore hole pump pipe.
7. Connect generator to pump and relocate where necessary for landfill operations.

All additional risers and ancillary items to allow extension of the pump well to the final surface of the landfill have been procured and are stored on site, ready for installation when required.

Extension of the pumpwell riser should be considered high-risk construction work. The following high-risk activities have been identified as relevant during extension of the pumpwell riser:

- There is a risk of falling more than 2 m into the pumpwell.
- The pumpwell is considered a confined space.
- The pumpwell and area around the pumpwell may have a contaminated or flammable atmosphere.
- Placement of additional risers involves the movement of powered mobile plant.
- Placement of additional risers involves lifting and crane operations.

The design of the pumpwell includes a number of features to mitigate the above risks, including the following:

- Anchor points for attachment of safety harnesses
- Grated pit cover to allow workers to stand over the pit
- Inclusion of pump rails and quick release connection for the pump to avoid the need for workers to enter the pumpwell
- GRE pump rails that can be cut with a hand saw to avoid the need for hot works

Despite the above safety features, LMCC should develop a safe work method statement to identify all relevant safety risks and develop appropriate strategies to manage these risks.

As outlined in Section 3.3.1, landfill gas is a specific hazard that is to be considered by LMCC and any contractors during the installation of additional risers. The area around the pumpwell should be considered a Hazardous Area as defined in AS/NZS 60079.10.1. All equipment and machinery used shall be intrinsically safe. Hot works and other ignition sources shall not be allowed. Gas monitoring for methane, carbon dioxide, carbon monoxide and hydrogen sulphide shall be undertaken during the works.

3.6.3 Contingency vertical pumping

It is envisaged that the existing horizontal leachate extraction system (as outlined in Section 3.6.1) may need to be replaced with a vertical leachate extraction system once landfilling has progressed to the final surface of the landfill. A DN225 pipe has been included in the pumpwell to facilitate installation of a vertical extraction (borehole) pump in the future (if required).

The provision of the future vertical extraction system also provides contingency should there be a failure within the existing horizontal leachate extraction system. The horizontal leachate extraction system has been designed such that the submersible pump can be removed for maintenance if required. The pump guide rails and coupler allow for removal of the pump without the need to enter the pumpwell. However, the reflux valve cannot be removed without entry into the pumpwell.

In the event that the reflux valve fails, or should the submersible pump fail and becomes stuck within the pumpwell, vertical leachate extraction can commence prior to landfilling reaching final surface levels.

Entering the pump well is extremely hazardous and there is insufficient space for a man cage. It is therefore not to be entered under any circumstances.

3.7 Under-liner leachate and landfill gas management

3.7.1 Under-liner landfill gas management

As shown on drawing 22-16920-C7113 (Appendix B), an under-liner landfill gas collection system has been installed beneath the Cells 1 and 2 to mitigate the following risks:

- Damage to the lining of Cells 1 and 2 by 'whaling' (flotation of the lining system) due to landfill gas build-up beneath the liner.
- Additional lateral sub-surface landfill gas emissions from the waste placed beneath Cells 1 and 2 occurring as a result of construction of the impermeable barrier over the waste.

The under-liner landfill gas collection system consists of a series of horizontal interconnected collection trenches that can be connected to LMS's existing active landfill gas collection system at three locations. Three vertical landfill gas extraction wells have also been included in the Cell 1/2 intercell bund as a provision for active extraction if required. These vertical extraction wells can also free-vent to the atmosphere if required.

The design intent of the under-liner landfill gas collection system is for LMS to connect to the three extraction locations and actively draw landfill gas into the system by providing a negative pressure (i.e. apply suction at each location). If active extraction is not undertaken by LMS, the risk of liner whaling and additional lateral sub-surface landfill gas emissions is increased.

Until the under-liner landfill gas collection system is connected to LMS' existing active landfill gas collection system, it is recommended that all extraction points are allowed to free-vent to mitigate build-up of landfill gas beneath the liner of Cells 1 and 2. The three proposed extraction points, as well as the three vertical landfill gas extraction wells, should all be uncapped and left to free-vent to the atmosphere.

3.7.2 Under-liner leachate management

During construction of Cells 1 and 2 it was identified that the underlying waste mass was saturated with leachate. The high leachate levels within the existing waste mass create the following risks for construction and operations of Cells 1 and 2:

- Damage to the bridging layer
- Flotation of the liner
- Flooding of the under-liner landfill gas collection system

To mitigate these risks, an under-liner leachate extraction system has been designed and constructed (refer to drawing 22-16920-C7106 (Appendix B)). The under-liner leachate extraction system consists of a vertical perforated pipe that penetrates down into the underlying waste mass. A submersible borehole pump is then inserted into the vertical pipe, and pumps leachate vertically into Cell 1.

The under-liner leachate extraction system is to be operated (as a minimum) until landfilling in Cells 1 and 2 has progressed to the height of the Cell 1/2 intercell bund in order to prevent liner flotation. Depending on leachate pumping data, it may be beneficial to continue operation of the under-liner leachate extraction system beyond this to prevent flooding of the under-liner landfill gas collection system.

4. Fill-out plan methodology

4.1 General

The following methodology is intended to be used as a guide for progressive filling of waste in Cells 1 to 6 and Cell 9, as well as phased construction and capping cells.

4.2 Cell 1 Stage 1 filling

4.2.1 Waste placement

Table 4-1 Cell 1 Stage 1 void

Cell Parameters	Volume (m ³)
Total Void	83,800
Total Capping	Not applicable

Drawing 22-16920-C7080 (Appendix A) shows the details of the filling plan for Cell 1 Stage 1 filling. Waste shall be placed as per the sequence and directions shown in the drawing.

An access track has been constructed to provide access to the cell and the leachate extraction sump riser. The access track is shown on drawing 22-16920-C7080.

The following sequence of filling should occur:

- As outlined in Section 3.1.2, a 0.5 to 1.0 m thick protective waste layer comprising select waste shall be placed across the floor of the cell in order to protect the underlying cell liner and leachate collection system. The protective waste layer shall be placed across the entire cell floor and covered prior to placement of the first lift of waste.
- The first lift of waste shall be placed as per the sequence shown in drawing 22-16920-C7080 to create a flat working platform, and shall therefore act as a corrective layer with variable thickness. Maximum thickness of the first lift of waste shall be 3.0 m at the leachate extraction sump. The thickness of the first waste lift will progressively reduce as the lift progresses away from the sump towards the perimeter of the cell.
- Filling Section 1 will progress from the existing access track at the entry to the cell towards the leachate extraction sump. A soil delineation bund shall be placed along the northern edge to control the width of the section. The western edge of the section shall be the working face (refer to Section 2.2.4).
- Waste shall not be placed against the Cell 1/2 intercell bund rainflap area, as this section of the bund is to be removed during commissioning of Cell 2, as outlined in Section 3.3.1. Ensure a distance of 5 m is maintained from the rainflap to allow future removal.
- Select fill used to construct the existing access track should be removed prior to landfilling in order to:
 - Remove material for use as cover soil
 - Create additional void space within the cell
 - Prevent clogging of the leachate collection system

Care is necessary to prevent damaging the separation geotextile beneath the select fill. If unintentional damage is caused to the separation geotextile layer, it shall be repaired prior to landfilling.

- Filling Section 2 will progress from the existing access track at the entry of the cell towards the eastern perimeter bund wall. A soil bund shall be placed along the northern edge to control the width of the section. The eastern edge of the section shall be the working face.
- Filling Sections 3, 5, 7 and 8 will progress from the existing access track towards the Cell 1/2 intercell bund at western side of the cell in a similar fashion to that outlined for Filling Section 1. The previously constructed soil bund placed along the northern edge of the adjacent filling section can be reclaimed (where possible) to use as the northern delineation bund of the new filling section.
- Filling Sections 4 and 6 will progress from the existing access track towards the eastern side of the cell in a similar fashion to that outlined for Filling Section 2. The previously constructed soil bund placed along the northern edge of the adjacent filling section can be reclaimed (where possible) to use as the northern delineation bund of the new filling section.
- This strategy of filling in sections will continue as outlined above until the first lift of waste is placed across the entire cell floor. As filling progresses, a cover of soil will be placed over the waste, allowing vehicles to traffic over the top.
- Additional waste lifts will progress in the same fashion as outlined above, until the Stage 1 filling contours are achieved. The aim of Stage 1 filling within Cell 1 is to create an intermediate surface with 5% grade to the south so that surface water can be shed from the cell, therefore reducing infiltration into the waste mass and minimising leachate generation. Landfilling will move into Cell 2 when the 5% intermediate surface has been achieved in Cell 1.

Temporary bunds shall be used to guide waste placement and delineate between active waste placement sections and inactive future waste placement areas.

4.2.2 Leachate sump

The leachate sump is positioned at the south-west corner of the cell. Leachate is extracted from the cell by pumping to a horizontal rising main, which connects to a transfer main to convey leachate to the main leachate pond at the southern end of the site. Future cells along the eastern edge of the landfill will also be able to connect to this transfer main.

The cell has been designed to provide sufficient capacity for the 10% Annual Exceedance Probability (AEP) 24 hour duration rainfall event (design rainfall 177 mm). The cell therefore has capacity to hold leachate from the design storm for 24 hours without pumping assuming the worst-case scenario of waste being at the crest of the bund, resulting in:

- No ability to shed rainfall away from the cell
- In-cell storage is reduced as void is taken up by waste

Leachate shall be removed from the cell as soon as practicable, pending available storage capacity within the leachate ponds.

The leachate sump pump has been designed for a pumping rate of 12 L/s, which was sized to match the maximum pump out rate of the sewer pump without overloading the system, while pumping out of Cells 1 & 2 as quickly as possible.

4.2.3 Stormwater

The key stormwater management features in operation during Cell 1 Stage 1 filling include:

- Clean surface water from the area to the north of Cell 1 will funnel into the northern clean water diversion pipe. Clean surface water from the vegetated catchment to the north of the site will funnel into this pipe, and is subsequently conveyed beneath the eastern wall of Cell 1 and discharge to the natural surface to the east of the site. Routine maintenance is required as follows:
 - At the upstream headwall to ensure any potential vegetation and debris are removed.
 - At the downstream discharge to monitor and repair any erosion.
- The perimeter drain along the east of Cell 1 will initially only capture runoff from the road, this runoff will be directed to the south east sedimentation pond. The maximum height of waste in Cell 1 during Stage 1 filling will be below the top of the cell crest and therefore, not contribute to the drain.
- The perimeter drain around the west of Cell 2 will run along the ridgeline until it passes the proposed stockpile area, where it will run down the natural batter into the current dirty water drain, subsequently feeding to the west dirty water ponds.
- The existing clean water diversion drain running along the western edge will continue to operate as a clean water drain in the section past the proposed stockpile location.
- Cells 3, 5 and 7 are to be revegetated to a grass coverage suitable to allow discharge directly offsite. The runoff from these areas is to be separated from the dirty water drain running along the east of the site. This will be achieved via placement of a diversion bund upstream of the dirty water drain, directing this clean runoff to collection points. These collection points will discharge through a pipe network under the access road at the south east corner of Cell 7.

4.2.4 Access track

The existing access track that previously serviced the green waste area and northern leachate pond is to remain in place for access to Cell 1.

The track along the northern perimeter is to have a bund installed along the southern edge (landfill edge) to prevent traffic from driving over the edge, this bund will also act as a clean and dirty water separation in later stages. The northern access track is to have cross banks (“whoa-boys”) installed at regular intervals to shed water to the clean water drain. For details on cross banks, refer to the Erosion and Sediment Control Plan (included in the LEMP).

4.2.5 Stockpiling

During excavation of Cells 1 and 2 an estimated 94,000 m³ of material will require stockpiling. A bulk excavation stockpile is to be located in the gully of future Cell 4 and 6.

4.3 Cell 2 Stage 1 filling

4.3.1 Waste placement

Table 4-2 Cell 2 Stage 1 void

Cell Parameters	Volume (m ³)
Total Void	107,500
Total Capping	Not applicable

Drawing 22-16920-C7081 (Appendix A) shows the details of the filling plan for Cell 2 Stage 1 filling. Waste shall be placed as per the sequence and directions shown in the drawing.

The general filling will be undertaken as follows:

- Prior to filling in Cell 2, commissioning steps are required to be undertaken as outlined in Section 3.3. This includes removal of the Cell 1/2 intercell bund rainflap.
- As outlined in Section 3.1.2, a 0.5 to 1.0 m thick protective waste layer comprising select waste shall be placed across the floor of the cell in order to protect the underlying cell liner and leachate collection system. The protective waste layer shall be placed across the entire cell floor and covered prior to placement of the first lift of waste.
- The first lift of waste shall be placed as per the sequence shown in drawing 22-16920-C7081 to create a flat working platform, and shall therefore act as a corrective layer with variable thickness. Maximum thickness of the first lift of waste shall be 3.0 m at the leachate extraction sump. The thickness of the first waste lift will progressively reduce as the lift progresses away from the sump towards the perimeter of the cell.
- Filling Section 1 will progress from the existing access track at the entry to the cell at the south-east corner of the cell (at the sump) towards the south-west corner of the cell (away from the sump in a south-westerly direction). As done in Cell 1, a soil bund shall be placed along the northern edge to control width of the section. The western edge of the section shall be the working face (refer to Section 2.2.4).
- Select fill used to construct the existing access track should be removed prior to landfilling in order to:
 - Remove material for use as cover soil
 - Create additional void space within the cell
 - Prevent clogging of the leachate collection system

Care is necessary to prevent damaging the separation geotextile beneath the select fill. If unintentional damage is caused to the separation geotextile layer, it shall be repaired prior to landfilling.

- Filling Sections 2, 3 and 4 will progress from the Cell 1/2 intercell bund in a south-westerly direction towards the western sidewall, in a similar fashion to that outlined for Filling Section 1. The previously constructed soil bund placed along the northern edge of the adjacent filling section can be reclaimed (where possible) to use as the northern delineation bund of the new filling section.
- This strategy of filling in sections will continue as outlined above until the first lift of waste is placed across the entire cell floor. As filling progresses, a cover of soil will be placed over the waste, allowing vehicles to traffic over the top.
- Additional waste lifts will progress in the same fashion as outlined above, until the Stage 1 filling contours are reached. The aim of Stage 1 filling within Cell 2 is to create an intermediate surface with 5% grade to the south so that surface water can be shed off the cell, therefore reducing infiltration to the waste mass and minimising leachate generation. When the 5% intermediate surface has been achieved in Cell 2, Stage 2 filling in Cells 1 and 2 can commence.

Temporary bunds shall be used to guide waste placement and delineate between active waste placement sections and inactive future waste placement areas.

4.3.2 Leachate sump

The Cell 2 leachate sump is connected with the Cell 1 leachate sump, located at the south-east corner of the cell. Leachate moves from the Cell 2 sump through a connecting pipe, and into Cell 1 for subsequent extraction as outlined in Section 4.2.2.

The cell has been designed to provide sufficient capacity for the 10% Annual Exceedance Probability (AEP) 24 hour duration rainfall event (design rainfall 177 mm). The cell therefore has capacity to hold leachate from the design storm for 24 hours without pumping, assuming the worst case scenario of waste being at the crest of the bund, resulting in:

- No ability to shed rainfall away from the cell
- In-cell storage is reduced as void is taken up by waste

Leachate shall be removed from the cell as soon as practicable, pending available storage capacity within the leachate ponds.

4.3.3 Stormwater

The stormwater arrangement outlined for Cell 1 in Section 4.2.3 shall be maintained during filling of Cell 2.

4.3.4 Access track

Access to Cell 2 will be provided over Cell 1 from either the eastern access road or the existing access track located within the footprint of future Cell 3 (if available).

4.3.5 Stockpiling

Previously stockpiled material from the excavation of Cells 1 and 2 can be used for cover soil in Cell 2 if available.

4.4 Cell 1 & 2 Stage 2 filling

4.4.1 Waste placement

Table 4-3 Cells 1 & 2 Stage 2 void

Cell Parameters	Volume (m ³)
Total Void	363,800
Total Capping	51,500 (TBC)

Drawing 22-16920-C7082 (Appendix A) shows the details of the filling plan for Cells 1 & 2 Stage 2 filling. Stage 2 filling shall proceed when the 5% graded intermediate cover layer has been achieved in Cells 1 and 2, and therefore surface water can be shed to the south in order to reduce rainwater infiltration.

Waste shall be placed as per the sequence and directions shown in the drawing. The following sequence of filling should occur:

- Filling Section 1 will progress from the north-west corner of the cell towards the south along the western sidewall of Cell 2. A soil bund shall be placed along the eastern edge to control width of the section. The southern edge of the section shall be the working face (refer to Section 2.2.4).
- A 1V:3H intermediate batter is to be constructed along the southern edge of Cells 1 & 2. This batter will eventually be filled over during filling of future Cells 3 and 4.
- Filling Sections 2 to 9 will progressively move towards the east, in a similar fashion to that outlined for Filling Section 1. The previously constructed soil bund placed along the

eastern edge of the adjacent filling section can be reclaimed (where possible) to use as the eastern delineation bund of the new filling section.

- This strategy of filling in sections will continue for each 3 m high lift as filling continues within Cells 1 and 2 until the approved final landform contours are reached. An intermediate cover soil layer is to be placed over each waste lift to allow vehicles to traffic over the top.

Temporary bunds shall be used to guide waste placement and delineate between active waste placement sections and inactive future waste placement areas.

4.4.2 Leachate sump

The Cell 1 leachate sump described in Section 4.2.2 will remain in operation during Stage 2 filling of Cells 1 and 2. As filling progresses, additional risers are required to be added to the leachate sump pumpwell in order to maintain access and power to the pump.

4.4.3 Stormwater

The stormwater arrangement outlined for Cell 1 in Section 4.2.3 shall be maintained during Stage 2 filling of Cells 1 and 2. In addition to this arrangement, surface water being shed off Cells 1 and 2 is to be captured in dirty water drains positioned along the southern edge of the cells and directed to the sediment ponds at the southern end of the site.

4.4.4 Access track

Access to Stage 2 filling in Cells 1 and 2 will be provided from the eastern access road. A suitable access ramp is to be constructed over the bund wall on the eastern side of Cell 1.

4.5 Cell 3

4.5.1 Waste placement

Table 4-4 Cell 3 void

Cell Parameters	Volume (m ³)
Total Void	327,500
Total Capping	42,000

Drawing 22-16920-C7083 (Appendix A) shows the details of the filling plan for Cell 3. Waste shall be placed as per the sequence and directions shown in the drawing.

The general filling will be undertaken as follows:

- Access into the cell will be directly off the existing sealed access track, with an initial access ramp and vehicle turnaround platform to be constructed.
- Upon completion of the turnaround areas, filling section 1 will commence in a north-west direction, butting up against the Cell 3 piggy back liner. For specific filling guidelines for the piggy back liner, refer to Section 2.3.4.
- Filling section 2, 3 and 4 will continue similar to above, creating one lift of waste across the floor of the cell.

- For lift two, the southern edge is stepped in from the edge of lift one to allow two-way traffic to move along the edge. The filling process then continues similar to above with 25 to 30 meter wide filling sequences running from south-east to north-west in parallel alignments.
- Each northern most alignment butts into the edge of the Cell 1 southern batter, creating one large waste profile.

Temporary bunds shall be used to guide waste placement and delineate between active waste placement sections and inactive future waste placement areas.

4.5.2 Leachate sump

A leachate sump shall be located in the south east corner, with a suitable sump to allow storage of leachate prior to pumping out. This may require excavation into the underlying material and installation of a storage tank. Leachate is to then be pumped to the previously installed ring main, discharging to the leachate pond.

4.5.3 Stormwater

The general stormwater management is the same as Cell 2, with the following alterations:

- Once runoff from Cell 1 is deemed to be sufficiently vegetated, the drain running along the eastern perimeter should be diverted to Pit 1/2 to allow direct discharge of the clean water to the eastern offsite area. This will reduce the demand on the south east sedimentation pond. The solid concrete pit cover is to be replaced with a Class C raised grate to allow water to enter the pit. To ensure this arrangement can be maintained, any future filling that would tie into the Cell 1 benches will have a batter chute at the vegetated/disturbed interface, allowing dirty water to be captured and diverted to the dirty water drain.
- Runoff from Cell 2 west is now contributing to the western perimeter drain and is being directed to the south west sedimentation ponds.
- The runoff from Cell 2 that discharges to the north will be managed as follows:
 - Revegetation to commence from the western edge, with capping profile to be built up to the existing bund constructed during Cell 1 construction. This allows any water shed from the cap to be captured on the landfill side and infiltrate into the cell.
 - As each portion is revegetated, remove that section of the bund, allowing discharge direct to the drain on the north side of the access track.

Diversion bunds are to be installed within Cell 3 between unused clean areas and active waste areas to maximise direct offsite disposal of stormwater.

4.5.4 Access track

Access to Cell 3 will be from the current access track along the eastern perimeter of the site, entering directly into the Cell from the south-eastern corner. As filling continues, the access track will run along the first lift of waste along the southern edge of the cell, ramping its way up to the central highpoint of the existing approved waste profile. It will eventually wind its way around to the northern end of Cell 4 subgrade as shown on DWG 22-16920-C7084 (Appendix A).

During initial filling, the shaping of filling should allow for a future access track into Cell 5, as shown in drawing 22-16920-C7085 (Appendix A). This will require a broad flat turning area midway along the eastern edge of Cell 3 with future widening of this perimeter access track to provide for the primary haul road.

4.5.5 Stockpiling

As discussed in Section 4.3.5, the stockpile located in Cell 6 shall be used for daily cover whilst filling Cell 3.

4.6 Cell 4

4.6.1 Waste placement

Table 4-5 Cell 4 void

Cell Parameters	Volume (m ³)
Total Void	357,500
Total Capping	31,000

Drawing 22-16920-C7084 (Appendix A) shows the details of the filling plan for Cell 4. Waste shall be placed as per the sequence and directions shown in the drawing.

The general filling will be undertaken as follows:

- An initial turnaround area will be constructed at the northern edge of the subgrade.
- Upon completion of the turnaround area, filling section 1 will commence, filling in a southern direction towards the south edge of the cell. This will achieve the first waste lift over the entire cell floor.
- Filling section 2 and 3 will then occur above the first lift, again running in a north to south direction. The filling sections will allow for a turning platform and access to the future Cell 6 area as shown in Drawing 22-16920-C7086 (Appendix A) and outlined in Section 4.8.4.
- Once these two full waste lifts occur the floor of the cell will be raised to a level suitable to begin filling in east to west direction, starting from the northern end, tying into the previously filled cells and allowing waste to be placed perpendicular to the lined walls.
- This east to west filling in 25 to 30 metre widths will continue, filling the void encompassed by the previously filled cell 1 to 3.

Temporary bunds shall be used to guide waste placement and delineate between active waste placement sections and inactive future waste placement areas.

4.6.2 Leachate sump

A leachate sump shall be provided in the south west corner. Leachate collected via this sump will be pumped to the leachate pond via connection to the perimeter ring main. A riser pipe is to extend up the perimeter wall to connect the sump to the ring main.

4.6.3 Stormwater

The general stormwater management is the same as Cell 3, with the following alterations:

- A batter chute will be installed at the interface between Cell 1 and 3, collecting the dirty water running along the Cell 3 benches and directing to the sedimentation pond.
- A temporary dirty water collection drain will run along the base of Cell 3 to direct collected runoff to the sedimentation pond. This will need to be monitored to ensure all waste is covered. If monitoring reveals leachate is contaminating this drain, it will need to be decommissioned and runoff from the temporary batters will need to infiltrate to be collected as leachate.
- A temporary clean water collection should be maintained within Cell 5 allowing collected stormwater to be directed offsite.

- Cells 1 and 2 should be fully rehabilitated with northern portions discharging through the northern clean water diversion drain directly offsite. The east portions of Cell 1 should also be discharging offsite.
- Vegetation on the west side of Cell 2 will now be established and runoff from this area can be treated as clean water. This drain can be linked with the existing clean water drain at the west of the site, and this clean runoff can be conveyed to the existing discharge point at the south-west of the site. A dirty water drain can be installed to the inside of the clean water drain and run parallel to it, conveying dirty water from Cell 4 and the stockpile on Cell 6 towards the sedimentation ponds.

4.6.4 Access track

Access to Cell 4 shall be gained by an access track around the perimeter of Cell 3 on top of the first lift of waste, followed by a small section along the perimeter of Cell 2. Access to Cell 4 shall be from the north east corner of the Cell.

The perimeter access track around the entire site should by now be completed to form a full perimeter loop removing the need for any turnaround bays in the steeper sections of the site.

4.6.5 Stockpiling

The stockpile located in Cell 6 will be fully depleted during operation of Cell 4. Alternative daily cover and imported capping material will be necessary for completion of Cell 4. Any excavations in preparation of Cell 5 and 6 could be used for daily cover during Cell 4 operation. Initial estimates indicate around 3,200 m³ of excavated material would be available.

4.7 Cell 5

4.7.1 Perimeter waste placement bund

This cell is the first to be built entirely above existing waste, with no excavation or natural material to build up against. For this reason and to limit the extent of piggy back lining required, a perimeter bund wall running along the east side of Cell 5 will be constructed. This bund wall will later extend along the edge of Cell 7 and 8.

The bund will be used to fill the first lift of waste against, with subsequent lifts to be placed in a terraced style working up the cell batter.

4.7.2 Waste placement

Table 4-6 Cell 5 void

Cell Parameters	Volume (m ³)
Total Void	146,000
Total Capping	36,000

Drawing 22-16920-C7085 (Appendix A) shows the details of the filling plan for Cell 5. Waste shall be placed as per the sequence and directions shown in the drawing.

The general filling will be undertaken as follows:

- As discussed in Section 4.7.1, the first lift will be placed against the constructed bund. This first lift will be wide enough to create a level platform to allow vehicles to turnaround.
- The second waste lift will be offset from the first to the west, creating a terraced style filling, with filling to be undertaken from the south to the north. The subsequent lifts will continue in this fashion, butting into the existing Cell 3 southern waste batter.

- Each lift of waste will be slanted at the south end allowing a continuous access ramp to be developed onto each new filling section.

Temporary bunds shall be used to guide waste placement and delineate between active waste placement sections and inactive future waste placement areas.

4.7.3 Leachate sump

Cell 5 will not have a traditional leachate sump, however leachate collection will occur at the low point of the slope. Consideration should be given to installing a tank excavated into underlying material to provide holding capacity. This tank could then be pumped to the perimeter collection ring main. As an additional safeguard against leachate overtopping, the collection system may tie into the collection system of Cell 3, utilising this sump.

4.7.4 Stormwater

The general stormwater management is the same as Cell 4, with the following alterations:

- The inlet to Pit 5\2 is to be blocked to discharge clean water directly from the high-flow spillway. Minor spillway alterations may be required here to prevent ponding of water at this location.
- Cell 3 should be revegetated and as such, the diversion chute can be removed from the Cell 1 and 3 interface. This will allow runoff collected from the Cell 3 benches to tie into the Cell 1 bench and discharge directly offsite.

4.7.5 Access track

Access to Cell 5 will vary as the profile increases, the different stages include:

- Initial filling of first lifts is to be gained via travelling along the existing eastern access road, crossing onto the perimeter access track. This track will require widening at the point where traffic is to u-turn to begin the ascent up to the Cell 5 filling area, as shown on drawing 22-16920-C7085. The access will be over Cell 3, with the profile of the track being shaped during Cell 3 filling, as outlined in Section 4.5.4.
- The second stage of filling will gain access via the access road shaped into Cell 7 and 8 during the initial filling works required prior to the landfill expansion commenced, as discussed in Section 4.2. The access will be along the edge of Cell 5 up to the crest of the current approved landform, allowing waste haulers to turn into the cell at various stages along the rise up to the crest.

4.7.6 Stockpiling

There is only minor excavation during construction of Cells 5 and 6 (approx. 3,200 m³). This material can be used as daily cover. Any imported material suitable for daily cover should be stockpiled adjacent to the active works area within the cell. As a guide, the site should maintain a minimum of two weeks supply of daily cover.

4.8 Cell 6

4.8.1 Waste placement

Table 4-7 Cell 6 void

Cell Parameters	Volume (m ³)
Total Void	327,000
Total Capping	43,500

Drawing 22-16920-C7086 (Appendix A) shows the details of the filling plan for Cell 6. Waste shall be placed as per the sequence and directions shown in the drawing.

The general filling will be undertaken as follows:

- Following placement of a turnaround area in the northern edge of the base, filling section 1 will fill from the north to the south covering the full cell floor.
- Fill section 2 and 3 will then follow in the same north to south direction creating the second lift of waste, creating a working platform of around 60 meters in width.
- The subsequent sections can then be orientated perpendicular to the east and west lined walls, allowing filling to be undertaken in an east to west direction, starting in the northern edge, and moving in a south direction. Tying into the previous Cell 4 batter.
- As each waste lift is completed, the access track will progressively be filled over.
- The southern edge of each lift will be pulled back from the preceding one to create a terraced finish.

Temporary bunds shall be used to guide waste placement and delineate between active waste placement sections and inactive future waste placement areas.

4.8.2 Leachate sump

A leachate sump is to be provided at the southern end of Cell 6, with a riser up to the perimeter road and connection into the ring main that feeds to leachate pond. The cell sump and adjoining perimeter bund should be sized to allow for temporary in-cell storage.

4.8.3 Stormwater

The general stormwater management is the same as Cell 5, with the following alterations:

- Stormwater captured on Cell 5 is to be diverted to the south east sedimentation pond while vegetation is established.
- The dirty water drain adjacent to Cell 4 can be removed as soon as vegetation is sufficiently established. Hence, clean water runoff from Cells 2 and 4 can be conveyed along the western clean water drain for direct discharge offsite at the existing discharge point at the south of the site.

4.8.4 Access track

Access to Cell 6 is to be gained via an access track built through Cell 7 and 8 during initial filling as discussed in Section 4.2, following as close as possible the ridge of Cell 7 to ensure minimal stormwater is intercepted by the road. The road travels along the ridge between Cell 5 and 6, then grades down the south edge of Cell 4 at a maximum grade of 15%. This will require shaping of filling during Cell 4 to allow the road to be cut into the batter. The final segment of ramp into Cell 6 will be cut into existing material within the north-west corner.

4.8.5 Stockpiling

The minor excavations required during construction of Cell 6 would have been utilised for daily cover of previous cells, therefore, no stockpiles will be present during this stage. Similar to Cell 5, any imported material suitable for daily cover should be stockpiled adjacent to the active works area within the cell. As a guide, the site should maintain a minimum of two weeks supply of daily cover.

4.9 Cells 7 and 8

Due to the limited potential fill capacity of Cells 7 and 8 these cells have been removed from the scope of this design. The cells will be finally capped during the initial construction stage for cells 1 and 2 in order to achieve the final height of the landform in the respective areas for cells 7 and 8.

4.10 Cell 9

4.10.1 Waste placement

Table 4-8 Cell 9 void

Cell Parameters	Volume (m ³)
Total Void	533,000
Total Capping	91,500

Drawing 22-16920-C7087 (Appendix A) shows the details of the filling plan for Cell 9. Waste shall be placed as per the sequence and directions shown in the drawing.

The general filling for Cell 9 will be undertaken as follows:

- Following construction of an access track along the south base of the landfill, a level pad will be built in the south east corner of Cell 9 base, to allow trucks to turnaround.
- From this initial pad, filling with progress in a west direction, creating filling section 1, a 25-30 meter wide level platform along the base.
- Filling Section 2 will be constructed in the same manner, starting at the south east edge and working west.
- This style of filling will continue until the entire Cell 9 base is covered. The direction will enable filling to be perpendicular to the lined batters.
- Once the filling has covered the entire base, the process can repeat itself. As each waste lift is finished, the next lift will be longer as the void widens out.

Temporary bunds shall be used to guide waste placement and delineate between active waste placement sections and inactive future waste placement areas.

4.10.2 Leachate sump

A leachate sump shall be placed at the southern end of the Cell. Leachate will be collected via this sump and connected to the ring main to be pumped to the leachate pond.

4.10.3 Stormwater

The general stormwater management is the same as Cell 6, with the following alterations:

- During construction the higher south-west pond will be removed, therefore only a single pond will remain on the western side. This pond remaining is sized for collection of all dirty water runoff from Cell 9 and a portion of Cell 8. To maximise dirty water retention on site, the removal of the pond should be delayed until final excavation is complete. The construction of Cell 9 may initially be confined to the northern end, this approach would allow the pond to be retained as a first flush capture of all the heavily sediment laden runoff from the construction works.
- The runoff along the west up to the north edge of Cell 6 is clean water and as such should be discharging directly to the west (if this option was allowed).

- An alternative arrangement would be a clean water diversion under Cell 9, which would include the following:
 - Construct the diversion drain under (or within the batter of) Cell 9, connecting to the western diversion drain, discharging to the south of Cell 9. All runoff within the perimeter drain will now discharge directly to the unnamed watercourse running along the south.
 - Finish excavation and lining of Cell 9 (this needs to occur before Cell 6 filling reaches the height where it will be discharging to the west perimeter drain).
 - As the filling in Cell 6 reaches the height of the perimeter drain, construct a bund running along the west edge of Cell 6. Any runoff from the uncapped/establishing grasses, will be kept separate from the clean water perimeter drain and instead drop into Cell 9 where it will be collected as leachate.
 - Upon completion of the vegetation of Cell 6, remove the west bund and allow discharge directly into the completed diversion drain.
- A perimeter drain along the west of Cell 9 should also be constructed. The works include:
 - A drain would collect the north west portion of the cell and flow towards the northern end of Cell 9. This should be clean water until runoff from Cell 9 contributes. Depending on the clean water arrangement chosen (western discharge point or Cell 9 subsurface diversion), this water would then either discharge directly to the west or flow through the diversion drain beneath Cell 9.
 - Once Cell 9 begins to contribute to this drain (i.e. it becomes dirty water), it should be discharged directly into Cell 9, where the dirty water will be treated as leachate. To allow this, the filling of the north-west corner of Cell 9 should be kept below the crest along the perimeter to act as a holding pond to allow infiltration to occur.
 - Once revegetation is complete, the drain can be redirected to the western discharge point or the diversion under Cell 9. The remaining depression in the north-west portion of Cell 9 will be filled and turfed to allow immediate discharge to the clean water system.
 - A drain would collect the south west portion of the cell, running south towards the remaining south west sedimentation basin. Initially this would be clean water and therefore, these waters could be discharged at the existing southern clean water discharge point.
 - Once Cell 9 starts to contribute to the drain running south, this should be feeding into the south west sedimentation pond. From there it may be manually pumped out (or siphoned) once it reaches required water quality parameters.
- If stockpiling within Cell 7 is required, upstream diversions should be constructed to divert clean water offsite around the east and west of the stockpile. The stockpile catchment will then direct sediment laden waters to the south east sedimentation pond.
- The runoff from the vegetated Cell 5 capping should now be clean water and able to be discharged directly offsite. With this capping complete, the entire eastern catchment should now be freely discharging direct offsite.

4.10.4 Access track

Access to Cell 9 will be via a haul road along the base of Cells 7 and 8. The access track will follow the southern edge and enter Cell 9 at the south-eastern corner. As each waste lift is completed, the haul road will be ramped up along the southern edge to allow access to the next lift.

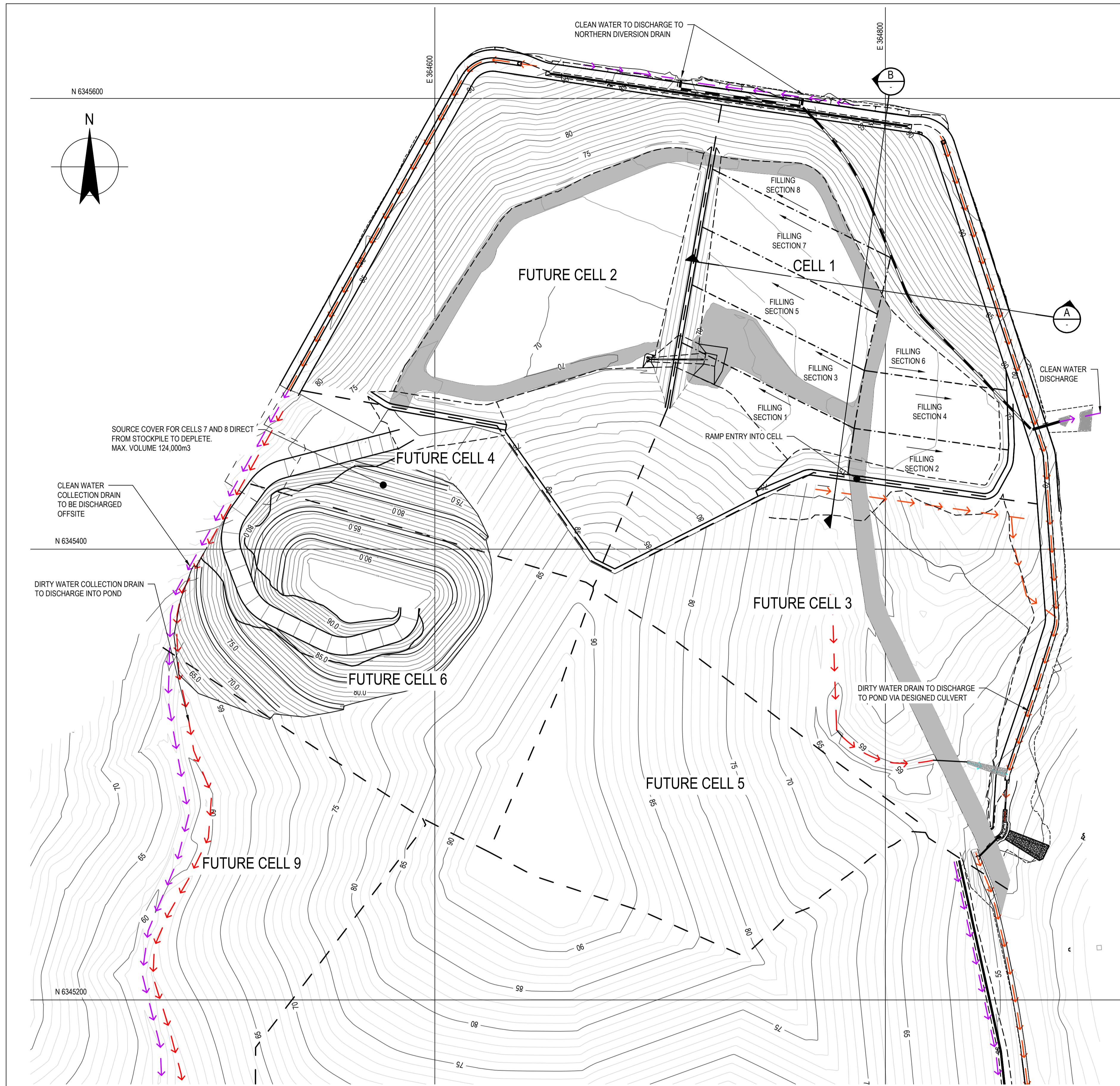
During construction of Cell 9, a haul road should be constructed from the northern tip of Cell 9, up onto the west edge of Cell 6, allowing construction movements along this edge into completed cells 4 and 5 to use any suitable excavated material for capping.

4.10.5 Stockpiling

Material excavated in construction of Cell 9 should be used as capping material in Cells 3, 4, 5 and 6 if appropriate with unsuitable material being placed within the active portions of Cell 6 for use as daily cover. Any remaining material should be stockpiled within the flatter southern base area of Cell 7 where the existing proposed final landform contours indicate a small gully will be formed. This will require diversion bunds to be established around the upstream portion to maintain a clean and dirty water separation.

Appendices

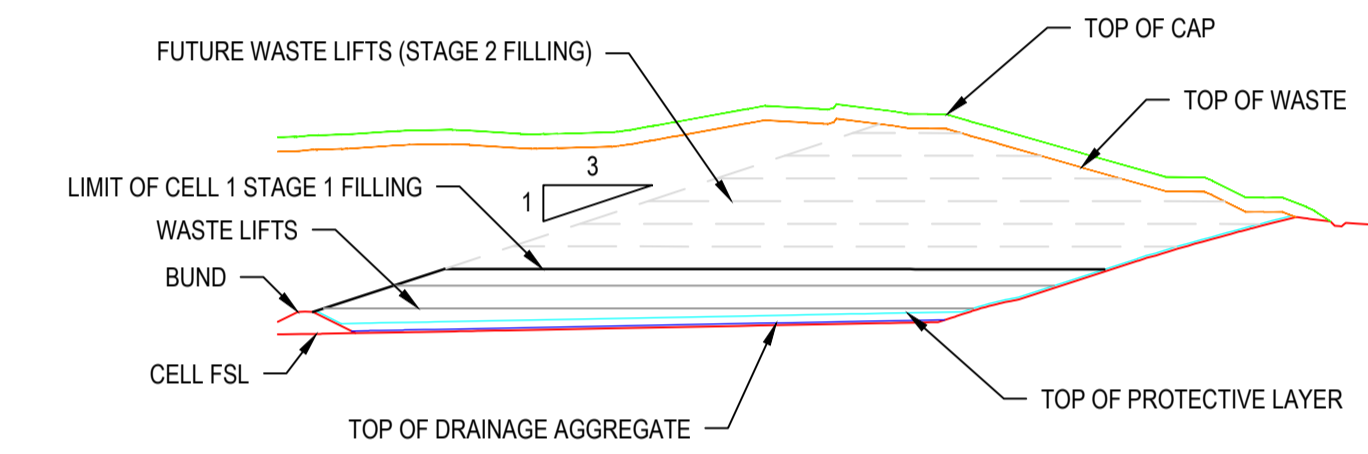
Appendix A – Filling concept drawings



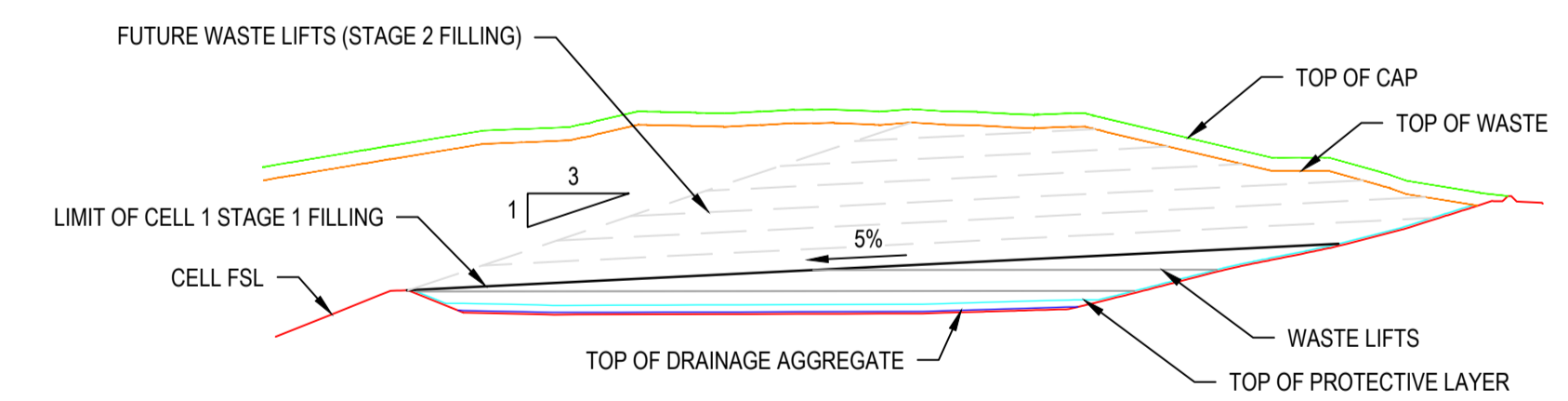
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NOTES:
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 - MINOR DESIGN CONTOUR
 - TOP OF DESIGN BATTER
 - - - - - APPROXIMATE FILLING SECTION BOUNDARY
 - → → CLEAN WATER COLLECTION DRAIN
 - → → DIRTY WATER COLLECTION DRAIN
 - — — DRAINAGE PIPE
 - → → EXISTING CREEK



A SECTION
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B SECTION
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GHD Tower, Level 3
24 Honeysuckle Drive, Newcastle NSW 2300 Australia
PO Box 5403 Hunter Rgn Mail Cent, NSW 2310
T 61 2 4979 9599 F 61 2 4979 9988
E ntlmail@ghd.com W www.ghd.com

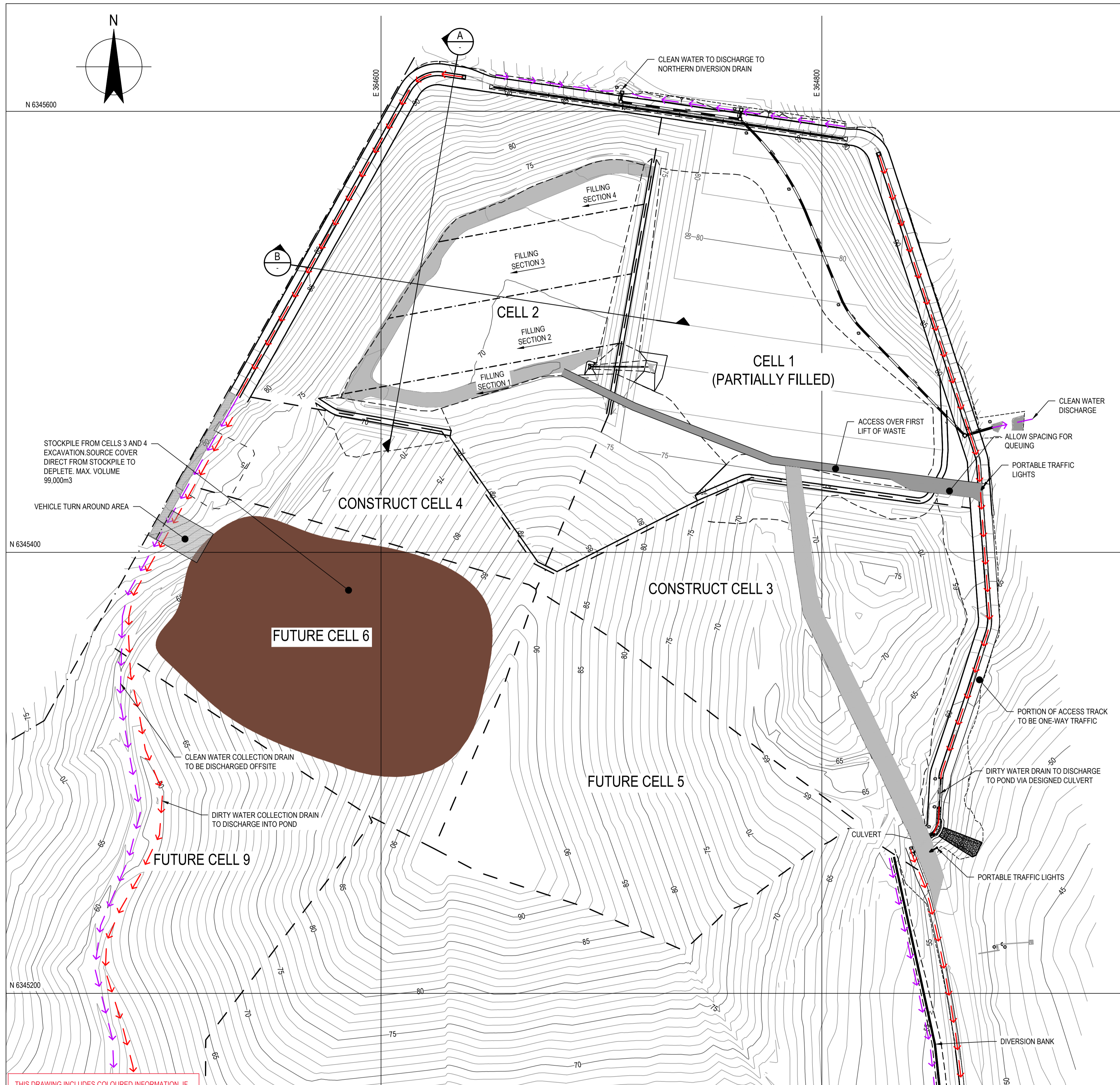
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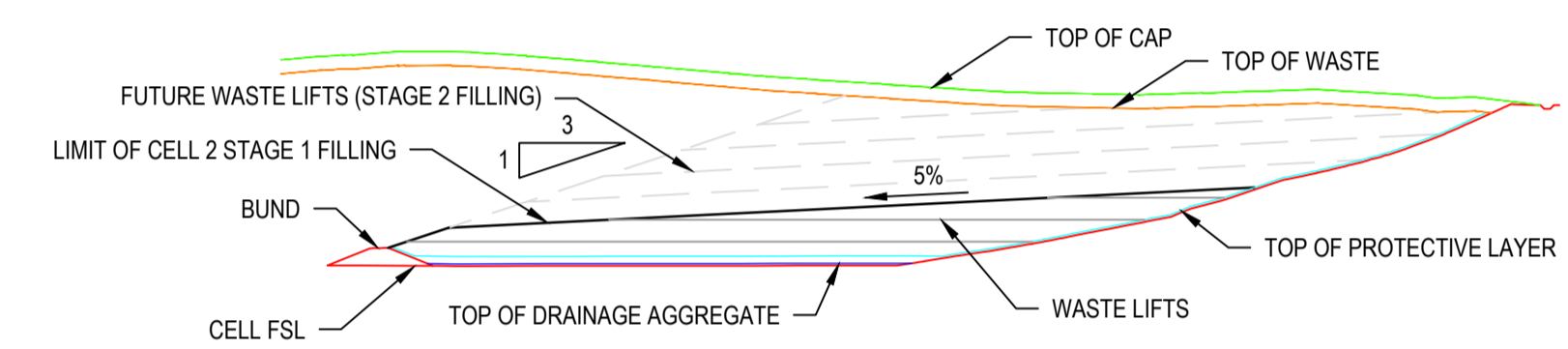
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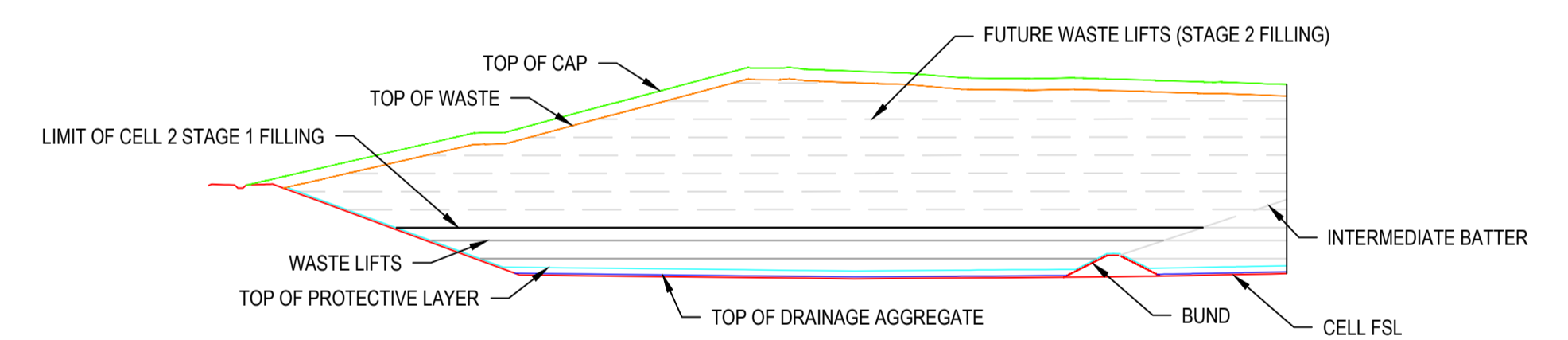


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 - - - - - TOE OF DESIGN BATTER/POND/BUND
 - - - - - APPROXIMATE FILLING SECTION BOUNDARY
 - → → → → CLEAN WATER COLLECTION DRAIN
 - → → → → DIRTY WATER COLLECTION DRAIN
 - DRAINAGE PIPE



A SECTION
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B SECTION
SCALE 1: 1000

PLAN
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 PO Box 5403 Hunter Rgn Mail Cent, NSW 2310
 T 61 2 4979 9599 F 61 2 4979 9988
 E ntmill@ghd.com W www.ghd.com

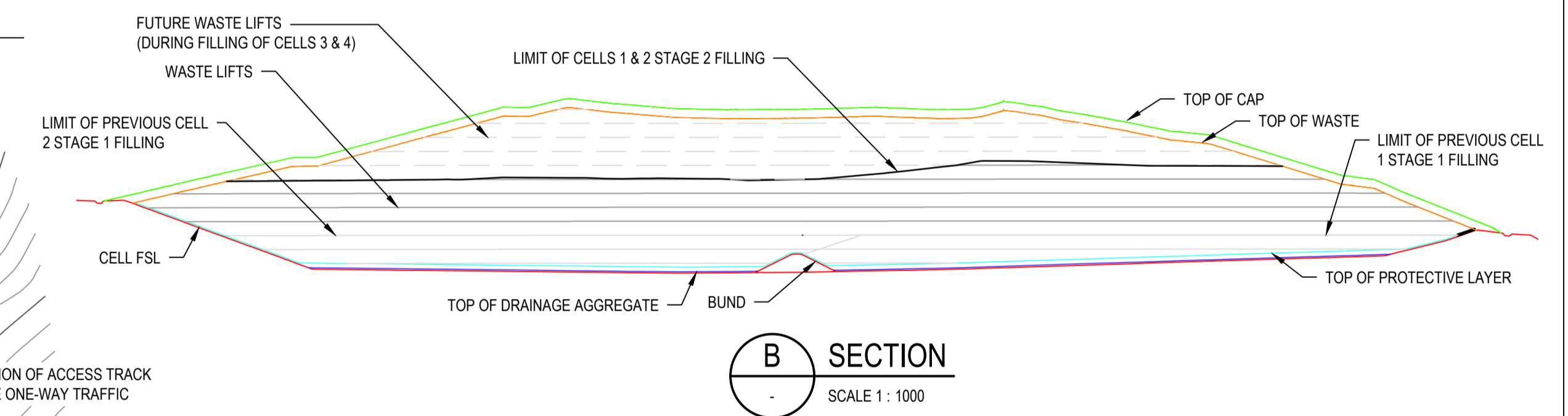
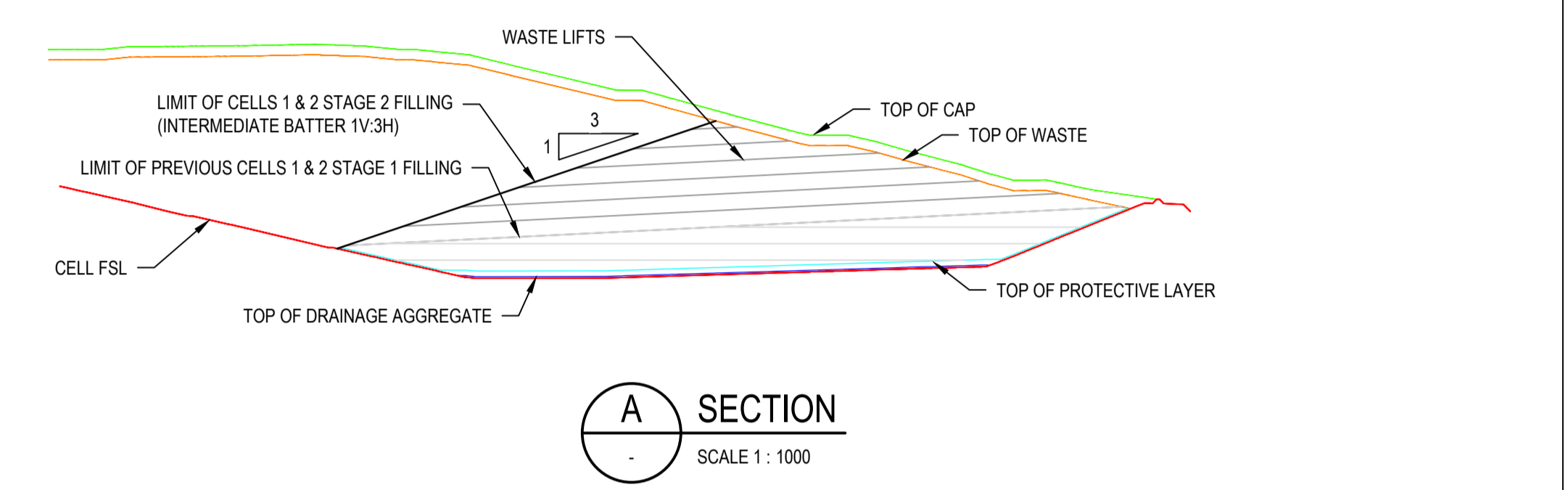
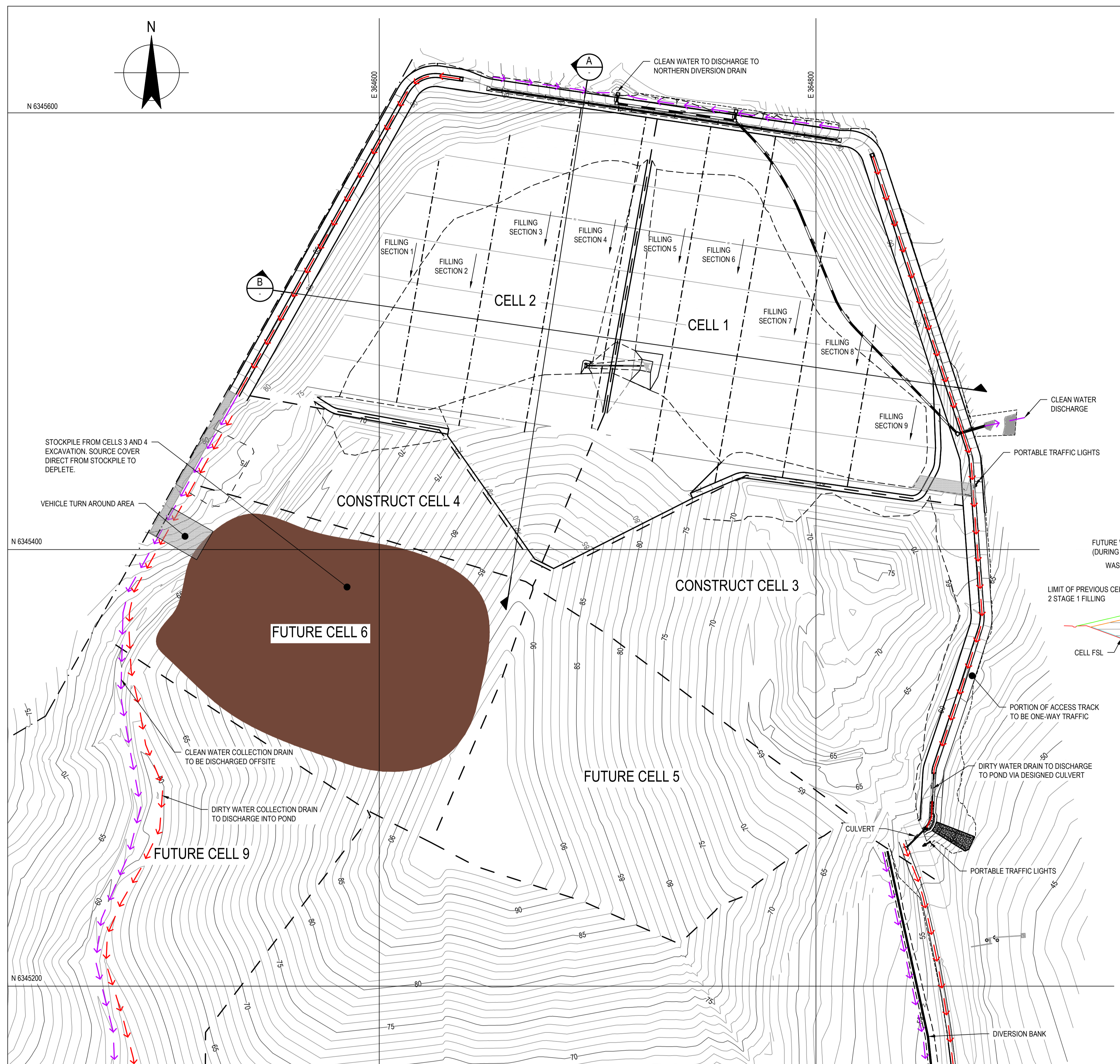
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		Rev:	B

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 - → → CLEAN WATER COLLECTION DRAIN
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 - DRAINAGE PIPE



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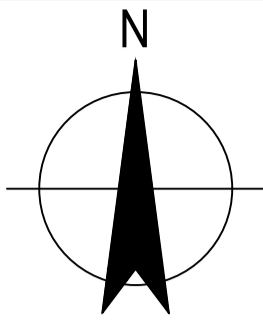
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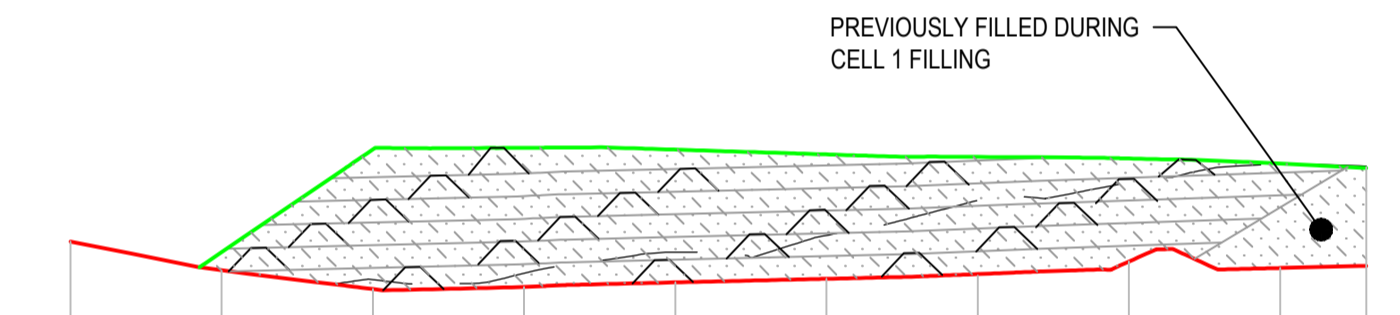
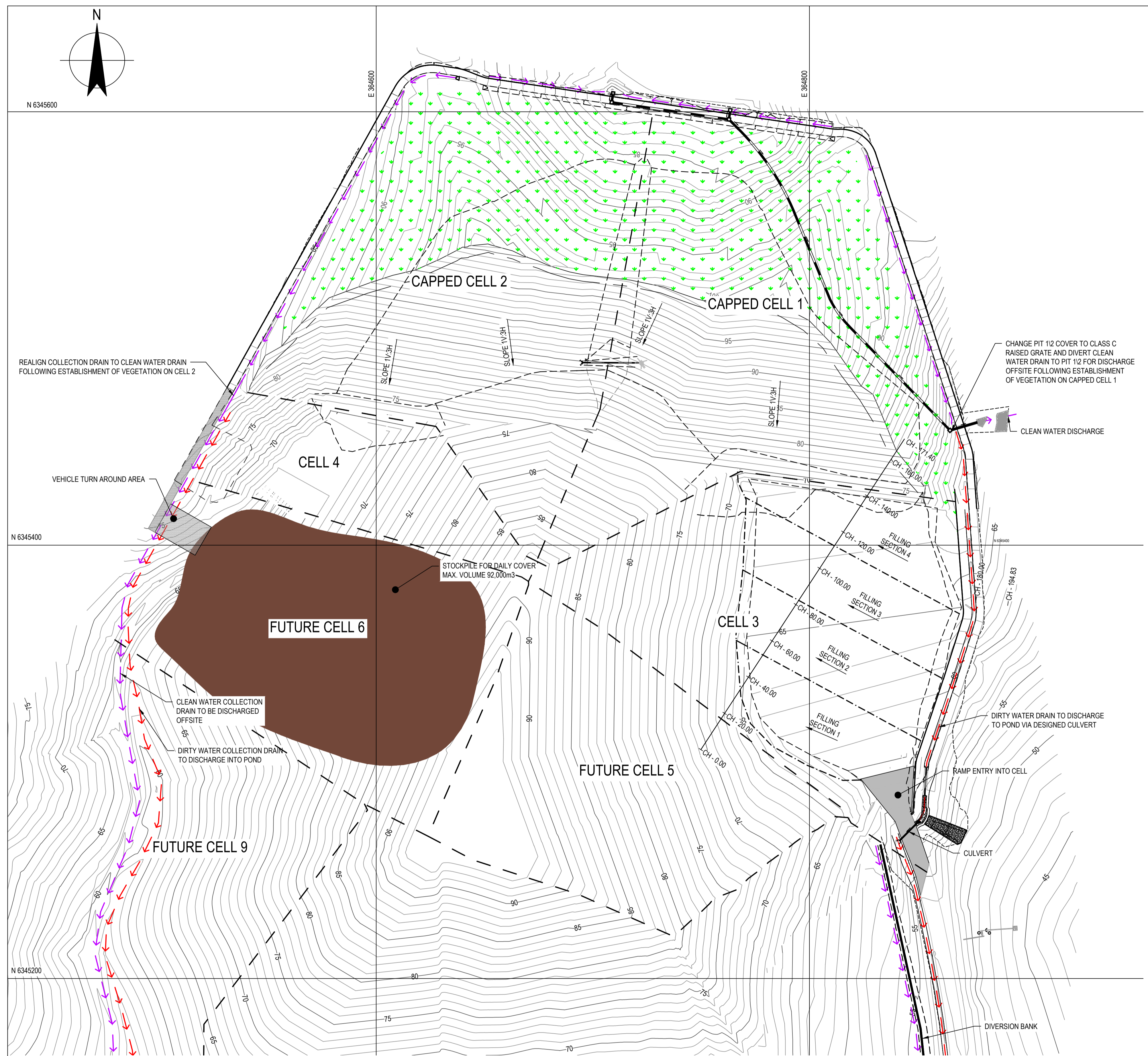
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 - TOP OF DESIGN BATTER
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 - - - - - APPROXIMATE FILLING SECTION BOUNDARY
 - → → CLEAN WATER COLLECTION DRAIN
 - → → DIRTY WATER COLLECTION DRAIN
 - DRAINAGE PIPE



DATUM RL. 49.00

CELL 3 TOP OF CAP	70.75	69.33	82.95	83.17	82.93	82.30	81.96	81.76	81.10	80.51
CELL 3 DESIGN SURFACE	70.75	66.97	64.50	64.77	65.37	66.95	66.47	66.13	67.28	67.55
EXISTING SURFACE LEVEL	70.75	66.97	65.73	65.58	69.37	71.59	76.22	78.62	81.06	80.75
LEVEL DIFFERENCE CUT - / FILL +	0	0	-1.23	-1.81	-4	-5.74	-9.95	-10.48	-7.27	-0.14
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	171.40

CELL 3 LONGITUDINAL SECTION
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DO NOT SCALE

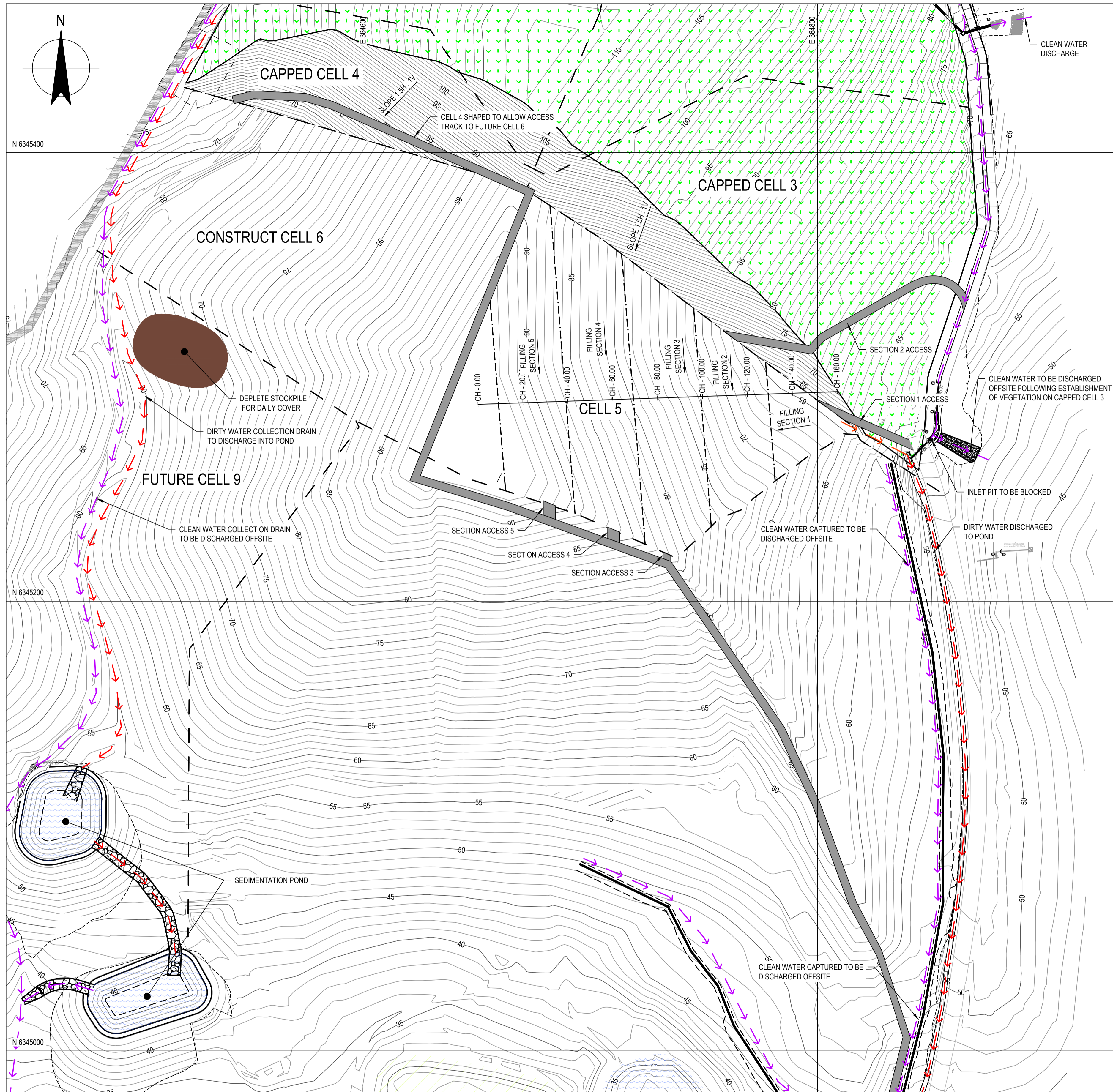
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Drafting Check	T. NGUYEN	Design Check	D. BARRETT
Approved (Project Director)	D. BARRETT		
Date	25.09.19		
Scale	AS SHOWN		

PRELIMINARY

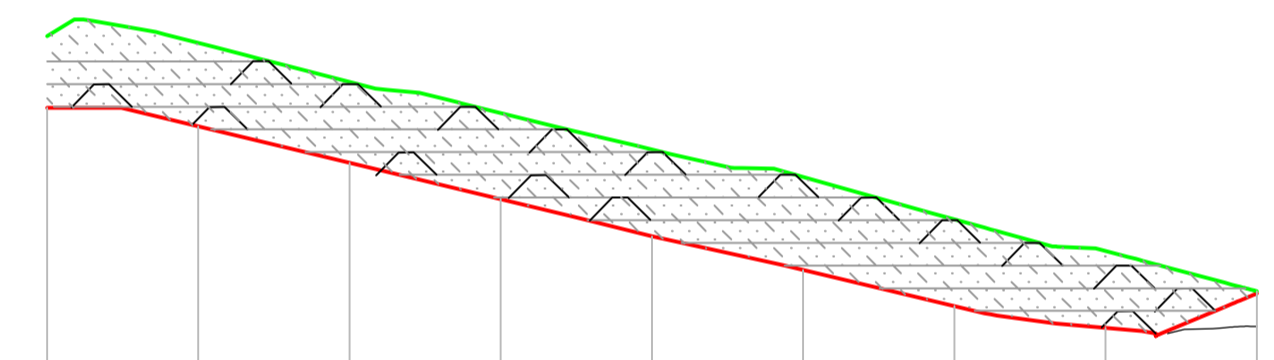
Client **LAKE MACQUARIE CITY COUNCIL**
 Project **AWABA WASTE MANAGEMENT FACILITY EXPANSION**
 Title **CELL 3 FILLING CONCEPT FILLING PLAN & TYPICAL SECTION**

Original Size **A1** Drawing No: **22-16920-C7083** Rev: **B**



NOTES:
 1. FOR LEGEND AND GENERAL NOTES REFER TO DRAWING 22-16920-C7001.

- LEGEND:**
- APPROXIMATE STAGING BOUNDARIES
 - 60— MAJOR DESIGN CONTOUR
 - MINOR DESIGN CONTOUR
 - TOP OF DESIGN BATTER
 - - - - - TOE OF DESIGN BATTER/POND/BUND
 - - - - - APPROXIMATE FILLING SECTION BOUNDARY
 - → → CLEAN WATER COLLECTION DRAIN
 - → → DIRTY WATER COLLECTION DRAIN
 - DRAINAGE PIPE



DATUM RL. 48.00

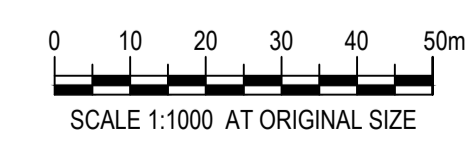
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CELL 5 DESIGN SURFACE	94.00	91.56	86.74	81.93	77.01	72.56	67.79	64.91	60.46
EXISTING SURFACE LEVEL	94.00	91.56	86.74	81.93	77.01	72.56	67.79	64.91	60.11
LEVEL DIFFERENCE CUT - / FILL +	0	-0	-0	-0	0	-0	0	-0	4.35
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00

CELL 5 LONGITUDINAL SECTION
 SCALE 1000V:1000H

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PLAN
 SCALE 1:1000

B	FOR INFORMATION	BS	KR	DMB	25.09.19	
A	PRELIMINARY ISSUE TO CLIENT	BS			22.08.19	
No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date



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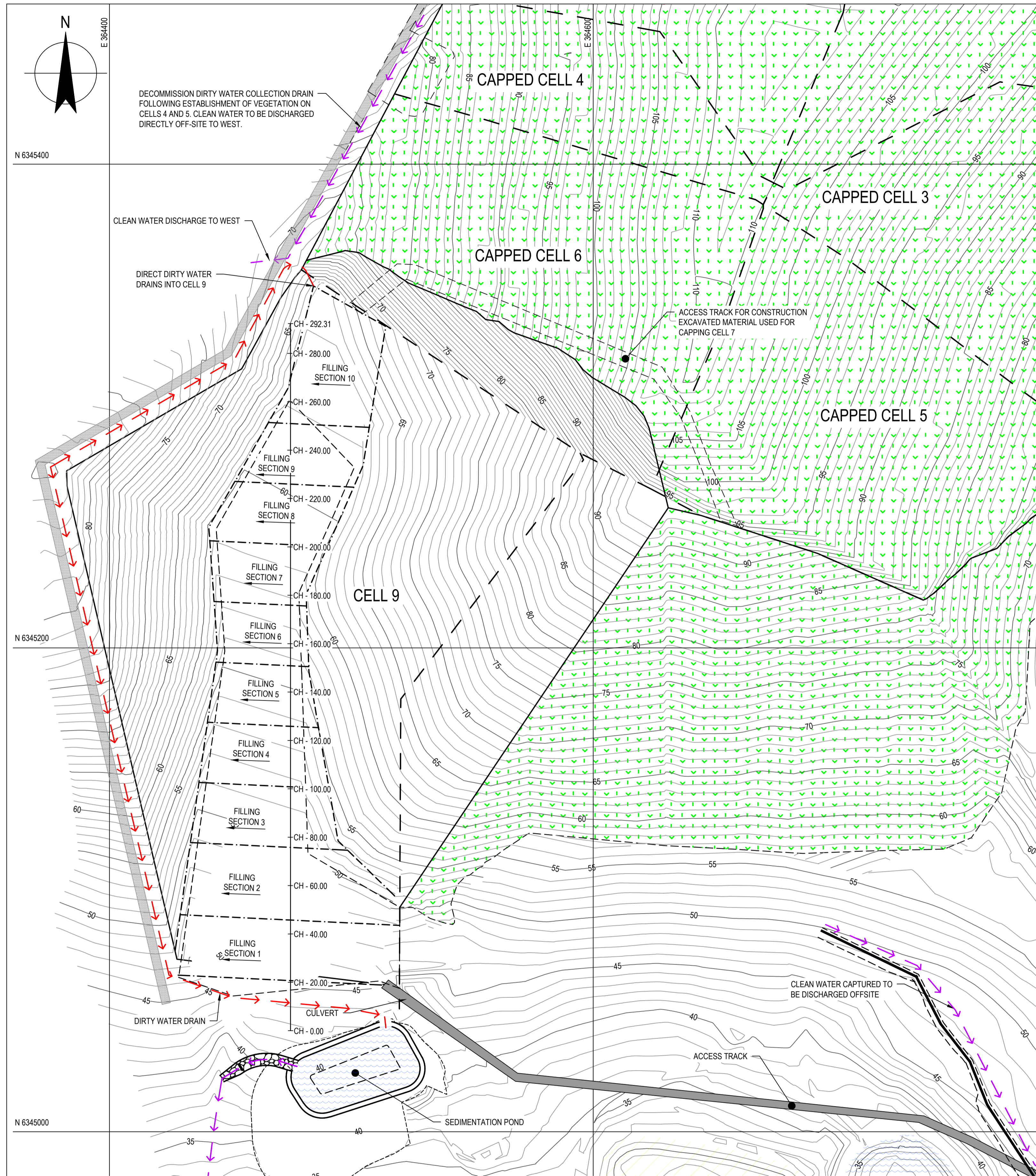
Drawn	B.STANKEWYCZ	Designer	J. DAWES
Drafting Check	T. NGUYEN	Design Check	D. BARRETT
Approved (Project Director)	D. BARRETT		
Date	25.09.19		
Scale	AS SHOWN		

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Client **LAKE MACQUARIE CITY COUNCIL**
 Project **AWABA WASTE MANAGEMENT FACILITY EXPANSION**
 Title **CELL 5 FILLING CONCEPT FILLING PLAN & TYPICAL SECTION**

Original Size **A1** Drawing No: **22-16920-C7085** Rev: **B**



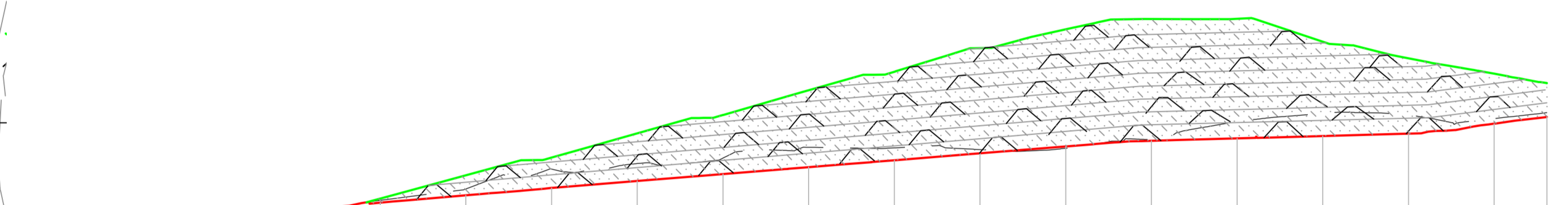
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PLAN
SCALE 1:1000

NOTE:
1. LIFT 1 ONLY IS SHOWN IN PLAN VIEW. REFER TO LONGITUDINAL SECTION FOR OTHER LIFTS.

NOTES:
1. FOR LEGEND AND GENERAL NOTES REFER TO DRAWING 22-16920-C7001.

- LEGEND:**
- APPROXIMATE STAGING BOUNDARIES
 - 60— MAJOR DESIGN CONTOUR
 - MINOR DESIGN CONTOUR
 - TOP OF DESIGN BATTER
 - - - - - TOE OF DESIGN BATTER/POND/BUND
 - - - - - APPROXIMATE FILLING SECTION BOUNDARY
 - → → CLEAN WATER COLLECTION DRAIN
 - → → DIRTY WATER COLLECTION DRAIN
 - DRAINAGE PIPE



DATUM RL. 27.00											
CELL 9 TOP OF CAP											
CELL 9 DESIGN SURFACE	42.60	45.00	46.71	48.42	50.04	51.65	53.26	54.87	56.48	58.09	59.69
EXISTING SURFACE LEVEL	42.60	45.55	48.20	52.81	54.11	55.37	57.90	57.75	57.36	57.65	63.90
LEVEL DIFFERENCE CUT - / FILL +	0	-0.55	-1.49	-4.39	-4.07	-3.72	-4.64	-2.88	-0.88	0.44	-3.94
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00

CELL 9 LONGITUDINAL SECTION
SCALE 1000V:1000H

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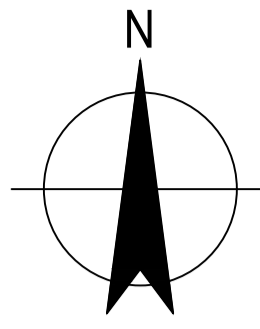
Drawn	B.STANKEWYCZ	Designer	J. DAWES
Drafting Check	T. NGUYEN	Design Check	D. BARRETT
Approved (Project Director)	D. BARRETT		
Date	25.09.19		
Scale	AS SHOWN		

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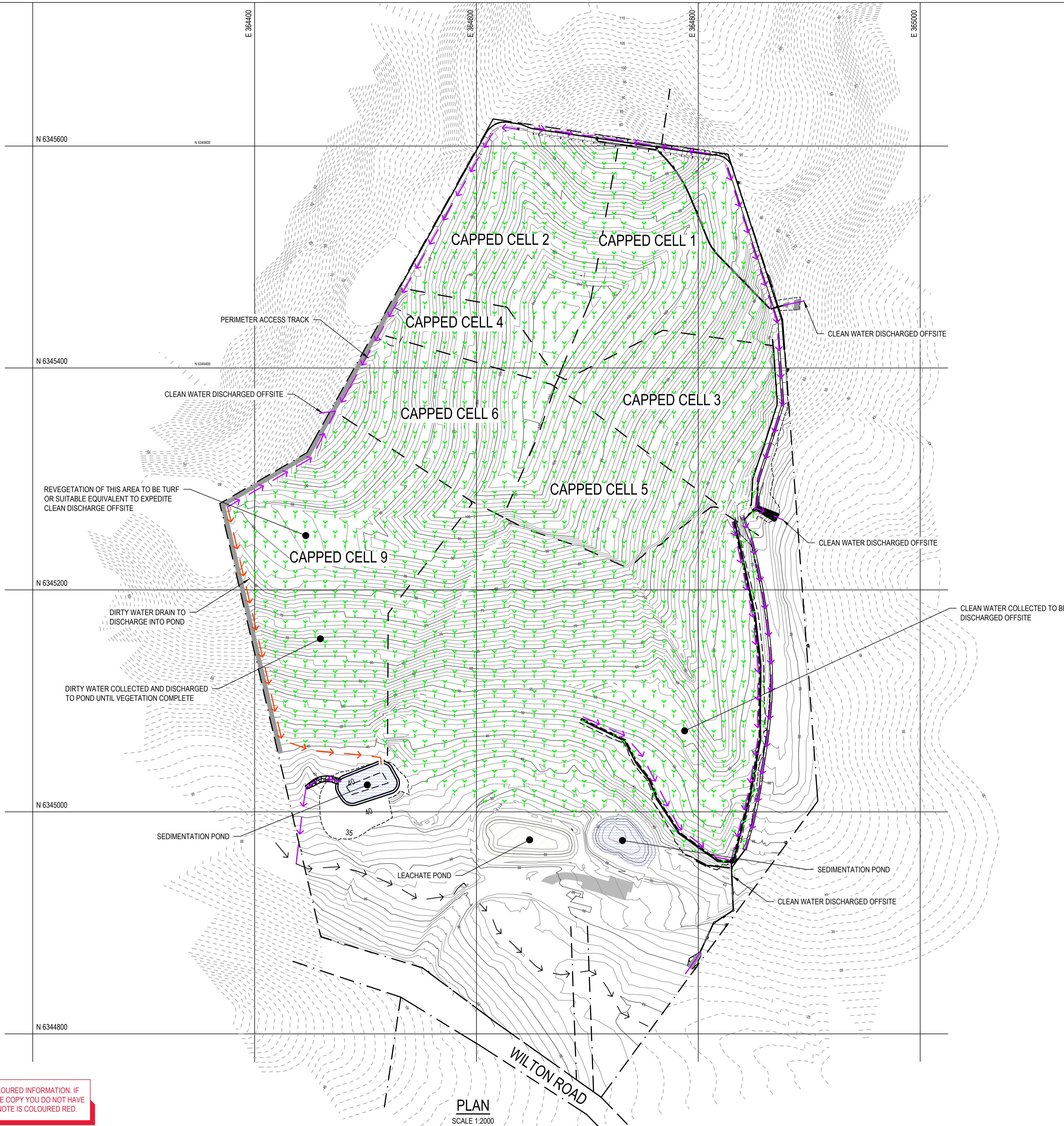
Client **LAKE MACQUARIE CITY COUNCIL**
Project **AWABA WASTE MANAGEMENT FACILITY EXPANSION**
Title **CELL 9 FILLING CONCEPT FILLING PLAN & TYPICAL SECTION**

Original Size **A1** Drawing No: **22-16920-C7087** Rev: **B**



NOTES:
 1. FOR LEGEND AND GENERAL NOTES REFER TO DRAWING 22-16920-C7001.

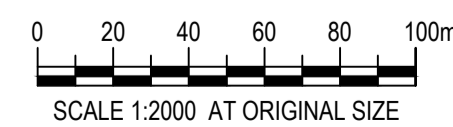
- LEGEND:**
- APPROXIMATE STAGING BOUNDARIES
 - 60— MAJOR DESIGN CONTOUR
 - MINOR DESIGN CONTOUR
 - → CLEAN WATER COLLECTION DRAIN
 - → DIRTY WATER COLLECTION DRAIN
 - DRAINAGE PIPE
 - RM — LEACHATE TRANSFER MAIN
 - → EXISTING CREEK



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B	FOR INFORMATION		BS	KR	DMB	25.09.19
A	PRELIMINARY ISSUE TO CLIENT		BS			22.08.19



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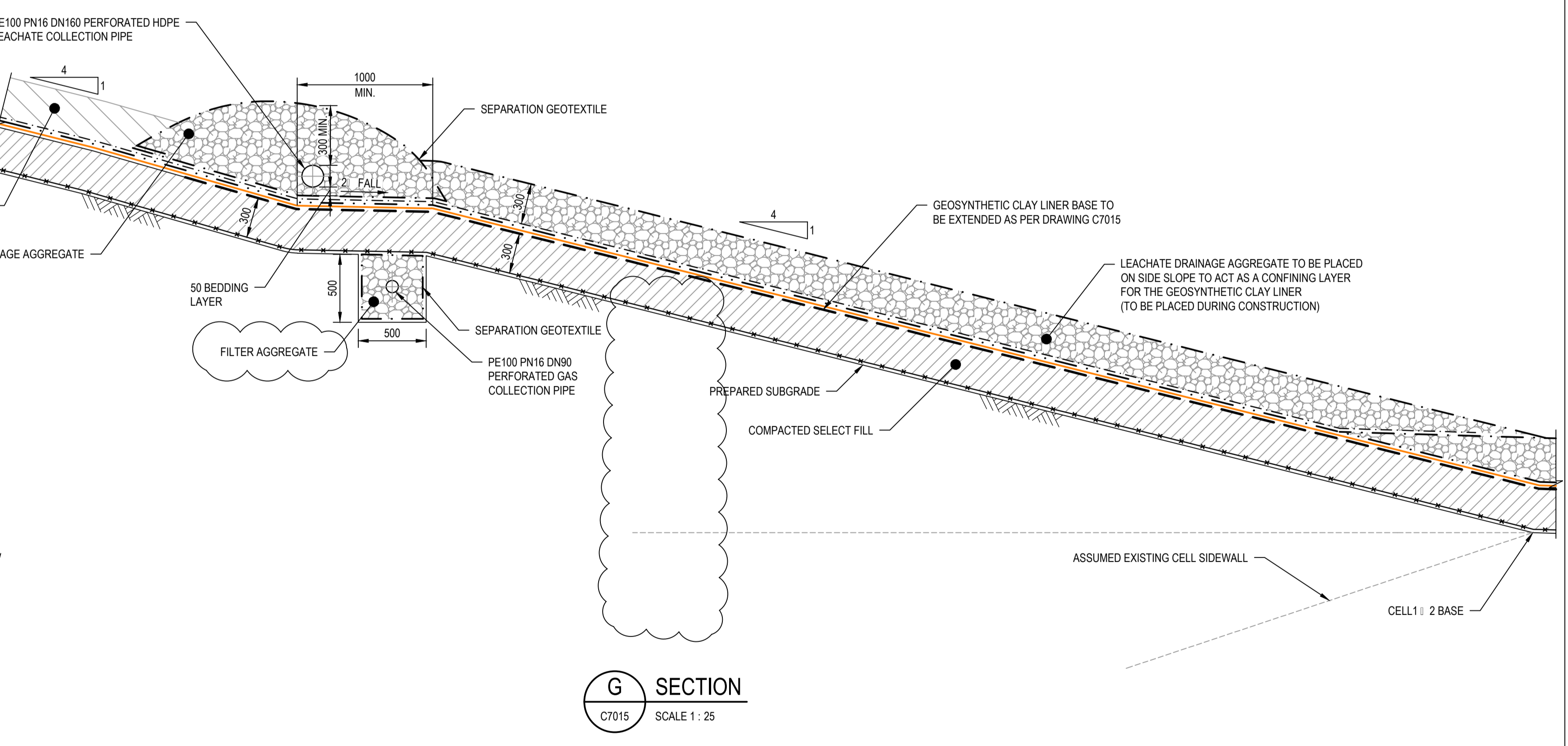
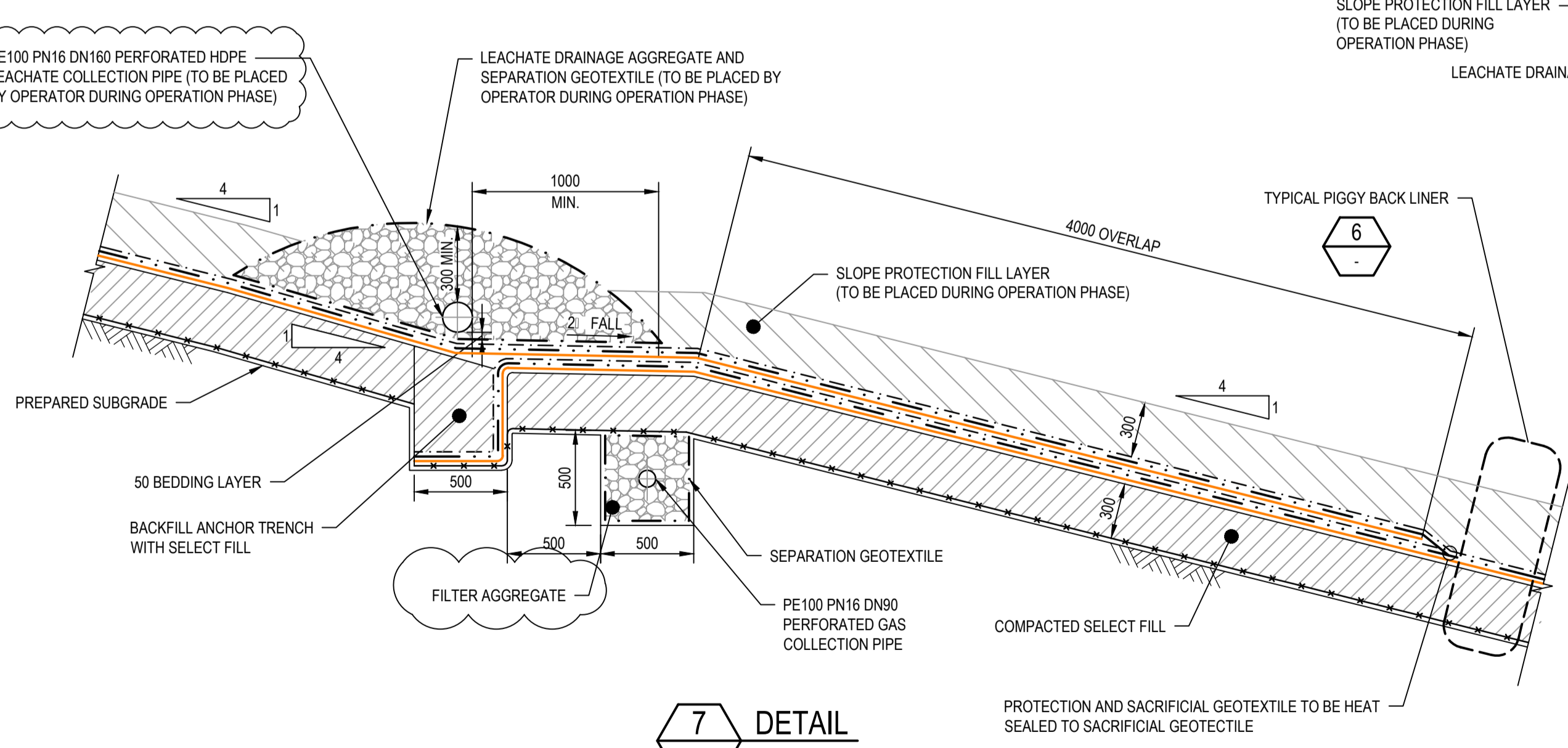
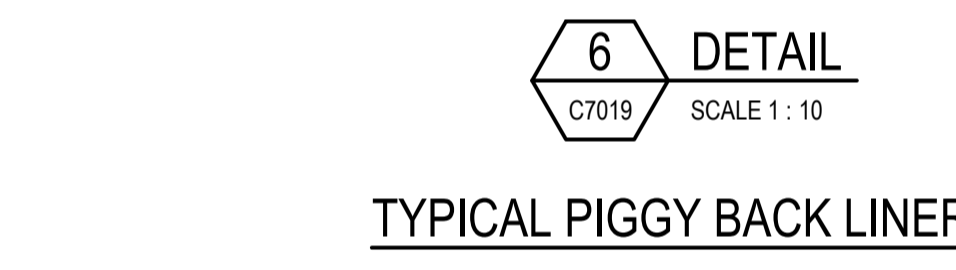
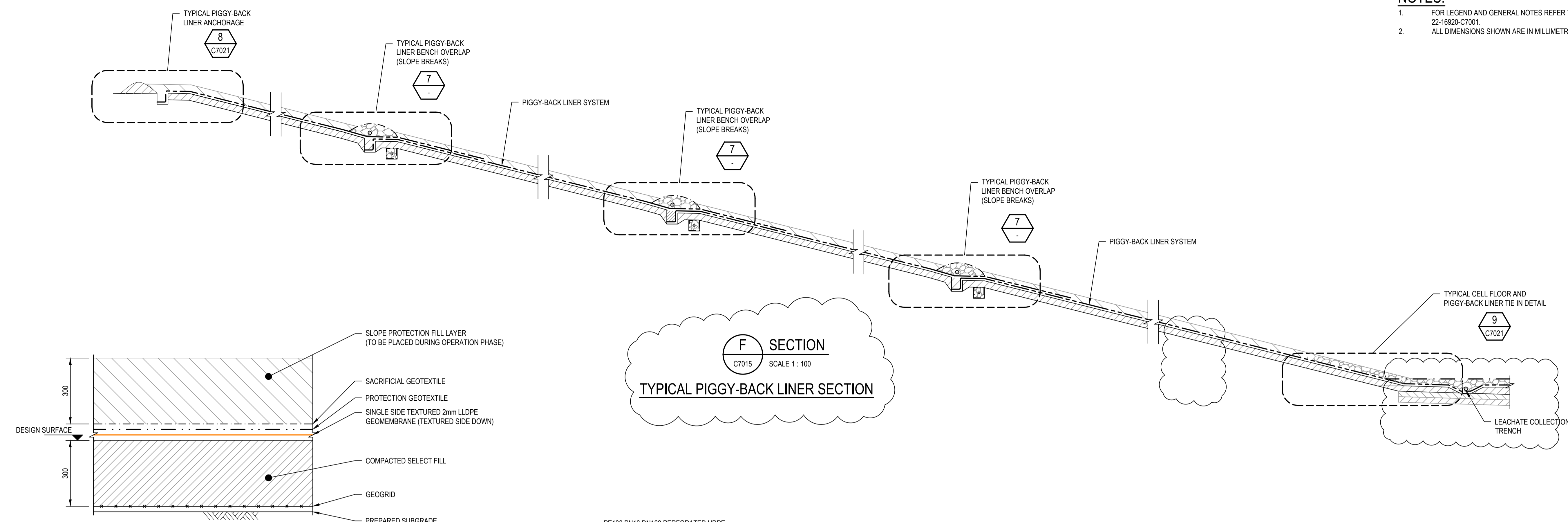
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Drafting Check	T. NGUYEN	Design Check	D. BARRETT
Approved (Project Director)	D. BARRETT		
Date	25.09.19		
Scale	AS SHOWN		

Client	LAKE MACQUARIE CITY COUNCIL		
Project	AWABA WASTE MANAGEMENT FACILITY EXPANSION		
Title	FILLING CONCEPT FINAL LANDFORM PLAN		
Original Size	A1	Drawing No:	22-16920-C7088
		Rev:	B

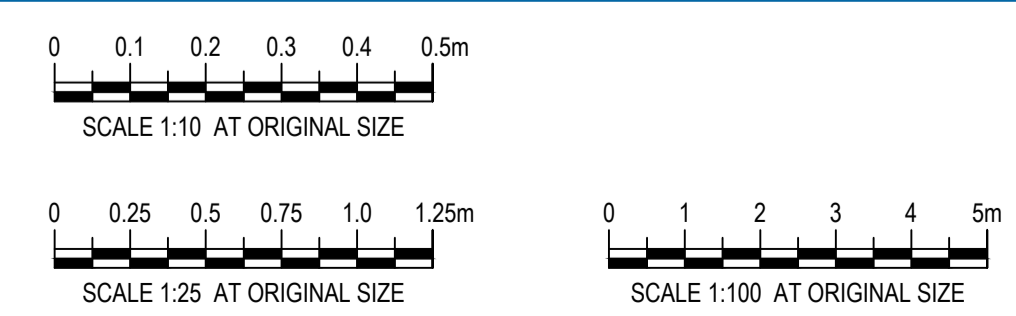
Appendix B – Ancillary drawings

- NOTES:**
- FOR LEGEND AND GENERAL NOTES REFER TO DRAWING 22-16920-C7001.
 - ALL DIMENSIONS SHOWN ARE IN MILLIMETRES.



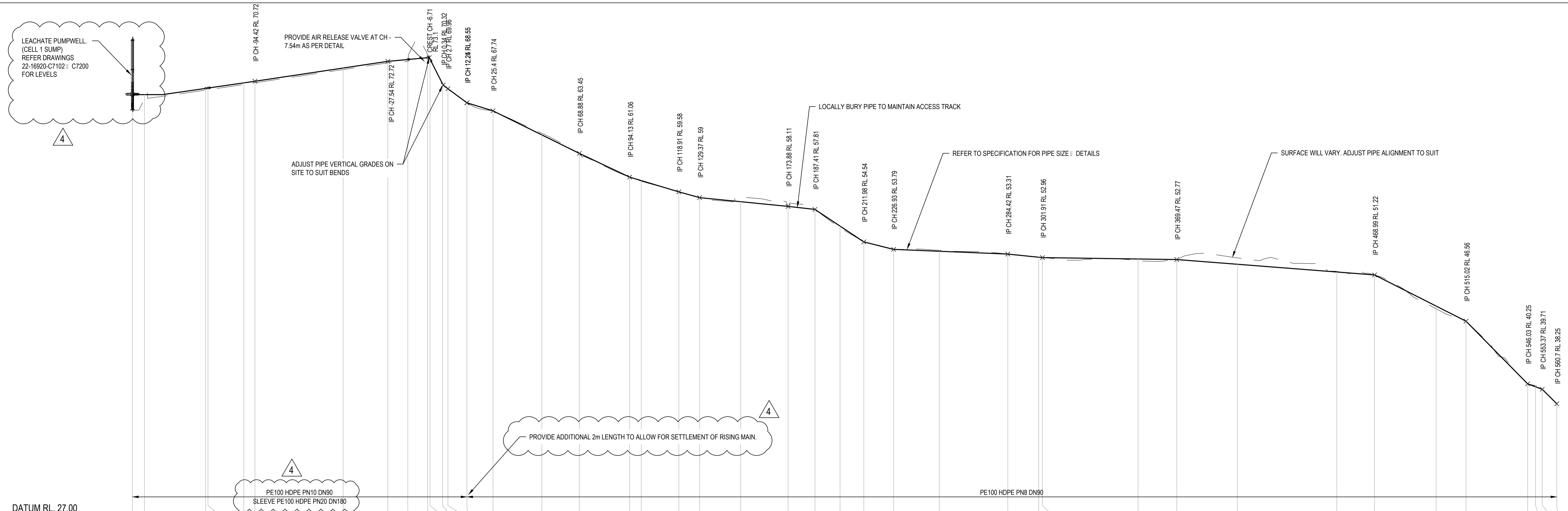
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No	Revision	Note	Drawn	Job Manager	Project Director	Date
4		LEACHATE COLLECTION TRENCH	B.D	K.R	D.B	06.09.18
3		NOTE CHANGE	BD	K.R*	D.B*	01.06.18
2		BRIDGING LAYER ADDED	RJC	K.R*	M.G*	15.05.18
1		LLDPE GEOMEMBRANE DETAIL REVISED	B.D	K.R*	M.G*	07.02.17
0		FOR CONSTRUCTION	C.B	K.R*	M.G*	19.10.16



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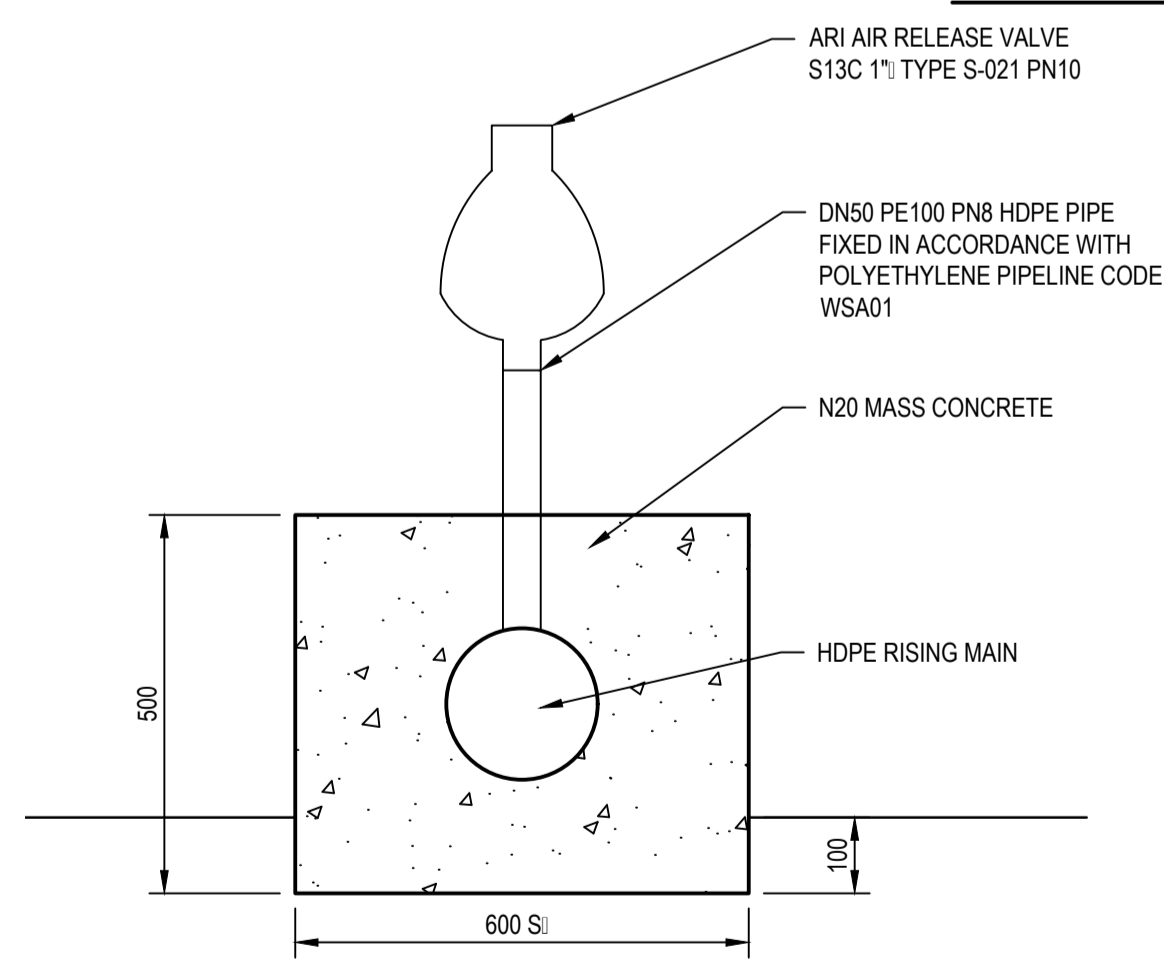
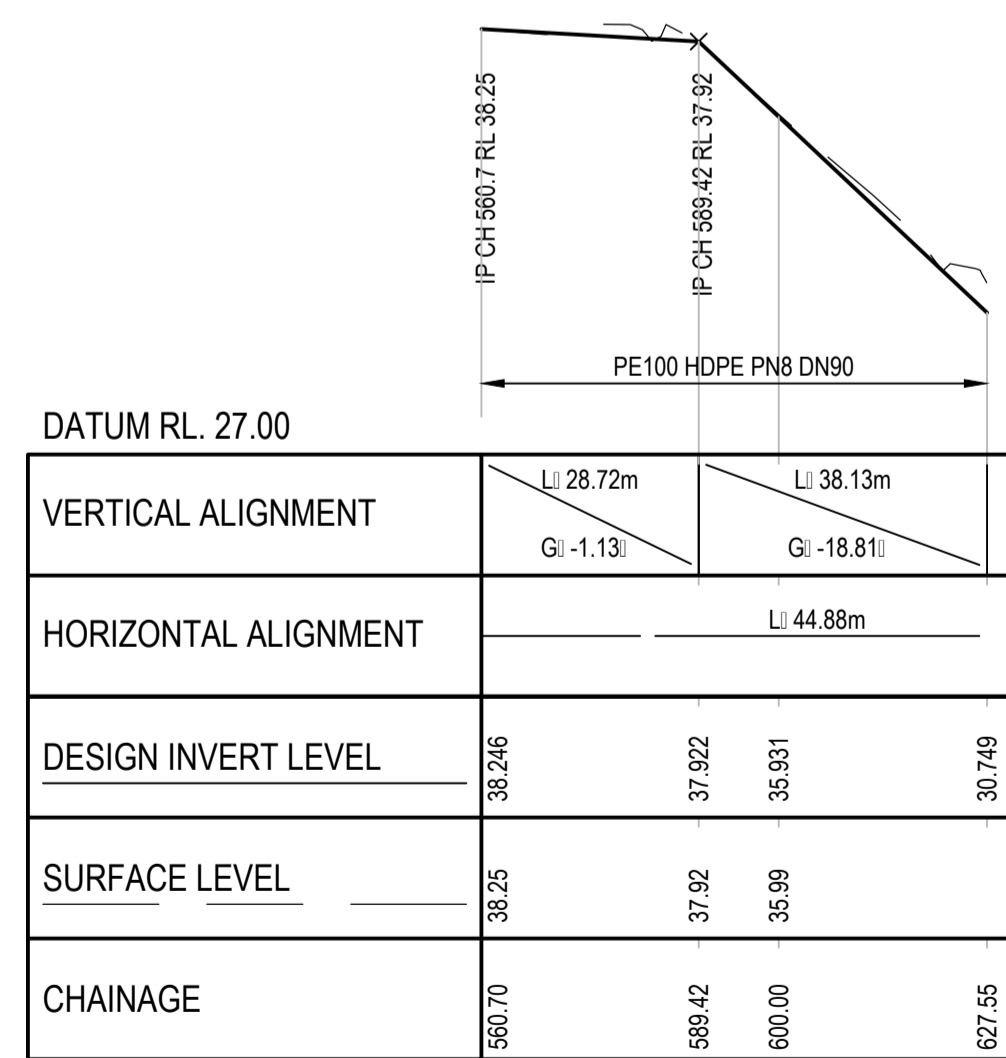
FOR CONSTRUCTION	
Client	LAKE MACQUARIE CITY COUNCIL
Project	AWABA WASTE MANAGEMENT FACILITY EXPANSION
Title	PIGGY-BACK LINER SYSTEM - TYPICAL SECTIONS & DETAILS - SHEET 1 OF 2
Original Size	A1
Drawing No:	22-16920-C7020
Rev:	4



	Li 36.78m	Li 22.77m	Li 66.87m	Li 10.04m	Li 0.57m	Li 0.22m	Li 9.54m	Li 13.15m	Li 43.48m	Li 25.25m	Li 24.78m	Li 10.46m	Li 44.51m	Li 13.53m	Li 24.58m	Li 14.94m	Li 57.49m	Li 17.5m	Li 67.55m	Li 99.52m	Li 46.04m	Li 31.01m	Li 7.34m	Li 19.33m															
VERTICAL ALIGNMENT	Li 36.78m Gi: 2.9i	Li 22.77m Gi: 2.9i	Li 66.87m Gi: 3i	Li 10.04m Gi: 1.8i	Li 0.57m Gi: -3.4i	Li 0.22m Gi: -1.4i	Li 9.54m Gi: -1.48i	Li 13.15m Gi: -6.15i	Li 43.48m Gi: -9.86i	Li 25.25m Gi: -9.46i	Li 24.78m Gi: -5.98i	Li 10.46m Gi: -5.56i	Li 44.51m Gi: -1.99i	Li 13.53m Gi: -2.23i	Li 24.58m Gi: -13.29i	Li 14.94m Gi: -5.02i	Li 57.49m Gi: -0.83i	Li 17.5m Gi: -2.04i	Li 67.55m Gi: -0.28i	Li 99.52m Gi: -1.56i	Li 46.04m Gi: -10.12i	Li 31.01m Gi: -20.33i	Li 7.34m Gi: -7.04i	Li 19.33m Gi: -19.93i															
HORIZONTAL ALIGNMENT	Li 7.57m	Li 29.22m	Li 10.3m Ri: -3.00m	Li 99.68m	Li 0.57m	Li 0.22m	Li 9.54m	Li 56.60m	Li 9.29m	Li 69.51m	Li 13.06m	Li 8.44m	Li 45.88m	Li 29.36m	Li 105.48m	Li 40.21m	Li 49.66m	Li 52.78m	Li 121.71m																				
DESIGN INVERT LEVEL	69.370 69.370	69.997 70.032	70.554 70.716	72.046	72.722	72.902	73.082	72.950	70.454	69.965	68.547	67.736	65.512	63.451	61.063	60.712	59.581	59.000	58.889	58.113	57.809	56.135	54.542	53.792	53.601	53.315	52.996	52.957	52.822	52.767	52.281	51.511	51.215	48.078	46.557	40.253	39.857	39.704	38.246
SURFACE LEVEL	67.30 68.97	68.82 68.85	70.39 70.56	71.89	72.57	72.71	73.42	72.94	70.45	69.97	68.55	67.74	65.47	63.41	61.06	60.66	59.57	59.00	59.03	58.11	57.81	56.00	54.54	53.79	53.69	53.32	52.99	52.96	52.67	52.77	52.93	51.57	51.22	47.81	46.56	40.25	40.07	39.71	38.25
CHAINAGE	-156.03 -150.00	-119.24 -118.03	-100.00 -94.42	-50.00	-27.54	-17.51	-7.54	-6.33	0.00	2.70	12.24	25.40	50.00	68.88	94.13	100.00	118.91	129.37	150.00	173.88	187.41	200.00	211.98	226.93	250.00	284.42	300.00	301.91	350.00	369.47	400.00	450.00	468.99	500.00	515.02	546.03	550.00	553.70	560.70

LONGITUDINAL SECTION - EASTERN LEACHATE TRANSFER MAIN

SCALE 1:1000 HOR 1:200 VER

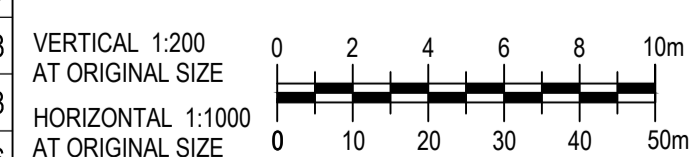


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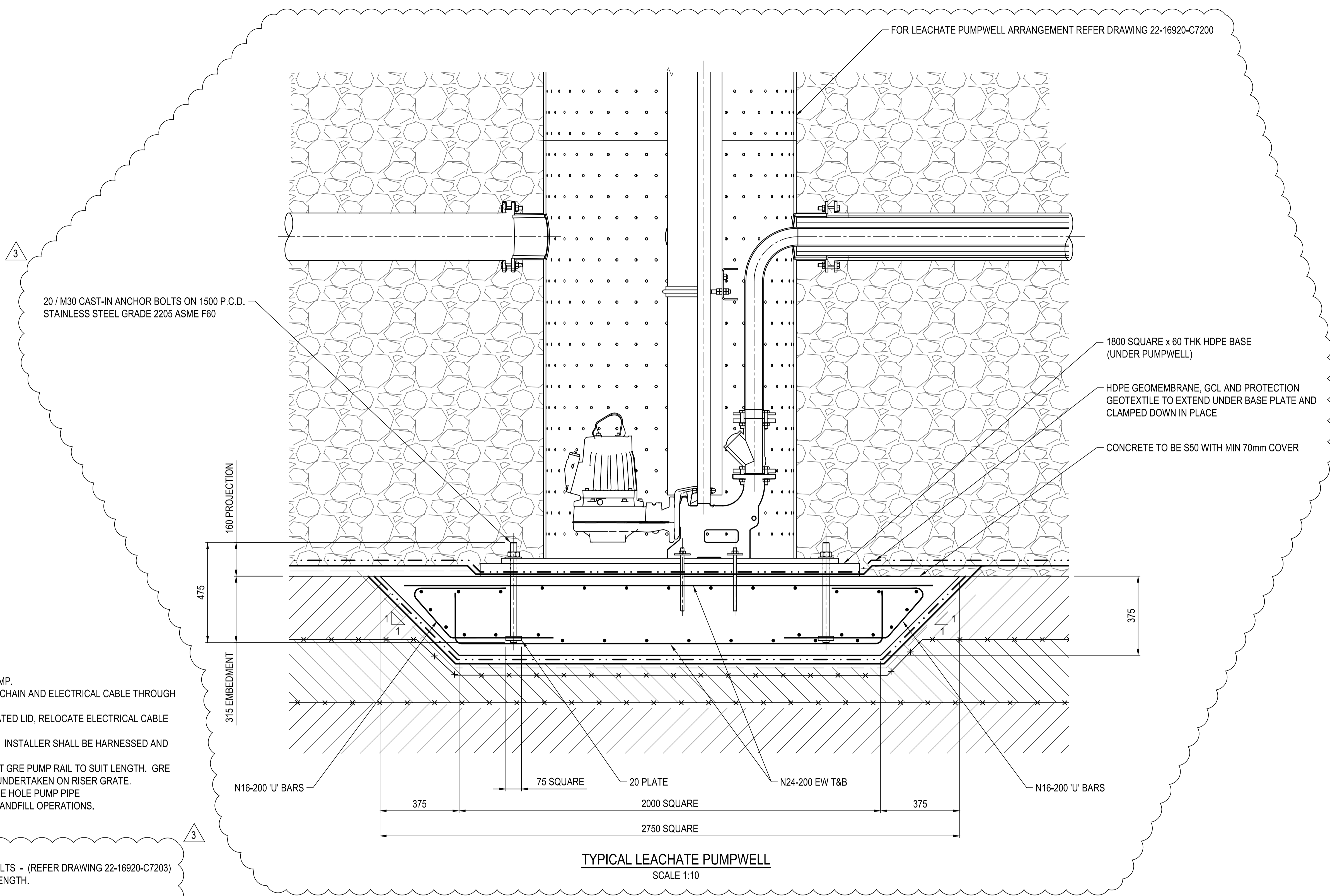
No	Revision	Note	Drawn	Job Manager	Project Director	Date
4	REVISED AS CLOUDED		C.RYE	K.R.*	D.B.*	31.01.19
3	FOR CONSTRUCTION		BS	K.R.*	D.B.*	06.09.18
2	RISING MAIN ADDED		C.P	K.R.*	D.B.*	31.08.18
1	UNREALISED COPY - FOR LMCC COMMENT		BS	K.R.*	M.G.*	06.07.18
0	FOR CONSTRUCTION		CB	K.R.*	M.G.*	19.10.16



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PO Box 5403 Hunter Rgn Mail Cent, NSW 2310
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		Approved (Project Director)	M. GEBHARD		
		Date	19.10.16		
		Scale	AS SHOWN		

Client	LAKE MACQUARIE CITY COUNCIL
Project	AWABA WASTE MANAGEMENT FACILITY EXPANSION
Title	LEACHATE TRANSFER SYSTEM LONGITUDINAL SECTION 1
Original Size	A1
Drawing No:	22-16920-C7024
Rev:	4



HDPE RISER EXTENSION NOTES:

1. DISENGAGE GENERATOR TO PUMP AND REMOVE GRATED LID OFF RISER PUMP.
2. INSTALL PUMP GUIDE RAIL SUPPORT TO 3M RISER AND EXTEND BOTH PUMP CHAIN AND ELECTRICAL CABLE THROUGH RISER. EXTEND STILLING PIPE RISER
3. LIFT RISER INTO PLACE AND INSTALL ALL BOLTS FOR FLANGES, INSTALL GRATED LID, RELOCATE ELECTRICAL CABLE SUPPORT, AND PUMP CHAIN SUPPORT.
4. INSTALL 4M LONG GRE PUMP RAIL (8KG) INTO LOWER PUMP RAIL EXTENDER. INSTALLER SHALL BE HARNESSSED AND SECURED TO ANCHOR POINTS.
5. INSTALL STAINLESS STEEL PUMP RAIL EXTENDER TO RAIL SUPPORT AND CUT GRE PUMP RAIL TO SUIT LENGTH. GRE PUMP RAIL IS TO BE CUT BY HAND TOOLS ONLY. NO HOT WORKS SHALL BE UNDERTAKEN ON RISER GRATE.
6. INSTALL EXTENSIONS FOR STILLING PIPE. N16 PIPE & FUTURE VERTICAL BORE HOLE PUMP PIPE
7. CONNECT GENERATOR TO PUMP AND RELOCATE WHERE NECESSARY FOR LANDFILL OPERATIONS.

NOTE: CONSTRUCTOR IS TO SUPPLY THE FOLLOWING ADDITIONAL ITEMS

- ITEMS -**
- 11 / 3m LONG x Ø1200 PN12.5 HDPE RISER EXTENSION AND CONNECTING BOLTS - (REFER DRAWING 22-16920-C7203)
 - 22 / 4m LONG 49.5 x 3.2 GRE PIPE PUMP RAIL. TO BE CUT ON SITE TO SUIT LENGTH.
 - 11 / UPPER PIPE SUPPORTS - (REFER DRAWING 22-16920-C7204)
 - 11 / UPPER MOUNTING BRACKET SOUTH - (REFER DRAWING 22-16920-C7204)
 - 11 / UPPER MOUNTING BRACKET NORTH - (REFER DRAWING 22-16920-C7204)
 - 11 / XYLEM 2" GUIDE BAR EXTENSION BRACKETS (STAINLESS STEEL GRADE 316)
 - 11 / DN80 U-BOLT - (REFER DRAWING 22-16920-C7204)
 - 11 / 3m LONG STILLING PIPE EXTENSION AND FITTING
 - 11 / 3m LONG FUTURE VERTICAL BOREHOLE PUMP PIPE
 - 11 / NON STANDARD U-BOLT - (REFER DRAWING 22-16920-C7204)

NOTES:

1. REFER TO DWG 22-16920-S1001, S1002 AND S1003 FOR CONCRETE & REINFORCEMENT SPECIFICATIONS.
2. REFER TO PROJECT SPECIFICATIONS FOR PUMP & RISER DETAILS

TYPICAL LEACHATE PUMPWELL
SCALE 1:10

FOR CONSTRUCTION

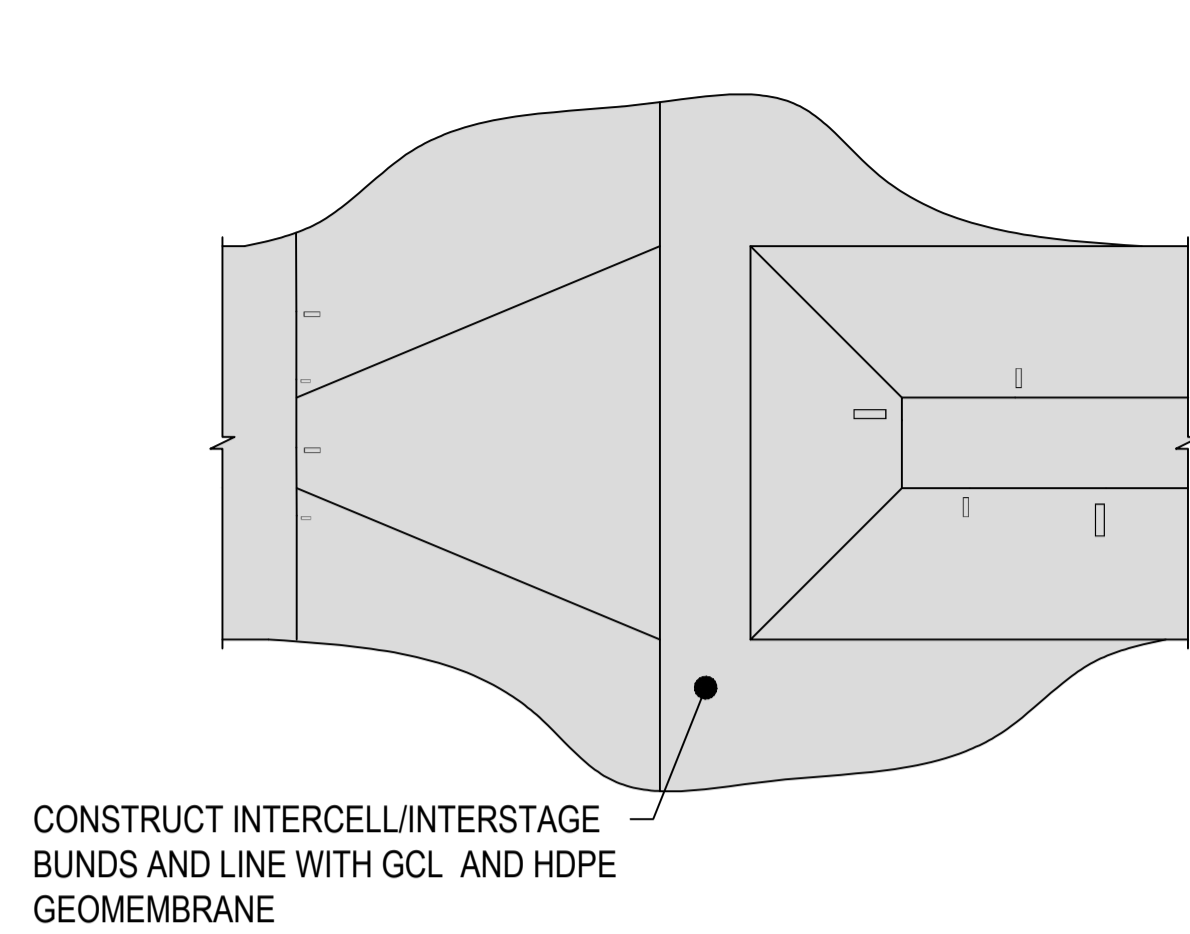
No	Revision	Note	Drawn	Job Manager	Project Director	Date
3	REVISED AS CLOUDED		C.RYE	K.R*	D.B*	31.01.19
2	ISSUED FOR CONSTRUCTION		C.P	K.R*	D.B*	06.09.18
1	UNREALISED COPY - FOR LMCC COMMENT		BS	K.R*	D.B*	06.07.18
0	ISSUED FOR EPA APPROVAL		RJC	K.R*	D.B*	07.05.18



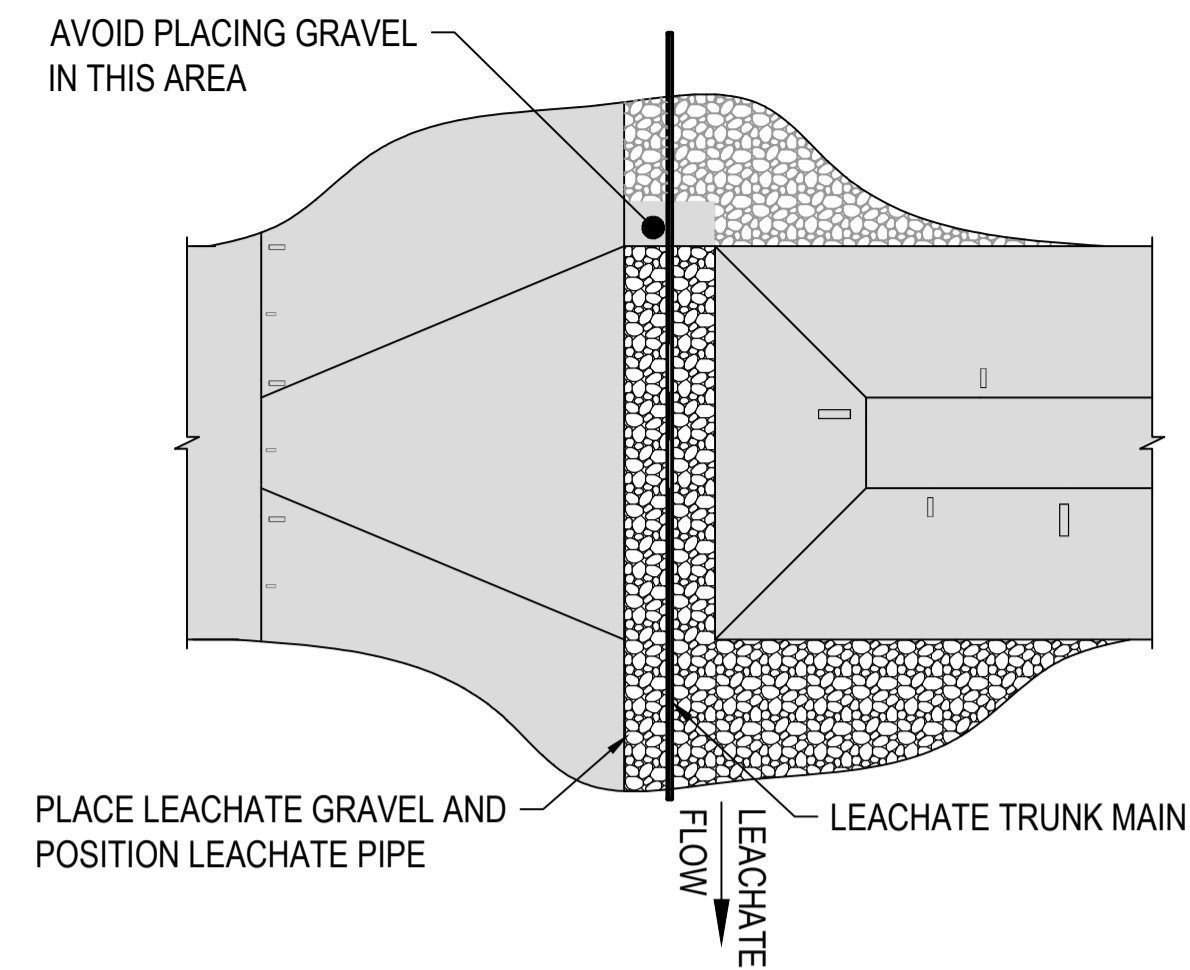
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Drafting Check	Approved (Project Director)	I. SMITH	D. BARRETT
Date			07.05.18
Scale	This Drawing must not be used for Construction unless signed as Approved		

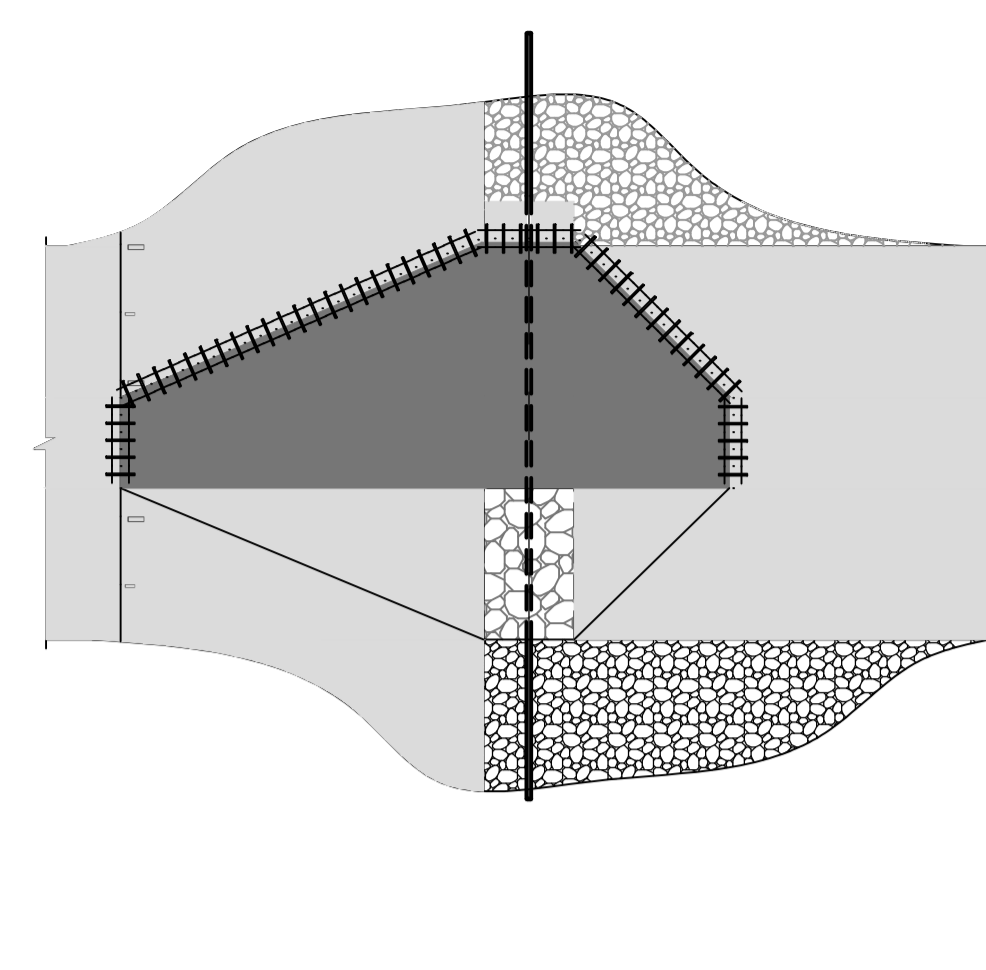
Client	Project	Title	Original Size	Drawing No:	Rev:
LAKE MACQUARIE CITY COUNCIL	AWABA WASTE MANAGEMENT FACILITY EXPANSION	LEACHATE COLLECTION SYSTEM SECTIONS AND DETAILS - SHEET 02	A1	22-16920-C7102	3



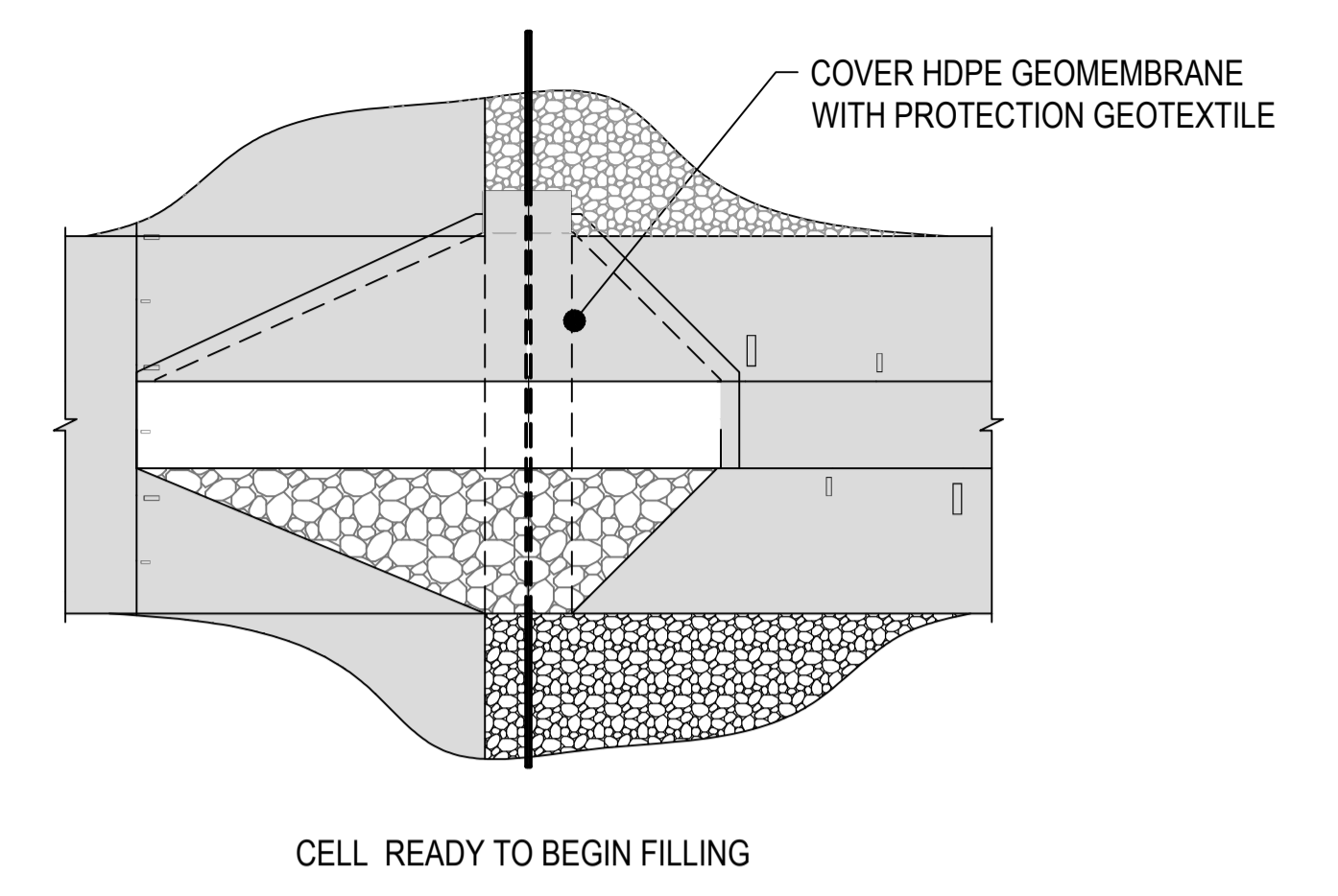
1. INTERNAL BUND AND DESIGN SURFACE LINING



2. PLACEMENT OF LEACHATE DRAINAGE LAYER AND PIPE CELL FILLING ALMOST COMPLETE



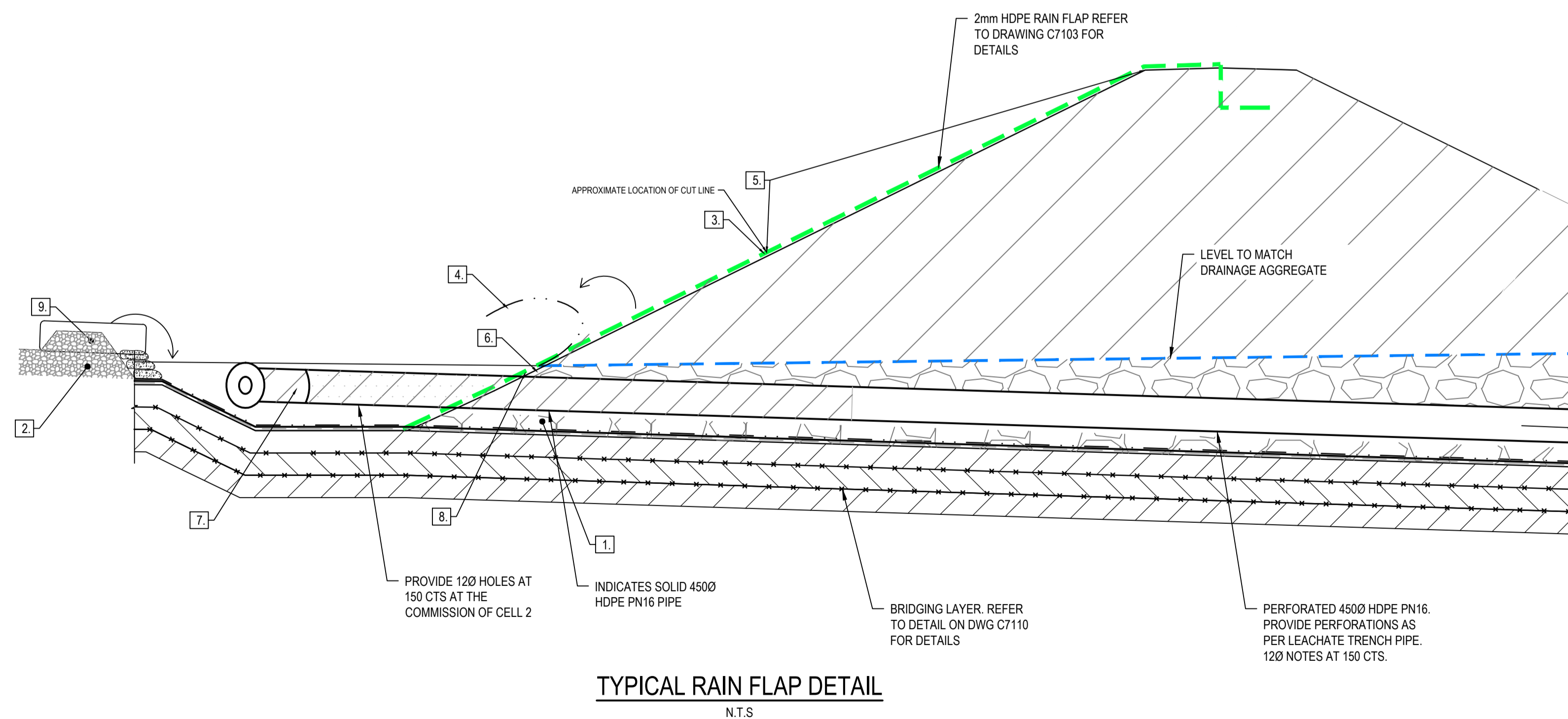
3. BACKFILLING OF BUND OPENING AND SEAL WITH HDPE GEOMEMBRANE



4. COMPLETION OF INTERCELL BUND READY FOR WASTE

CELL CONNECTION

- 1 ENSURE LEACHATE LEVEL IS BELOW INVERT OF CELL 2 SUMP.
- 2 PUMP ALL SURFACE WATER FROM CELL INTO FACILITY'S TREATMENT SYSTEM.
- 3 CUT AND REMOVE SECTION OF SACRIFICIAL GEOTEXTILE LAYER (CUT 1m UP SLOPE).
- 4 PEEL BACK REMAINING SECTION OF SACRIFICIAL GEOTEXTILE TO REMOVE SURFACE WATER SEDIMENT BUILD UP FROM HDPE GEOMEMBRANE.
- 5 CUT AND REMOVE SECTION OF HDPE TO FACILITATE LANDFILL GAS EVACUATION FROM BUND.
- 6 CUT AND REMOVE HDPE GEOMEMBRANE ALONG TOE OF INTERMEDIATE BUND.
- 7 REMOVE BLANK FLANGES & CONNECT CELL 2 LEACHATE PIPE WITH EXTENSION PIPE & DRILL 120 HOLES AT 150 CTS INTO PIPEWORK.
- 8 CUT AND REMOVE REMAINING SECTION OF SACRIFICIAL GEOTEXTILE LAYER.
- 9 RELOCATE SMALL BUND OF LEACHATE DRAINAGE GRAVEL TO FILL VOID.



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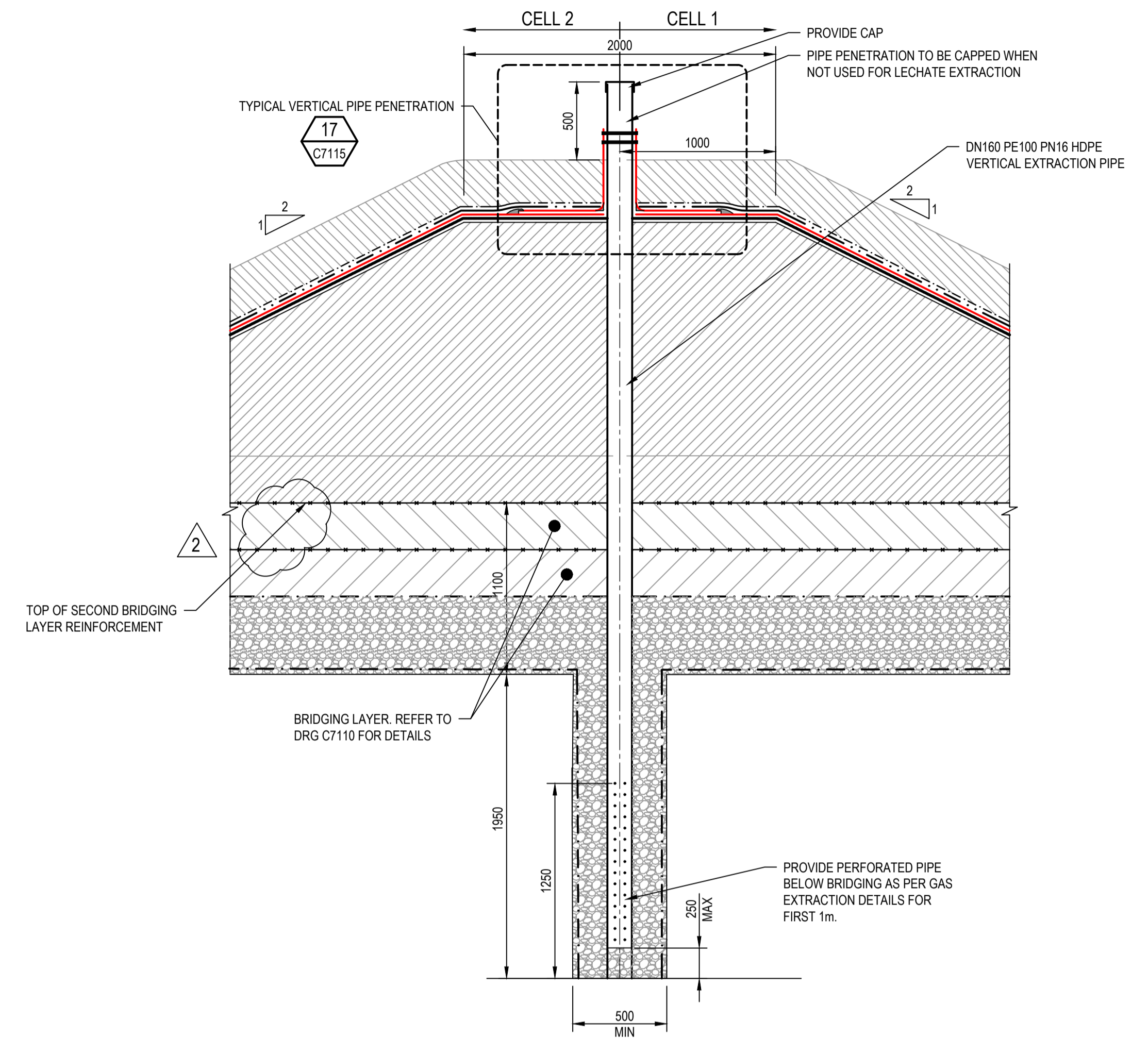
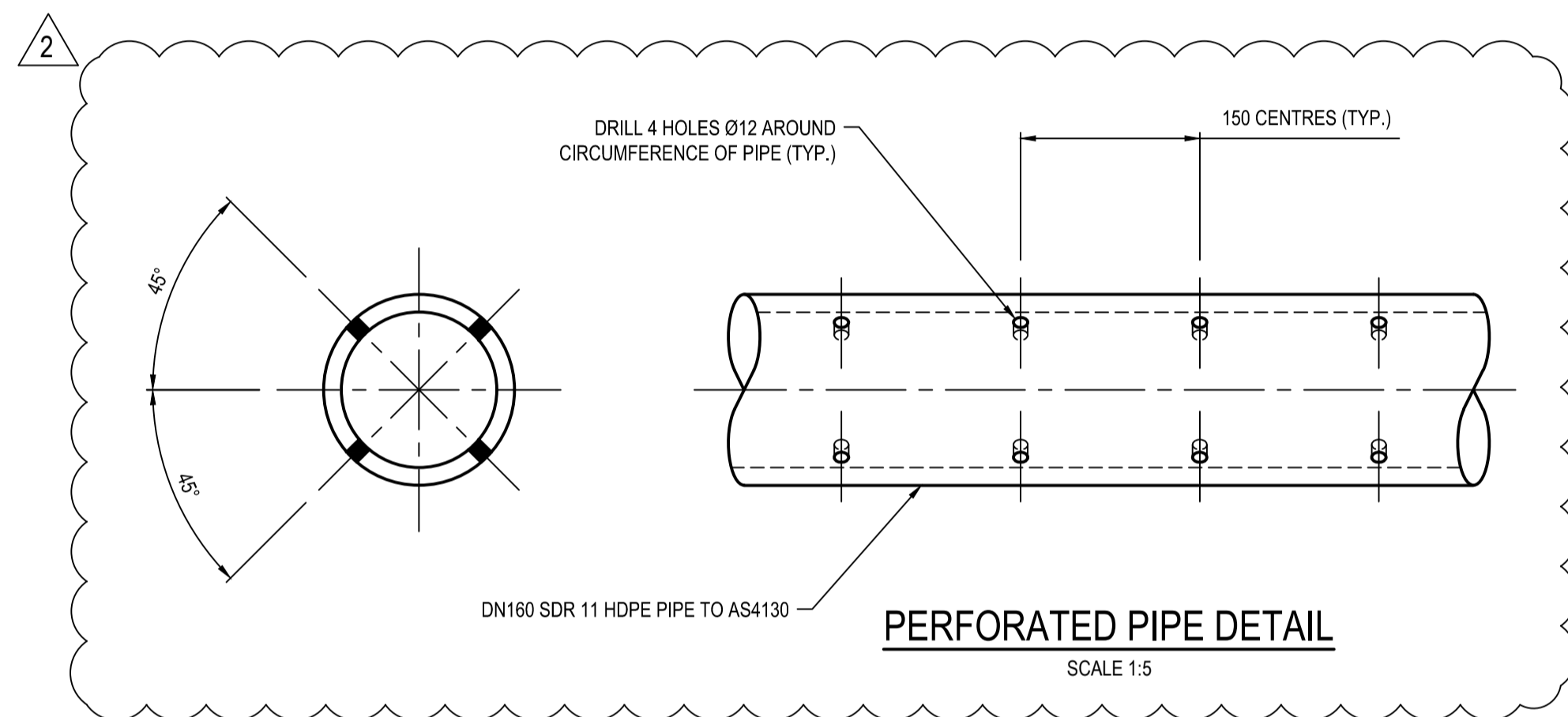
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PO Box 5403 Hunter Rgn Mail Cent, NSW 2310
T 61 2 4979 9999 F 61 2 4979 9988
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Date	06.07.18		
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Client	LAKE MACQUARIE CITY COUNCIL		
Project	AWABA WASTE MANAGEMENT FACILITY EXPANSION		
Title	LEACHATE COLLECTION SYSTEM STAGING PLAN		
Original Size	Drawing No:	22-16920-C7103	Rev: 1



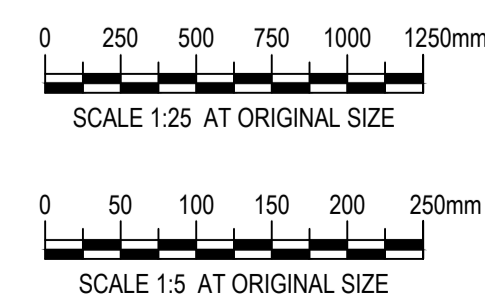
**UNDER LINER LEACHATE EXTRACTION SYSTEM
(CELL 1 & 2 INTERCELL BUND)**
SCALE 1:25

UNDER LINER LEACHATE EXTRACTION SYSTEM:

1. PROVIDE 4" GRUNDFOS ENVIRO RETROFITTED SUBMERSIBLE PUMP (MODEL 35S OR SIMILAR TO PROVIDE FLOW RATES UP TO 50 LPM FOR RE-RISED LIFT). PUMP IS TO BE CONNECTED TO GENERATOR FOR RISING MAIN PUMP.
2. PUMP TO BE LOCATED 0.25 M WITHIN BASE OF THE WELL AND ABOVE THE PERFORATED ZONE OF THE CASING.
3. PROVIDE BUBBLE TUBE SYSTEM TO BE USED FOR MONITORING THE LEACHATE LEVEL IN THE WELL. LEACHATE LEVEL TO BE MAINTAINED AT LEAST 0.6 M ABOVE PUMP. PUMP TO BE SWITCHED OFF WHEN LEVEL FALLS BELOW 0.6 M ABOVE PUMP.
4. ELECTRICAL GENERATOR CONNECTION TO BE SUPPLIED BY LMCC.

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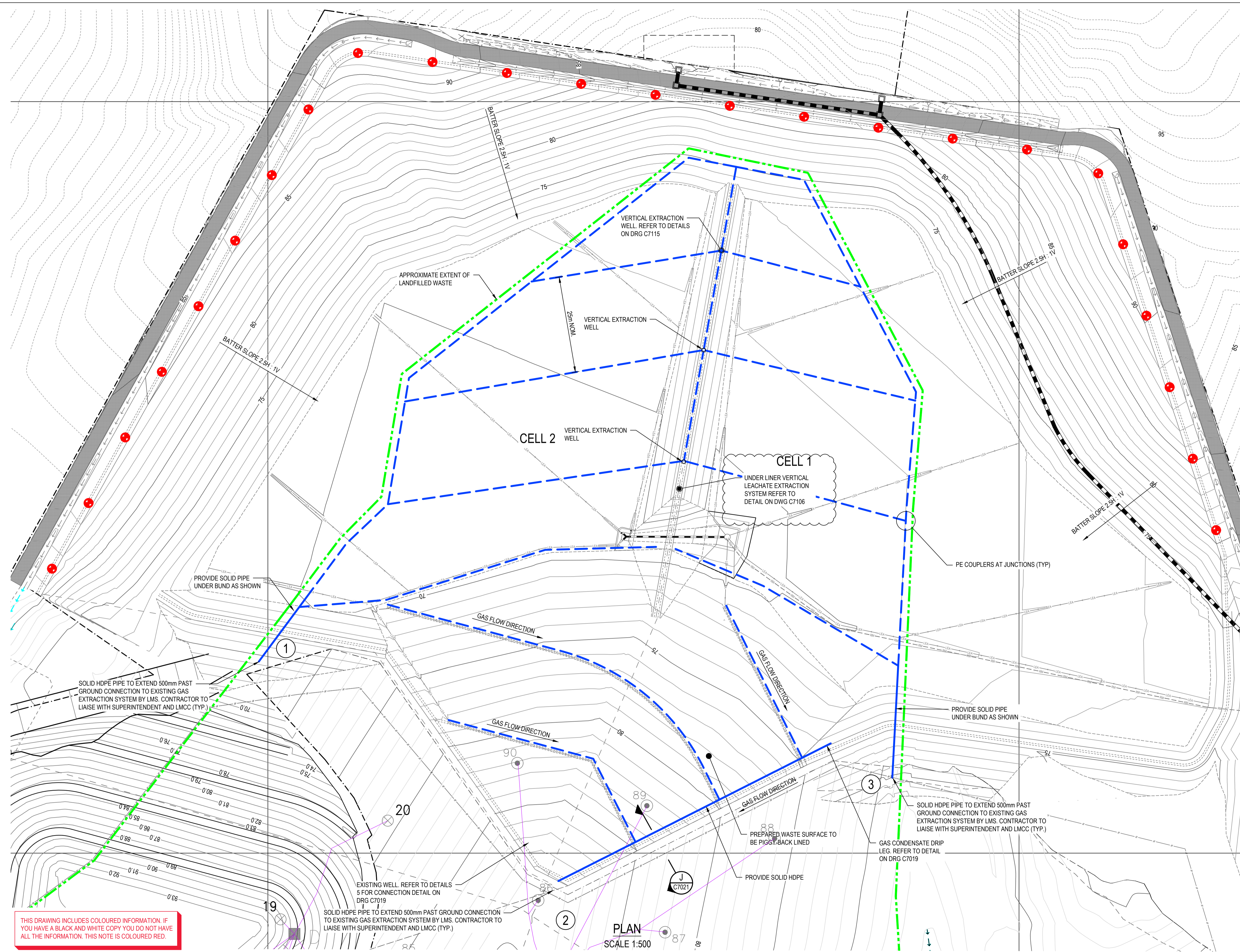
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1		REVISED AS CLOUDED	A.S	K.R	D.B	17.09.18
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GHD
 GHD Tower, Level 3
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Title	LEACHATE COLLECTION SYSTEM SECTIONS AND DETAILS - SHEET 03		
Original Size	A1	Drawing No:	22-16920-C7106
Rev:	2		

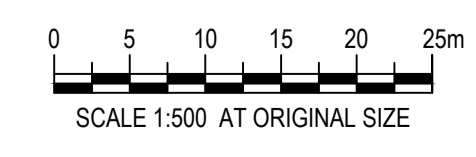


- LEGEND**
- LANDFILL GAS VENT POCKETS
 - SOLID DN90 PE100 SDR11/PN16 PIPE
 - - - PERFORATED DN90 PE100 SDR11/PN16 PIPE

- NOTES**
1. LOCATION OF GAS EXTRACTION PIPEWORK INDICATIVE ONLY. LOCATION AND DEPTH TO BE CONFIRMED ON SITE.
 2. REFER TO DRG C7110 FOR PIPE TRENCH DETAILS AND SPECIFICATIONS

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4	PIPELINE ADDED	K.K	K.R*	D.B*	018.18	
3	PIPELINE AND NOTES ADDED	B.D	K.R*	D.B*	11.07.18	
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 Project **AWABA WASTE MANAGEMENT FACILITY EXPANSION**
 Title **LANDFILL GAS DRAINAGE PLAN**

Original Size **A1** Drawing No: **22-16920-C7113** Rev: **5**

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Appendix C – Safety in Design (SiD) risk register

Job Name:		Awaba Waste Management Facility - Landfill Cells 1 and 2				Job No:		2216920		Client:		LMCC		Date: 06/07/2018		
Design Reference	Keyword	Hazards	Design Life Cycle Stage	Risk	Existing Control Measures	Initial Risk Rating			Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating			Comments
						C	L	RR					C	L	RR	
Falls of people	Eliminate or substitute	Fall from steep slopes causing personal injury or death. Damage to equipment and/or liner.	Construction/Operations	Plant or people falling down batters during construction or early stages of operation	Control access to access track. Provide physical barrier such as large rocks and bunds between access track and slope - Construction operators with own SWMS (e.g. personnel harnessed)	E	2	Significant	Contractor and LMCC to develop SWMS if work is to be undertaken on slope using personnel harness etc.	LMCC/Contractor	Prior to the commencement of works and day to day operations	Detail design reviewed and finalised.	E	1	Moderate	LMCC and Contractor to manage residual risks.
Ground Water	Eliminate or substitute	Liner bubbles which is unsafe and compromises GCL integrity adding to environmental pollution to groundwater.		Construction issues associated with groundwater	Groundwater depressurisation systems to be provided in design.	C	2	Low	Contractor to monitor and provide additional groundwater diversion if required.	Contractor	During construction	Detail design reviewed and finalised.	C	2	Low	Contractor to manage residual risks during construction
Ground gas		Engulfment or explosion	Construction/Operations	Landfill gas may collect in the base of Cells 1 and 2 during construction and operations	Section 1.15 of the Technical Specification includes warning of landfilled waste and states that the Contractor shall exercise all due caution when undertaking works, considering potential landfill gas emission Further control measures have been identified in	D	2	Moderate	Contractor and LMCC to monitor and manage ground gas risk during construction and operations.	Contractor	During construction and operations	Technical specification provided. Further advice provided in Redesign Report	D	2	Moderate	Contractor and LMCC to manage residual risks during operations.
Falling Material/objects	Eliminate or substitute	Falling objects and materials	Construction/Operations	objects fall from top of batter during construction	Control access to access track. Provide physical barrier such as large rocks and bunds between access track and slope	D	3	Significant	Contractor and LMCC to develop procedures to avoid works on top the batter while operations and construction is occur at the base of the batter.	LMCC/Contractor	During construction and operations	ongoing	D	2	Moderate	
Stepping on or striking against objects	Eliminate or substitute			Excavation of leachate pond may involve excavation into waste.	Pond has been designed to minimise depth of excavation into waste.	C	4	Moderate	Contractor to develop SWMS during excavation to avoid physical contact with waste.	Contractor	During Construction	To be reviewed by contractor	C	2	Low	
Machinery	Eliminate or substitute	Falls from Heights	Construction	Excavators may need to trim the slope from the top with potential risk of the machine falling down the batter. Max. slope length is 60 m.	Benching was investigated but not possible due to the site constraints. Risks to managed by the contractor.	E	2	Significant	Contractor cover batter with temporary liner to avoid erosion and trim and prepare the batter slope progressively during excavation.	Contractor	During Construction	To be reviewed by contractor	E	2	Significant	Risks to be managed by Contractor.

Job Name:		Awaba Waste Management Facility - Landfill Cells 1 and 2				Job No:		2216920		Client:		LMCC		Date: 06/07/2018		
Design Reference	Keyword	Hazards	Design Life Cycle Stage	Risk	Existing Control Measures	Initial Risk Rating			Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating			Comments
						C	L	RR					C	L	RR	
Toxicity/Fires	Eliminate or substitute	Blasting in vicinity of landfill gas	Construction/Operations	Potential explosions during rock blasting due to landfill gas	Geotechnical investigation has been undertaken and highlighted the risk that some rock may need hydraulic jacking, but excavation should be able to be completed with ripping. Specification has highlighted that ripping will be required and the contractor to provide equipment suitable for ripping into rock	E	2	Significant	LMCC to manage risk with contractor during construction. Hydraulic jacking maybe required to avoid blasting	Contractor	During construction	Technical specification provided.	E	2	Significant	
utilities		Stabilisation of batter		Stabilisation and construction of the northern diversion stormwater pipe	Open trench has been provided in the documentation has been provided. Depth of excavation has been minimised. HDPE pipe has been used to remove pits on the batter.	D	2	Moderate	Contractor to install pipe prior to excavation under the pipe to avoid working from heights and to develop other safe work methods.	Contractor	During Construction	Design has been reviewed and finalised by GHD and LMCC	D	2	Moderate	
utilities		Leachate could break or injure staff	Construction/Operations	Leachate transfer main is location above ground and could move	Specifications has include mass concrete fixings and warning signs specified.	C	2	Low	Contractor and LMCC to inspect regularly and provide additional support if required.	LMCC/Contractor	During construction and operations	Specifications has been reviewed and finalised	C	2	Low	
natural disasters		Flooding	Construction/Operations	Flooding egressing the landfill site.	Diversion pipes and drains have been provided. Overflow paths have also been design and protected. Leachate transfer main has also been provided.	C	2	Low	LMCC to develop procedures and training to staff in the event of flooding	LMCC	Upon completion of the cells.		C	2	Low	
Access/ egress	Avoid	Steep access to the top of the landfill cells	Construction/Operations	Vehicle lost control in the wet conditions due to very steep stops (15%)	Bunding to divert water off the road has been provided. Pavement specification has been included to increase traction. Slope has been minimised during the design.	C	3	Moderate	LMCC and contractor to develop SWMS and training such as 4WD drive training. LMCC to maintain access track to keep the road in good condition	LMCC	During construction/operations	Design has been reviewed and finalised.	C	3	Moderate	
Cell2	Avoid	Working around water and leachate	Construction/Operations	Risk of leachate and engulfment	Proceedures have been provided which requires the leachate levels to be reduced prior to connection of the pipework	D	3	Significant	LMCC to develop a SWMS for access into the Cell 2 for inspection and dirty water pumping operations	LMCC	During construction/operations		D	3	Significant	LMCC to access risk depending on operation requirements.
Cell2		working around water	Operations	Working around water and slipping liner to dewater cell 2 into the clean water	LMCC to provide pump to extract dirty water into the sediment pond	C	3	Moderate	LMCC to develop a SWMS for access into Cell 2 for inspection and dirty water pumping operations	LMCC	Operations		C	3	Moderate	LMCC to access risk depending on operation requirements.
Leachate Well	Avoid	Explosive atmosphere	Operations	overcome from landfill gas	Grating and anchor points have been provided to minimise consequence.	C	3	Moderate	LMCC to develop a SWMS for working on the riser platform. Including monitoring for landfill gas and other PPE	LMCC	During operations		C	3	Moderate	
Leachate Well	Guide rail	Explosive atmosphere	Construction/Operations	Hot works around hot works	Design avoids welding and hot works over the leachate well during lifting operations of the riser .	D	2	Moderate	LMCC develop a SWMS and training for lifting operations for the leachate well	LMCC	During construction/operations		D	1	Moderate	
Leachate Well	Weight	Heavy lifts	Construction/Operations	Risk of heavy objects to fall onto staff during lifting operations to lift the riser and equipment	Weight of objects have been minimised and limited to less than 1 tonne	E	2	Significant	LMCC and contractor develop SWMS and training to operation heavy machinery for lifting operations	LMCC/Contractor	During construction/operations		E	1	Moderate	
Leachate Well	Height	Working from heights	Construction/Operations	Fall from height into the leachate well	Anchor points have been provided at the grate.	E	2	Significant	LMCC and construction to provide elevated platforms for access. Staff to be trained in working at heights and anchored to anchor points	LMCC	During construction/operations	Anchor points have been provided	E	1	Moderate	

Job Name:		Awaba Waste Management Facility - Landfill Cells 1 and 2				Job No:		2216920		Client:		LMCC		Date: 06/07/2018		
Design Reference	Keyword	Hazards	Design Life Cycle Stage	Risk	Existing Control Measures	Initial Risk Rating			Potential Control Measures <small>(Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)</small>	Responsibility	By When	Decision / Status	Residual Risk Rating			Comments
						C	L	RR					C	L	RR	
Leachate Well	Confine Space	Confine Space in leachate well	Operations/construction	Engulfment from Leachate and landfill gas	Guide rails have been installed to avoid entry. Grating and anchor points to the grated roof to avoid access.	E	1	Moderate	Contractor to develop SWMS during construction for confine space entry required during commissioning of riser . LMCC to develop SWMS to avoid	LMCC	During construction/operations	Design has been sent to LMCC for review	E	1	Moderate	
JM Name & Signature: Kirk Rowe					Staff Involved in Risk Assessment: Kirk Rowe; David Barrett; Jeremy Dawes											

GHD



Level 3 GHD Tower 24 Honeysuckle Drive Newcastle NSW 2300
PO Box 5403 Hunter Region Mail Centre NSW 2310
T: (02) 4979 9999 F: (02) 4979 9988 E: ntlmail@ghd.com

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Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	J. Dawes	D. Barrett	On file	D. Barrett	On file	25/09/2019
1	J. Dawes	D. Barrett		D. Barrett		24/02/2020

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Appendix E – Soil, Water & Leachate Management Plan



Lake Macquarie City Council
Awaba Waste Management Facility
Soil, Water and Leachate Management Plan

14 August 2019

Appendices

Appendix A Site Water Quantity and Quality Assessment

Appendix B Site Water Balance

Appendix C Leachate Management Plan

Appendix D Surface Water Management Plan

Appendix E Surface, Groundwater & Leachate Monitoring Program

Appendix F Surface Water, Groundwater & Leachate Response Plan

Appendix A
Site Water Quantity and Quality Assessment



Awaba Waste Management Facility - Water Quantity and Quality Assessment

600308

Prepared for Lake Macquarie City Council

December 2011



Cardno (NSW/ACT) Pty Ltd

ABN 95 001 145 035

Level 3 910 Pacific Highway

Gordon NSW 2073

Australia

Telephone: 02 9496 7700

Facsimile: 02 9499 3902

International: +61 2 9496 7700

sydney@cardno.com.au

www.cardno.com.au

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1 INTRODUCTION

Cardno was commissioned by Lake Macquarie City Council to undertake a comprehensive Environmental Assessment (EA) of the extension of land filling operations at the Awaba Waste Management Facility (AWMF). One of the components of this environment assessment was an assessment of surface water management practices.

The surface water management assessment of the proposed Awaba landfill extension was undertaken in accordance with the *Environmental Planning and Assessment Act 1979* and the EA requirements recommended by OEH (formerly DECCW).

A catchment based water quality model was developed to investigate stormwater runoff from the landfill and its quality. A qualitative assessment of flood impact due to the proposed extension of the Awaba landfill was undertaken using a hydrological model.

1.1 Objectives

This surface water assessment investigates the following aspects of surface waters at the AWMF:

- Stormwater runoff from the landfill and its quality discharging to the watercourse;
- Assessment of any impact on the existing watercourse; and
- Qualitative assessment of flood impacts.

The above objectives are based on the Director General Requirements and guidelines of OEH for the extension of the AWMF.

1.2 Staging of Expansion Works

OEH guidelines provide recommendations for surface water and leachate volume calculations as follows:

1. 50% of daily rainfall on an intermediate cover area becomes leachate;
2. 90% of daily rainfall becomes leachate when the level of fill in a cell is below the surrounding natural ground level; and
3. 10% of daily rainfall becomes leachate under final capping.

The remaining percentages of rainfall produce surface runoff which is subject to evaporation and surface losses.

The assessment of water quality impacts was undertaken for the case where the highest possible levels of polluted stormwater are expected to be generated. This has been undertaken assuming the whole site has been disturbed and is generating pollutants from all cells with an intermediate cover.

The assessment of water quantity was undertaken following final capping when the highest volume of runoff is expected to be generated. Runoff following capping is not expected to contain high levels of pollutants as the landfill operations have ceased and re-vegetation would be established.

During times of excavation where the level of the cell is lower than surrounding ground low volumes of runoff and pollutants are expected as the majority of rainfall (90%) is converted into leachate.

2 AVAILABLE INFORMATION

2.1 Documents and Data

A number of documents were obtained from the following sources:

1. Environmental Protection License provided by Lake Macquarie City Council
2. Existing site survey provided by Lake Macquarie City Council
3. Landfill Expansion Drawings (SK010, SK011, SK012, SK013, SK014, SK015, SK016, SK017, SK018-20) provided by GHD
4. Existing Dam Data provided by Lake Macquarie City Council
5. Daily Rainfall and Evaporation Data provided by the Bureau of Meteorology (BOM)
6. Water Quality Data at Monitor Sites provided by Lake Macquarie City Council

2.2 Rainfall

Daily rainfall data was obtained from the nearest Bureau of Meteorology (BOM) station in Toronto, station No.61322 (www.bom.gov.au). The details are summarised in **Table 2.1**.

Table 2.1 Details of Daily Rainfall Data

Station	Name	Period	Type
61322	Toronto	1/10/1972-31/03/2011	Daily

The annual rainfall recorded at Station 61322 from 1973 to 2010 is summarised in **Table 2.2**. The mean annual rainfall at Toronto for the period 1/01/1973 – 31/12/2010 was 1146.7 mm.

Table 2.2 Annual Rainfall at Station 61322 from 1973 - 2010

Year	Annual Rainfall (mm)	Year	Annual Rainfall (mm)	Year	Annual Rainfall (mm)
1973	969.0	1986	989.8	1999	*
1974	1575.7	1987	1131.4	2000	853.5
1975	1451.6	1988	1578.6	2001	1013.0
1976	*	1989	1636.2	2002	*
1977	1073.4	1990	*	2003	861.7
1978	1650.5	1991	*	2004	935.8
1979	887.8	1992	*	2005	979.2
1980	675.8	1993	*	2006	1051.5
1981	1411.8	1994	*	2007	1405.3
1982	996.5	1995	*	2008	1416.9
1983	1121.6	1996	*	2009	771.7
1984	1274.5	1997	984.9	2010	1020.6
1985	1243.8	1998	*		

*indicates incomplete daily rainfall data, this is comparable to the rainfall data available for other local weather stations

The calculated 10th, 50th and 90th percentile annual rainfalls were 858.4 mm, 1051.5 mm and 1576.9 mm respectively. The average annual rainfall for the period was 1146.7 mm.

2.3 Evaporation

The default daily pan evaporation data in MUSIC model for Sydney was utilised in this study in the absence of available pan evaporation data from the Toronto weather station. **Table 2.3** summarises the monthly average pan evaporation and the monthly average Potential Evapo-Transpiration (PET).

The monthly average PET adopted in MUSIC was estimated to be 70% of monthly average pan evaporation in accordance with the OEH recommendation included in the EA requirements.

Table 2.3 Summary of Pan Evaporation and PET

Month	Daily Average Pan Evaporation (mm)	Monthly Average Pan Evaporation (mm)	Monthly Average PET (mm)
January	8.3	257	180
February	6.9	191	134
March	5.9	181	127
April	4.0	121	85
May	2.7	86	60
June	2.0	61	43
July	2.0	61	43
August	2.7	86	60
September	4.1	126	88
October	5.9	181	127
November	7.0	217	152
December	7.6	233	163

3 SITE CHARACTERISTICS

3.1 Site Description

The existing site layout is shown in **Figure 3.1**. The landfill is divided into 4 areas denoted as Cells 1, 2, 3 and 4. Cell 4 drains to sediment Basin 2, while Cells 1 and 2 drain to sediment Basin 5. Basin 5 spills to Basins 3 and 4 which also receive runoff from Cell 3. Overflows from sediment Basins 2 and 4 are directed to an un-named watercourse via surface drains. These drains discharge stormwater approximately 30 m from the centreline of the waterway.

The landfill area is to be extended to the north, east and west. This will involve excavation, filling and capping according to the design drawings prepared by GHD (SK 012-13). As shown in **Figure 3.2**, the existing cell boundaries will be re-aligned and extended laterally and increased in height in Areas A and B while in Area C the landfill will be increased in height only. Sediment Basin 2 will remain as existing. Existing sediment Basins 3, 4 and 5 will be consolidated into two sediment basins re-numbered 1 and 3 in the design scenario. The modification will utilise available space in order to maximise the size of the surface water management system on the site. Discharges to the watercourse will occur from sediment Basins 2 and 3 during expansion.

For the purposes of water quality modelling the worst case where 50% daily rainfall is assumed to runoff from large disturbed areas. This scenario allows for the generation of pollutants from the landfill during expansion. While the scenario following final capping will generate higher volumes of runoff, it is not expected to contain high levels of pollutants as the landfill operations have ceased and re-vegetation would be established.

It is noted that re-use for irrigation purposes is ongoing under current conditions however this was not included in the surface water assessment because no data was available at the time of reporting for the quantities of surface water which are re-used on the site.

No re-use of stored water is proposed on the site as part of the AWMF expansion.

3.2 Catchment Delineation

The landfill area under Existing Conditions is divided into four sub-catchments as shown in **Figure 3.1**. The total landfill area under existing conditions is 15.35 hectares.

The landfill area as a result of the expansion was divided into seven sub-catchments based on the area of land that will be disturbed. Each of the cells that will be progressively excavated and filled, refer **Figure 3.2**. The total landfill area under the expansion scenario is 20.95 hectares.

The landfill area under capped conditions was divided into four sub-catchments as shown in **Figure 5.1**. The total landfill area under existing conditions is 23.92 hectares, being larger than that of the landfill expansion scenario as the capping layer will extend beyond the area of the landfill cells.

The subcatchment areas under Existing, Expansion and Capped Conditions are summarised in **Table 3.1**.

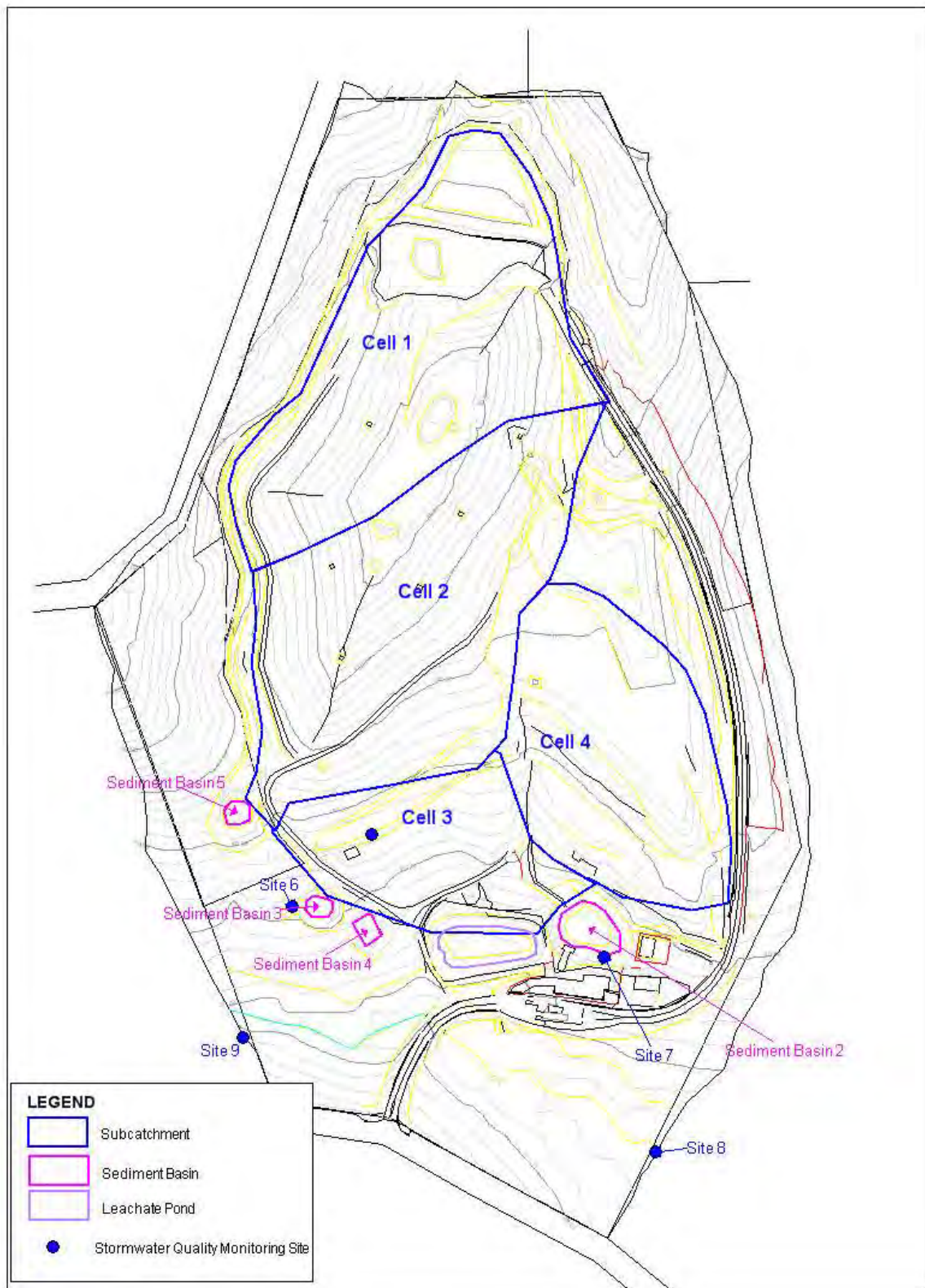


Figure 3.1 Existing Site Layout (Source: Lake Macquarie Council EPL)

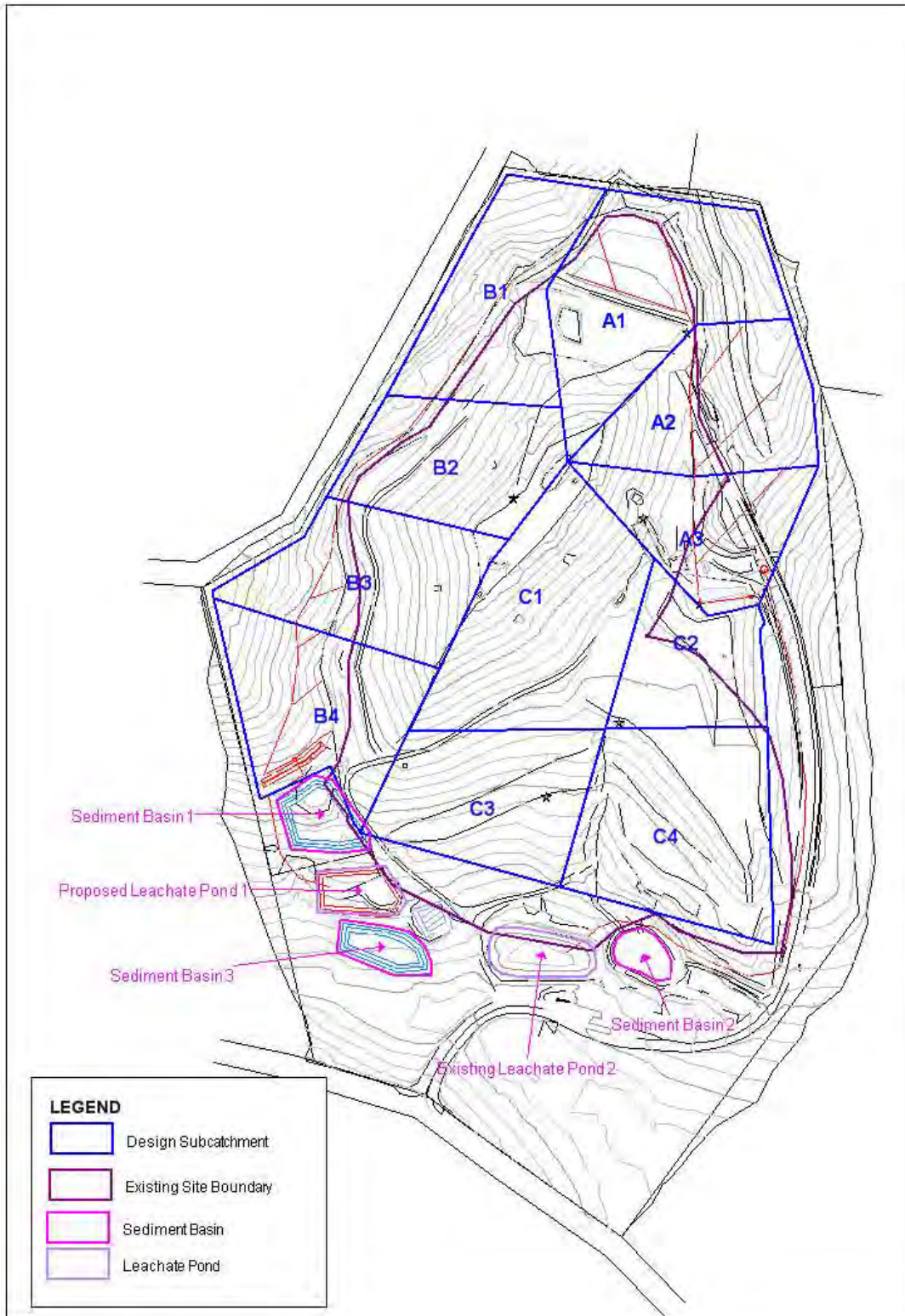


Figure 3.2 Proposed Site Layout

Table 3.1 Subcatchment Areas under Existing, Operations and Capped Conditions

Existing Conditions		Expansion Conditions		Capped Conditions	
Subcatchment	Area (ha)	Subcatchment	Area (ha)	Subcatchment	Area (ha)
C1	4.83	A1	2.4	A	6.26
C1	5.12	A2	1.8	B	8.48
C3	2.11	A3	1.41	C	4.39
C4	3.29	B1	1.82	D	4.79
		B2	1.63		
		B3	1.86		
		B4	1.89		
		C1	2.61		
		C2	1.23		
		C3	1.82		
		C4	2.43		
Total	15.35		20.95		23.92

4 SURFACE WATER QUALITY

A catchment based water quality model was developed to investigate stormwater runoff from the landfill and its quality.

4.1 The MUSIC Model

The MUSIC model which was created was based on a daily rainfall-runoff model in conjunction with representative baseflow and stormflow event mean concentration (EMCs).

4.1.1 Water Quantity Parameters

The adopted values of various MUSIC rainfall and runoff parameters are summarised in **Table 4.1**. The validation of estimates based on these parameter values is discussed in **Section 4.2**.

Table 4.1 Adopted MUSIC Rainfall/Runoff Parameters

Parameter	Value
<i>Impervious Area Properties</i>	
Rainfall Threshold (mm/day)	1.0
<i>Previous Area Properties</i>	
Soil Storage Capacity (mm)	90
Soil Initial Storage (% of Capacity)	30
Field Capacity (mm)	60
Infiltration Capacity coefficient - a	200
Infiltration Capacity exponent- a	1.00
<i>Groundwater Properties</i>	
Initial Depth (mm)	10
Daily Recharge Rate (%)	10
Daily Baseflow Rate (%)	0
Daily Deep Seepage Rate (%)	0

4.1.2 Water Quality Parameters

Stormwater quality is characterised using Event Mean Concentrations (EMCs) under storm and base flow conditions. **Table 4.2** summaries the values of water quality parameters adopted in this study.

Table 4.2 Adopted MUSIC Water Quality Parameters

Parameter	Value
Baseflow	
Baseflow TSS Mean (log mg/L)	1.400
Baseflow TSS Standard Deviation (log mg/L)	0.130
Stormflow TSS Mean (log mg/L)	2.55
Stormflow TSS Standard Deviation (log mg/L)	0.31
Baseflow TP Mean (log mg/L)	-0.880
Baseflow TP Standard Deviation (log mg/L)	0.13
Stormflow	
Stormflow TP Mean (log mg/L)	-0.270
Stormflow TP Standard Deviation (log mg/L)	0.30
Baseflow TN Mean (log mg/L)	0.074
Baseflow TN Standard Deviation (log mg/L)	0.13
Stormflow TN Mean (log mg/L)	0.59
Stormflow TN Standard Deviation (log mg/L)	0.26

4.1.3 Stormwater Treatment Measures

The stormwater treatment measures that were assessed using MUSIC included a number of sediment basins that already exist on the site. In the future it is proposed to reconstruct and consolidate Existing Basins 3, 4 and 5 into two basins (new Basins 1 and 3) to treat runoff from the expanded area of landfill. Sediment Basin 2 is to be retained unchanged.

The adopted properties of sediment basins are summarised in **Table 4.3**.

The adopted parameter values for sediment basins are summarised in **Table 4.4**.

4.1.4 MUSIC Model Layout

The water quality model only considers the landfill area since runoff generated outside of the landfill area is diverted around the landfill and is conveyed by surface drains to an off-site natural creek.

The layouts of the MUSIC models under Existing and Operations Conditions are given in **Figures 4.1** and **4.2**.

Table 4.3 Adopted Properties of Sediments Basins

Basin ID	Volume (m ³)	Plan Area (m ²)	Average Depth (m)
Existing Conditions			
2	3345	1400	2.4
3	269.0	460	0.6
4	192	320	0.6
5	795	755	1.05
All Future Conditions			
1	1580	2107	0.75
2	3,345	1400	2.4
3	1026	1368	0.75

Table 4.4 Adopted MUSIC Parameters for Sediment Basins

Parameter	Existing Conditions		
	Basin 2	Basin 3 & 4	Basin 5
Lo-flow bypass rate (m ³ /s)	0	0	0
Hi-flow bypass rate (m ³ /s)	100	100	100
Surface area (m ²)	1400	780	755
Extended detention depth (m)	2.4	0.6	1.05
Permanent pool volume (m ³)	700	390	375
Exfiltration Rate (mm/hr)	0	0	0
Evaporative loss as % of PET	75	75	75
Overflow weir width (m)	2.0	2.0	2.0
Notional Detention Time (hrs)	2.87	0.8	1.02
Parameter	All Future Conditions		
	Basin 1	Basin 2	Basin 3
Lo-flow bypass rate (m ³ /s)	0	0	0
Hi-flow bypass rate (m ³ /s)	100	100	100
Surface area (m ²)	2107	1400	1368
Extended detention depth (m)	0.75	2.4	0.75
Permanent pool volume (m ³)	1050	700	685
Exfiltration Rate (mm/hr)	0	0	0
Evaporative loss as % of PET	75	75	75
Overflow weir width (m)	2.0	2.0	2.0
Notional Detention Time (hrs)	87	103	56.2

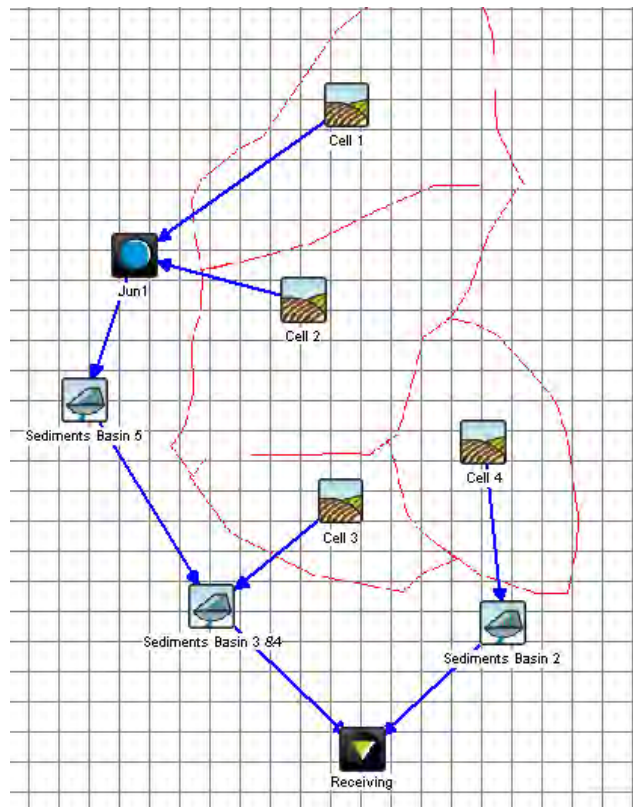


Figure 4.1 MUSIC Model Layout under Existing Conditions

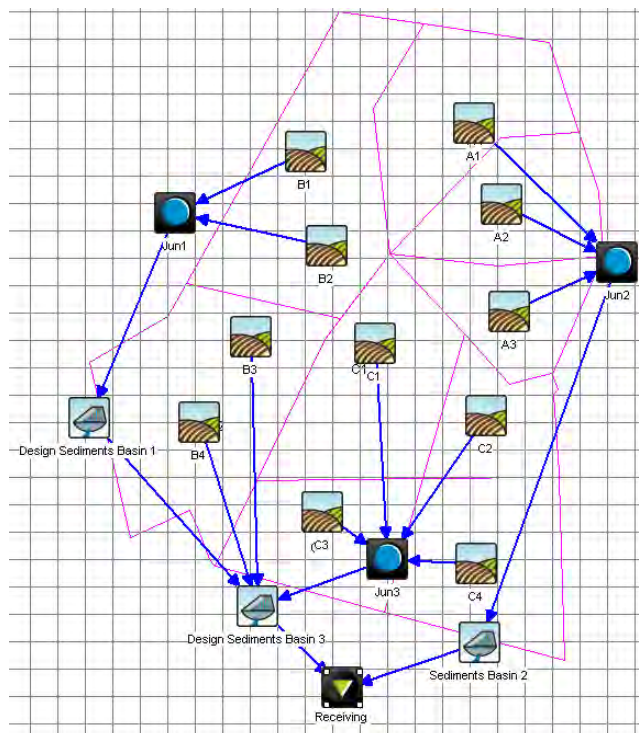


Figure 4.2 MUSIC Model Layout under Expansion Conditions

4.2 MUSIC Model Validation

The MUSIC model was validated to ensure that the values of water quantity and quality parameters for the MUSIC model can reasonably represent the catchment.

4.2.1 Validation of Water Quantity

A calculation was undertaken to estimate the average annual runoff volume from the landfill during operation as follows. This estimate was compared with the MUSIC model estimates to validate the MUSIC model parameter values.

In the absence of any gauged runoff from the catchment, a calculation was undertaken to estimate the coefficient of runoff volume (Cv) for the catchment.

The daily rainfall from Toronto (Station 61322) were used for the period from 1973 to 2010. The daily average evaporation data in **Table 2.3** was utilised for the calculation. The daily runoff volume was estimated under the Operations Scenario with rainfall loss assumptions in accordance with OEH guidelines (see **Section 1.2**). The equation is expressed as follows:

$$R = P - Le - E - IL \quad (1)$$

where
R = daily runoff
P = daily precipitation
Le = daily leachate
E = daily evaporation.
IL = initial loss (assumed to be 2.5 mm)

Under the Operations Scenario Equation (1) becomes:

$$R = P/2 - E - IL \quad (2)$$

Table 4.5 summaries the estimated annual runoff from the AWMF under Existing and Operations conditions calculated at a daily time step using Equation 2. The total landfill area for Existing Conditions is 15.35 ha, whilst the total landfill area under Future Conditions is 20.93 ha.

The MUSIC model water quantity results are summarised in **Table 4.6**.

A comparison of the results given in **Tables 4.5** and **4.6**, disclosed that the MUSIC model performs well in comparison with the water balance calculations.

The coefficient of runoff volume (Cv) was estimated to be 0.23 using the calculations described in equation 1 and 2. This is comparable to the Cv estimated by the MUSIC model of 0.24. It is therefore concluded therefore that the values of water quantity parameters adopted in the MUSIC model are appropriate for the site.

Table 4.5 Summary of Water Balance Calculations

Year	Annual Rainfall (mm)	Existing Conditions			Operations Scenario		
		Rainfall (ML)	Runoff (ML)	Cv	Rainfall (ML)	Runoff (ML)	Cv
1973	969	148.7	19.5	0.13	202.8	26.6	0.13
1974	1576	241.9	62.4	0.26	329.8	85.1	0.26
1975	1452	222.8	61.7	0.28	303.8	84.1	0.28
1976	1657	254.4	70.7	0.28	346.9	96.4	0.28
1977	1073	164.8	40.0	0.24	224.7	54.6	0.24
1978	1651	253.4	63.6	0.25	345.5	86.8	0.25
1979	888	136.3	26.9	0.20	185.8	36.7	0.20
1980	676	103.7	20.2	0.20	141.5	27.6	0.20
1981	1412	216.7	66.8	0.31	295.5	91.0	0.31
1982	997	153.0	31.9	0.21	208.6	43.4	0.21
1983	1122	172.2	31.5	0.18	234.8	42.9	0.18
1984	1275	195.6	44.2	0.23	266.8	60.2	0.23
1985	1244	190.9	36.2	0.19	260.3	49.3	0.19
1986	990	151.9	36.9	0.24	207.2	50.4	0.24
1987	1131	173.7	35.5	0.20	236.8	48.5	0.20
1988	1579	242.3	66.0	0.27	330.4	90.0	0.27
1989	1636	251.2	62.2	0.25	342.5	84.8	0.25
1990	1856	284.9	79.6	0.28	388.5	108.6	0.28
1991	858	131.6	23.1	0.18	179.5	31.5	0.18
1992	1319	202.4	54.7	0.27	276.0	74.5	0.27
1993	831	127.6	24.7	0.19	173.9	33.7	0.19
1994	831	127.6	27.8	0.22	173.9	37.9	0.22
1995	1093	167.8	43.3	0.26	228.8	59.1	0.26
1996	984	151.0	37.0	0.25	206.0	50.5	0.25
1997	985	151.2	31.1	0.21	206.2	42.4	0.21
1998	1251	192.0	41.5	0.22	261.7	56.6	0.22
1999	1477	226.8	51.8	0.23	309.2	70.6	0.23
2000	854	131.0	24.2	0.19	178.7	33.1	0.19
2001	1013	155.5	35.1	0.23	212.0	47.8	0.23
2002	172	26.4	9.9	0.37	36.0	13.5	0.37
2003	862	132.3	20.5	0.16	180.4	28.0	0.16
2004	936	143.6	31.5	0.22	195.9	42.9	0.22
2005	979	150.3	37.1	0.25	205.0	50.6	0.25
2006	1052	161.4	41.7	0.26	220.1	56.9	0.26
2007	1405	215.7	61.8	0.29	294.2	84.3	0.29
2008	1417	217.5	57.6	0.26	296.6	78.5	0.26
2009	815	125.1	28.0	0.22	170.6	38.2	0.22
2010	1021	156.7	34.6	0.22	213.6	47.2	0.22
50th %tile	1073.4	164.8	37.0	0.23	224.7	50.5	0.23
Average	1140.3	175.0	41.4	0.23	238.7	56.4	0.23

Table 4.6 MUSIC Model Water Quantity Results

Conditions	Annual Rainfall (ML)	Annual Runoff (ML)	Cv
Existing	175.5	42.5	0.24
Operations	239.4	57.9	0.24

4.2.2 Validation of Water Quality Parameters

Water quality data provided by Council was used to validate the water quality parameters adopted in the MUSIC models.

Under the EPL Council are required to monitor four surface water monitoring sites for the AWMF including Sites 6, 7, 8 and 9. The locations of these sites are shown in **Figure 3.1**.

- Site 6 – Sediment pond 3
- Site 7 – Sediment pond 2
- Site 8 – Natural waterway
- Site 9 – Natural waterway

Site 8 was not included in the validation process since this site is well downstream of the site in the natural watercourse. The water quality data for Sites 6, 7, and 9 are summarised in **Table 4.7**.

Table 4.7 Summary of Observed Surface Water Quality at Stations 6 and 7

Site	Total Suspended Solids (mg/L)	Phosphate (mg/L)	Nitrate (mg/L)	Year
Site 6	27	-	2	2008
Site 7	667.5	0.005	0.28	2008
Site 6	404	-	6.32	2009
Site 7	1020	0.005	0.72	2009
Site 6	14.33	-	8.647	2010
Site 7	12	-	0.895	2010
Average	357	<0.01	3.14	

The default values of the EMCs for Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN) for industrial landuse are approximately 200 mg/L, 0.54mg/L and 3.89 mg/L respectively. The average observed TSS concentration exceeded the default value for TSS while the average observed Nitrate concentration is similar to the default TN EMC. It was not possible to draw any conclusions regarding TP EMC values because there were only two Phosphate readings both of which were very low.

Based on this comparison the TSS EMC was set equal to 357 mg/L while the default EMC values for TP and TN were retained.

4.2.3 MUSIC Results

The results of the MUSIC modelling are summarised in **Table 4.8**. The estimated pollutant reductions exceed the Best Management Practice guidelines (DECCW 2007) that recommend 85%, 65% and 45% reductions in average annual exports of TSS, TP and TN respectively.

Table 4.8 Summary of MUSIC Results

Parameter	Source Runoff	Discharge from AWMF	Reduction
Existing Conditions			
Flow (ML/y)	42.5	39.7	6%
TSS (kg/y)	18,800	1,020	95%
TP (kg/y)	28.2	5.52	80%
TN (kg/y)	204	111	46%
Expansion Conditions			
Flow	57.9	53.3	8%
TSS	26,200	1,370	95%
TP	38.6	7.51	81%
TN	266	128	52%

It is concluded that the treatment train to be implemented as part of the expansion of the AWMF will achieve pollutant capture rates equal or better than under Existing Conditions.

4.2.4 Quality of Discharges from the AWMF

The stormwater quality leaving the site is to be in accordance with the limits outlined by ANZECC as advised by OEH. Furthermore there is an EPL in place for the AWMF which identifies limits for surface water Discharges.

The EPL issued by OEH on 25th January 2011 included:

- A TSS discharge limit of 50 mg/L. Higher discharge concentrations are allowed at Sites 6 and 7 if the rainfall is higher than 90th percentile of the 5 day rainfall; and
- All surface water must be managed in drains that convey the 10 yr ARI runoff away from disturbed areas of landfill.

An assessment of the water quality under Existing Conditions and estimation of the water quality under Future Conditions was undertaken. **Table 4.9** provides an assessment of surface water quality based on sampled data for 2008-2010 in comparison with the MUSIC model results.

It should be also noted that Schedule 5 of the POEO (General) Regulation 2009 lists the prescribed matter for the definition of water pollution. Under this section, the ANZECC 2000 guidelines are identified as the appropriate standard against which chemical toxicants should be compared.

Table 4.9 Water Quality Assessment

Parameter	Observed (Site 8)	MUSIC Existing Conditions	MUSIC Expansion Scenario	2000 ANZECC Guideline ^a
pH	7			6.5 - 8.0
DO (% Saturation)				85 - 110
Electrical Conductivity (mS/cm)	0.523			0.125 - 2.2
Turbidity (NTU)	-			6 - 50
TSS (mg/L)	87	2* (91.6 ^m)	5* (65.5 ^m)	250 ^b
Total Dissolved Solids	490			-
Arsenic (mg/L)	0.004			0.013
Cadmium (mg/L)	nil			0.0002 0.0002 - 0.005 ^b
Chromium (mg/L)	nil			0.001, 0.02 ^b
Copper (mg/L)	0.17			0.0014, 0.0004 ^b
Nickel (mg/L)	-			0.011
Lead (mg/L)	0.03			0.0034
Iron (mg/L)	0.15			0.04 ^c
Mercury (mg/L)	nil			0.00006
TN (mg/L)	2.2	0.17* (5.2 ^m)	0.41* (7.4 ^m)	0.5 ^d (3.5 ^b)
TP (mg/L)	0.01	0.014* (0.26 ^m)	0.035* (0.26 ^m)	0.05 ^d , 0.6 ^b
Naphthalene	nil			950
Anthracene	nil			180
Phenanthrene	nil			80
Flouranthene	nil			200
Benzo(a)pyrene	nil			0.2

Notes: a values refer to ANZECC (2000) trigger values for toxicants for slightly to moderately disturbed freshwater systems unless indicated otherwise.

b ANZECC (2000) trigger values are for Lowland Rivers (<150m altitude) in south-east Australia.

c Australian Runoff Quality (ARQ) (2004).

d ANZECC (2000) Interim working values in the absence of reliable trigger values (Section 8.3.7)

* Mean concentration

m Maximum concentration

The 2004 ARQ values represent the average concentrations of observed physio-chemical parameters for urban stormwater runoff in Australia. This data is considered to also provide a useful comparison.

Site 8 is located in the watercourse downstream of the landfill (refer **Figure 3.1**). The sample results show that the ANZECC limits are acceptable for most parameters except

some metals (copper and iron). In addition it is estimated that the TSS requirements of the EPL will be met under Future Conditions.

5 SURFACE WATER QUANTITY

The AWMF is located adjacent to an un-named natural watercourse that is a tributary of Kilaben Creek. Impacts on the watercourse will be mitigated through the implementation of stormwater quantity and quality management measures.

A 30 m buffer zone will be established from the watercourse centre line. All water management measures will to be located outside of the buffer.

Stormwater quality and quantity is to be managed using sediment basins. Three basins are proposed to capture surface runoff from the landfill during its operation and should be maintained following capping for on-going stormwater management.

A qualitative assessment of flood impact due to the proposed extension of the Awaba landfill was undertaken using a hydrological model

The following scenarios were assessed:

- Natural Conditions – This case represents the site prior to development of the landfill
- Existing Conditions – This case represents the landfill as it exists currently;
- Capped Conditions – This case generates the highest volume of surface runoff during storms and represents the worst case.

5.1 The xprafits Model

The hydrological model was assembled was follows.

5.1.1 Subcatchment Layout

Subcatchments were broadly delineated based on the design contours under Capped Conditions (GHD, 2010). The capped landfill will be a cone shape with eastern and western subcatchments draining to their respective sediment basins. Overflows from the basins will be conveyed in table drains which will discharge runoff into the watercourse via rock lined level spreaders. No low level outlets were included.

The subcatchment layout of the **xprafits** model under Existing Conditions is given in **Figure 3.1** while the subcatchment layout under Capped Conditions is shown in **Figure 5.1**.

5.1.2 Model Parameters

Subcatchments

The subcatchment attributes under Existing Conditions and Capped Conditions are given in **Tables 5.1** and **5.2** respectively.

Under the Natural Conditions scenario a total catchment area of 23.92 ha was adopted for consistency with the catchment area under Capped Conditions.

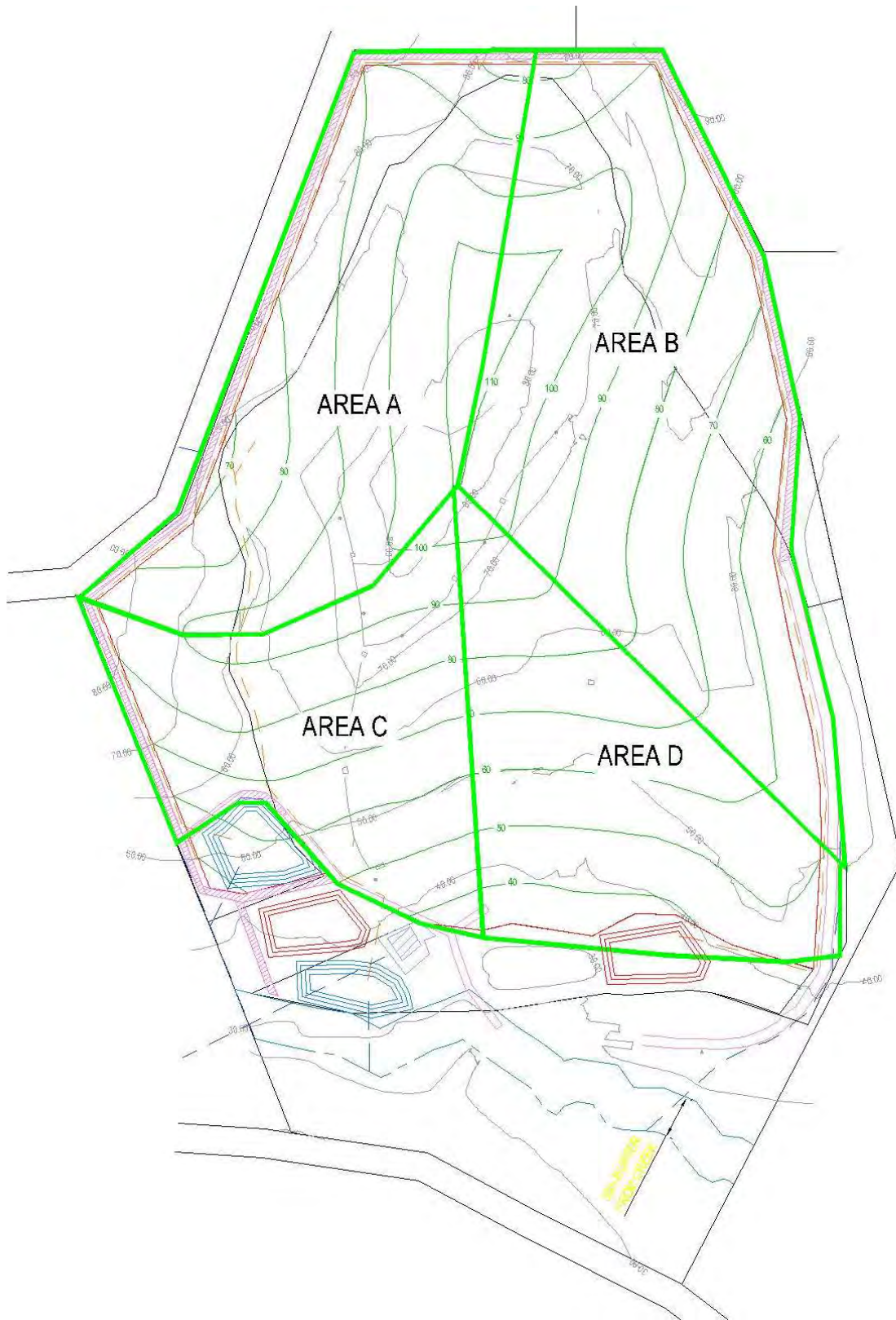


Figure 5.1 Subcatchment Layout under Capped Conditions

Table 5.1 Catchment Attributes under Existing Conditions

Subcatchment	Pervious Area (ha)	Impervious Area (ha)	Imperviousness	Total Area (ha)	Slope
Cell 1	4.59	0.24	5%	4.83	9.7%
Cell 2	4.86	0.26	5%	5.12	8.8%
Cell 3	2.00	0.11	5%	2.11	10.0%
Cell 4	3.13	0.16	5%	3.29	4.4%

Table 5.2 Catchment Attributes under Capped Conditions

Subcatchment	Pervious Area (ha)	Impervious Area (ha)	Imperviousness	Total Area (ha)	Slope
A	6.13	0.13	2%	6.26	17.4%
B	8.31	0.17	2%	8.48	17.1%
C	4.30	0.09	2%	4.39	18.5%
D	4.69	0.10	2%	4.79	14.0%

Rainfall Loss Rates

The adopted rainfall loss rates are as follows:

- Pervious surfaces - 20 mm initial loss and 2.5 mm/h continuing loss
- Impervious surfaces - 1.5 mm initial loss and 0 mm/h continuing loss

Subcatchment Roughness

The adopted roughness values for pervious and impervious surfaces were 0.04 and 0.015 respectively.

Basin Properties

Stage-storage relationships were prepared based on the properties given in **Table 4.3**.

5.2 Results & Discussion

The **xprafits** model was run for the 1 yr ARI and 2 yr ARI events to assess the impact of the proposed expansion on runoff from frequent storms while the 100 yr ARI event was run to assess the impact of the proposed expansion on runoff under large infrequent storms.

The hydrographs for each of the scenarios modelled under 1 yr ARI, 2 yr ARI and 100 yr ARI events are compared in **Figures 5.2, 5.3 and 5.4** respectively.

It should be noted that the catchment areas under Capped Conditions are 56% greater than under Existing Conditions. Consequently there is a slight increase in the peak flows and the flow durations under Capped Conditions in comparison with Existing Conditions. It was also noted that hydrographs under the Capped Conditions does not exceed the hydrograph under Natural Conditions.

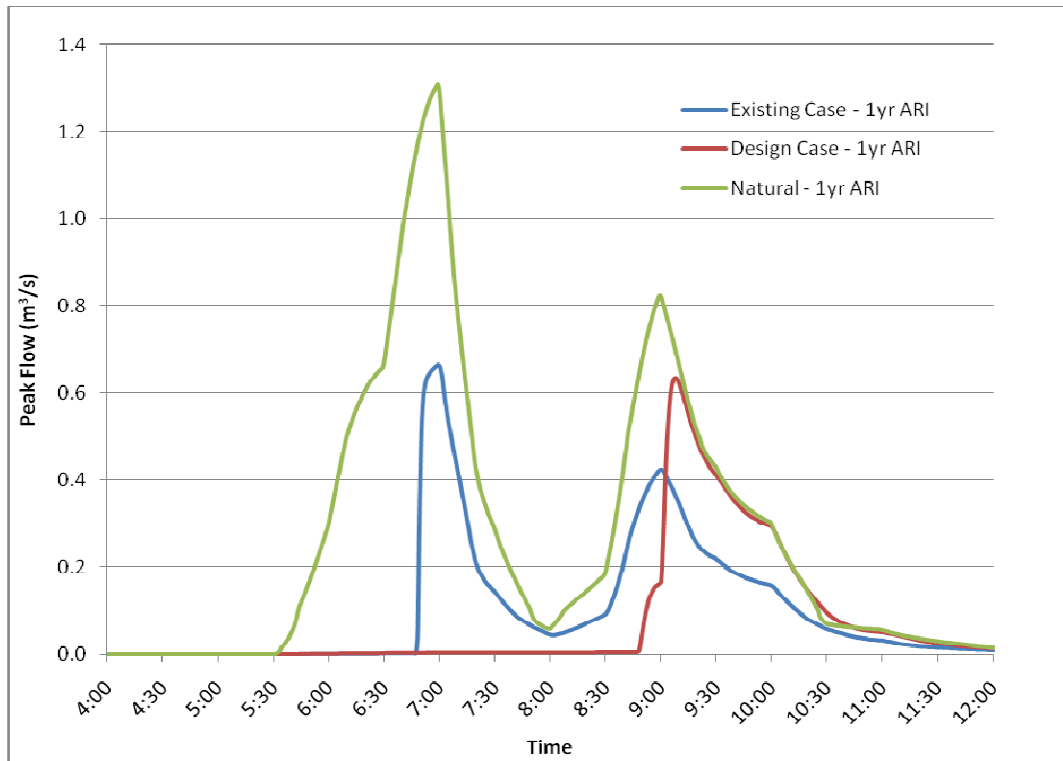


Figure 5.2 Comparison of 1 yr ARI Hydrographs discharging to the Watercourse

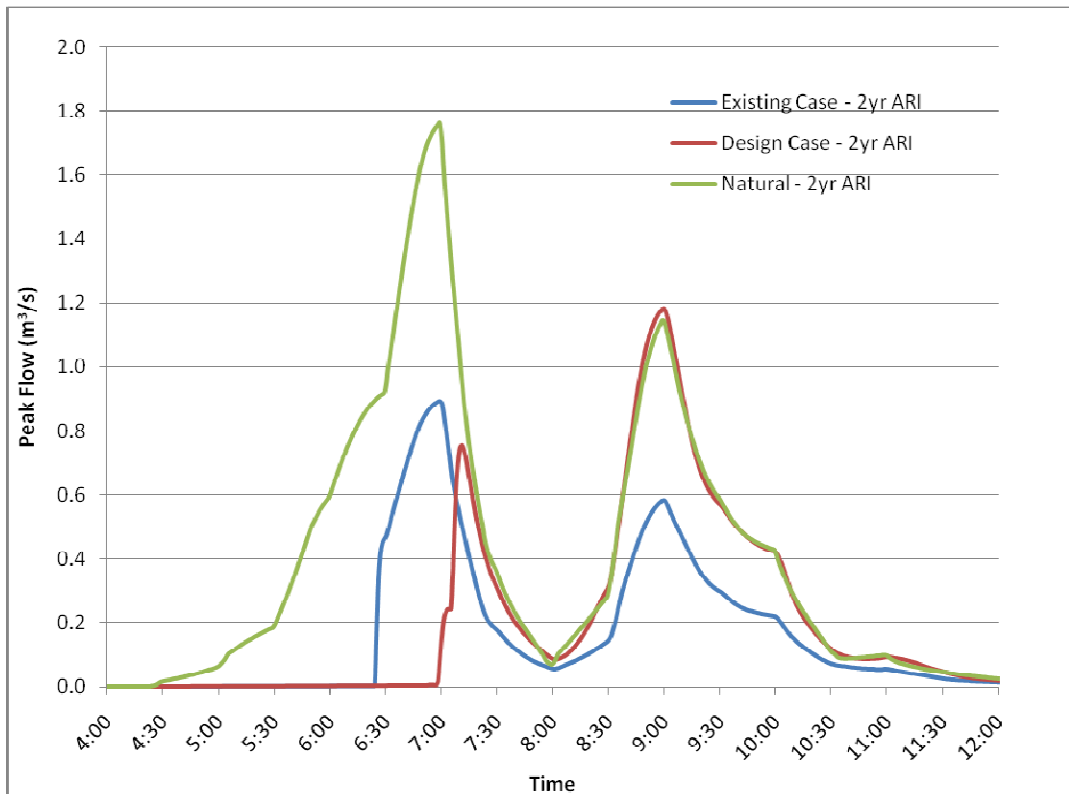


Figure 5.3 Comparison of 2 yr ARI Hydrographs discharging to the Watercourse

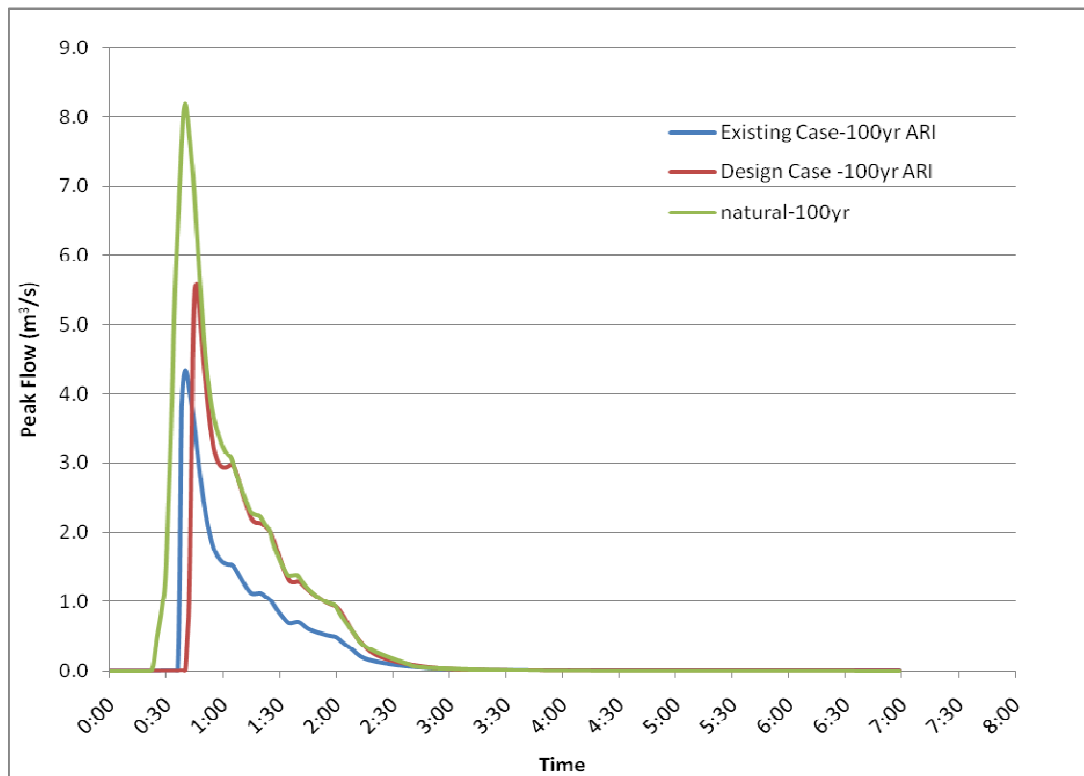


Figure 5.4 Comparison of 100 yr ARI Hydrographs discharging to the Watercourse

It was therefore concluded that there will be negligible impact on the watercourse as a result of the proposed expansion. Interestingly it could be argued that the proposed expansion is returning the catchment runoff to levels closer to pre-development conditions.

5.3 Qualitative Flood Impact Assessment

The proposed expansion will increase the landfill footprint and steepen the slope of the capped surface. These modifications will generate higher peak runoff than under Existing Conditions and there would be some expected increase in flood levels as a result however any increases would still result in flood levels lower than would be estimated under pre-development conditions.

5.4 Stormwater Conveyance

Conveyance of the 10 year ARI peak flows to the watercourse will be required during the operations and under Capped Conditions. Open channels will be required to convey surface runoff to the sediment basins. The sizing of the channels was undertaken based on the estimated 10 year ARI peak flows under Capped Conditions. The estimated peak 10 yr ARI flows from each subcatchment are summarised in **Table 5.3** while the indicative channel sizes are summarised in **Table 5.4**.

The adopted Manning roughness value for all channels which are expected to be rock-lined was 0.04.

Table 5.3 Estimated Peak 10 year ARI Flow under Capped Conditions

Subcatchment	Peak Flow (m ³ /s)
A	1.4
B	1.8
C	1.1
D	1.1

Table 5.4 Indicative Dimensions of Open Channels

Sub-catchment	Required Capacity (m ³ /s)	Indicative Bed Slope (%)	Base Width (m)	Top Width (m)	Depth (m)
A	1.4	2	1.2	2.2	0.5
B	1.8	3	1.4	2.4	0.5
C	2.5	10	1	2	0.5
D	2.9	7	1.4	2.4	0.5

6 CONCLUSIONS

The surface water assessment of the proposed expansion of the AWMF has demonstrated that surface runoff will be managed in accordance with the DGRs and recommendations from OEH.

It is concluded that the proposed sediment basins are sufficient to reduce the average annual export of stormwater pollutants to acceptable levels and to retard peak flows to levels lower than under pre-development conditions.

In addition a qualitative flood impact assessment found that downstream flood levels would remain lower than would be estimated under pre-development conditions.

The following recommendations are made in support of the proposed expansion:

- Proposed basins should be lined to prevent interaction with groundwater;
- The active storage depth in proposed basins should be 0.75 m from permanent water level to the level of the primary spillway;
- Overflows from the basins should be conveyed to the outfall(s) via 0.5 m deep rock lined channel with base widths of 2 m and side slopes of 1(V):2(H)
- Discharges to the watercourse are to be via a level spreader(s).
- Surface water quality monitoring should continue in accordance with the existing Annual Returns to ensure compliance with the EPL.

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Appendix **B**
Site Water Balance



Lake Macquarie City Council

Awaba WMF - Environmental Investigation

Site Water Balance

June 2019

Executive summary

Awaba Waste Management Facility (Awaba WMF), owned and operated by Lake Macquarie City Council (Council), is located in south-western Lake Macquarie. As part of landfill operations, Council is required to manage leachate generated by the Awaba WMF, as part of a broader water management system. Regular water quality monitoring is also undertaken as part of the site water management.

The leachate water typically has elevated levels of ammonia, as a result of anoxic decomposition of organic materials. Leachate water that cannot be stored and reused on site is discharged into the sewer, under a trade waste agreement between Council and Hunter Water. The trade waste agreement includes limits on the daily mass of ammonia (and other chemicals) that can be discharged into the sewer. Water quality monitoring indicates that the mass of ammonia being discharged into the sewer is likely to be in excess of this limit.

Council engaged GHD Pty Ltd (GHD) to develop a water balance model of the Awaba WMF, in order to estimate the movement of water through the site under existing and future conditions, and to identify and test potential mitigation measures to improve water management and leachate disposal.

The site water balance was developed using the Goldsim software package, a water balance modelling software, and the input data, methodology and results are presented and described. The water balance model was developed from a schematisation of the existing site water management system, and operational rules, and climatic conditions. The existing site water management system is intended to reflect the current water management infrastructure on site, and included separate systems to manage clean, dirty and leachate water, and considers direct rainfall, runoff, infiltration and seepages across the site. The operational rules dictate when specific events occur, such as the activation and deactivation of pump, the commencement of discharges to sewer. The climatic conditions used in the water balance modelling are based on historical daily rainfall and evaporation, allowing the natural climatic variability to be considered in the modelling.

The water balance model was validated using the observed rainfall, water levels, and pumping volumes, with model indicating that when water levels within the landfill were elevated, leachate water was likely to seep into the dirty water drainage system and subsequently into the downstream environment. This is consistent with recent observations in the western drain. A sensitivity analysis was also included to better understand the realism and accuracy of the model, given the limited data available.

The water balance model was used to estimate the future water management requirements, and to identify and test mitigation options. The range of potential responses was estimated using Monte Carlo methods, which utilised 130 climate sequences derived from the observed historical data. The modelling indicated that leachate volumes generated by the Awaba WMF are likely to continue exceed the proposed capacity of the WTP (250 kL/day), resulting in the need for a cumulative total of about 20 000 (median) or 25 000 (95th percentile) tankers to be used to manage the excess leachate over the fill out plan to 2045.

This forecast includes variations of average monthly average tanker volumes up to about 800 kL/day. These volumes are much higher than observed at the site during the last 12 months, however the last 12 months corresponds to quite dry year at the site (approximately 5th to 10th percentile average annual rainfall). The model is likely to be conservative, as the necessary simplifications are unlikely to fully consider the storage attenuation provided by the existing landfill. However, as the fill out plan proceeds and new cells are commissioned, the storage attenuation effects of the existing landfill are expected to diminish. Therefore the model is considered a reasonably conservative representation of future leachate behaviour of the landfill.

In consultation with Council, two mitigation options were considered to reduce the number of tankers required: doubling the capacity of the WTP (from 250 to 500 kL/day), and; capping Cells 7 and 8. The modelling indicated that both options reduced the number of tankers that are likely to be required in the future by about 75% and about 50% (by year 2045), respectively.

Based on this assessment, the following are recommended:

1. Continue the existing surface water monitoring program, to allow the water balance model to be improved and refined.
2. Consider undertaking a benefit-cost analysis of the above mitigation measures (or others).
3. Improve the management of the current leachate discharge along the western slope, by constructed a cut off wall along the western slope.

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1. Introduction

1.1 Background

Awaba Waste Management Facility (Awaba WMF) is owned and operated by Lake Macquarie City Council (Council). It is located on the western side of Lake Macquarie approximately 30 km south west of Newcastle NSW.

Council engaged GHD Pty Ltd (GHD) to prepare a site water balance to determine environmental risks and impacts to leachate management at Awaba WMF. This study will then be used to determine mitigation measures and strategies to reduce environmental impacts of leachate migration and ultimately allow for the leachate management plan be updated and mitigation measures be developed to minimise the risk of environmental impacts from uncontrolled releases of leachate.

1.2 Purpose of this report

The purpose of this report is to describe the site water balance of Awaba WMF. The site water balance has been analysed using a site water balance model. This report describes input data, the model methodology and presents and interprets the results of the model.

1.3 Scope and limitations

The scope of the site water balance includes the rainfall, runoff and evaporation of water storages on site, gravity and pumped flows of water. This model has been calibrated to observe seepages to the west and measured leachate flowrate. An estimation has been made to estimate the potential range of leachate seepage to the surface and into the local groundwater.

This water balance considers the effect of rainfall variation on the results of the model, based on a historical rainfall record. This approach assumes that the historical rainfall record is characteristic of future rainfall variability and does not explicitly consider inter-annual climate patterns such as the El Niño Southern Oscillation or long term trends such as climate change.

This report has been prepared by GHD for Lake Macquarie City Council and may only be used and relied on by Lake Macquarie City Council for the purpose agreed between GHD and Lake Macquarie City Council as set out in Section 1.2. GHD otherwise disclaims responsibility to any person other than Lake Macquarie City Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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2. Water management

The water management system at Awaba WMF can be divided into clean, dirty and leachate categories.

The inflows to Awaba WMF are:

- Direct rainfall and catchment runoff, including infiltration and percolation to the landfill mass
- Groundwater inflows

The outflows from Awaba WMF are:

- Evaporation losses from surface storages
- Discharge to sewer
- Tanker removal by Remondis
- Off site discharges of treated dirty water

2.1 Clean water management

The clean water management system consists of clean water diversion drains that divert runoff from the surrounding natural bushland catchment around the site. The clean water management system minimises the volume of water required to be actively managed by the site.

2.2 Dirty water management

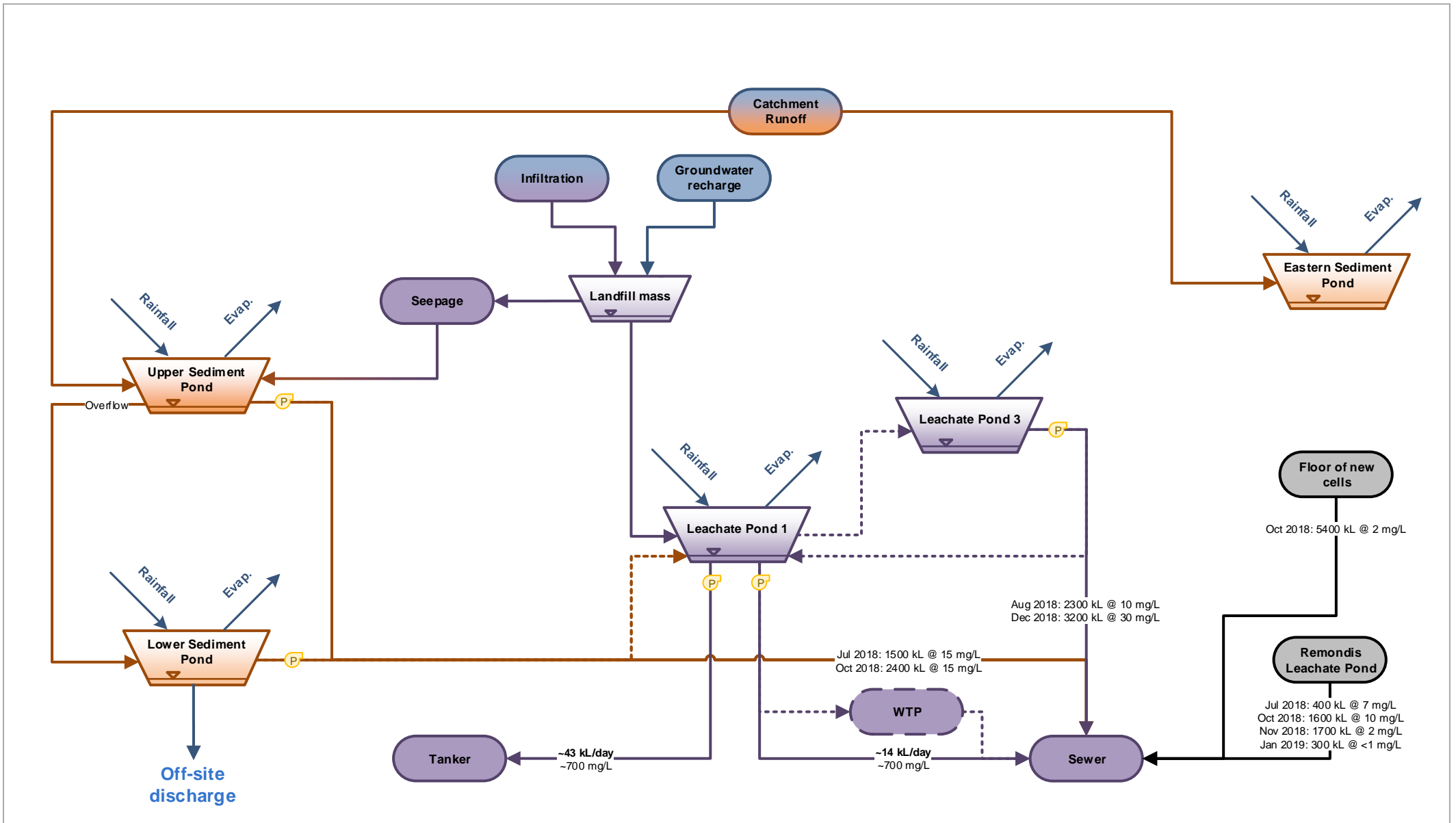
The dirty water management system captures runoff from disturbed areas of the site. Dirty water is diverted using dirty water drains that direct it into sediment basins, known as the Upper and Lower Sediment Basin (on the western boundary) and the Eastern Sediment Basin. Dirty water is treated by settling and other means to achieve acceptable water quality and discharged off-site. Recently, the dirty water collected in the western sediment basins has been observed to be contaminated with leachate that is seeping from the landfill mass.

2.3 Leachate water management

The leachate water management system minimises the generation of, contains, collects, stores and disposes of leachate. Leachate is water that has passed through landfill. Leachate is collected by a number of subsurface drains and contained in two lined storages, Leachate Pond 1 and Leachate Pond 3.

2.4 Water management features

The water management system at Awaba WMF was conceptualised into a series of water management features, as shown in Figure 2-1. Figure 2-1 shows the typical flow rates and concentrations observed at the site during 2018.



Legend

- | | | | | | | | |
|--|---------------------|--|---------------------|--|------------------------|--|----------|
| | Clean water storage | | Dirty water storage | | Leachate water storage | | Pump |
| | Clean water process | | Dirty water process | | Leachate water process | | Existing |
| | Clean water flow | | Dirty water flow | | Leachate water flow | | Proposed |



LAKE MACQUARIE CITY COUNCIL
AWABA WASTE MANAGEMENT FACILITY

WATER CYCLE SCHEMATIC

Project No. 2219425
Revision No. A
Date 01/03/2019

FIGURE 2-1

Created by Tyler Tinkler

3. Data

The water balance for Awaba WMF involved the collation and interpretation of data from various sources. The purpose of this section is to summarise the data used. The sources of data used are shown in Table 3-1.

Table 3-1 Summary of data sources

Data	Source
Historical rainfall and evaporation record	SILO (DSITI, 2019)
Catchment areas and land use	Interpreted from contours and aerial imagery provided by Council.
Storage geometry	Based on design surfaces. Maximum surface area interpreted from site contours and aerial imagery.
Observed pumping, detailed in Table 3-2	Information was provided by Council from the following sources: <ul style="list-style-type: none"> • Pumping data file supplied by Council for internal transfers. • Tanker load invoices from Central Coast Council. • Tanker load invoices from Remondis.

Table 3-2 Observed datasets

Dataset	Units	Time period	Comment	Cumulative Total (ML)	Cumulative Total for Validation Period (ML)
Leachate Pond 1 Sewer Pump	L/day	25/06/2017 – 01/02/2019	Consistent usage besides 10/07/2018 to 14/11/2018 and 19/12/2018 to 14/01/2019 where no pumping occurred.	5.97	1.74
Leachate Pond 1 Tanker Pump	kL/day	01/12/2017 – 31/01/2019	Consistent usage with no periods of no pumping.	16.19	11.82
Leachate Pond 3 Pump	ML/day	25/06/2017 – 01/02/2019	Minimal usage with small amount of usage from 01/08/2018 – 12/08/2018 and 20/12/2018 – 12/01/2019.	5.58	4.39
Lower Sediment Pond Pump	ML/day	25/06/2017 – 01/02/2019	Minimal usage with small amount of usage from 24/07/2018 – 30/07/2018.	1.47	1.47
Upper Sediment Pond Pump	ML/day	25/06/2017 – 01/02/2019	Release of water from 28/10/2018 for 9 days until 5/11/2018 but outside this window no pumping occurred.	2.39	2.39

Dataset	Units	Time period	Comment	Cumulative Total (ML)	Cumulative Total for Validation Period (ML)
Landfill Water Level Pump	M	01/09/2018 – 01/03/2019	Recorded once monthly.	N/A	N/A
New Cells to Sewer Pump	L/day	25/06/2017 – 01/02/2019	Release of water from 19/10/2018 for 8 days until 26/10/2018 but outside this window no pumping occurred.	5.45	5.45
Landfill to LDP Overflow	ML/day	22/03/2018 – 22/03/2019	Consistent data with some days of no overflow.	4.84	3.06
Landfill to LDP Sump	ML/day	22/03/2018 – 22/03/2019	Data every day except from 2/12/2018 to 8/12/2018.	19.56	16.41
Landfill to LDP Weir	ML/day	22/03/2018 – 22/03/2019	Consistent data points through the dataset.	17.47	14.3

3.1 Climate

A historical record of daily rainfall, evaporation and evapotranspiration depths was obtained in the form of a patched point data set from the Scientific Information for Land Owners (SILO) database operated by the Queensland Department of Science, Information Technology and Innovation (DSITI). SILO patched point data is based on observed historical data from a particular Bureau of Meteorology (BOM) station with missing data 'patched in' by interpolating with data from nearby stations (DSITI, 2019).

For this assessment, SILO data was obtained for the Cooranbong (Avondale) station (station number 061412), which is located approximately 14 km south-west of the site. This station was chosen based on proximity to the site and similarity of elevation. The period of rainfall data used for this assessment extended from 1 January 1889 to 1 January 2018 (a total of 129 years).

Figure 3-1 shows the distribution on annual rainfall and evaporation totals near Awaba WMF. Annual rainfall totals near Awaba WMF vary between about 550 mm to 2000 mm, with an average of about 1150 mm. Annual potential evaporation totals are about 1415 mm, resulting in a net annual evaporation of about 200 mm.

Figure 3-2 shows the average monthly rainfall and evaporation totals near Awaba WMF. On average, more rainfall occurs in late summer and early autumn than in late winter and early spring. Evaporation is highest in summer and lowest in winter.

Figure 3-3 shows the average distribution of daily rainfall totals near Awaba WMF. On average, daily rainfall totals exceeding 0.1 mm occur on about 60 % of days, while daily rainfall totals exceeding 50 mm occur on less than 10 % of days.

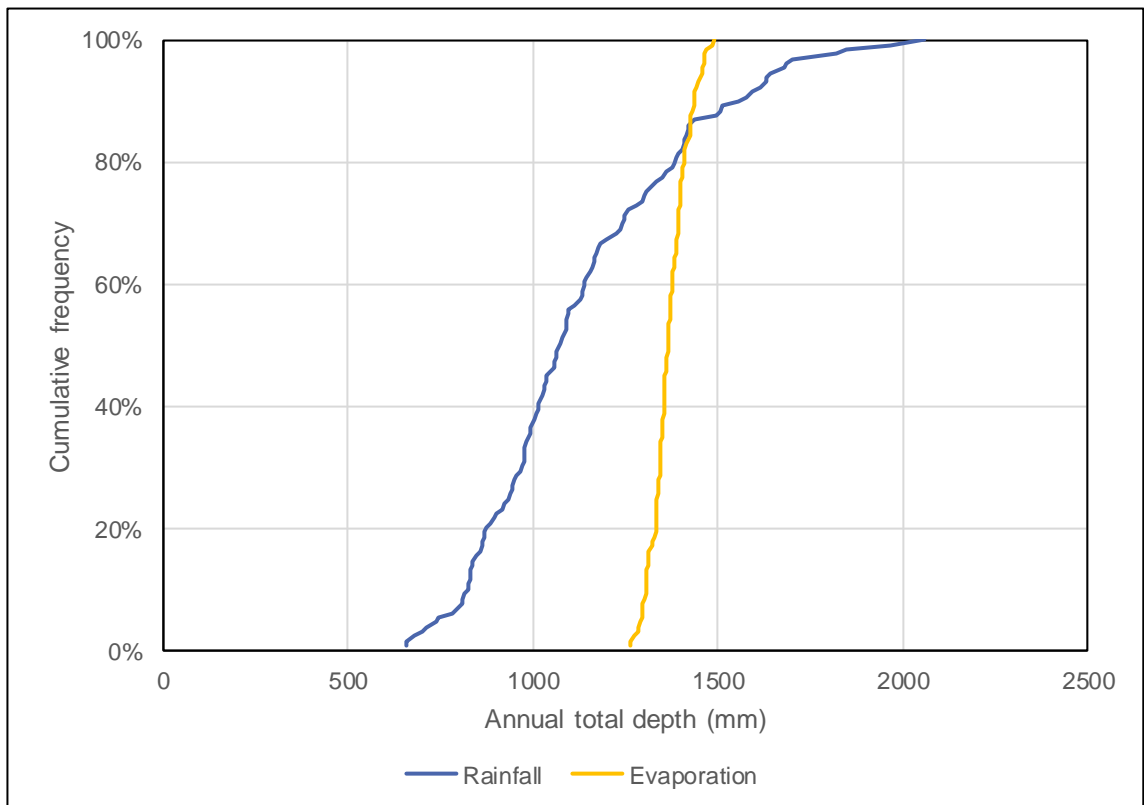


Figure 3-1 Annual rainfall and evaporation totals

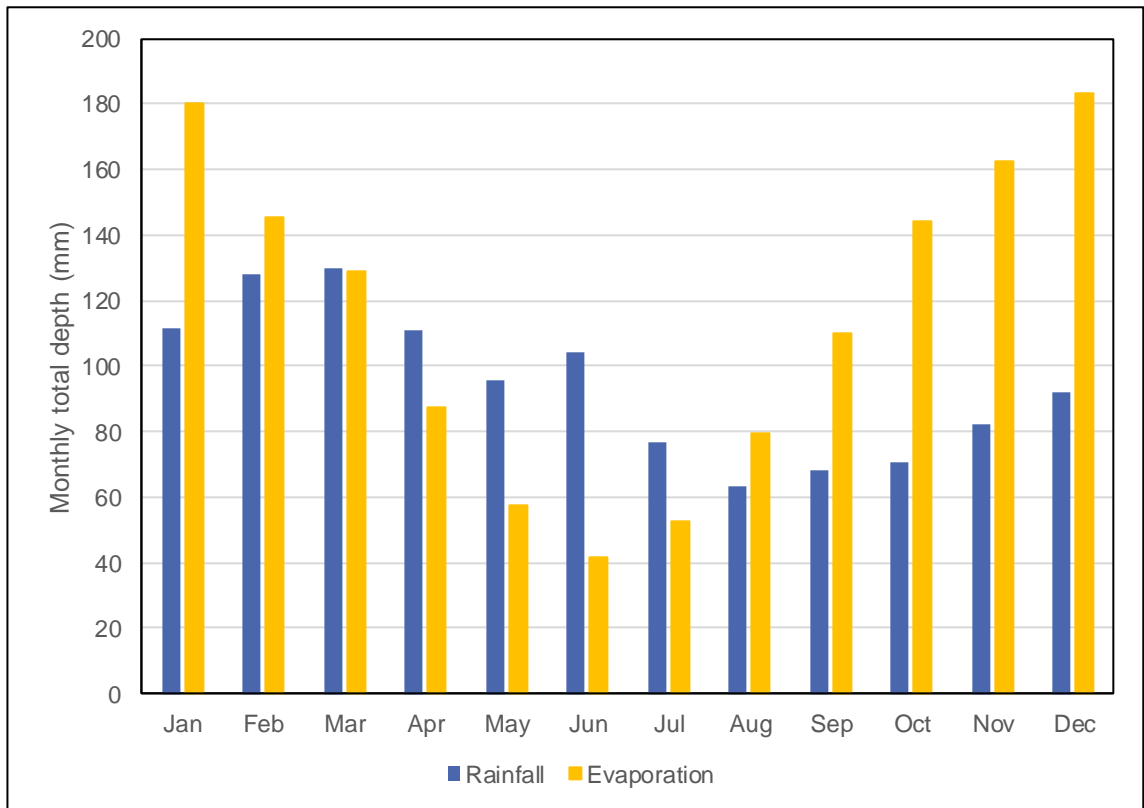


Figure 3-2 Monthly rainfall and evaporation totals

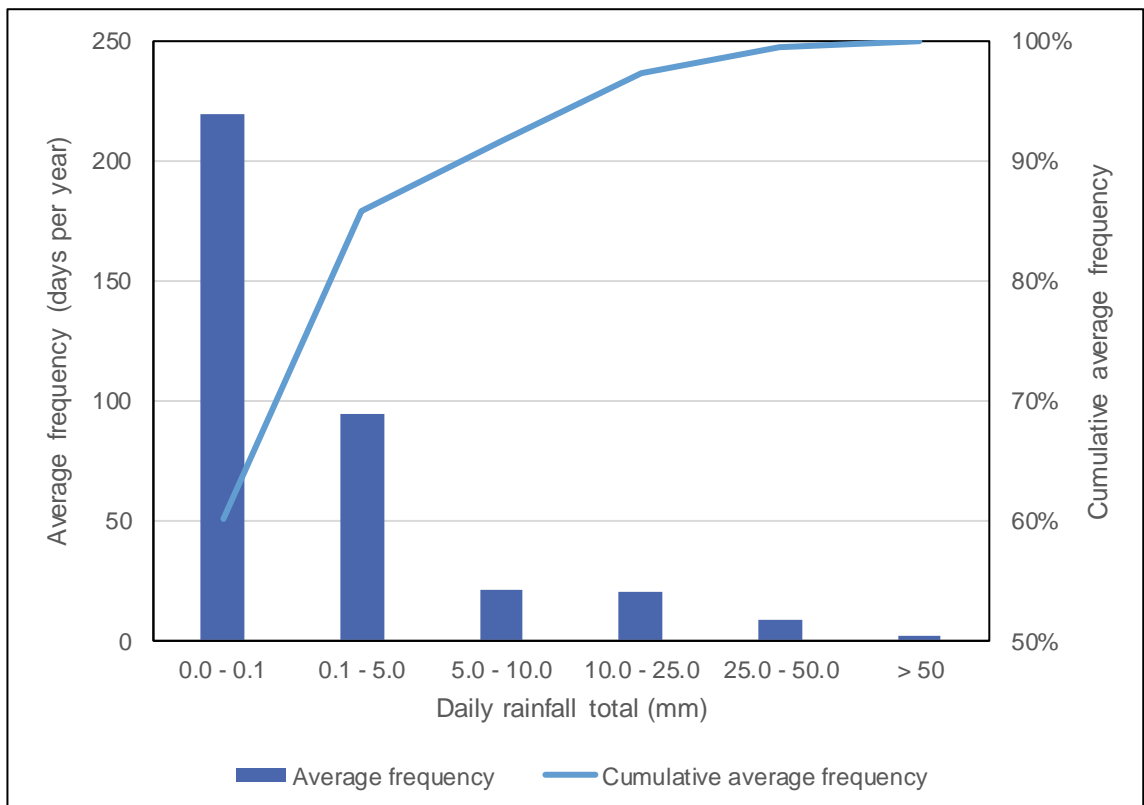


Figure 3-3 Daily rainfall totals

3.2 Catchments

The catchment areas and land uses for each water management feature were estimated from aerial imagery and contours. The land use of the site was characterised into two different classes:

- Landfill: areas above the landfill mass without a final cap.
- Natural: all undisturbed bush land and grassed areas.
- Infrastructure: sealed and compacted areas such as roads and working pad areas.

The existing catchment areas are summarised in Table 3-3. The forecasts of the model were based on the fill out plan as described in GHD (2016) which is summarised in Table 3-4 and in Figure 3-4. As the cell progressed to a final cap, the contribution of percolation to the landfill mass was assumed to reduce to a negligible amount.

Table 3-3 Catchment areas (existing)

Catchment area (ha)	Landfill	Natural	Infrastructure
Upper Sediment Pond	3.9	0.3	0.6
Eastern Sediment Pond	8.5	0.0	1.8
Lower Sediment Pond	0.3	0.0	0.3
Leachate Pond 1	0.7	0.0	0.5
Leachate Pond 3	0.7	0.0	0.0
New Cells	5.7	0.0	0.0

Table 3-4 Fill out plan

Model year	Stage	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Cell 6	Cell 7	Cell 8	Cell 9
2022	Stage 1a	Active	Construction	Intermediate cap	Intermediate cap	Intermediate cap	Intermediate cap	Intermediate cap	Intermediate cap	Intermediate cap
2025	Stage 1b	Intermediate cap	Active	Construction	Intermediate cap	Intermediate cap	Intermediate cap	Intermediate cap	Intermediate cap	Intermediate cap
2028	Stage 2a	Final cap	Intermediate cap	Active	Construction	Intermediate cap	Intermediate cap	Intermediate cap	Intermediate cap	Intermediate cap
2031.5	Stage 2b	Final cap	Final cap	Intermediate cap	Active	Construction	Intermediate cap	Intermediate cap	Intermediate cap	Intermediate cap
2032.5	Stage 3a	Final cap	Final cap	Final cap	Intermediate cap	Active	Construction	Intermediate cap	Intermediate cap	Intermediate cap
2035.5	Stage 3b	Final cap	Final cap	Final cap	Final cap	Intermediate cap	Active	Intermediate cap	Intermediate cap	Construction
2040.5	Stage 4a	Final cap	Final cap	Final cap	Final cap	Final cap	Intermediate cap	Intermediate cap	Intermediate cap	Active
2043	Stage 4b	Final cap	Final cap	Final cap	Final cap	Final cap	Final cap	Intermediate cap	Intermediate cap	Intermediate cap
2045	Stage 5	Final cap	Final cap	Final cap	Final cap	Final cap	Final cap	Final cap	Final cap	Final cap

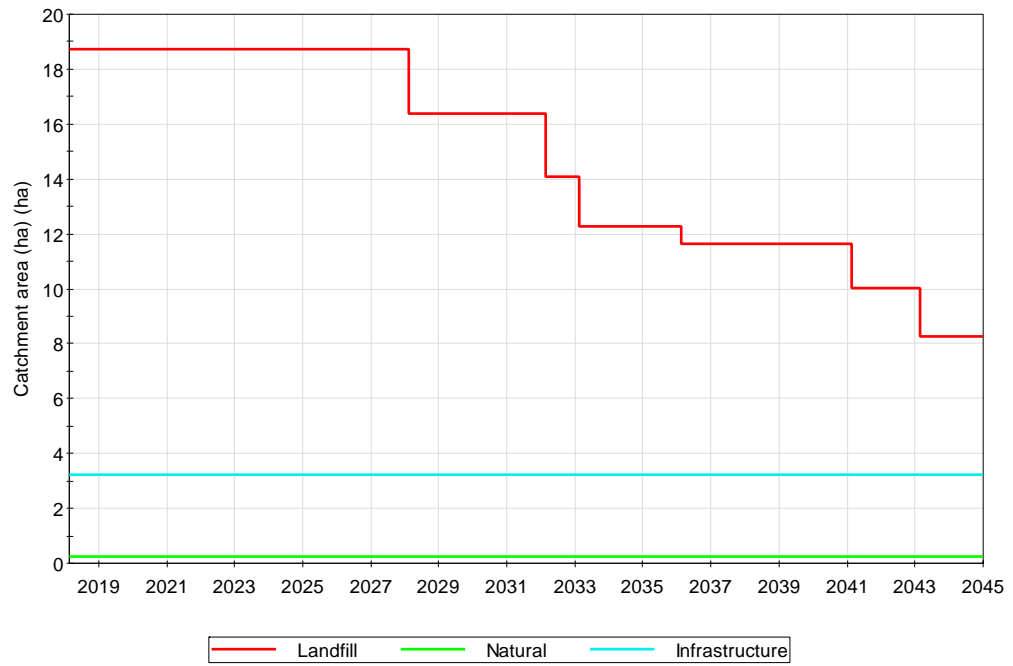


Figure 3-4 Staging of catchment land uses

3.3 Storages

The geometry of surface water storages was determined from design geometry and historical survey provided by Council. The geometric properties of the surface water storages are summarised in Table 3-5.

Table 3-5 Storage geometry

Water management feature	Spill level (m AHD)	Capacity (ML)	Maximum surface area (m ²)
Eastern Sediment Pond	38.5	9390	2331
Landfill Mass	84.3	NA	NA
Leachate Pond 1	32.2	8695	3461
Leachate Pond 3	41.0	5420	2818
Lower Sediment Pond	42.6	3140	1395
Upper Sediment Pond	53.9	4600	1362
New Cells	NA	10	NA

The storage geometry for the landfill mass was based on the difference between the existing landfill surface and an historical survey of the pre-landfill surface provided by Council. The storage capacity assumed a bulk porosity of the landfill of 0.2 (GHD 2019). A plot of the stage storage curve is presented in Figure 3-5.

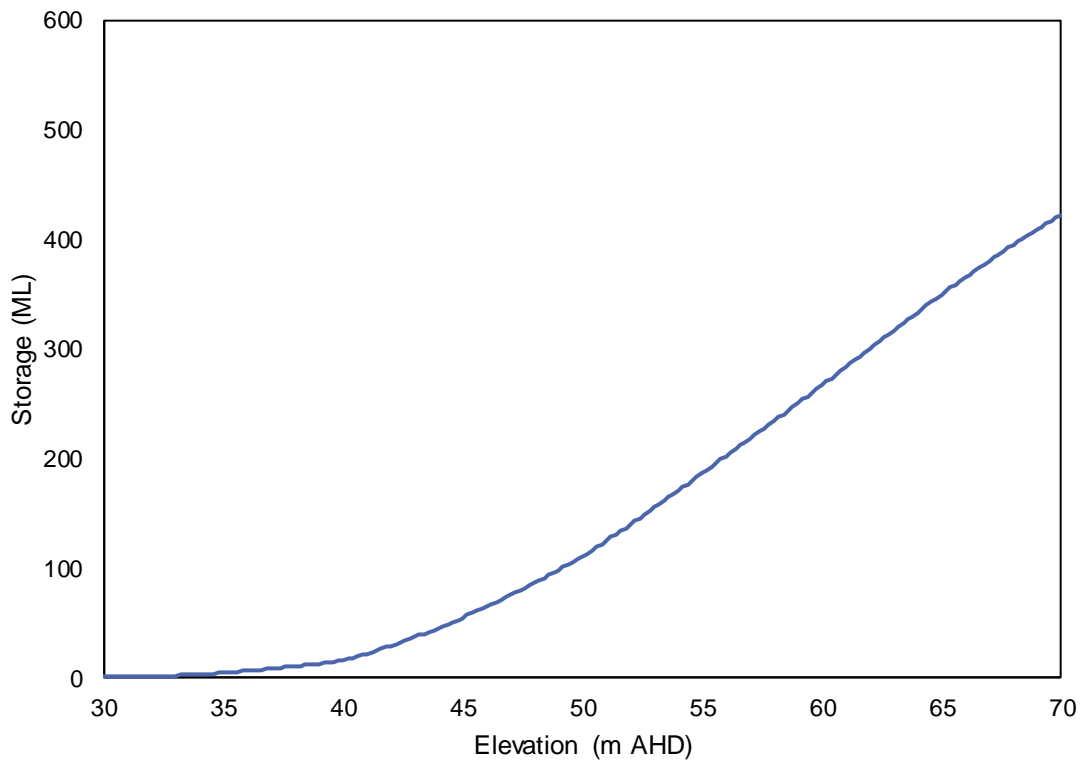


Figure 3-5 Stage storage of landfill mass

4. Model methodology

4.1 Water balance

The site water balance for Awaba WMF was modelled as a semi-distributed mass balance, considering the water management features described in Section 2.4. A site-specific water balance equation was derived from the catchment scale water balance equation described by Ladson (2008). The water balance equation applies conservation of mass to derive an ordinary differential equation that describes how the volume of water V changes over time t :

$$\frac{dV}{dt} = R + C + G_{in} + P_{in} + Q_{in} - E - P_{out} - Q_{out}$$

The water balance considered the inflows into each storage:

- Direct rainfall R , estimated from the simulated water surface area of the storage and the simulated rainfall intensity.
- Catchment runoff C , using the Australian Water Balance model (AWBM) (Boughton & Chiew, 2003) and accounting for the change in simulated water surface area.
- Surface infiltration G_{in} , as described in on Section 4.5.

The water balance considered the outflows from each storage:

- Evaporation E , estimated from the simulated water surface area of the storage. A pan factor of 0.9 was adopted to the pan evaporation to estimate both potential evaporation and potential evapotranspiration from simulated pan evaporation.

The water balance considered transfers between storages:

- Pumped transfers P_{in} and P_{out} , according to site-specific operating rules and pump rates.
- Overland channel and gravity pipe flow Q_{in} and Q_{out} , according to site-specific operating rules and flow rates and due to overflows from one storage to another.

4.2 Rainfall variability

Rainfall variability was considered in the site water balance by sampling simulated rainfall from the historical rainfall record (refer to Section 0). A series of simulations were performed, each beginning in a different year of the historical rainfall record and proceeding consecutively through the record (and looped where required).

4.3 Hydrologic model

The Australian Water Balance Model (AWBM) (Boughton & Chiew, 2003) was used to estimate the runoff contributing to the surface water storages. The AWBM was adopted as it:

- Is widely used throughout Australia, especially for mining application.
- Has been verified through comparison with large amounts of recorded streamflow data.
- Has literature available to assist in estimating input parameters.
- Considers soil moisture retention state when determining runoff.

The AWBM is a soil moisture water balance model that calculates runoff from rainfall after allowing for losses and storage. Figure 4-1 is a schematic of the model, which shows that the model consists of three storage elements (with surface areas A_1 , A_2 and A_3) representing soil moisture.

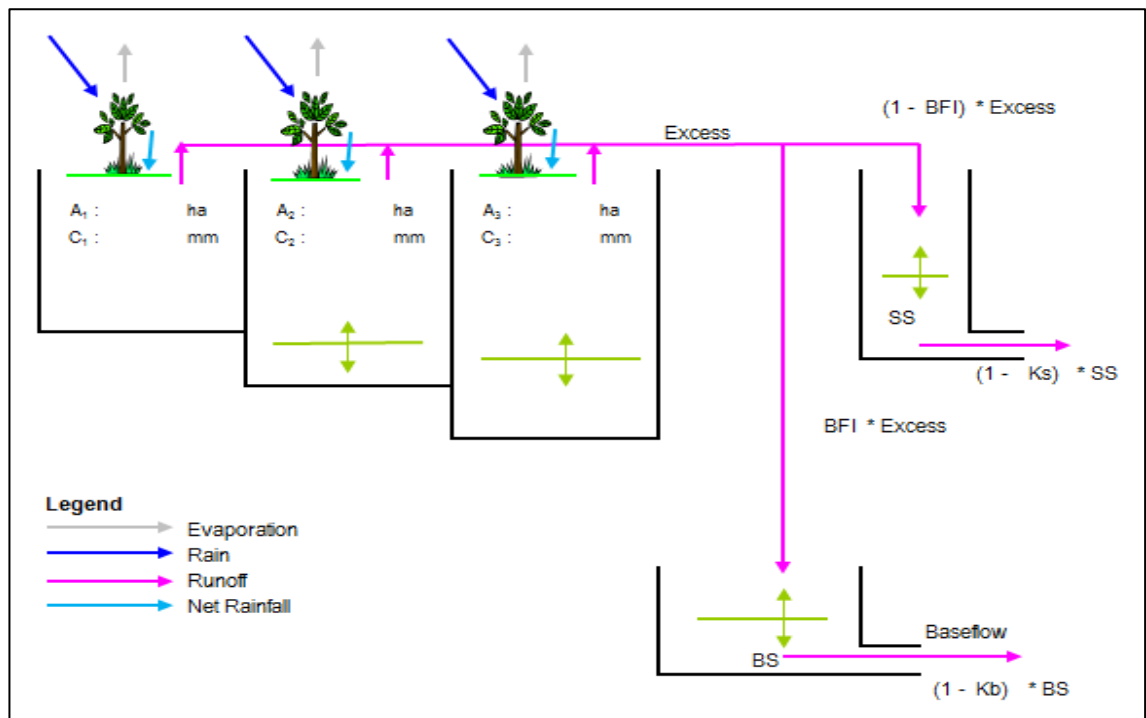


Figure 4-1 AWBM model schematic

Rainfall enters these storages and when a storage element is full, any additional rainfall is considered to be excess rainfall. Of this excess rainfall a proportion is routed to the baseflow storage (BS) while the remainder is routed to the surface flow storage (SS). The discharge from the baseflow storage and surface flow storage is estimated as a proportion of the volume of the storages at the end of each day. The total runoff is the combined volume of water discharged from these two storages. The parameters of the AWBM are summarised in Table 4-1.

Table 4-1 AWBM parameters

Parameter	Description
A ₁ , A ₂ , A ₃	The partial areas of the overall catchment contributing to each storage.
C ₁ , C ₂ , C ₃	The capacity of storages 1, 2 and 3 respectively.
BFI	The proportion of excess rainfall flowing to the baseflow.
K _b	The proportion of the volume of the baseflow storage remaining in the storage.
K _s	The proportion of the surface storage remaining in the storage.

The site-specific land uses (refer to Section 3.2) were characterised with different sets of AWBM parameters.

The AWBM parameters adopted for the water balance model are summarised in Table 4-2.

Table 4-2 Parameterisation of Australian Water Balance Model

Parameter	New Cells	Infrastructure	Natural	Landfill
A ₁ , A ₂ , A ₃	0.134, 0.433, 0.433	0.134, 0.433, 0.433	0.134, 0.433, 0.433	0.134, 0.433, 0.433
C _{ave} (mm)	50	10	150	150
BFI	0.3	0.3	0.3	0.3
K _b	0.98	0.98	0.98	0.99
K _s	1	1	1	1

The parameters were adopted based on industry experience and calibrated to observed water levels and volumes. Section 5 provides a summary of the model validation process.

To model the percolation of water from the surface to the landfill mass, the AWBM was modified as follows:

- Baseflow for the landfill land use was routed to the landfill storage while the quick flow was routed to the corresponding surface storage.
- A spatially lumped infiltration model was used to estimate the rate of percolation from the surface to the landfill mass. A linear percolation routing model was used, where the flow per unit area was proportional to the depth of moisture in the AWBM soil moisture storage. The routing parameter of 0.015/day was calibrated to observations and the overall model is validated in Section 5.

4.4 Seepage

The seepage rate was estimated using a lumped Darcy's Law approach, where the seepage flow rate was proportional to the simulated head difference between the landfill mass and invert of the western drain (about 57 mAHD) as follows:

$$Q = k (H - 57)$$

Where H was the simulated water level elevation in the landfill mass. The k parameter was calibrated to the ratio of observed ammonia concentrations in the sediment ponds to Leachate Pond 1, and a value of 1 m²/day was adopted. The calibrated model is validated in Section 5.

4.5 Groundwater inflows

There is a clean water catchment with area 24.8 ha up gradient of the landfill mass that likely contributes groundwater flows to the landfill mass. A simple groundwater recharge model was adopted with a regional rainfall recharge coefficient of 3% adopted. The groundwater inflow signal was smoothed using an erlang distribution with a standard deviation of 203 days and mean delay time of 90 days.

4.6 Numerical implementation

The water balance model was implemented in GoldSim (version 12.1). A basic timestep of 0.5 day was used, with timesteps dynamically inserted were required. GoldSim uses the forward Euler method to solve the mass conservation equations described in Section 4.1.

5. Model validation

Validation is the process of testing whether a model is a reasonably accurate representation of a physical system. The site water balance model of Awaba WMF was validated, using observed rainfall, water levels and pumping volumes. The data available for the calibration and validation process was limited, and therefore, although a reasonable fit was achieved, there is likely to be equifinality in the modelled system, in other words, the model may have achieved the right answers for the wrong reasons. A sensitivity analysis is undertaken in Section 6 and further monitoring is recommended in Section 7.

The model was validated from 20 March 2018 to 1 January 2019. This period was limited by the extent of the observed data available. 20 March 2018 was selected as the starting date, as by this time Leachate Pond 2 was decommissioned, marking significant shift in the hydrology of the site. A period of significant rainfall (73 mm over a week) following a month of little rainfall also began at 20 March 2018, which initialised the soil moisture storages. The total rainfall depth for the site for year ending 1 March 2019 was 922 mm, which is about a 25th percentile year compared to the historical record, well below average rainfall conditions.

5.1 Landfill mass

The observed and modelled water levels in the landfill mass are compared in Figure 5-1. As the water balance model is spatially lumped, it cannot account for the spatial variability in water levels across the landfill mass. Therefore, a *characteristic* water level was adopted, based on well 88, which is the highest observed water level.

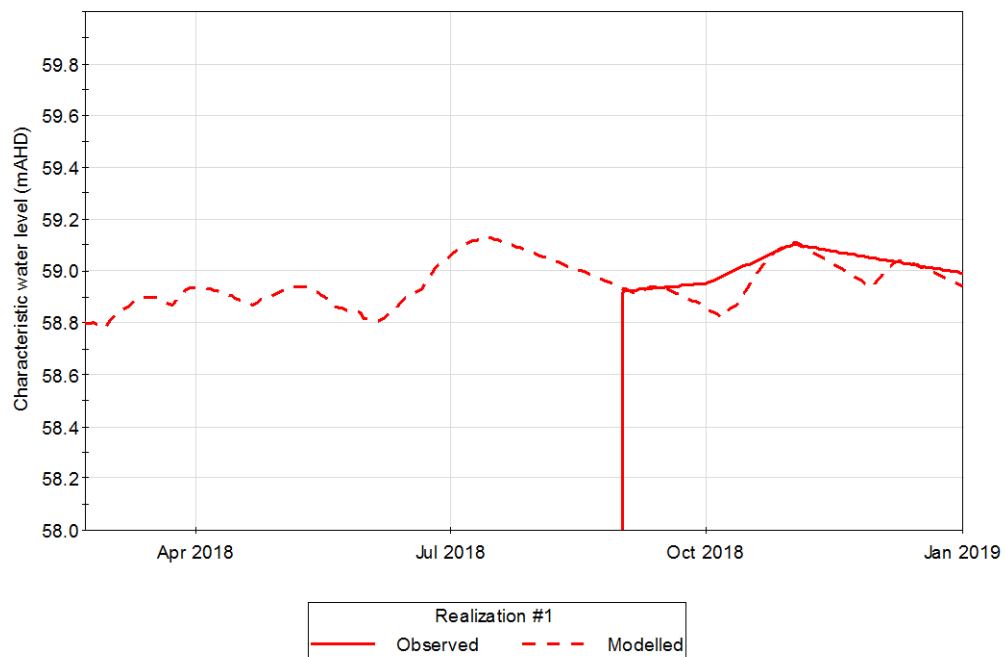


Figure 5-1 Validation of water levels in landfill mass

Figure 5-1 shows a fit to general trend in the observations of water level in September, October and November 2018 and February 2019. The model replicates the response of water level to rainfall in October 2018. The absolute fit is less significant, as it depends on adopted initial water level, which was selected to match the observed water levels in order to provide a suitable initial condition for the forecasts in Section 6.

5.2 Leachate Pond 1

The observed discharges to sewer and by tanker from Leachate Pond 1 are presented in Figure 5-2, which also shows the simulated the water volume in Leachate Pond 1.

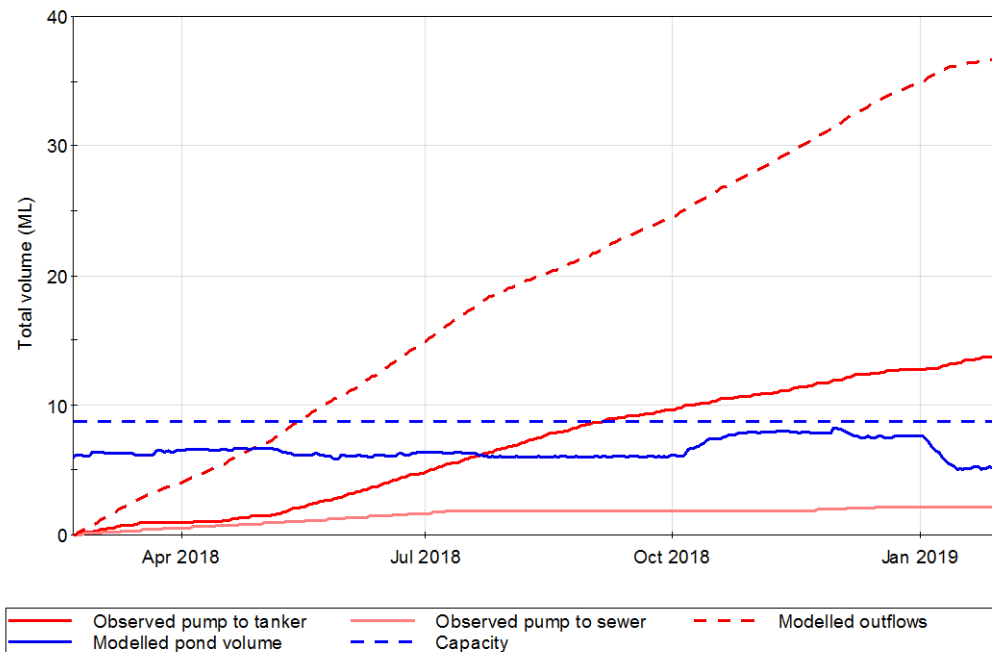


Figure 5-2 Validation of Leachate Pond 1 outflows

Figure 5-2 shows that the observed disposal of leachate to sewer and by tanker to Central Cost Council is less than the cumulative modelled volume. This difference is assumed to be the volume of leachate disposed by tanker to Hunter Water, which Council were unable to provide for this study.

5.3 Sediment ponds

The observed and modelled transfers from the Upper Sediment Pond to sewer are compared in Figure 5-3, which also show the simulated water volumes in the Upper Sediment Pond. The Upper Sediment Pond is understood to have begun as empty after it's commissioning in March 2018.

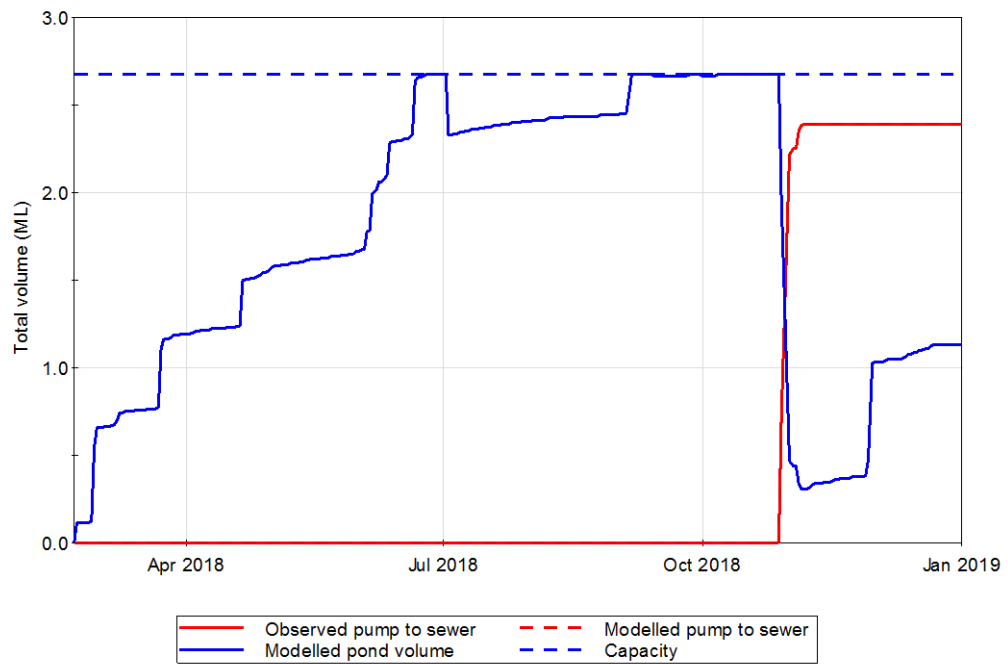


Figure 5-3 Validation of Upper Sediment Pond

Figure 5-3 shows that sufficient water was simulated to be available to satisfy the observed transfer to sewer in November 2018. The simulated water level suggests that the pond may have spilled or been close to spilling in June and October of 2018, but the model does not account for any pumping that may have occurred between the Upper and Lower Sediment Pond. The model suggests the Upper Sediment Pond would have been about half full at the end of 2018.

The observed and modelled transfers from the Lower Sediment Pond to sewer are compared in Figure 5-4, which also show the simulated water volumes in the Lower Sediment Pond. The Lower Sediment Pond is understood to have been about half full at the commissioning of the Upper Sediment Pond in March 2018.

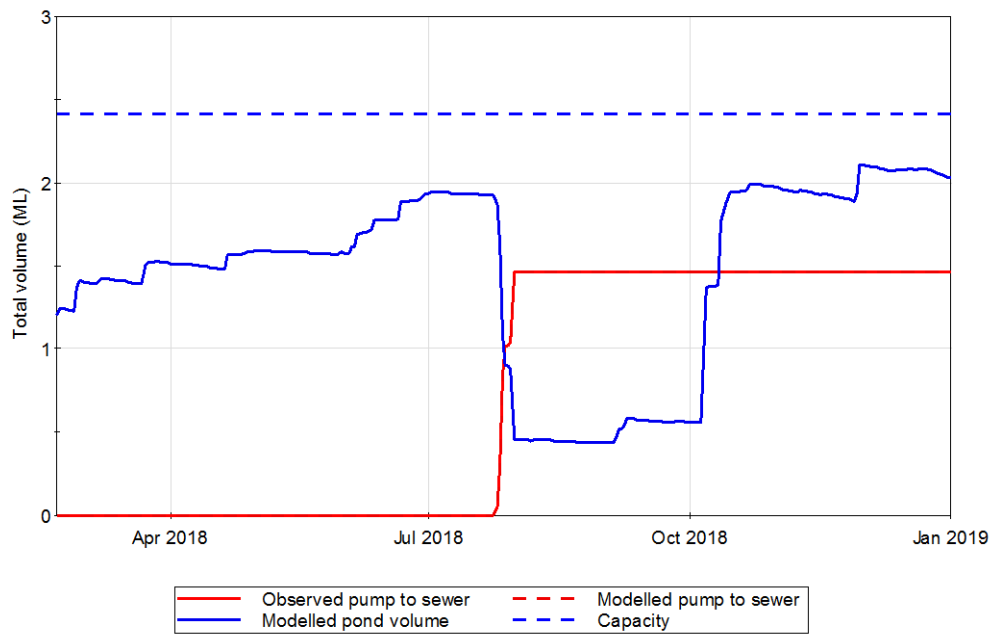


Figure 5-4 Validation of Lower Sediment Pond

Figure 5-4 shows that sufficient water was simulated to be available to satisfy the observed transfer to sewer in August 2018. The simulated water level suggests that the pond may have spilled or been close to full towards the end of 2018.

5.4 New cells and Leachate Pond 3

The observed and modelled transfers from the New Cells to sewer are compared in Figure 5-5, which also show the simulated water volumes in the New Cells. The New Cells were understood to begin as dry at the time of their commissioning in March 2018.

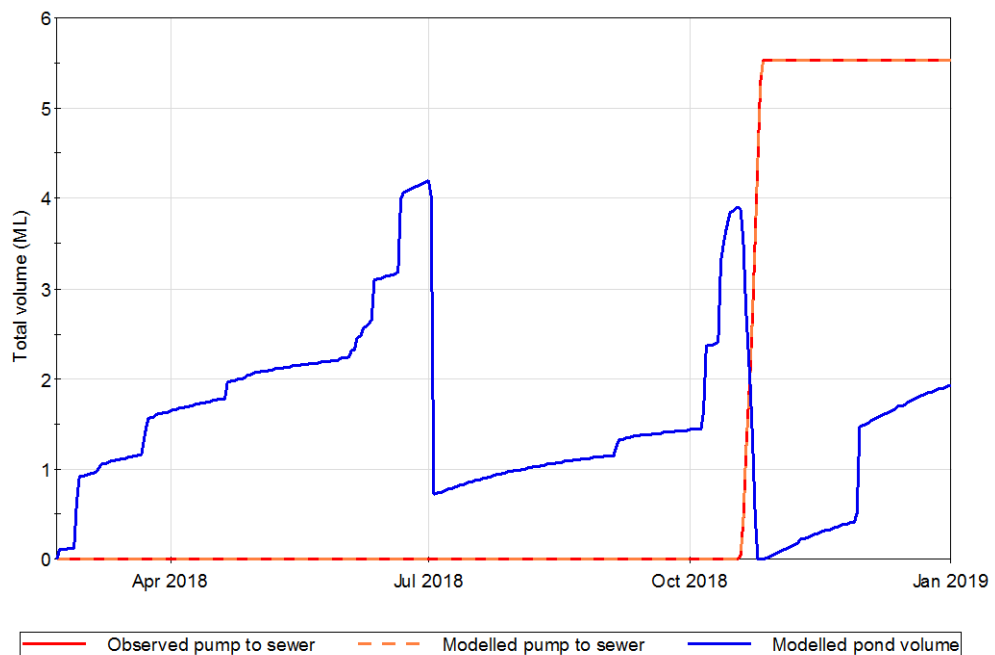


Figure 5-5 Validation of new cells

Figure 5-5 shows that sufficient water was simulated to be available to satisfy the observed transfer to sewer in November 2018. The simulated water level suggests that there was some water accumulated in the New Cells around the end of 2018.

The observed and modelled transfers from the Leachate Pond 3 to sewer are compared in Figure 5-6, which also show the simulated water volumes in Leachate Pond 3. Leachate Pond 3 is understood to have been commissioned in July 2018, at which time water was transferred from the New Cells, Upper Sediment Pond and Lower Sediment Pond.

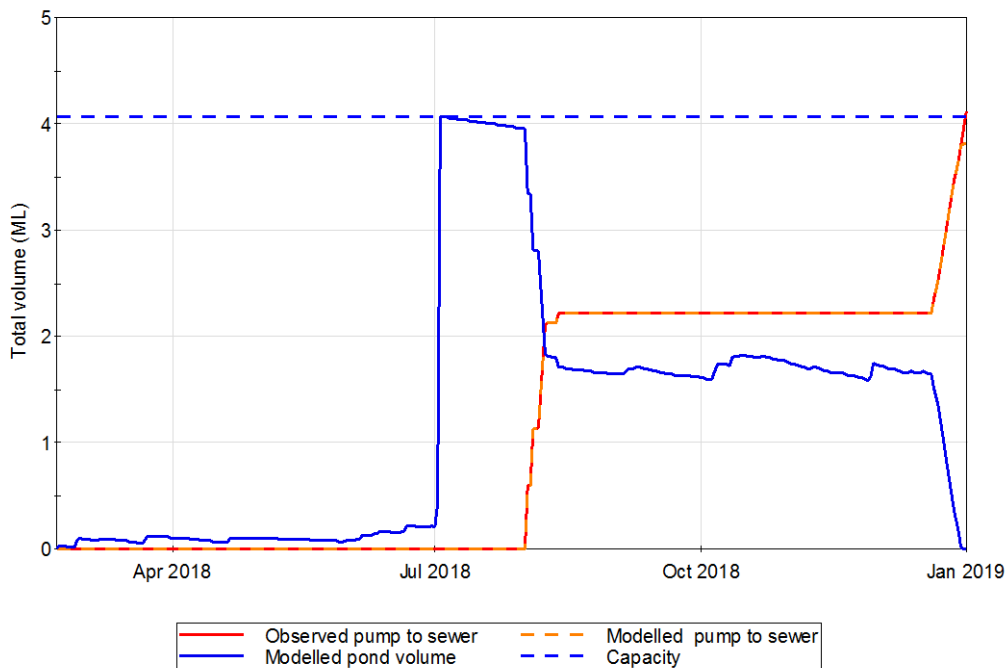


Figure 5-6 Validation of Leachate Pond 3

Figure 5-6 shows that sufficient water was simulated to be available to satisfy the observed transfer to sewer in August and December 2018. The simulated water level suggests that Leachate Pond was dry at the end of 2018.

5.5 Summary

Overall, the validation shows that the model has achieved a reasonable fit to the available water levels, transfers rates and anecdotal reports of water volumes, based on the observed rainfall near the site. Therefore, the model is considered an adequate tool for forecasting potential future water balance of the site, however, given the limited data used and the likely equifinality of the model parameters, a sensitivity analysis is considered in Section 6.4.

6. Model forecasts

The validated site water balance model for Awaba WMF was used to estimate the site water balance for a range potential rainfall sequences for future conditions sampled from the historical record. The model was initialised with the final water volumes from the validation simulation described in Section 5. For the forecast modelling it was assumed that:

- A WTP was commissioned to treat up to 250 kL/day of leachate with an ammonia concentration of up to 600 mg/L down to a nominal 5 mg/L of ammonia.
- The fill out proceeded according as described in Section 3.2.
- The seepage to the western drain did not occur and all leachate was captured in the leachate management system.

6.1 Interpretation of results

To consider potential climate variability, a total of 130 different rainfall patterns were simulated (as described Section 0). The results presented include the average, median, 75th percentile and 95th percentile values. The purpose of displaying the three results is to indicate both the average value and the likely possible range. For example, the 95th percentile represents the value at which 95% of the modelled outputs were less than this value. The 95th percentile values have been used rather than the maximum values to exclude infrequent extreme wet and dry conditions. The set of 95th percentile values do not necessarily all correspond to the same rainfall series, that is, they do not correspond to a 95th percentile “wet” year.

6.2 Annual water balance

The predicted average annual water balance for Awaba WMF under future conditions is summarised in Table 6-1. Results for two different years are presented to account for the change in catchments simulated over time.

Table 6-1 Average annual site water balance

Water flux	Average annual volume (ML/year)	
	2026	2040
Inflows		
Direct rainfall	7	7
Catchment runoff	41	32
Percolation to landfill	70	42
Groundwater inflows	8	8
Total inflows	126	90
Outflows		
Evaporation	8	8
Leachate discharge	85	53
Dirty water discharge	33	29
Total outflows	126	90
Change in storage		
Change in storage	0	0

Table 6-1 shows that, on average, the main source of inflows at Awaba WMF is catchment runoff and percolation into the landfill mass. The catchment runoff approximately corresponds to dirty water discharges, while the percolation to landfill approximately corresponds to the leachate discharges. As the landfill is simulated to be progressively capped, the dirty water and infiltration catchment decreases over time, resulting in a decrease in catchment runoff and percolation to landfill respectively.

6.3 Leachate volumes

The water balance model was used to forecast of average monthly volume of leachate disposed via sewer and tanker. The modelling assumed the following disposal mean, in order of priority:

1. Untreated leachate from Leachate Pond 1 to sewer. It was assumed that the sewer trade waste agreement for ammonia mass limit of 12 kg/day was the limiting factor. The treated stream had a mass rate of 1 kg/day (250 kL/day at 5 mg/L), leaving 11 kg/day for the untreated stream. At the assumed concentration of 600 mg/L, up to 18 kL/ of untreated leachate could be discharged directly to sewer. The results for this stream are shown in Figure 6-1.
2. Treated water to sewer. The future WTP was assumed to be able to treat up to 250 kL/day down to an ammonia concentration of 5 mg/L. The results for this stream are shown in Figure 6-2.
3. Untreated leachate via tanker. When the volume of leachate reporting to Leachate Pond 1 exceeded the capacity of the treated and untreated to sewer and the storage capacity of Leachate Pond 1 and Leachate Pond 3, the excess leachate was simulated to be removed by tanker. The results for this stream are shown in Figure 6-3. Note that the median result in Figure 6-3 is zero. The forecast cumulative tanker movements (assuming 20 kL/tanker) is shown in Figure 6-4.

A full manifest of results is included in Appendix A.

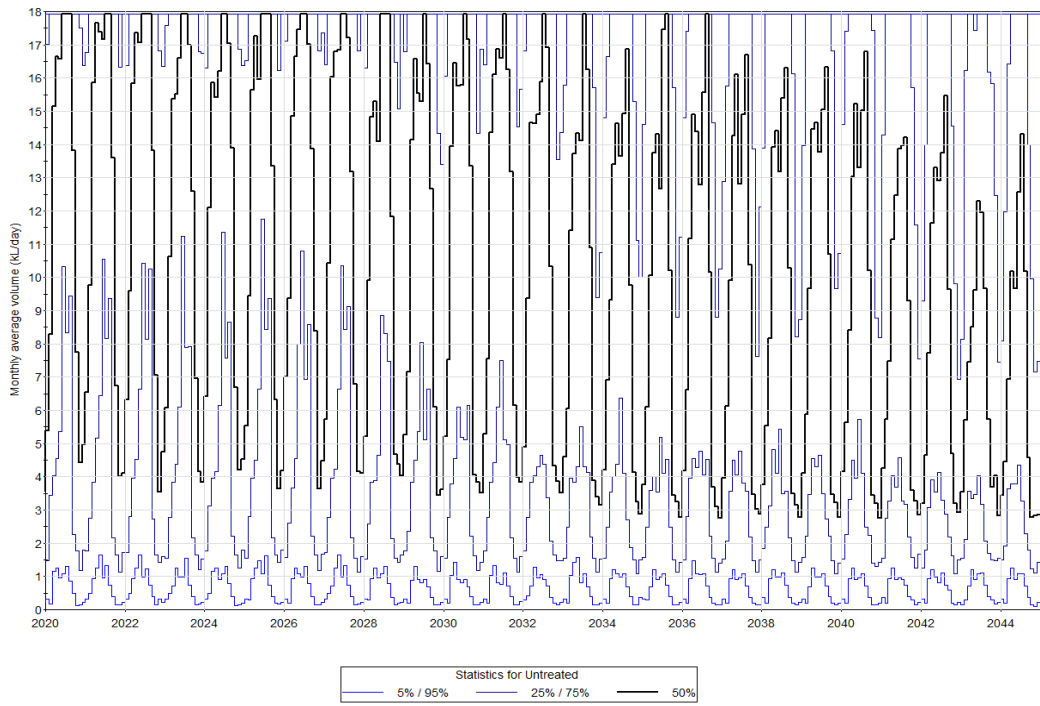


Figure 6-1 Forecast untreated leachate discharge to sewer

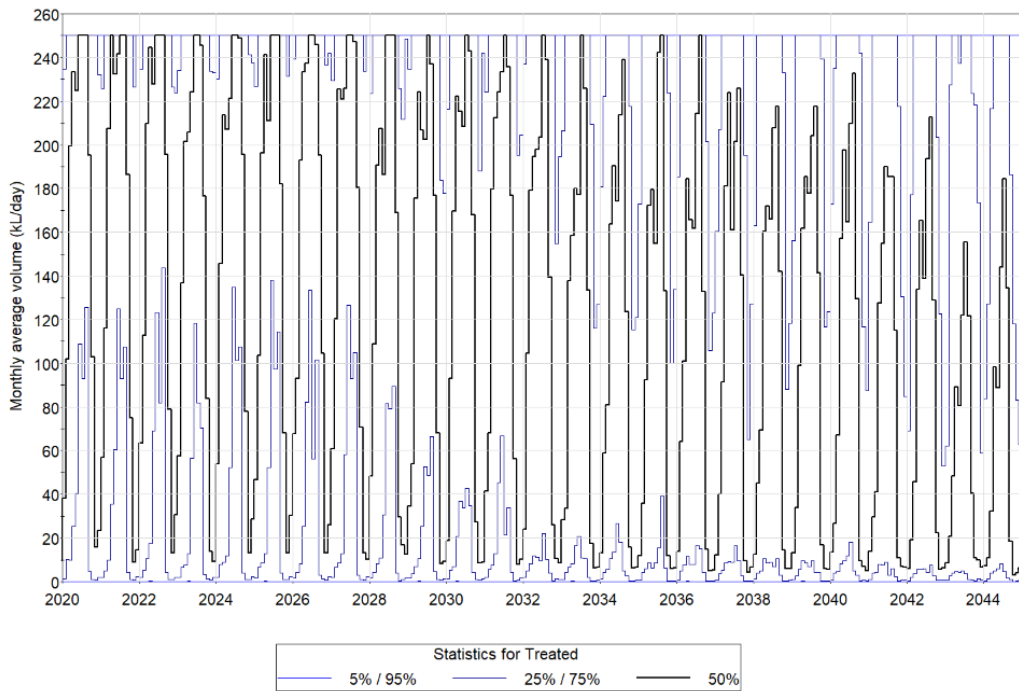


Figure 6-2 Forecast treated leachate discharge to sewer

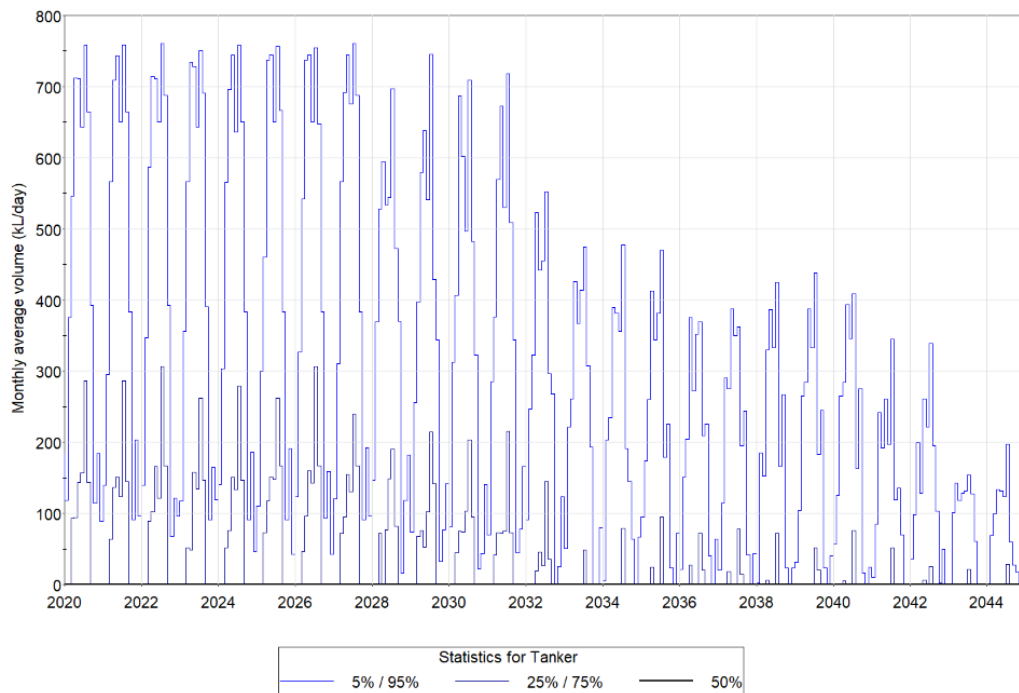


Figure 6-3 Forecast leachate disposed by tanker

The results show a strong seasonal variation, corresponding to seasonal variation in average evaporation and rainfall. Leachate volumes are forecast to be higher in winter than in summer on average, however this average seasonal variation will not be apparent in actual years as:

- Rainfall is skewed, meaning that higher leachate volumes will correspond to rainfall events.
- Rainfall is serially correlated, meaning that, for example, dry winters tend to follow dry summers, and wet winters tend to follow wet summers.

The potential variation in requirements for the WTP with rainfall variation greatly exceeds the change in average requirement over the fill out plan and therefore treatment is expected to be required throughout the fill out plan.

Figure 6-3 shows that the proposed treatment plant and trade waste agreement is forecast to have a 50% or greater chance of being adequate in all months over the fill out plan. There is a 5% chance that the required volume to be tankered may exceed about 750 kL/day in winter and about 100 kL/day in summer until final capping of cells begins to be complete in the late 2020s. For the 5% chance of the tanker volume exceeding 750 kL/day in winter the required total monthly rainfall would be in the order of 300 mm. As final capping progresses, the 95th percentile volume required to be tankered is forecast to reduce to about 250 kL/day in winter and 0 kL/day in summer. The 50% values for the forecasted leachate disposal by tanker becomes 0 after February 2019 which results in it not being represented on the graph.

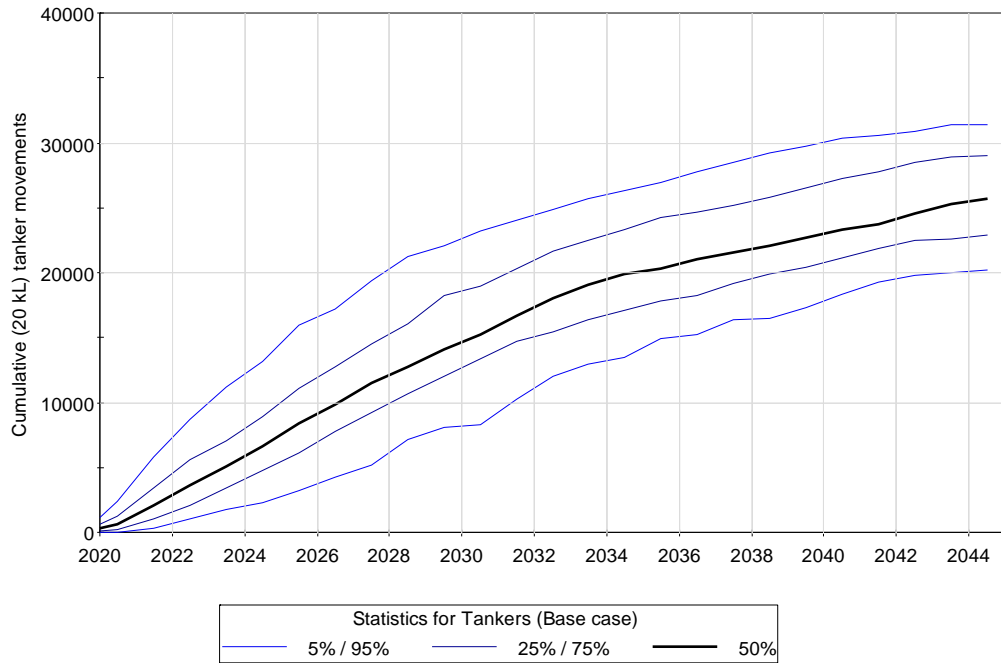


Figure 6-4 Forecast cumulative tanker movements

Figure 6-4 shows that the model forecasts a 90% chance of total tanker movements over the fill out plan being between 20 000 to 32 000 loads (assuming 20 kL/load). The reduction in the rate of tankers during the 2030s reflects the reduced area of uncapped landfill as the fill out plan proceeds.

6.4 Sensitivity analysis

Any model of a complex system is subject to uncertainty. The uncertainty of the site water balance model has been mitigated by calibrating the model to available observations (refer to Section 5) and considering the key driver of year to year variability, rainfall, in Section 6.3. A sensitivity analysis was undertaken to assess the residual uncertainty of the key model parameters on key model results. The mean cumulative tanker volume (refer to Figure 6-4) was selected as a key model outcome, and the key model parameters were identified as the average soil moisture store capacity and the percolation recession constant of the landfill (refer to Section 4.3) and the porosity of the landfill storage (refer to Section 3.3). The key model parameters were varied by 20% and the relative change on the key model results are summarised in Table 6-2. The 20% variance was selected from industry experience as an appropriate sensitivity range for a partially calibrated hydrologic model.

Table 6-2 Sensitivity analysis

Parameter	Change	Change to mean cumulative total tanker volume
Landfill average soil moisture store capacity	-20%	-21%
	+20%	17%
Landfill percolation recession constant	-20%	-2%
	+20%	3%
Landfill porosity	-20%	-22%
	+20%	20%

Table 6-2 shows that the model is most sensitive to the hydrologic parameters of the landfill surface, compared to the landfill porosity. This is expected, as the operating rules in the model do not rely on storage of water in the landfill mass.

The model predictions are sensitive to inherent uncertainties in the model validation process (refer to Section 5). The 12 months of observed data used in the validation corresponds to very dry year at the site (approximately 5th to 10th percentile average annual rainfall), as shown in Figure 6-5. Net rainfall (rainfall less evaporation) has been used in order to more easily compare summer to winter months.

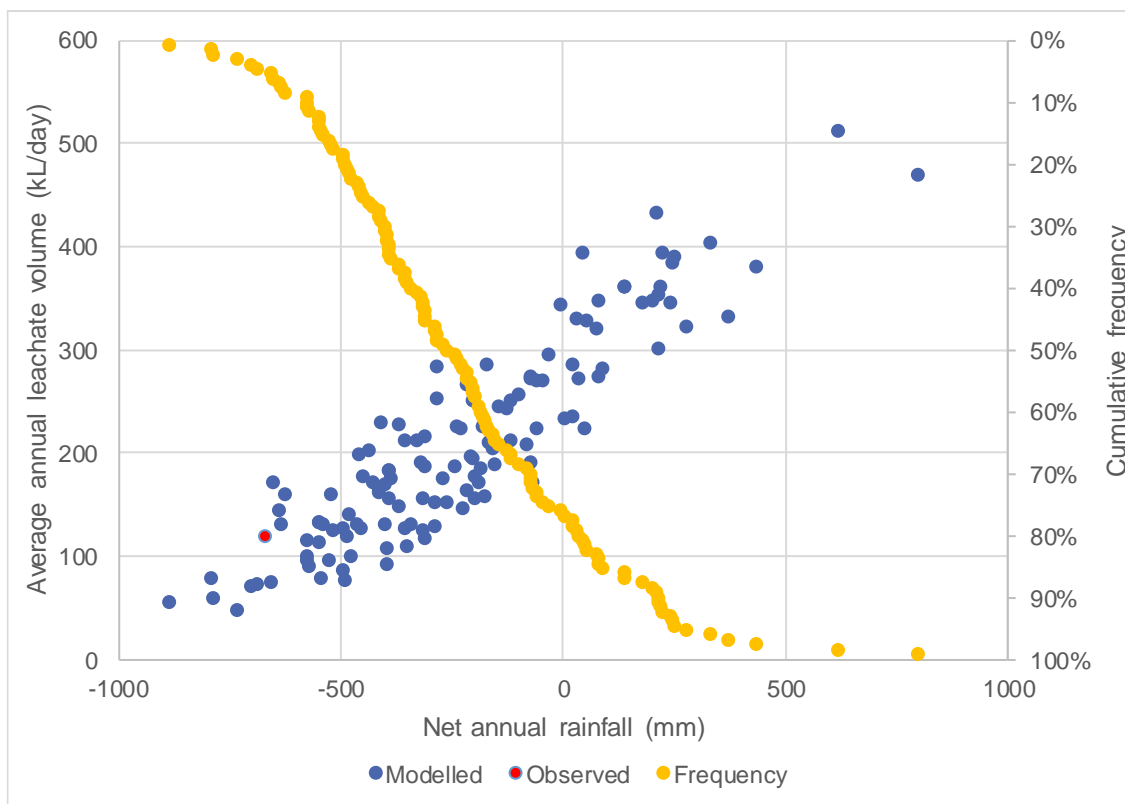


Figure 6-5 Observed and modelling annual leachate volumes

Figure 6-5 shows that, at least on an annual basis, the model predictions can be thought of as extrapolations from this single data point. This illustrates that the observed data set of rainfall and leachate volumes does not include an extended period of above average rainfall, where the more of the “soil” profile of the landfill mass may become saturated, increasing the infiltration and percolation rates and therefore total leachate volumes.

A necessary limitation of the conceptual model is that it does not represent the likely spatial heterogeneity throughout the landfill mass. Leachate flows through the existing landfill are likely attenuated by zones of lower hydraulic conductivity, creating a network of interconnected storages within the landfill from north to south. However, without a detailed history of landfill emplacement, it is not useful to attempt to model this detail in the water balance model. However, this simplification is likely to neglect attenuation in the landfill and overestimate how quickly the leachate flow rates respond to rainfall. The observed and modelled monthly leachate volumes are compared to rainfall in Figure 6-6.

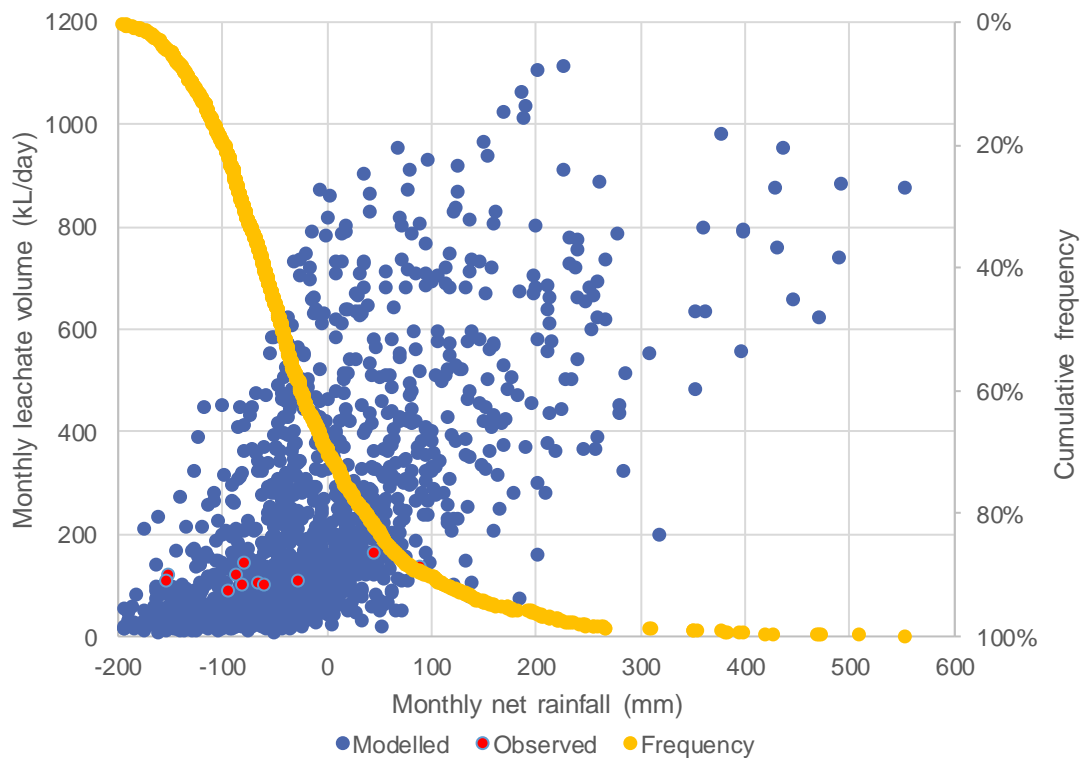


Figure 6-6 Observed and modelling monthly leachate volumes

Figure 6-6 shows that the observed monthly rainfall are generally dry to very dry, clustered at about the 20th percentile, with two isolated above average months in the 80th to 90th percentile range. The modelled results are consistent with the observed results, but show a much greater variance. This variance reflects that the observed months occurred in a dry year, where the “soil” profile of the landfill was likely to be relatively dry. The model forecasts that an average month of rainfall will generate more leachate in a wet year than in a dry year, due to the moisture already present in the “soil” profile.

The variance is also attributable to the fact that the model likely overestimates how quickly the landfill responds to rainfall. This conservatism is considered desirable in the predictions, since the proposed future cells of the landfill will have individual dewatering points, meaning that dewatering of the landfill following rainfall will need to occur more rapidly than under existing conditions. Therefore the attenuation currently afforded by the existing landfill mass that is represented in the observed dataset should not be relied on for future planning.

6.5 Options assessment

Following discussion with Council of the results presented in Sections 6.2 and 6.3 (the base case), three concept options intended to reduce leachate volumes were considered:

- Capping cells 7 and 8 with an intermediate or final cap that eliminated infiltration to the landfill mass (Cells 7/8 capped).
- Increasing the treatment capacity of the proposed WTP to 500 kL/day (WTP at 500 kL/day).
- Both of the above (Cells 7/8 capped and WTP at 500 kL/day).

Figure 6-7 compared the average cumulative tanker movements over the fill out plan for the options, the base case representing the results presented in Figure 6-4.

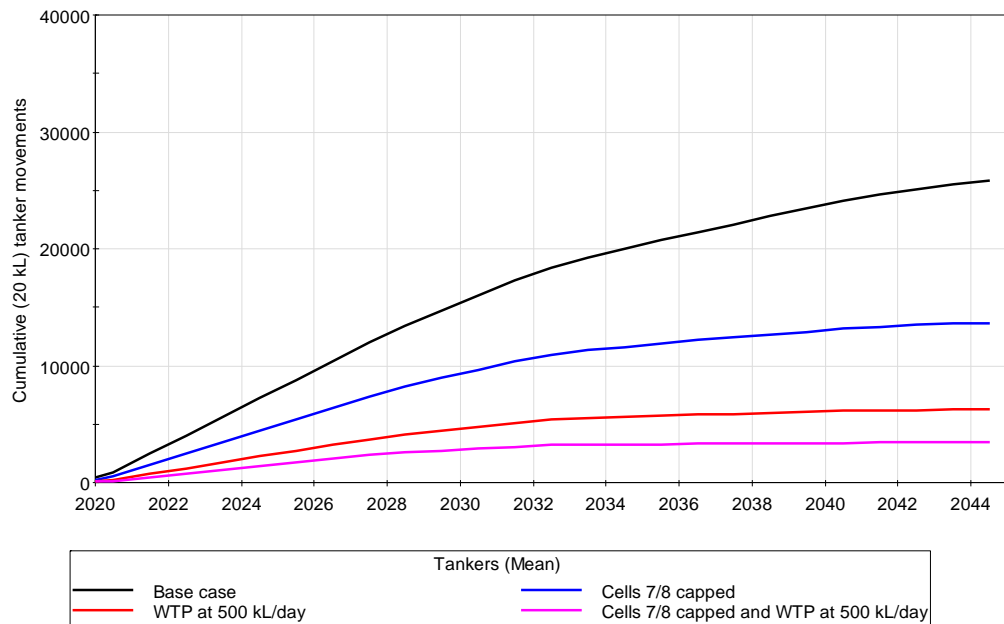


Figure 6-7 Average tanker volumes for options assessment

Figure 6-7 shows that:

- Capping cells 7 and 8 resulted in a modelled reduction of cumulative tanker volumes of 40% by 2030 and 47% by 2045.
- Increasing the capacity of the WTP to 500 kL/day resulted in a modelled reduction of cumulative tanker volumes of 70% by 2030 and 76% by 2045.
- Both options combined resulted in a modelled reduction of cumulative tanker volumes of 82% by 2030 and 87% by 2045 from the base case, or 39% by 2030 and 45% by 2045 compared to the WTP at 500 kL/day option.

Overall, the results shows that increasing the treatment rates provides a greater benefit than capping cell 7 and 8. Capping of cell 7 and 8 provides the same relative benefit (about 40% reduction), independent of the capacity of the WTP, which simply reflects the change in catchment area.

7. Conclusion and recommendations

GHD has developed a site water balance model for the Awaba WMF. The model was conceptualised based on previous studies and the water management system of the site. Recent rainfall, pumping and water level data was used to calibrate the model parameters to achieve an adequate fit between modelled and observed data.

The calibrated site water balance model was used to forecast the average annual site water balance and the statistical range of the treated (up to 250 kL/day), untreated (up to 18 kL/day) leachate discharges to sewer and disposal of excess leachate by tanker. The total rainfall depth for the calibration period was well below average compared to the historical record, and accordingly the model forecast volumes are higher than has been recently observed at site.

Until final capping of cells is completed as planned in mid to late 2020s, the model forecasts that there is about a 50% chance of disposal of leachate by tanker being required in any given month. The volume required to tankered is forecast to vary up to 800 kL/day, with particularly high risk in winter, when lower evaporation rates occur.

As final capping progresses, the volume of leachate is forecast to decrease, however the requirement for the WTP and disposal via tankering is expected to remain. The potential variation in leachates with rainfall variation from month to month greatly exceeds the change in average requirement over the fill out plan.

The residual uncertainty of the model was assessed using a sensitivity analysis of the key model parameters that cannot be measured. The analysis found that hydrological parameters of the landfill surface are the key uncertainty.

Failure to achieve timely disposal of leachate from the landfill will result in seepage to the dirty water management system and to the surrounding environment, as has been observed in the western drain.

It is recommended that Council consider the following:

- Continue the existing surface water monitoring program, including: flows in Leachate Pond 1 (weir and sump), discharge to sewer, discharges via tanker and regular monitoring of water levels in the landfill mass. This will allow the model to be improved with additional data.
- Consider undertaking a cost benefit analysis of a number of mitigation measures design to reduce tanking to determine if they have value when compared to the current situation. These mitigation measures include the following:
 - Capping cell 7 and 8 immediately to reduce leachate and the amount of tanking required.
 - Increasing the WTP to achieve a great design flow rate.
 - Increase storage on site to allow buffering during wet months.
- Mitigate current leachate discharge along the western slope by providing a cut off wall along the western slope to mitigate contamination of the dirty water. Our modelling has assumed that the current contamination will no longer be occurring. To achieve to council will need to improve the containment along this slope. GHD will provide a separate report discussing the options for this cut off wall.

8. References

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Appendices

Appendix A – Water balance results

	Untreated to sewer (kL/day)					Treated to sewer (kL/day)					Untreated via tanker (kL/day)				
	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%
2020 Jan	0.31	1.48	5.38	17.02	17.92	0.00	1.13	33.33	233.90	250.00	0.00	0.00	0.00	0.00	0.00
2020 Feb	0.18	3.43	8.28	17.92	17.92	0.00	7.47	93.64	250.00	250.00	0.00	0.00	0.00	0.00	720.00
2020 Mar	1.17	4.04	15.16	17.92	17.92	0.00	9.35	191.80	250.00	250.00	0.00	0.00	0.00	0.00	724.80
2020 Apr	1.26	4.54	16.65	17.92	17.92	0.00	12.20	222.30	250.00	250.00	0.00	0.00	0.00	0.00	736.00
2020 May	0.97	5.36	16.56	17.92	17.92	0.00	40.32	209.70	250.00	250.00	0.00	0.00	0.00	0.00	732.40
2020 Jun	1.07	10.33	17.92	17.92	17.92	0.00	108.40	250.00	250.00	250.00	0.00	0.00	0.00	0.00	733.70
2020 Jul	1.29	8.35	17.92	17.92	17.92	0.00	90.30	250.00	250.00	250.00	0.00	0.00	0.00	0.00	751.10
2020 Aug	0.86	9.44	17.92	17.92	17.92	0.00	112.80	243.80	250.00	250.00	0.00	0.00	0.00	0.00	727.00
2020 Sep	0.48	2.26	13.82	17.92	17.92	0.00	3.53	182.40	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2020 Oct	0.13	1.78	7.75	17.92	17.92	0.00	0.45	90.09	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2020 Nov	0.15	1.18	4.43	17.50	17.92	0.00	0.30	10.35	239.90	250.00	0.00	0.00	0.00	0.00	0.00
2020 Dec	0.22	1.79	4.96	16.39	17.92	0.00	1.41	20.78	218.70	250.00	0.00	0.00	0.00	0.00	0.00
2021 Jan	0.32	1.78	6.54	16.76	17.92	0.00	1.50	50.25	221.40	250.00	0.00	0.00	0.00	0.00	0.00
2021 Feb	0.49	2.75	9.77	17.92	17.92	0.00	3.90	112.50	250.00	250.00	0.00	0.00	0.00	0.00	720.70
2021 Mar	0.94	3.84	15.85	17.92	17.92	0.00	9.35	206.20	250.00	250.00	0.00	0.00	0.00	0.00	725.70
2021 Apr	1.26	5.16	17.65	17.92	17.92	0.00	32.51	240.60	250.00	250.00	0.00	0.00	0.00	0.00	734.50
2021 May	1.66	6.45	17.38	17.92	17.92	0.00	47.25	231.70	250.00	250.00	0.00	0.00	0.00	0.00	733.20
2021 Jun	0.96	10.55	17.17	17.92	17.92	0.00	124.70	237.30	250.00	250.00	0.00	0.00	0.00	0.00	733.20
2021 Jul	1.32	8.17	17.92	17.92	17.92	0.00	89.93	250.00	250.00	250.00	0.00	0.00	0.00	0.00	732.60
2021 Aug	0.73	9.36	17.92	17.92	17.92	0.00	90.84	250.00	250.00	250.00	0.00	0.00	0.00	0.00	727.00
2021 Sep	0.39	2.16	13.61	17.92	17.92	0.00	3.53	183.30	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2021 Oct	0.14	1.65	6.74	17.92	17.92	0.00	0.33	65.47	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2021 Nov	0.15	1.13	4.00	16.33	17.92	0.00	0.25	8.81	225.00	250.00	0.00	0.00	0.00	0.00	0.00
2021 Dec	0.22	1.71	4.12	17.92	17.92	0.00	1.41	12.58	242.00	250.00	0.00	0.00	0.00	0.00	0.00
2022 Jan	0.32	1.71	6.32	16.37	17.92	0.00	1.32	60.31	223.40	250.00	0.00	0.00	0.00	0.00	0.00
2022 Feb	0.49	2.79	9.59	17.92	17.92	0.00	4.61	106.50	250.00	250.00	0.00	0.00	0.00	0.00	720.70
2022 Mar	0.94	3.97	15.82	17.92	17.92	0.00	9.35	208.90	250.00	250.00	0.00	0.00	0.00	0.00	725.30
2022 Apr	1.26	4.52	17.35	17.92	17.92	0.00	11.98	237.30	250.00	250.00	0.00	0.00	0.00	0.00	731.70
2022 May	1.64	6.65	17.08	17.92	17.92	0.00	55.13	224.80	250.00	250.00	0.00	0.00	0.00	0.00	733.20
2022 Jun	0.98	10.43	17.92	17.92	17.92	0.00	122.40	243.80	250.00	250.00	0.00	0.00	0.00	0.00	734.40
2022 Jul	1.24	8.13	17.92	17.92	17.92	0.00	75.62	250.00	250.00	250.00	0.00	0.00	0.00	0.00	736.80
2022 Aug	0.73	10.26	17.92	17.92	17.92	0.00	130.30	243.10	250.00	250.00	0.00	0.00	0.00	0.00	725.00
2022 Sep	0.39	2.72	13.82	17.92	17.92	0.00	3.53	182.40	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2022 Oct	0.14	1.65	7.05	17.92	17.92	0.00	0.33	72.27	244.60	250.00	0.00	0.00	0.00	0.00	0.00
2022 Nov	0.32	1.43	3.55	16.82	17.92	0.00	0.53	8.78	226.20	250.00	0.00	0.00	0.00	0.00	0.00
2022 Dec	0.22	1.61	4.74	16.36	17.92	0.00	1.34	20.78	214.80	250.00	0.00	0.00	0.00	0.00	0.00
2023 Jan	0.32	1.56	6.08	17.57	17.92	0.00	1.51	50.14	233.90	250.00	0.00	0.00	0.00	0.00	0.00
2023 Feb	0.49	2.78	10.62	17.92	17.92	0.00	4.61	122.00	250.00	250.00	0.00	0.00	0.00	0.00	722.20
2023 Mar	0.71	3.84	15.36	17.92	17.92	0.00	5.46	199.60	250.00	250.00	0.00	0.00	0.00	0.00	725.30
2023 Apr	1.26	4.39	15.53	17.92	17.92	0.00	11.51	195.80	250.00	250.00	0.00	0.00	0.00	0.00	731.70
2023 May	0.99	6.10	16.61	17.92	17.92	0.00	54.94	223.70	250.00	250.00	0.00	0.00	0.00	0.00	733.50
2023 Jun	0.98	11.23	17.92	17.92	17.92	0.00	116.70	250.00	250.00	250.00	0.00	0.00	0.00	0.00	734.50
2023 Jul	1.55	7.90	17.92	17.92	17.92	0.00	67.73	250.00	250.00	250.00	0.00	0.00	0.00	0.00	732.40
2023 Aug	0.73	7.92	16.99	17.92	17.92	0.00	56.93	233.90	250.00	250.00	0.00	0.00	0.00	0.00	724.70
2023 Sep	0.39	2.16	12.58	17.92	17.92	0.00	2.54	166.70	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2023 Oct	0.14	1.65	6.97	17.92	17.92	0.00	0.33	74.49	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2023 Nov	0.17	1.20	4.16	16.79	17.92	0.00	0.30	12.25	227.40	250.00	0.00	0.00	0.00	0.00	0.00

	Untreated to sewer (kL/day)					Treated to sewer (kL/day)					Untreated via tanker (kL/day)				
	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%
2023 Dec	0.22	1.52	3.83	16.75	17.92	0.00	1.31	8.35	218.90	250.00	0.00	0.00	0.00	0.00	0.00
2024 Jan	0.32	1.77	6.41	16.29	17.92	0.00	1.54	51.60	222.70	250.00	0.00	0.00	0.00	0.00	0.00
2024 Feb	0.50	3.12	12.09	17.92	17.92	0.00	5.35	142.50	250.00	250.00	0.00	0.00	0.00	0.00	720.00
2024 Mar	1.16	3.97	15.87	17.92	17.92	0.00	7.25	206.20	250.00	250.00	0.00	0.00	0.00	0.00	724.80
2024 Apr	1.26	4.14	15.43	17.92	17.92	0.00	11.01	194.10	250.00	250.00	0.00	0.00	0.00	0.00	734.50
2024 May	0.92	6.14	16.20	17.92	17.92	0.00	48.98	209.70	250.00	250.00	0.00	0.00	0.00	0.00	734.30
2024 Jun	1.07	11.37	17.92	17.92	17.92	0.00	133.00	250.00	250.00	250.00	0.00	0.00	0.00	0.00	733.20
2024 Jul	1.29	7.58	17.92	17.92	17.92	0.00	88.73	250.00	250.00	250.00	0.00	0.00	0.00	0.00	732.70
2024 Aug	0.80	8.66	17.05	17.92	17.92	0.00	92.91	226.70	250.00	250.00	0.00	0.00	0.00	0.00	725.30
2024 Sep	0.39	2.22	13.90	17.92	17.92	0.00	3.46	183.30	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2024 Oct	0.13	1.65	6.68	17.92	17.92	0.00	0.33	64.97	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2024 Nov	0.15	1.24	4.21	16.86	17.92	0.00	0.55	12.25	228.10	250.00	0.00	0.00	0.00	0.00	0.00
2024 Dec	0.20	1.79	4.53	16.39	17.92	0.00	1.41	17.96	224.90	250.00	0.00	0.00	0.00	0.00	0.00
2025 Jan	0.32	1.55	5.53	16.53	17.92	0.00	1.27	39.84	220.30	250.00	0.00	0.00	0.00	0.00	0.00
2025 Feb	0.30	2.79	9.45	17.92	17.92	0.00	4.61	103.10	250.00	250.00	0.00	0.00	0.00	0.00	723.60
2025 Mar	0.94	3.97	15.63	17.92	17.92	0.00	7.25	197.80	250.00	250.00	0.00	0.00	0.00	0.00	726.50
2025 Apr	1.26	4.51	17.26	17.92	17.92	0.00	10.66	231.80	250.00	250.00	0.00	0.00	0.00	0.00	734.50
2025 May	1.48	6.65	15.97	17.92	17.92	0.00	47.25	203.60	250.00	250.00	0.00	0.00	0.00	0.00	734.30
2025 Jun	1.09	11.75	17.92	17.92	17.92	0.00	132.30	250.00	250.00	250.00	0.00	0.00	0.00	0.00	732.60
2025 Jul	1.62	8.44	17.92	17.92	17.92	0.00	92.21	250.00	250.00	250.00	0.00	0.00	0.00	0.00	731.80
2025 Aug	0.73	9.36	17.92	17.92	17.92	0.00	110.60	242.70	250.00	250.00	0.00	0.00	0.00	0.00	727.00
2025 Sep	0.39	2.16	13.36	17.92	17.92	0.00	2.54	168.40	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2025 Oct	0.20	1.65	6.32	17.92	17.92	0.00	0.33	53.60	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2025 Nov	0.17	1.43	3.63	16.23	17.92	0.00	0.53	10.68	216.80	250.00	0.00	0.00	0.00	0.00	0.00
2025 Dec	0.22	1.79	4.17	17.92	17.92	0.00	1.57	20.36	242.60	250.00	0.00	0.00	0.00	0.00	0.00
2026 Jan	0.32	1.58	7.00	17.12	17.92	0.00	1.27	61.57	228.60	250.00	0.00	0.00	0.00	0.00	0.00
2026 Feb	0.19	2.62	9.36	17.92	17.92	0.00	3.81	92.53	250.00	250.00	0.00	0.00	0.00	0.00	731.90
2026 Mar	0.94	3.67	14.85	17.92	17.92	0.00	6.78	191.60	250.00	250.00	0.00	0.00	0.00	0.00	724.80
2026 Apr	1.26	4.55	16.64	17.92	17.92	0.00	24.10	227.50	250.00	250.00	0.00	0.00	0.00	0.00	734.50
2026 May	1.09	7.99	17.46	17.92	17.92	0.00	76.21	237.00	250.00	250.00	0.00	0.00	0.00	0.00	734.30
2026 Jun	0.98	10.79	17.92	17.92	17.92	0.00	124.70	250.00	250.00	250.00	0.00	0.00	0.00	0.00	734.40
2026 Jul	1.31	6.93	17.92	17.92	17.92	0.00	46.85	250.00	250.00	250.00	0.00	0.00	0.00	0.00	734.40
2026 Aug	0.80	8.59	17.02	17.92	17.92	0.00	88.71	230.70	250.00	250.00	0.00	0.00	0.00	0.00	728.60
2026 Sep	0.39	2.21	13.86	17.92	17.92	0.00	2.54	182.40	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2026 Oct	0.14	1.66	8.37	17.92	17.92	0.00	0.45	97.87	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2026 Nov	0.15	1.18	3.63	16.83	17.92	0.00	0.30	8.31	225.20	250.00	0.00	0.00	0.00	0.00	0.00
2026 Dec	0.22	1.68	4.47	17.36	17.92	0.00	1.47	17.35	241.00	250.00	0.00	0.00	0.00	0.00	0.00
2027 Jan	0.32	1.71	5.73	16.40	17.92	0.00	1.32	54.69	222.90	250.00	0.00	0.00	0.00	0.00	0.00
2027 Feb	0.49	2.78	10.42	17.92	17.92	0.00	4.61	111.70	250.00	250.00	0.00	0.00	0.00	0.00	722.20
2027 Mar	0.71	3.97	16.03	17.92	17.92	0.00	6.78	213.30	250.00	250.00	0.00	0.00	0.00	0.00	724.80
2027 Apr	1.26	4.24	16.79	17.92	17.92	0.00	11.51	215.20	250.00	250.00	0.00	0.00	0.00	0.00	732.30
2027 May	1.64	6.65	16.85	17.92	17.92	0.00	54.94	225.80	250.00	250.00	0.00	0.00	0.00	0.00	733.50
2027 Jun	0.98	10.34	17.92	17.92	17.92	0.00	124.70	250.00	250.00	250.00	0.00	0.00	0.00	0.00	734.50
2027 Jul	1.32	8.44	17.92	17.92	17.92	0.00	91.75	250.00	250.00	250.00	0.00	0.00	0.00	0.00	732.50
2027 Aug	0.73	9.13	17.22	17.92	17.92	0.00	100.20	241.90	250.00	250.00	0.00	0.00	0.00	0.00	725.30
2027 Sep	0.39	2.16	13.19	17.92	17.92	0.00	2.33	166.80	250.00	250.00	0.00	0.00	0.00	0.00	714.10
2027 Oct	0.15	1.55	6.78	17.92	17.92	0.00	0.33	61.06	250.00	250.00	0.00	0.00	0.00	0.00	0.00

	Untreated to sewer (kL/day)					Treated to sewer (kL/day)					Untreated via tanker (kL/day)				
	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%
2027 Nov	0.16	1.14	4.16	16.83	17.92	0.00	0.46	8.78	226.20	250.00	0.00	0.00	0.00	0.00	0.00
2027 Dec	0.22	1.61	4.12	17.92	17.92	0.00	1.41	9.41	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2028 Jan	0.32	1.53	5.22	16.29	17.92	0.00	1.27	41.18	222.30	250.00	0.00	0.00	0.00	0.00	0.00
2028 Feb	0.30	2.58	9.92	17.92	17.92	0.00	3.69	108.00	250.00	250.00	0.00	0.00	0.00	0.00	720.70
2028 Mar	0.94	3.84	14.82	17.92	17.92	0.00	6.78	190.20	250.00	250.00	0.00	0.00	0.00	0.00	725.40
2028 Apr	1.26	3.89	15.28	17.92	17.92	0.00	10.01	197.70	250.00	250.00	0.00	0.00	0.00	0.00	729.90
2028 May	0.97	4.65	14.09	17.92	17.92	0.00	17.76	174.20	250.00	250.00	0.00	0.00	0.00	0.00	732.40
2028 Jun	1.07	8.85	17.92	17.92	17.92	0.00	79.63	247.70	250.00	250.00	0.00	0.00	0.00	0.00	734.40
2028 Jul	1.29	8.31	17.92	17.92	17.92	0.00	72.58	250.00	250.00	250.00	0.00	0.00	0.00	0.00	729.90
2028 Aug	0.80	7.47	17.92	17.92	17.92	0.00	76.27	250.00	250.00	250.00	0.00	0.00	0.00	0.00	726.40
2028 Sep	0.37	2.13	11.84	17.92	17.92	0.00	2.54	154.30	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2028 Oct	0.14	1.54	4.68	16.47	17.92	0.00	0.08	19.89	225.80	250.00	0.00	0.00	0.00	0.00	0.00
2028 Nov	0.21	1.43	4.37	15.07	17.92	0.00	0.60	15.81	198.10	250.00	0.00	0.00	0.00	0.00	0.00
2028 Dec	0.22	1.66	4.04	17.92	17.92	0.00	1.17	11.70	244.30	250.00	0.00	0.00	0.00	0.00	0.00
2029 Jan	0.32	1.78	5.25	16.79	17.92	0.00	1.15	29.15	224.20	250.00	0.00	0.00	0.00	0.00	0.00
2029 Feb	0.19	2.37	7.16	17.92	17.92	0.00	2.72	52.29	250.00	250.00	0.00	0.00	0.00	0.00	719.20
2029 Mar	0.90	3.84	14.14	17.92	17.92	0.00	5.46	173.30	250.00	250.00	0.00	0.00	0.00	0.00	725.70
2029 Apr	1.32	4.51	16.57	17.92	17.92	0.00	9.84	223.50	250.00	250.00	0.00	0.00	0.00	0.00	734.50
2029 May	0.92	5.36	15.53	17.92	17.92	0.00	17.76	200.50	250.00	250.00	0.00	0.00	0.00	0.00	732.40
2029 Jun	0.81	8.05	15.29	17.92	17.92	0.00	51.44	202.80	250.00	250.00	0.00	0.00	0.00	0.00	733.20
2029 Jul	0.91	5.11	17.92	17.92	17.92	0.00	35.33	250.00	250.00	250.00	0.00	0.00	0.00	0.00	730.30
2029 Aug	0.69	6.64	16.42	17.92	17.92	0.00	53.47	224.80	250.00	250.00	0.00	0.00	0.00	0.00	724.70
2029 Sep	0.37	2.16	12.65	17.92	17.92	0.00	2.54	164.30	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2029 Oct	0.14	1.77	6.10	17.92	17.92	0.00	0.33	55.02	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2029 Nov	0.15	1.16	3.45	14.35	17.92	0.00	0.25	6.88	183.30	250.00	0.00	0.00	0.00	0.00	0.00
2029 Dec	0.22	1.61	3.62	13.41	17.92	0.00	0.79	8.01	177.40	250.00	0.00	0.00	0.00	0.00	0.00
2030 Jan	0.32	1.55	5.21	16.07	17.92	0.00	1.13	17.30	214.70	250.00	0.00	0.00	0.00	0.00	0.00
2030 Feb	0.19	2.79	7.52	17.92	17.92	0.00	4.15	80.57	250.00	250.00	0.00	0.00	0.00	0.00	720.70
2030 Mar	1.03	3.78	13.94	17.92	17.92	0.00	5.03	165.10	250.00	250.00	0.00	0.00	0.00	0.00	726.60
2030 Apr	1.42	4.56	16.46	17.92	17.92	0.00	11.98	210.10	250.00	250.00	0.00	0.00	0.00	0.00	732.30
2030 May	0.90	6.10	15.77	17.92	17.92	0.00	22.45	205.60	250.00	250.00	0.00	0.00	0.00	0.00	732.40
2030 Jun	0.81	5.18	15.78	17.92	17.92	0.00	32.21	206.20	250.00	250.00	0.00	0.00	0.00	0.00	734.40
2030 Jul	0.91	5.11	17.92	17.92	17.92	0.00	42.13	250.00	250.00	250.00	0.00	0.00	0.00	0.00	729.70
2030 Aug	0.69	6.15	17.17	17.92	17.92	0.00	32.79	236.50	250.00	250.00	0.00	0.00	0.00	0.00	727.00
2030 Sep	0.39	2.21	13.36	17.92	17.92	0.00	3.53	161.40	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2030 Oct	0.14	1.63	4.05	17.92	17.92	0.00	0.21	18.77	244.60	250.00	0.00	0.00	0.00	0.00	0.00
2030 Nov	0.15	1.18	3.83	14.35	17.92	0.00	0.30	8.13	181.70	250.00	0.00	0.00	0.00	0.00	0.00
2030 Dec	0.22	1.43	3.52	16.86	17.92	0.00	0.66	8.01	231.70	250.00	0.00	0.00	0.00	0.00	0.00
2031 Jan	0.32	1.78	5.29	16.40	17.92	0.00	1.50	34.72	222.70	250.00	0.00	0.00	0.00	0.00	0.00
2031 Feb	0.19	2.79	7.55	17.92	17.92	0.00	4.61	63.00	250.00	250.00	0.00	0.00	0.00	0.00	719.80
2031 Mar	1.03	3.84	14.36	17.92	17.92	0.00	6.78	174.90	250.00	250.00	0.00	0.00	0.00	0.00	723.40
2031 Apr	1.33	4.43	16.10	17.92	17.92	0.00	11.51	202.00	250.00	250.00	0.00	0.00	0.00	0.00	734.50
2031 May	0.82	6.10	16.86	17.92	17.92	0.00	41.85	222.80	250.00	250.00	0.00	0.00	0.00	0.00	731.60
2031 Jun	0.76	7.50	16.60	17.92	17.92	0.00	54.25	224.20	250.00	250.00	0.00	0.00	0.00	0.00	733.30
2031 Jul	1.12	5.11	17.92	17.92	17.92	0.00	19.97	250.00	250.00	250.00	0.00	0.00	0.00	0.00	731.40
2031 Aug	0.72	4.97	16.26	17.92	17.92	0.00	32.25	223.20	250.00	250.00	0.00	0.00	0.00	0.00	724.70
2031 Sep	0.39	2.16	13.17	17.92	17.92	0.00	3.53	164.30	250.00	250.00	0.00	0.00	0.00	0.00	0.00

	Untreated to sewer (kL/day)					Treated to sewer (kL/day)					Untreated via tanker (kL/day)				
	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%
2031 Oct	0.15	1.55	6.14	17.92	17.92	0.00	0.11	43.35	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2031 Nov	0.15	1.13	3.98	14.52	17.92	0.00	0.46	7.19	184.20	250.00	0.00	0.00	0.00	0.00	0.00
2031 Dec	0.25	1.61	3.83	15.67	17.92	0.00	1.17	8.44	189.90	250.00	0.00	0.00	0.00	0.00	0.00
2032 Jan	0.28	1.77	4.91	16.83	17.92	0.00	1.27	19.22	224.60	250.00	0.00	0.00	0.00	0.00	0.00
2032 Feb	0.42	2.78	9.37	17.92	17.92	0.00	3.77	98.04	250.00	250.00	0.00	0.00	0.00	0.00	719.20
2032 Mar	0.71	3.84	14.66	17.92	17.92	0.00	6.78	167.10	250.00	250.00	0.00	0.00	0.00	0.00	725.40
2032 Apr	1.28	4.04	14.62	17.92	17.92	0.00	10.01	184.50	250.00	250.00	0.00	0.00	0.00	0.00	728.60
2032 May	0.97	4.31	14.91	17.92	17.92	0.00	10.27	189.00	250.00	250.00	0.00	0.00	0.00	0.00	732.40
2032 Jun	1.05	4.66	15.89	17.92	17.92	0.00	7.22	191.70	250.00	250.00	0.00	0.00	0.00	0.00	733.20
2032 Jul	0.91	4.38	17.92	17.92	17.92	0.00	20.83	250.00	250.00	250.00	0.00	0.00	0.00	0.00	729.10
2032 Aug	0.70	3.36	16.92	17.92	17.92	0.00	7.05	224.70	250.00	250.00	0.00	0.00	0.00	0.00	726.40
2032 Sep	0.38	2.07	10.33	17.92	17.92	0.00	3.05	125.50	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2032 Oct	0.20	1.65	4.32	17.92	17.92	0.00	0.14	16.69	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2032 Nov	0.15	1.49	3.87	13.54	17.92	0.00	0.78	7.37	144.90	250.00	0.00	0.00	0.00	0.00	0.00
2032 Dec	0.22	1.47	3.52	14.35	17.92	0.00	0.47	7.66	185.50	250.00	0.00	0.00	0.00	0.00	0.00
2033 Jan	0.32	1.55	4.61	15.78	17.92	0.00	0.77	19.85	205.90	250.00	0.00	0.00	0.00	0.00	0.00
2033 Feb	0.19	2.47	6.05	17.92	17.92	0.00	3.82	31.74	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2033 Mar	1.03	3.97	11.41	17.92	17.92	0.00	5.03	130.00	250.00	250.00	0.00	0.00	0.00	0.00	722.10
2033 Apr	1.42	3.85	13.72	17.92	17.92	0.00	7.46	153.80	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2033 May	1.57	4.31	14.35	17.92	17.92	0.00	10.27	172.40	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2033 Jun	0.81	5.51	14.12	17.92	17.92	0.00	20.04	175.30	250.00	250.00	0.00	0.00	0.00	0.00	731.00
2033 Jul	1.08	4.30	17.92	17.92	17.92	0.00	10.00	245.30	250.00	250.00	0.00	0.00	0.00	0.00	526.30
2033 Aug	0.69	4.13	16.24	17.92	17.92	0.00	6.66	213.00	250.00	250.00	0.00	0.00	0.00	0.00	724.70
2033 Sep	0.39	2.19	10.89	17.92	17.92	0.00	1.33	126.60	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2033 Oct	0.14	1.54	3.89	15.71	17.92	0.00	0.11	10.31	204.70	250.00	0.00	0.00	0.00	0.00	0.00
2033 Nov	0.15	1.13	3.39	9.39	17.92	0.00	0.01	5.20	105.10	250.00	0.00	0.00	0.00	0.00	0.00
2033 Dec	0.20	1.52	3.15	10.75	17.92	0.00	0.33	5.88	121.20	250.00	0.00	0.00	0.00	0.00	0.00
2034 Jan	0.32	1.54	4.21	14.81	17.92	0.00	1.02	11.40	179.60	250.00	0.00	0.00	0.00	0.00	0.00
2034 Feb	0.19	2.47	6.91	16.65	17.92	0.00	3.81	47.40	214.30	250.00	0.00	0.00	0.00	0.00	0.00
2034 Mar	0.94	3.53	9.32	17.92	17.92	0.00	4.68	74.88	250.00	250.00	0.00	0.00	0.00	0.00	720.00
2034 Apr	1.20	4.00	13.40	17.92	17.92	0.00	9.84	159.10	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2034 May	1.09	4.39	14.63	17.92	17.92	0.00	8.81	177.00	250.00	250.00	0.00	0.00	0.00	0.00	729.80
2034 Jun	0.98	6.36	13.65	17.92	17.92	0.00	24.67	162.70	250.00	250.00	0.00	0.00	0.00	0.00	732.00
2034 Jul	1.08	4.11	14.92	17.92	17.92	0.00	16.62	201.60	250.00	250.00	0.00	0.00	0.00	0.00	729.40
2034 Aug	0.69	2.70	16.86	17.92	17.92	0.00	3.51	227.90	250.00	250.00	0.00	0.00	0.00	0.00	724.20
2034 Sep	0.40	1.87	9.76	17.92	17.92	0.00	2.14	108.30	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2034 Oct	0.14	1.51	4.14	15.30	17.92	0.00	0.11	8.73	209.70	250.00	0.00	0.00	0.00	0.00	0.00
2034 Nov	0.15	1.08	3.24	11.12	17.92	0.00	0.00	4.79	102.60	250.00	0.00	0.00	0.00	0.00	0.00
2034 Dec	0.38	1.49	2.89	10.01	17.92	0.00	0.17	5.56	105.40	250.00	0.00	0.00	0.00	0.00	0.00
2035 Jan	0.32	1.58	3.76	14.60	17.92	0.00	0.36	10.32	171.50	250.00	0.00	0.00	0.00	0.00	0.00
2035 Feb	0.30	2.47	6.11	17.92	17.92	0.00	3.82	27.78	241.40	250.00	0.00	0.00	0.00	0.00	0.00
2035 Mar	0.68	3.60	10.06	17.92	17.92	0.00	5.01	85.76	250.00	250.00	0.00	0.00	0.00	0.00	720.10
2035 Apr	1.20	4.02	13.74	17.92	17.92	0.00	7.46	166.10	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2035 May	0.92	3.54	14.32	17.92	17.92	0.00	5.28	174.20	250.00	250.00	0.00	0.00	0.00	0.00	382.80
2035 Jun	0.98	5.20	12.66	17.92	17.92	0.00	7.20	143.50	250.00	250.00	0.00	0.00	0.00	0.00	731.70
2035 Jul	1.08	4.11	17.45	17.92	17.92	0.00	14.53	241.90	250.00	250.00	0.00	0.00	0.00	0.00	728.50
2035 Aug	0.73	4.54	17.92	17.92	17.92	0.00	32.26	250.00	250.00	250.00	0.00	0.00	0.00	0.00	724.30

	Untreated to sewer (kL/day)					Treated to sewer (kL/day)					Untreated via tanker (kL/day)				
	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%
2035 Sep	0.39	2.48	10.19	17.92	17.92	0.00	5.58	118.30	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2035 Oct	0.15	1.51	3.44	15.71	17.92	0.00	0.11	8.02	211.30	250.00	0.00	0.00	0.00	0.00	0.00
2035 Nov	0.15	1.14	3.24	8.79	17.92	0.00	0.01	3.67	100.00	250.00	0.00	0.00	0.00	0.00	0.00
2035 Dec	0.22	1.43	2.79	11.22	17.92	0.00	0.00	5.15	120.10	250.00	0.00	0.00	0.00	0.00	0.00
2036 Jan	0.32	1.51	4.18	14.81	17.92	0.00	0.33	12.47	178.60	250.00	0.00	0.00	0.00	0.00	0.00
2036 Feb	0.18	2.79	6.61	17.40	17.92	0.00	3.77	53.13	236.90	250.00	0.00	0.00	0.00	0.00	0.00
2036 Mar	0.94	3.97	11.16	17.92	17.92	0.00	6.78	92.30	250.00	250.00	0.00	0.00	0.00	0.00	720.00
2036 Apr	1.46	4.55	14.91	17.92	17.92	0.00	10.66	179.00	250.00	250.00	0.00	0.00	0.00	0.00	728.90
2036 May	1.09	4.29	14.37	17.92	17.92	0.00	7.04	160.30	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2036 Jun	1.05	4.77	12.78	17.92	17.92	0.00	4.27	145.80	250.00	250.00	0.00	0.00	0.00	0.00	729.10
2036 Jul	1.08	4.06	15.56	17.92	17.92	0.00	15.29	209.70	250.00	250.00	0.00	0.00	0.00	0.00	729.70
2036 Aug	0.72	4.53	17.92	17.92	17.92	0.00	13.39	250.00	250.00	250.00	0.00	0.00	0.00	0.00	723.60
2036 Sep	0.38	2.22	10.16	17.92	17.92	0.00	3.53	117.70	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2036 Oct	0.20	1.54	3.68	14.66	17.92	0.00	0.00	13.31	191.20	250.00	0.00	0.00	0.00	0.00	0.00
2036 Nov	0.16	1.13	3.09	8.81	17.92	0.00	0.00	3.56	101.50	250.00	0.00	0.00	0.00	0.00	0.00
2036 Dec	0.14	1.41	2.76	10.24	17.92	0.00	0.00	4.35	106.40	250.00	0.00	0.00	0.00	0.00	0.00
2037 Jan	0.32	1.52	3.95	12.88	17.92	0.00	0.36	9.19	148.00	250.00	0.00	0.00	0.00	0.00	0.00
2037 Feb	0.19	2.07	6.13	15.76	17.92	0.00	2.72	38.23	205.40	250.00	0.00	0.00	0.00	0.00	0.00
2037 Mar	0.94	3.57	9.91	17.92	17.92	0.00	4.80	90.37	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2037 Apr	1.20	4.49	14.26	17.92	17.92	0.00	7.46	172.70	250.00	250.00	0.00	0.00	0.00	0.00	727.40
2037 May	0.92	4.06	16.11	17.92	17.92	0.00	8.07	217.70	250.00	250.00	0.00	0.00	0.00	0.00	73.38
2037 Jun	0.96	4.77	12.82	17.92	17.92	0.00	4.90	148.50	250.00	250.00	0.00	0.00	0.00	0.00	581.40
2037 Jul	1.08	3.82	14.90	17.92	17.92	0.00	16.13	200.40	250.00	250.00	0.00	0.00	0.00	0.00	730.70
2037 Aug	0.70	3.56	16.69	17.92	17.92	0.00	8.05	220.00	250.00	250.00	0.00	0.00	0.00	0.00	724.20
2037 Sep	0.37	2.19	10.38	17.92	17.92	0.00	2.25	129.00	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2037 Oct	0.20	1.47	3.46	13.86	17.92	0.00	0.00	7.48	183.30	250.00	0.00	0.00	0.00	0.00	0.00
2037 Nov	0.15	1.13	3.02	7.62	17.92	0.00	0.01	3.56	57.01	250.00	0.00	0.00	0.00	0.00	0.00
2037 Dec	0.14	1.49	2.89	12.13	17.92	0.00	0.17	5.56	119.10	250.00	0.00	0.00	0.00	0.00	0.00
2038 Jan	0.37	1.84	3.76	13.88	17.92	0.00	0.83	10.59	160.90	250.00	0.00	0.00	0.00	0.00	0.00
2038 Feb	0.19	2.47	5.54	17.92	17.92	0.00	2.46	36.06	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2038 Mar	0.94	3.12	8.17	17.92	17.92	0.00	4.60	56.41	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2038 Apr	1.20	4.82	13.91	17.92	17.92	0.00	9.84	157.40	250.00	250.00	0.00	0.00	0.00	0.00	727.10
2038 May	0.99	4.09	14.42	17.92	17.92	0.00	7.04	169.20	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2038 Jun	0.98	5.44	13.18	17.92	17.92	0.00	7.22	154.80	250.00	250.00	0.00	0.00	0.00	0.00	730.50
2038 Jul	1.11	3.50	15.40	17.92	17.92	0.00	4.61	195.00	250.00	250.00	0.00	0.00	0.00	0.00	729.40
2038 Aug	0.73	3.56	16.29	17.92	17.92	0.00	9.16	217.70	250.00	250.00	0.00	0.00	0.00	0.00	721.90
2038 Sep	0.37	2.16	10.27	17.92	17.92	0.00	2.54	126.90	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2038 Oct	0.20	1.47	3.49	16.13	17.92	0.00	0.11	8.12	217.70	250.00	0.00	0.00	0.00	0.00	0.00
2038 Nov	0.15	1.13	3.15	8.21	17.92	0.00	0.00	4.18	85.09	250.00	0.00	0.00	0.00	0.00	0.00
2038 Dec	0.22	1.43	2.77	8.73	17.92	0.00	0.30	4.73	101.00	250.00	0.00	0.00	0.00	0.00	0.00
2039 Jan	0.32	1.57	4.11	13.96	17.92	0.00	0.77	10.59	154.50	250.00	0.00	0.00	0.00	0.00	0.00
2039 Feb	0.19	2.22	5.87	17.92	17.92	0.00	2.38	32.85	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2039 Mar	0.68	3.48	9.66	17.92	17.92	0.00	4.80	87.98	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2039 Apr	1.26	4.56	14.47	17.92	17.92	0.00	8.48	153.90	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2039 May	0.99	4.30	14.67	17.92	17.92	0.00	7.82	171.50	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2039 Jun	0.98	4.66	13.76	17.92	17.92	0.00	4.90	162.10	250.00	250.00	0.00	0.00	0.00	0.00	730.50
2039 Jul	1.08	3.49	15.05	17.92	17.92	0.00	7.56	201.60	250.00	250.00	0.00	0.00	0.00	0.00	728.50

	Untreated to sewer (kL/day)					Treated to sewer (kL/day)					Untreated via tanker (kL/day)				
	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%
2039 Aug	0.72	2.73	16.32	17.92	17.92	0.00	3.92	217.70	250.00	250.00	0.00	0.00	0.00	0.00	724.20
2039 Sep	0.39	2.22	10.70	17.92	17.92	0.00	3.53	128.20	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2039 Oct	0.20	1.47	3.46	16.82	17.92	0.00	0.11	15.54	226.90	250.00	0.00	0.00	0.00	0.00	0.00
2039 Nov	0.15	1.08	3.21	9.68	17.92	0.00	0.01	4.81	104.90	250.00	0.00	0.00	0.00	0.00	0.00
2039 Dec	0.20	1.41	2.79	10.72	17.92	0.00	0.00	4.24	112.10	250.00	0.00	0.00	0.00	0.00	0.00
2040 Jan	0.32	1.53	4.16	14.60	17.92	0.00	0.33	12.47	171.50	250.00	0.00	0.00	0.00	0.00	0.00
2040 Feb	0.18	2.25	5.63	17.41	17.92	0.00	3.68	23.52	234.80	250.00	0.00	0.00	0.00	0.00	0.00
2040 Mar	0.94	3.31	8.40	17.92	17.92	0.00	4.00	59.53	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2040 Apr	1.26	4.50	13.04	17.92	17.92	0.00	7.44	147.90	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2040 May	0.92	3.97	15.23	17.92	17.92	0.00	8.62	198.00	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2040 Jun	0.96	5.74	13.30	17.92	17.92	0.00	10.29	155.40	250.00	250.00	0.00	0.00	0.00	0.00	730.70
2040 Jul	1.08	4.11	15.01	17.92	17.92	0.00	16.62	196.70	250.00	250.00	0.00	0.00	0.00	0.00	728.80
2040 Aug	0.72	2.48	16.80	17.92	17.92	0.00	3.92	225.80	250.00	250.00	0.00	0.00	0.00	0.00	724.00
2040 Sep	0.37	2.25	10.20	17.92	17.92	0.00	2.56	120.80	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2040 Oct	0.14	1.41	3.44	17.44	17.92	0.00	0.00	8.17	241.90	250.00	0.00	0.00	0.00	0.00	0.00
2040 Nov	0.15	1.31	3.20	8.79	17.92	0.00	0.10	6.22	101.90	250.00	0.00	0.00	0.00	0.00	0.00
2040 Dec	0.20	1.42	2.76	8.20	17.92	0.00	0.00	4.06	85.46	250.00	0.00	0.00	0.00	0.00	0.00
2041 Jan	0.37	1.56	4.25	14.28	17.92	0.00	0.77	12.57	163.50	250.00	0.00	0.00	0.00	0.00	0.00
2041 Feb	0.19	2.75	5.72	17.92	17.92	0.00	2.87	26.55	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2041 Mar	0.94	3.28	7.48	17.92	17.92	0.00	3.68	36.25	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2041 Apr	1.26	4.03	11.15	17.92	17.92	0.00	6.64	120.90	250.00	250.00	0.00	0.00	0.00	0.00	724.50
2041 May	0.92	3.68	12.46	17.92	17.92	0.00	6.25	149.40	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2041 Jun	0.96	4.58	13.86	17.92	17.92	0.00	7.21	171.40	250.00	250.00	0.00	0.00	0.00	0.00	730.50
2041 Jul	0.91	3.28	13.97	17.92	17.92	0.00	2.39	185.50	250.00	250.00	0.00	0.00	0.00	0.00	728.50
2041 Aug	0.73	3.18	14.22	17.92	17.92	0.00	4.36	177.40	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2041 Sep	0.40	2.19	9.30	17.92	17.92	0.00	1.92	101.40	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2041 Oct	0.30	1.56	3.60	15.71	17.92	0.00	0.00	9.84	204.80	250.00	0.00	0.00	0.00	0.00	0.00
2041 Nov	0.15	1.26	3.27	11.58	17.92	0.00	0.43	6.22	112.80	250.00	0.00	0.00	0.00	0.00	0.00
2041 Dec	0.22	1.68	2.84	7.54	17.92	0.00	0.31	5.38	69.92	250.00	0.00	0.00	0.00	0.00	0.00
2042 Jan	0.32	1.24	3.20	9.30	17.92	0.00	0.02	5.26	52.23	250.00	0.00	0.00	0.00	0.00	0.00
2042 Feb	0.19	1.80	4.66	13.98	17.92	0.00	1.73	16.63	163.00	250.00	0.00	0.00	0.00	0.00	0.00
2042 Mar	0.94	3.07	7.72	17.92	17.92	0.00	3.11	40.71	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2042 Apr	1.20	3.92	11.64	17.92	17.92	0.00	4.20	128.70	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2042 May	0.99	3.55	13.31	17.92	17.92	0.00	5.05	155.20	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2042 Jun	0.81	4.13	12.91	17.92	17.92	0.00	4.11	131.80	250.00	250.00	0.00	0.00	0.00	0.00	730.50
2042 Jul	1.12	3.30	13.75	17.92	17.92	0.00	2.49	179.80	250.00	250.00	0.00	0.00	0.00	0.00	729.40
2042 Aug	0.73	2.87	15.47	17.92	17.92	0.00	4.36	208.80	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2042 Sep	0.58	2.19	9.65	17.92	17.92	0.00	2.14	114.90	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2042 Oct	0.20	1.63	4.70	14.57	17.92	0.00	0.11	18.34	200.20	250.00	0.00	0.00	0.00	0.00	0.00
2042 Nov	0.15	1.08	3.20	9.81	17.92	0.00	0.30	4.62	106.30	250.00	0.00	0.00	0.00	0.00	0.00
2042 Dec	0.22	1.49	2.94	6.93	17.92	0.00	0.30	5.27	46.13	250.00	0.00	0.00	0.00	0.00	0.00
2043 Jan	0.15	1.55	3.55	8.14	17.92	0.00	0.33	7.38	55.14	250.00	0.00	0.00	0.00	0.00	0.00
2043 Feb	0.30	2.12	5.70	16.22	17.92	0.00	2.38	19.32	211.50	250.00	0.00	0.00	0.00	0.00	0.00
2043 Mar	0.71	3.57	7.46	17.92	17.92	0.00	3.58	41.38	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2043 Apr	1.20	3.34	8.51	17.92	17.92	0.00	3.60	72.14	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2043 May	0.92	3.47	9.62	17.42	17.92	0.00	3.79	76.85	237.00	250.00	0.00	0.00	0.00	0.00	0.00
2043 Jun	1.07	4.02	12.28	17.92	17.92	0.00	4.02	111.70	250.00	250.00	0.00	0.00	0.00	0.00	0.00

	Untreated to sewer (kL/day)					Treated to sewer (kL/day)					Untreated via tanker (kL/day)				
	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%
2043 Jul	1.12	3.18	11.96	17.92	17.92	0.00	2.95	143.10	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2043 Aug	0.73	2.07	9.67	17.92	17.92	0.00	0.32	110.50	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2043 Sep	0.40	1.70	5.74	16.18	17.92	0.00	0.36	33.22	206.50	250.00	0.00	0.00	0.00	0.00	0.00
2043 Oct	0.30	1.51	3.68	15.84	17.92	0.00	0.02	10.05	204.90	250.00	0.00	0.00	0.00	0.00	0.00
2043 Nov	0.17	1.48	4.03	12.47	17.92	0.00	0.91	8.05	158.30	250.00	0.00	0.00	0.00	0.00	0.00
2043 Dec	0.22	1.54	2.83	7.45	17.92	0.00	0.32	5.38	57.95	250.00	0.00	0.00	0.00	0.00	0.00
2044 Jan	0.31	1.51	3.45	8.09	17.92	0.00	0.02	6.29	67.98	250.00	0.00	0.00	0.00	0.00	0.00
2044 Feb	0.18	1.92	4.44	11.97	17.92	0.00	0.99	9.75	124.60	250.00	0.00	0.00	0.00	0.00	0.00
2044 Mar	0.94	3.63	6.94	16.42	17.92	0.00	3.11	30.41	214.00	250.00	0.00	0.00	0.00	0.00	0.00
2044 Apr	1.26	3.80	10.19	17.92	17.92	0.00	3.33	91.15	250.00	250.00	0.00	0.00	0.00	0.00	728.90
2044 May	0.92	3.80	9.67	17.92	17.92	0.00	4.81	81.52	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2044 Jun	1.07	4.35	12.56	17.92	17.92	0.00	8.12	139.20	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2044 Jul	1.08	3.28	14.31	17.92	17.92	0.00	4.15	185.50	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2044 Aug	0.70	2.29	10.18	17.92	17.92	0.00	1.15	124.50	250.00	250.00	0.00	0.00	0.00	0.00	0.00
2044 Sep	0.37	1.81	4.57	13.99	17.92	0.00	0.36	15.18	172.90	250.00	0.00	0.00	0.00	0.00	0.00
2044 Oct	0.14	1.23	2.77	9.95	17.92	0.00	0.00	2.54	103.00	250.00	0.00	0.00	0.00	0.00	0.00
2044 Nov	0.09	1.10	2.82	7.15	17.92	0.00	0.01	3.41	65.81	250.00	0.00	0.00	0.00	0.00	0.00
2044 Dec	0.22	1.44	2.84	7.48	17.92	0.00	0.32	4.71	56.45	250.00	0.00	0.00	0.00	0.00	0.00

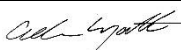

GHD

Level 3 GHD Tower 24 Honeysuckle Drive Newcastle NSW 2300
PO BOX 5403 Hunter Region Mail Centre NSW 2310
T: 61 2 4979 9999 F: 61 2 4979 9988 E: ntlmail@ghd.com

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Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	T Tinkler	A Wyatt		D Barrett		21/05/2019
1	T Tinkler B Dagg	A Wyatt		A Wyatt		14/06/2019

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Appendix **C**
Leachate Management Plan



Lake Macquarie City Council
Awaba Waste Management Facility
Leachate Management Plan

Revision 2

February 2016

Disclaimer

This plan has been prepared by GHD for Lake Macquarie City Council and may only be used and relied on by Lake Macquarie City Council for the purpose agreed between GHD and the Lake Macquarie City Council as set out in Section 1.2 of this plan.

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

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

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

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

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

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- Appendix A – Layout plan with landfill cells
- Appendix B – Water balance results
- Appendix C – Leachate pumping data
- Appendix D – Proposed leachate barrier and collection system
- Appendix E – Design drawings: Quarry cell

1. Introduction

1.1 General

GHD Pty Ltd (GHD) was engaged by Lake Macquarie City Council (Council) to provide design and delivery phase services for the Awaba Waste Management Facility (the site) Expansion Project. As part of this engagement, GHD has been tasked with the preparation of this Leachate Management Plan (this plan) in accordance with the Council's Design Brief to satisfy Conditions 18 and 19 (c), Schedule 4 of Planning Assessment Commission (PAC) Specific Environmental Conditions.

This document forms part of the Soil, Water and Leachate Management Plan (SWLMP) for this project (GHD, 2014) and shall be read in conjunction with the SWLMP and the associated Site Water Balance Report (GHD, 2014), Erosion and Sediment Control Plan (GHD, 2014), Stormwater Management Plan (GHD, 2014), and Surface Water, Groundwater and Leachate Response Plan (GHD, 2014) for the project.

1.2 Purpose of this plan

The purpose of this plan is to meet the requirements of Council's design brief. Specifically, the purpose is to identify final detailed design specifications of the leachate management and collection system on-site; and to satisfy Conditions 18 & 19 (c), Schedule 4 of PAC (Specific Environmental Conditions).

The table below identifies each of the conditions as well as the corresponding section of the Plan which addresses each item

Table 1-1 Summary of PAC requirements

Condition	Description	Section of plan
18 (a)	Design and install the leachate management and collection system generally in accordance with the conceptual design in the EA, applicable Australian Standards and industry standard best practice guidelines, or otherwise approved by the EPA	5.3
18 (b)	Ensure that leachate generated by the Project is minimised and appropriately contained, collected and disposed of	5.2, 5.3, 5.4, 5.5
18 (c)	As required, leachate generated by the Project shall be transferred for disposal to the Rathmines No. 6 WWPS in accordance with HWC's requirements	4.5, 5.5
18 (d)	Install a leachate barrier system to be used for the direct impoundment of leachate	5.3
18 (e)	Design and operate the leachate management system to prevent leachate from escaping to surface water, groundwater or the surrounding subsoils	5.2, 5.3
18 (f)	Direct all surface water from areas not subject to waste disposal or leachate disposal away from the leachate management system	5.2
18 (g)	Treat all water that has entered areas filled with waste, or been contaminated by leachate, as leachate	4.4.2, 5.3

Condition	Description	Section of plan
19 (c)	<p>The Proponent shall prepare and implement a Soil, Water and Leachate Management Plan for the Project. The plan shall be prepared by a suitably qualified and experienced expert in consultation with LMCC, the NOW and the EPA and be submitted to the Director-General for approval prior to the commencement of Operations. The plan shall include:</p> <p>A leachate management plan that:</p> <ul style="list-style-type: none"> Includes final detailed design specifications of the leachate management and collection system on site; and Demonstrates how the requirements of Condition 18 of Schedule 4 have been addressed. 	<p>5.2, 5.3, 5.4, 5.5</p> <p>See above</p>

1.3 Scope of this plan

Specifically, this plan addresses the following:

- Review of existing leachate management measures.
- Review of design criteria (including regulatory requirements) for leachate management at the site.
- Estimation of leachate generation at the site considering existing and future leachate generation over the life of the site, including verification of the model through comparison against available site leachate extraction/pumping data (if able).
- Development of a suitable leachate management strategy for the site, including identification of ongoing leachate minimisation, containment, collection, storage and disposal.
- Development of an implementation program for the proposed leachate management strategy.

1.4 Reliance

The following information, provided by Council, has been relied on:

Documents from Council

- Additions to Awaba Waste Management Facility, Submissions Report and Revised Statement of Commitments, prepared by Cardno dated March 2013.
- Additions to Awaba Waste Management Facility, Environmental Assessment - Volume 1 (Main Report), prepared by Cardno dated 29 August 2012 (herein referred to and referenced as “the EA Report, 2012”).
- Additions to Awaba Waste Management Facility, Environmental Assessment - Volume 2 (Appendices A to H), prepared by Cardno dated 29 August 2012.
- Additions to Awaba Waste Management Facility, Environmental Assessment - Environmental Assessment - Volume 3 (Appendices I to K), prepared by Cardno dated 29 August 2012.
- Additions to Awaba Waste Management Facility, Environmental Assessment - Volume 4 (Appendices L to Q), prepared by Cardno dated 29 August 2012.

- In particular, Appendix F of the EA Report - letter report titled “Extension of Awaba Landfill Facility, Wilton Road, Awaba, Geotechnical Services” prepared by Indra Jworchan (Geotechnique) addressed to Christopher Holloway (Cardno) dated December 2011 (herein referenced as Geotechnique, 2011).
- Awaba Landfill Environmental Management Plan Version 05, prepared by Council dated 20 October 2006.

Information from site visit by GHD staff on the 9 September 2013

- Photographs taken on the day
- Information supplied by Council on the day

2. Site characteristics

2.1 Location, access and footprint

The site is situated within the Lake Macquarie Local Government Area (LGA), which covers an area of approximately 645 square km in the Hunter region of NSW, Australia. The estimated population in the LGA is 202,347 (City of Lake Macquarie Annual Report 2012/2013).

The site is located off Wilton Road, Awaba, approximately 1.2 km south-east of the township of Awaba and 4 km west of the suburb of Toronto. Access to the site is via Wilton Road. The location of the site is shown in Figure 2-1.



Figure 2-1 Awaba Waste Management Facility (Google, 2013)

The majority of the expansion works are situated within Lot 372 DP 723259, which has an area of 32.5 ha including the existing landfill operations. Approximately 23.5 ha comprises the existing site and the majority of the remaining 9 ha comprises natural bushland. The components of the expansion works that will be located outside of Lot 372 DP 723259 include a sewer pipeline which connects the site and Rathmines No. 6 WWPS for leachate disposal and the intersection upgrade at Wilton and Wangi Roads.

2.2 History

Prior to operation as a landfill, the area consisted of undisturbed natural bushland. Development consent was granted in 1986 for the site to operate as a landfill catering for household wastes, privately transported residential rubbish, construction and municipal wastes and some industrial wastes. Approximately 20 ha of the site was devoted to the landfill and supporting infrastructure as part of the original project approval in 1986. This expanded to the current 23.5 ha in 1995 to allow for extension of the facility (The EA Report, 2012). A lined cell was established in an existing quarry on the eastern portion of the site in 2006-07 and has been subsequently filled.

2.3 Topography and hydrology

2.3.1 Overview

Topographically, the site slopes generally in a south easterly direction from a ridgeline to the north and west of the site boundary towards a drainage line south of the weighbridge. The site has been altered significantly from the natural surface morphology due to the waste containment cell.

Most of the site has been cleared of vegetation. South of the weighbridge, the site slopes to a drainage line, with vegetation in this area typically including shrubs and grasses.

The proposed Cell's 1 and 2 are located to the north of the current operating area and located to the south of a west to east trending ridgeline. The high point of the ridge is located over 100 m to the north of the site. The cell development area will be approximately 200 m long (orientated in a north to south direction) and will range in width from 200 m at its northern end to 380 m at its southern end.

2.3.2 Regional

The natural topography in the vicinity of the AWMF has been significantly altered such that the northern catchment above the landfill is diverted around the central waste mass, with the western section running alongside the facility discharging to the southern creek and the eastern section is routed to the eastern watercourse. The natural topography of the area drains in a southerly direction towards an unnamed creek, with the entire waste management facility draining to the creek. The receiving unnamed creek is intermittently flowing and drains in an easterly direction for approximately 3 km before draining into Lake Macquarie at Rathmines Bay. Lake Macquarie is a brackish coastal lake with connection to the Pacific Ocean at Swansea Heads, to the southeast of where the unnamed creek discharges into the lake.

The landscapes across the site belong to the Awaba Group (aw), which is characterised by rolling low hills on predominantly coarse grained sediments of the Narrabeen Group and Newcastle coal measures in the Awaba hills. Local relief is of 20 m to 80 m and slope gradient is usually 10 % to 25 % with some localised steep slopes up to 60%.

Drainage lines are narrow and incised. The limitations in this landscape include steep slope (localised), mass movement (localised), very high erosion hazard, shallow and stony soils, strongly acidic soils with low fertility (Geotechnique, 2011).

2.3.3 Local

The site is situated on undulating terrain and the highest point of the site is 82.6 m AHD, with the site sloping down from the north-west to the south-east (The EA Report, 2012). Local topography is typical of the landforms throughout the lower Hunter Region.

2.4 Soils, geology and hydrogeology

2.4.1 Soils

Topsoil/fill materials at the site is predominantly sandy and comprise fine to coarse grained clayey silty sand, silty sand, gravelly clayey sand and gravelly silty sand with some low to medium plasticity sandy silt and sandy silty clay. Residual soils are also predominantly sandy and comprise fine to coarse grained and medium dense to dense clayey sand, silty sand, clayey gravelly sand, gravelly silty sand and gravelly sand with bands of low to medium plasticity and stiff to hard silty clay and sandy clay, with cobbles at places.

Borehole and test pit logs at the site show that the combined thickness of topsoil/fill and residual soils across proposed new cell areas varies from approximately 0.2 m to 1.5 m (Geotechnique, 2011).

2.4.2 Regional geology

As shown in the 1:100 000 scale Newcastle Coalfield Regional Geology map, the site lies across the geological boundary between the Munmorah Conglomerate member of the Clifton Subgroup (Rn) of the Narrabeen Group and the Moon Island Beach Subgroup (Pnm) of the Newcastle Coal Measures. An extract from the geology map is provided in Figure 2-2 below.

Munmorah Conglomerate is of the early Triassic/late Permian period and typically comprises conglomerate, tuff, sandstone, claystone and coal.

The underlying Moon Island Beach Subgroup is of late Permian period and typically comprises conglomerate, sandstone, siltstone, tuff and coal.

NSW Mine Subsidence Board advised that the proposed landfill cells are underlain by coal seams, which are likely to be mined sometime in the future by Centennial Coal Company Limited, who owns the mining lease.

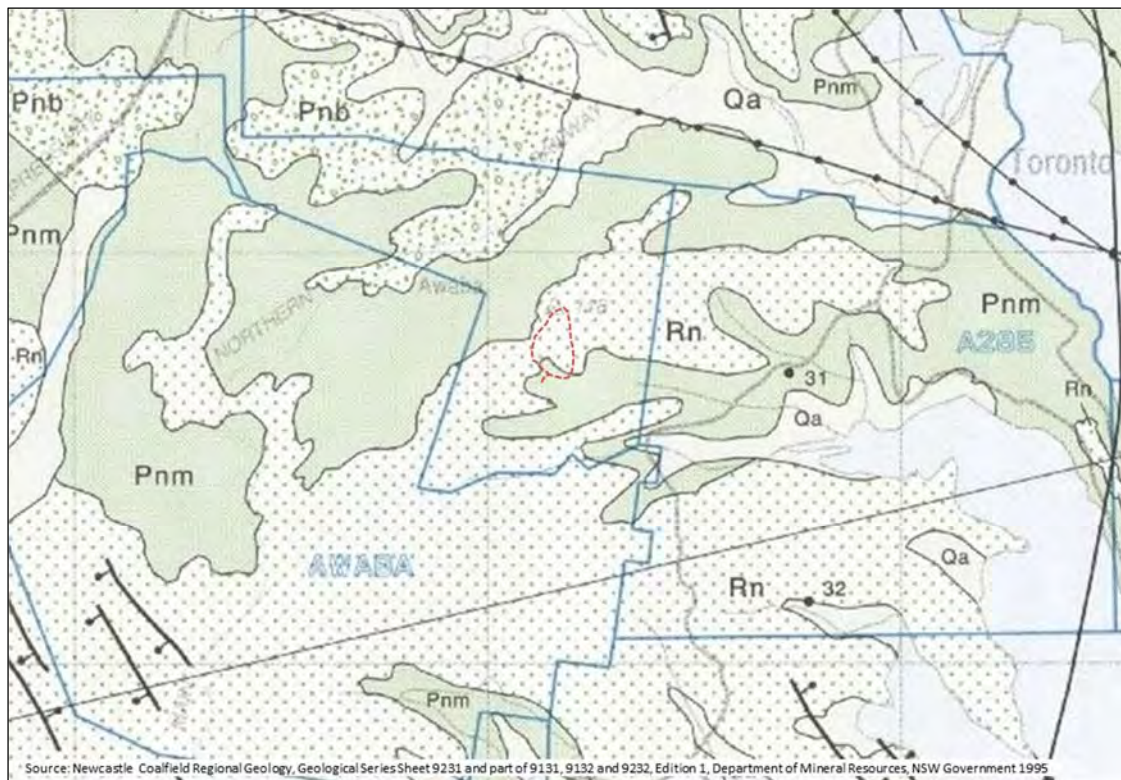


Figure 2-2 Regional Geology for Awaba Waste Management Facility

NSW Mine Subsidence Board advised that the proposed landfill cells are underlain by coal seams, which are likely to be mined sometime in the future by Centennial Coal Company Limited, who owns the mining lease.

2.4.3 Hydrogeology

Investigations undertaken (Geotechnique, 2011) indicate that groundwater was not reached via the constructed boreholes and test pits (to a depth of 2.7 – 3.2 m). The one exception was a borehole (BH4) adjacent to an existing dam, with the level corresponding with the level in the dam at the time of the investigation. The conclusion from Geotechnique was that groundwater is unlikely to be encountered at less than 3.0 meters below existing ground surface except in close proximity to existing dams.

2.5 Flora and fauna

2.5.1 Flora

The threatened flora species *Tetradlea juncea* (Black-eyed Susan) is located within the direct footprint of the works on the site. *Tetradlea juncea* is listed as vulnerable under both the Threatened Species Conservation Act 1995 and the EPBC Act. It was determined that 2,302 *Tetradlea juncea* plants will need to be removed to facilitate the proposed works on the site.

Due to the location of *Tetradlea juncea* over the site, it is not possible to avoid or minimise impacts on this species due to the expansion works. LMCC will ensure that a restrictive covenant burdening Lot 463 DP 1138964 be registered in favour of the Minister for Planning and Infrastructure, to offset the proposed AWMF development.

No Endangered Ecological Communities (EECs) were identified at the site.

2.5.2 Fauna

No threatened fauna species were considered to be significantly impacted by the Expansion Project (The EA Report, 2012).

2.6 Heritage

Investigations conducted by Insight Heritage and Niche as part of the Environmental Assessment identified Aboriginal artefacts within the expansion footprint. In order to manage heritage during the expansion works, Council will develop a Cultural Heritage Management Plan in partnership with Aboriginal stakeholders which will be implemented for the construction phase of the project.

2.7 Zoning

Table 2-1 outlines key land use zoning of the site and surroundings.

Table 2-1 Key land use zonings (the EA Report, 2012)

Location	LEP 2004 (In Force) Zoning		LEP 2011 (Draft) Zoning	
The site	9	Natural Resources	SP1	Infrastructure (Waste or Resource Management Facility)
Surrounding bushland	9	Natural Resources	E2	Environmental Conservation
	7 (2)	Conservation (Secondary)		
Awaba village	2 (1)	Residential Zone	R2	Low Density Residential
Wilton Road and immediate surrounds	5	Infrastructure	SP2	Infrastructure
	6(2)	Tourism and Recreation	RE2	Private Recreation
	7(2)	Conservation (Secondary)	E2	Environmental Conservation
			RU2	Rural Landscape

2.8 Existing services and infrastructure

Council holds an Environmental Protection Licence (EPL, Licence No. 5873) for the current operation of the site. Site facilities and infrastructure include:

- Gatehouse with two weighbridges, entry and exit lanes, security compound and security monitoring system
- Machinery compound
- Reuse centre
- Leachate collection ponds (2), bunded irrigation areas and leachate recirculation system
- Sediment collection pond (3)
- Roads and access, drains and berms, fences, gates and signs
- General waste processing area
- Garden waste receiving and processing area
- Landfill compactor, traxcavator loaders and other operational equipment
- Pumps
- Landfill gas engines

2.9 Waste operations

Key waste operations are summarised in Table 2-2.

Table 2-2 Key operations at the site (adapted from the EA Report, 2012)

Waste Aspect	Operations
Waste Handling and Recovery	Waste arrives at the site from a variety of sources, including Council collection vehicles, waste collection contractors, and waste self-hauled by businesses and residents. Upon entering the site, the waste is classified and charged in accordance with a number of categories.
	A community recycling centre is included in the site facilities, which is located in the southern portion of the existing site. Batteries, oil, dry recyclables, e-waste and household problem wastes can be dropped at the centre on site prior to proceeding to the main tip face. Council also have procedures in place to scavenge metals from the tip face and take for metal recycling.
	Green waste is currently tipped separately at the site. Green waste processing is currently undertaken using an excavator to load a mobile shredder on site. Green waste processing at the site currently involves shredding and stockpiling the green waste material then transferring it offsite for use and/or composting.
	Street sweepings, dredging and seaweed, along with fill that is purchased by the site is also tipped separately and then used as cover material. There is currently no separate tipping point for construction and demolition (C&D) waste or hazardous waste; it is all tipped at the main tip face.
	Council currently undertake litter patrols to manage stray litter.
Active tip face	The active tipping face is currently accessed by both private/commercial vehicles as well as Council waste vehicles.
	The active tipping face is sprayed with daily cover at the end of each day.

Waste Aspect	Operations
Leachate management	Existing leachate management system is described in Section 3 of this Plan.
Landfill gas	Landfill gases are currently captured and utilised to generate electricity on site, which is then fed back into the grid. Gas flaring is used only as a fall back option when the generator is not operational
Waste Monitoring	Council currently collects waste volume and waste stream information for the site and compiles it on a monthly basis.
	Council currently commissions periodic independent audits of the waste entering the site and of the domestic kerbside mobile garbage bins in the Lake Macquarie LGA.
	Council monitor the volume of landfill gas flared and captured for electricity generation on a monthly basis and report this to Council on a six monthly basis. The percentage of methane (CH ₄) in the landfill gas is also measured and reported for the reporting month.

2.10 Waste characteristics

The site is an EPA licensed solid waste landfill. The license permits waste defined by the NSW Government's EPA (1996) guidelines as Solid Waste Class 1 to be disposed at the site. A Solid Waste Class 1 landfill means that all solid waste including putrescible wastes and other wastes approved by the EPA are accepted at the landfill.

The site currently receives approximately 100,000 tonnes of waste annually, with an expected increase by approximately 1% to 1.2% each year. Council currently collects information on the volumes of numerous different specific waste streams received at the site, compiled on a monthly basis. These specific waste streams are then categorised into the following three primary waste streams:

- Municipal Solid Waste (MSW):
 - Household weekly bin collection
 - Parks and gardens waste
 - Bulk domestic waste kerbside collections
 - Self-hauled residential waste
- Commercial and Industrial (C&I) waste
- Construction and Demolition (C&D) waste

Table 2-3 shows the total waste landfilled per annum, based on data from the 2003/04 financial year to the 2009/10 financial year, both excluding and including the cover material used to cap the landfill.

Table 2-3 Waste tonnages and composition landfilled at the site (the EA Report, 2012)

Financial year	MSW		C&I		C&D		Total (tpa) (ex. cover material)	Total (tpa) (inc. cover material)
	(tpa)	(% of total)	(tpa)	(% of total)	(tpa)	(% of total)		
2003/04	74,246	45%	14,134	9%	75,490	46%	163,870	200,736
2004/05	77,940	66%	14,540	12%	25,436	22%	117,917	152,680
2005/06	79,625	67%	12,489	10%	27,145	23%	119,258	160,778
2006/07	81,579	73%	12,831	12%	16,740	15%	111,149	158,828
2007/08	90,203	76%	10,725	9%	17,262	15%	118,191	150,230
2008/09	82,311	82%	8,950	9%	9,276	9%	100,537	120,795
2009/10	80,198	85%	6,976	7%	7,034	7%	94,208	109,233

Data provided within Table 2-4 is sourced from the Greenhouse Gas Model provided by LMCC. Note, these values are per calendar year.

Table 2-4 Tonnage and composition of landfilled waste

Calendar year	MSW		C&I		C&D		Total (T/yr) (ex. Cover material) ¹	Total (T/yr) (inc. Cover material)
	(T/yr)	(% of Total)	(T/yr)	(% of Total)	(T/yr)	(% of Total)		
2007	80,933	61	32,487	24	19,282	15	-	125,403
2008	81,484	51	39,215	25	38,705	24	-	148,347
2009	78,529	60	25,348	19	26,905	21	99,120	122,136
2010	76,560	59	22,360	17	30,954	24	91,570	121,003
2011	77,634	68	21,061	18	15,915	14	94,447	109,291
2012	79,528	64	25,756	21	18,667	15	98,136	116,477
2013	82,214	71	4,943	4	28,691	25	94,150	106,829

2.11 Future waste management operations

2.11.1 General

With construction of the expansion for the Waste Management Facility, waste management operations at the site will be augmented by the elements outlined below.

¹ Includes transferred green waste and inert material

2.11.2 Waste transfer station

The Waste Transfer Station (WTS) will be located along the site access road to the east of the landfill footprint. The main purpose is to provide for centralised access and disposal of waste by domestic and small commercial customers, with consolidated disposal at the landfill by site vehicles. The WTS allows for preventing direct access to the landfill by small domestic and commercial vehicles, and provides for additional receptacles for recyclables and segregated materials to be diverted from landfill.

2.11.3 Alternative waste treatment facility

The Alternative Waste Treatment Facility (AWT) will be located to the east of the current site and will be operated by a third-party contractor. It will operate under a separate Environment Protection Licence and will comprise a process for treatment of biodegradable waste.

2.11.4 Reuse and recycling centre

The Reuse and Recycling Centre (RRC) will be located at the site entrance complex north of the weighbridge facility and will provide customers with an outlet for recyclables and difficult household wastes. It will also comprise a building for acceptance of potentially reusable items, which can be re-sold and therefore diverted from landfill disposal.

3. Review of existing leachate management

3.1 EPL requirements

The following conditions included in the site EPL pertaining to leachate management, disposal and maintenance are provided in the table below.

Table 3-1 EPL leachate management, disposal and maintenance conditions

EPL clause	EPL condition
O5.1	The sedimentation basins and leachate holding dams must be maintained to ensure that their design capacity is available for the storage of stormwater/leachate
O6.2	A leachate barrier system detailed in Appendix 3 of the LEMP and leachate collection system detailed on pages 4 and 5 of Section 6 of the LEMP must be installed on each surface within the premises to be used for the disposal of waste. This condition does not apply to any surface used for the emplacement of waste before 1 July 1998 when landfilling commenced, however it does apply to all future new landfill cells.
O6.3	Surface drainage must be diverted away from any area where waste is being or has been landfilled.
O6.4	A leachate barrier system as detailed on Page 4 of Section 6 of the LEMP must be installed on each surface within the premises to be used for the storage of leachate. Note: Condition O6.4 does not apply to the back-up leachate pond which recirculates leachate via a process of reinjection.
O6.5	Leachate impounded in the surface leachate storage ponds and leachate collected by the subsurface leachate collection system may be irrigated on the following utilisation area(s): – Any landfilled area within the facility.
R2.3	Whenever leachate is discharged to surface waters from the premises the licensee must notify the event to the EPA in accordance with condition R2.1.
R2.4	The licensee must provide written details of any leachate discharge(s) to the EPA within 7 days of the date on which the incident occurred in accordance with R2.5.
R2.5	The written details referred to in the above condition must be provided as a report. The report must include the following information: (a) the volume of the leachate discharged and over what time period the discharge occurred; (b) the date and time of the commencement of the overflow; (c) the weather conditions at the time of the discharge, specifying the amount of rainfall on a daily basis that had fallen: – on the day(s) of the discharge; and – for the one week period prior to the discharge. (d) the most recent monitoring results of the chemical composition of the leachate; (e) an explanation as to why the discharge occurred; (f) the location(s) of the discharge; (g) a plan of action to prevent a similar discharge in the future; and (h) was the discharge permitted by this licence.

3.2 Minimisation

GHD understand that the following measures are implemented to minimise leachate generation at the site:

- Landfilled waste is compacted following placement and covered daily. Due to the lack available material on-site, Council utilise alternative daily cover (ADC) at the active tipping face.
- Intermediate cover layers are placed on areas of waste exposed for an extended period of time (> 90 days, but not yet final capped) to minimise infiltration and promote surface water runoff. This intermediate cover layer is approximately 400 mm in depth. The material characteristics for the intermediate cover layers is variable due to the numerous sources of the material.
- Portions of the intermediate cover layers have been revegetated to stabilise the cover layer.
- Clean stormwater is diverted away from landfilled areas which have not yet reached their final levels and grades (in accordance with EPL Condition O5.2).
- Intermediate covered areas are mostly sloped to encourage runoff.
- The active tipping face is sprayed with EPA-approved daily cover at the end of each day.

3.3 Containment and collection

The existing landfilled areas can be broadly delineated into two areas, the unlined landfilled area and the lined quarry cell.

The unlined areas consist of the majority of the existing landfill footprint. These areas feature no engineered liner (leachate barrier). Leachate is collected from these areas via a subsurface interception trench and associated perforated pipework, where it is then pumped into the existing leachate ponds.

The quarry cell is lined with a GCL and a compacted clay along the base and GCL along the side slopes. However, no lining was placed on the western side slope, consisting of existing waste from the unlined area. Leachate is collected via a sump in the south-western corner of the cell, where it gravity feeds into the existing leachate pond to the south. Construction drawings for the quarry cell are provided in Appendix E.

3.4 Storage

The site is currently serviced by two existing leachate storage ponds:

- Leachate Pond 1 (lined, 6 ML capacity) is the main pond, located at the site entrance in the south.
- Leachate Pond 2 (unlined, 4 ML capacity) is a holding dam up at the very northern end of the site, only used for storage of leachate intended for spray irrigation at the northern end of the site. This pond will be decommissioned as part of the expansion works.

3.5 Disposal

The primary leachate disposal for the existing site operations is evaporation via spray irrigation. Leachate spray irrigation is conducted over the landfilled waste in the existing unlined areas in accordance with EPL condition O6.5. Leachate spray irrigation is carried out at the site during appropriate weather conditions, such as dry weather (no rain) with appropriate wind directions. Spray irrigation is monitored to ensure that no leachate runoff occurs off-site.

3.6 Monitoring

Leachate pumping records are maintained for the unlined areas and the quarry cell to monitor the quantity of leachate extracted from these areas. The leachate dam capacity is also monitored, with records maintained on spray irrigation periods. Recent leachate quantity data is attached in Appendix C.

Leachate quality monitoring is conducted at Leachate Pond 2 in accordance with EPL Condition P1.2.

4. Leachate management basis

4.1 General

This section details the basis for the leachate management strategy developed in Section 6.

4.2 Ongoing site development

Landfill expansion

As part of the expansion works, the landfilling footprint will be extended at the site. Further landfilling will be undertaken in new areas, as well as over the top of previously landfilled areas (lined and unlined). A piggyback liner will be constructed over existing waste of the currently approved landfill area. The expansion works are expected to extend the lifespan of the landfill site by an estimated 20 years.

Sewer connection

Council are proposing to augment the existing leachate disposal system through installation of a package pumping station on-site and a rising main to transfer leachate to No. 6 Waste Water Pump Station (WWPS) of Hunter Water Corporation at Rathmines. The pumping station will be located immediately south of Leachate Pond 1 and connected directly to this pond.

Upgrade of surface water management measures

Existing surface water management measures will be reviewed in light of the landfill expansion works. Additional infrastructure will be constructed to maintain diversion of stormwater away from landfilled areas.

4.3 Leachate generation

Leachate generation modelling (Section 5) has been undertaken to determine the requirements of leachate disposal mechanisms at the site and to inform the direction of the site leachate management strategy.

4.4 Other factors

Constraints

- Currently no final capping has been constructed over the existing landfilled areas.
- Leachate Pond 2 is unlined and unsuitable for long-term leachate storage.
- Untreated leachate irrigation currently occurs over unlined landfilled areas of the site, where irrigated leachate may potentially infiltrate into the existing landfilled waste which may not be effectively contained and collected via the existing subsurface interception trench and associated perforated pipework..

Opportunities

- Existing landfilled areas can be progressively capped as part of the piggy-back lined/capped to reduce leachate generation.
- Surface water may be diverted away from the landfilled areas to reduce leachate generation.
- The sewer connection will provide significant additional leachate disposal capacity.
- Leachate Pond 1 is suitable for use as a holding pond for the sewer connection infrastructure.

5. Leachate generation modelling

5.1 General

Rainfall infiltration for various cover scenarios at the site was modelled using the United States Environmental Protection Agency's (USEPA) Hydrological Evaluation of Landfill Performance (HELP) model. The HELP model takes available input such as climate data, soil and material characteristics, landfill construction and filling sequence to estimate infiltration.

Data from the HELP model was then transferred to site water balance model to provide an estimate of the volumes of leachate generated and the required site leachate storage capacity, based on the proposed site filling sequence and leachate disposal mechanisms. The site water balance model is discussed further in the Site Water Balance Report (GHD, 2014).

5.2 Basis criteria development

5.2.1 Methodology

The USEPA's HELP model was used to evaluate infiltration through existing and future landfill cover layers. Local climatic data was used where available, as discussed in Section 5.2.2, and a number of cover scenarios modelled, as discussed in Section 5.3.

Consideration was given to leachate generation via infiltration of rainfall through the existing landfill cover layers and into the landfilled waste. The results of the leachate generation were fed into the site water balance model.

For the purposes of evaluating the leachate generation at the site it was assumed that:

- No leachate escapes through the base of lined cells (all leachate that infiltrates through the landfill cover layers is captured by the existing leachate collection system in these cells).
- No excessive outflow of leachate from the unlined cells. This is a conservative estimate which has been assumed due to limited actual leachate pumping/extraction data available (see Section 5.4.4).
- Leachate collection efficiency from unlined areas is effectively 100% (i.e. leachate generation and collection are balanced). This is a conservative estimate which has been assumed due to limited actual leachate pumping/extraction data available (see Section 5.4.4).
- As described in Section 5.4.2, the systems are in place to prevent stormwater mixing with leachate in the cells (through diversion).
- As discussed in Section 5.4.3 there is no groundwater ingress into the landfilled waste.

The modelling was undertaken using local historic climate data, which was analysed and the 10th percentile Annual Exceedance Probability (AEP) rainfall (wet) year identified as well as the 50% AEP rainfall (median) year and a number of scenarios modelled to represent various capping arrangements.

5.2.2 Climate data

Rainfall, evaporation and temperature data were required in developing the HELP model. The following assumptions were been made in collating this data:

- Rainfall data was taken from weather station Toronto WWTP (016322) from 1943 to 2013, located approximately 5 km north-east of the site.
- Temperature data was not recorded at Toronto WWTP (016322), therefore temperature data was taken from weather station Cooranbong (061012) from 1943 to 2013 using the SILO climate database. Cooranbong is located approximately 10 km south-west of the site. Temperature data was developed by SILO by interpolating daily observations from this weather station.
- Similarly, evaporation data was not recorded at Toronto WWTP (016322), therefore evaporation data was taken from weather station Cooranbong (061012) from 1943 to 2013 using the SILO climate database. Cooranbong is located approximately 10 km south-west of the site. Evaporation data was developed by SILO by interpolating daily observations from this weather station from 1970 onwards, however long term averages were used for years prior to this (due to limited observations available).

The modelling was conducted using historic climate data for the period 1943 to 2013. The data was analysed and the 10% AEP wet year was identified (1974) as well as the 50% AEP median year (1977). This period was chosen as it represents the most current available data and the largest period available without requiring significant supplementary data from weather stations located away from the site.

5.3 Rainfall infiltration modelling

5.3.1 Landfill cover profiles

The modelled cover profiles for the site are detailed in Table 5-1. The materials were chosen to reflect the type of material utilised/anticipated to be utilised onsite. In defining these capping profiles, the following assumptions were made:

- Soil types were selected based on information provided by Council regarding soil profiles.
- Existing and proposed profiles for the active tipping face were identified based on discussions with Council. GHD understands that Council uses Posi-Shell as alternative daily cover (ADC) material. Given the limited information available on the protection this ADC provides against infiltration, GHD has modelled the active tipping face areas as uncovered waste to be conservative.
- Existing and proposed intermediate cover profiles were identified based on discussions with Council.
- As no final decision has been made on the final capping for the site, the proposed final cover profiles were defined with reference to NSW EPA Environmental Guidelines: Solid Waste Landfills.
- Where specific material hydraulic properties were not available, the soil characteristics for total porosity, field capacity, wilting point, and saturated hydraulic conductivity were selected from the HELP model default values based on the type of material utilised/anticipated to be utilised at the site.

Table 5-1 Cover profiles

Layer Type	Layer thickness (m)	Comment
Existing/Proposed Intermediate Cover Profile – Bare/Grassed – Flat/Sloped Surfaces		
Intermediate Cover	0.4 m	Sandy Clay Loam HELP default values for total porosity, field capacity, wilting point and saturated hydraulic conductivity ($K = 1.2 \times 10^{-6} \text{ ms}^{-1}$)
Proposed Final Cover Profile – Flat/Sloped Surfaces		
Revegetation Layer	1 m	Loam HELP default values for total porosity, field capacity, wilting point and saturated hydraulic conductivity ($K = 3.7 \times 10^{-6} \text{ ms}^{-1}$)
Infiltration Drainage Layer	0.3 m	Gravel HELP default values for total porosity, field capacity, wilting point and saturated hydraulic conductivity ($K = 3.0 \times 10^{-3} \text{ ms}^{-1}$)
Sealing Layer	0.5 m	Barrier Soil HELP default values for total porosity, field capacity and wilting point. $K = 1 \times 10^{-8} \text{ ms}^{-1}$
Gas Drainage Layer	0.3 m	Gravel HELP default values for total porosity, field capacity, wilting point and saturated hydraulic conductivity ($K = 3.0 \times 10^{-3} \text{ ms}^{-1}$)
Seal Bearing Layer	0.4 m	Sandy Clay Loam HELP default values for total porosity, field capacity, wilting point and saturated hydraulic conductivity ($K = 1.2 \times 10^{-6} \text{ ms}^{-1}$)

5.3.2 HELP model results

The results of HELP modelling are summarised, as a percentage of rainfall infiltrating through the cover profile, is included in Table 5-2.

Table 5-2 HELP model results (percentage infiltration)

Scenario	Total rainfall (mm)	Tipping face	Intermed. cover – flat – bare	Intermed. cover – sloped – revegetated	Final cover
50% AEP median year (1977)	1073	59%	26%	28%	23%
10% AEP wet year (1974)	1620	68%	27%	35%	23%

5.4 Water balance modelling

5.4.1 Landfill staging

For the purposes of the water balance modelling, a number of different scenarios were modelled to reflect the likely staging of the new cells until closure. The different scenarios will be analysed to determine the peak leachate generation volumes for the cells. The different scenarios were developed based on the information provided by Council and the staging plans developed by GHD (Appendix A). Areas and grades were determined based on existing drawings and surveys and proposed future staging plans. Consideration was given to the piggy-back lining progressing over the landfilling stages and how it impacts the leachate generation.

The stages considered included:

- Existing landfilled areas (lined and unlined)

- Cells 1- 9, in accordance with the proposed staging plans (including consideration of reduced in infiltration through the previously landfilled areas as they are piggy-back lined/capped)
- Final landform

As per the EPL and PAC requirements, it has been assumed that all new cells will incorporate a leachate barrier system and associated collection system. As such, 100% collection efficiency (i.e. leachate generation and collection are balanced) has been assumed for the future landfill cells.

Based on discussions with Council, the active tipping face was assumed to be 0.25 ha over the proposed landfilling stages.

5.4.2 Stormwater run-on and run-off

Based on discussions with Council and the information provided, it is understood that all stormwater run-on is diverted away from existing cells and shall continue to be diverted away during the operation of the future cells, as part of the proposed stormwater management strategy. Therefore it was assumed that for all modelled scenarios (for the purposes of the leachate generation modelling) stormwater will be efficiently managed and consequently the stormwater run-on from adjacent areas will not impact leachate generation.

The influence of stormwater falling directly onto the footprint of the existing and proposed landfill footprint was based on the scenario being modelled and whether landfilling is occurring below grade or above grade.

5.4.3 Groundwater inflow

Based on the information provided by Council, it is understood that the existing and proposed landfilling areas do not intersect the groundwater table, and thus for the purposes of this modelling it has been assumed there is no groundwater ingress into the landfill cells.

5.4.4 Unlined areas

Two issues were identified in estimating leachate generation/collection from the unlined areas:

- The amount of leachate flowing out of the these landfilled areas and into the local geology (i.e. not collected)
- The efficiency of the leachate collection system for these areas

It is difficult to ascertain the effects of these issues on leachate generation/collection from the unlined areas without relevant leachate pumping/extraction data for these areas. Given the limited data available (see Section 5.4.6), GHD has adopted a conservative approach to address these issues, assuming no excessive outflow of leachate from the unlined areas and effectively 100% collection efficiency (i.e. leachate generation and collection are balanced). These assumptions could be refined if further relevant site leachate data was collected over time.

5.4.5 Existing and future leachate disposal

As discussed in Section 3.5, the primary leachate disposal for the existing site operations is evaporation via spray irrigation. However, as discussed in Section 4.2, Council are looking to augment the leachate disposal system through installation of package pumping station on-site and a rising main to transfer leachate to Hunter Water Corporation's No. 6 WWPS at Rathmines. Leachate Pond 1 shall be retained for use as a holding pond for the pump station, whilst Leachate Pond 2 will be decommissioned. This is discussed further in Section 5.5.

5.4.6 Comparison with actual data

Council provided GHD with leachate discharge data from the site for the unlined landfilled areas from 2007-2013. GHD has reviewed this data and identified that it indicates higher volumes of leachate collected in comparison to the model's predicted generation volumes, particularly in the most recent available data. Based on GHD's review and our previous experience, we have identified a number of potential causes for this inconsistency:

- There is a potential overlap in the leachate collected from the unlined areas with leachate generated in the lined cell (i.e. leachate flowing from the lined area to the unlined area), as the lined cell is not lined on the western face, which it shares with the unlined landfilled area. The lined cell is also graded towards the unlined area.
- Spray irrigation over the unlined areas has been occurring at the site for a number of years, which increases the actual leachate collection volumes (in comparison to leachate generation volumes) due to the reintroduction of leachate into the system (through infiltration of the irrigated leachate into the waste mass).
- Furthermore, the large amounts of leachate spray irrigation being undertaken at the site may have resulted in saturation of the waste mass, which would result in larger volumes of leachate collection over time (as no absorptive capacity remains for the landfilled waste).

Given the above issues and the complexity of calibrating leachate generation with respect to regular spray irrigation, it was chosen not to calibrate the model using this data. Rather, GHD recommend that Council utilise the model we have developed and seek to collect additional data over time and use this data to recalibrate the model in the future to improve its accuracy.

5.4.7 Estimated leachate generation

The results of the leachate generation modelling can be found in Appendix B and is summarised in Table 5-3 and Table 5-4.

It can be seen that the volume of leachate expected to be collected from the landfill fluctuates throughout the life of the expansion, with the most leachate expected to be generated during Stage 4. The modelling shows that final capped areas produce less leachate than intermediate capped areas so increasing the proportion of the landfill that has final capping in-place, decreases the total volume of rain infiltrating into the waste. Additionally, it should be noted that delaying final capping of completed areas of landfill will increase the volumes of leachate being collected from the cells.

Table 5-3 Leachate generation modelling results – 50% AEP rainfall year

Stage	Average month (kL/month)	Peak month (kL/month)	Total for year (kL)
Existing	4,100	11,200	49,200
1	3,800	8,600	46,100
2	4,300	9,200	52,100
3	4,300	8,400	52,100
4	4,800	9,000	57,600
Final	4,600	8,400	55,000

Table 5-4 Leachate generation modelling results – 10% AEP rainfall year

Stage	Average monthly (kL/month)	Peak month (kL/month)	Total for year (kL)
Existing	7,500	17,400	90,600
1	6,300	12,000	75,800
2	6,900	12,300	83,300
3	6,700	10,400	79,900
4	7,200	10,600	85,800
5	6,300	12,400	80,800

5.5 Estimated required discharge rates

As discussed in Section 5.4.5, Council are proposing to install a sewer connection to the WWPS at Rathmines and utilise the connection as the primary leachate disposal mechanism at the site. The site water balance model was used to estimate the required discharge rates to the WWPS over the life of the site.

Based on iterations the water balance parameters, the following configuration and capacity of the leachate transfer system was developed:

- Maximum transfer capacity of 11.2 L/s
- Maximum 12 hours per day of transfer when the leachate basin is less than 25% full
- Maximum 18 hours per day of transfer when the leachate basin is more than 25% full

Refer to the Site Water Balance Report (GHD, 2014) for further details.

6. Leachate management strategy

6.1 General

A leachate management strategy has been developed for the site based on the environmental and regulatory requirements for the site leachate management system (including the EPL conditions and the PAC conditions), an evaluation of the existing leachate management measures and consideration of the estimated leachate generation over the life of the site. The strategy focusses on expansion and integration of the on-site leachate management system.

6.2 Minimisation

Effective leachate minimisation shall be attained through the following strategies:

- The size of the active face and subsequent daily cover footprint shall be minimised as practical. Improving the cover system will significantly reduce the portion of rainfall able to infiltrate through the cover into the waste (refer Table 5-2).
- Final capping shall be installed once areas that have reached final levels to reduce the portion of rainfall able to infiltrate through the cover into the waste (refer Table 5-2).
- Landfill development shall be efficiently staged as to maximise the amount of final capped areas in comparison to the landfill footprint.
- Landfill development shall be efficiently staged as to maximise the progressive piggy-back capping of the previously landfilled areas over time.
- Designing and commissioning new cells to be staged in a manner which maximises the separation of stormwater and leachate for as long as possible.
- Establishing perimeter diversion drains with each new cell, and maintaining those around existing cells, to direct site stormwater around the landfill areas.

For further details on the proposed stormwater management strategy at the site, including diversion and collection of stormwater on and around the landfilled areas, please consult site Stormwater Management Plan (GHD, 2014).

6.3 Containment and collection

Effective leachate containment and collection shall be attained through the following strategies:

- All future landfill cells shall include a leachate barrier system and associate leachate collection system (details on the proposed leachate barrier and collection system is shown in Appendix D).
- Leachate will continue to be collected from the unlined areas and quarry cell as they are progressively piggy-back capped.

6.4 Storage

Based on the results of the leachate disposal modelling, Leachate Pond 2 shall be decommissioned once the sewer connection has been established. Leachate Pond 1 shall continue to operate as a holding pond for leachate prior to sewer disposal.

6.5 Disposal

As discussed in Section 5.5, Council propose to install and utilise a sewer connection to the HWC's WWPS at Rathmines as the primary leachate disposal mechanism at the site. The sewer connection shall be sized to accommodate the estimate discharge requirements identified in Section 5.5 and the Site Water Balance Report (GHD, 2014). The sewer connection shall consist of an on-site package pumping station (connected to Leachate Pond 1) and an associated rising main.

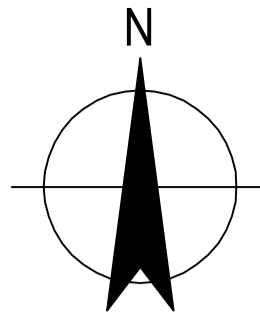
6.6 Monitoring

As discussed in Section 5.4.6, it is recommended that further leachate quantity data is collected over time to recalibrate the model in the future to improve its accuracy. Council shall expand the existing leachate quantity monitoring program to monitor leachate collected from the new landfill cells as they are progressively filled. Council shall also record volumes of any spray irrigation undertaken at the site, and continue to monitor leachate pond capacity and leachate pumping quantities from the existing landfilled areas.

Leachate quality monitoring shall be undertaken at Leachate Pond 1.

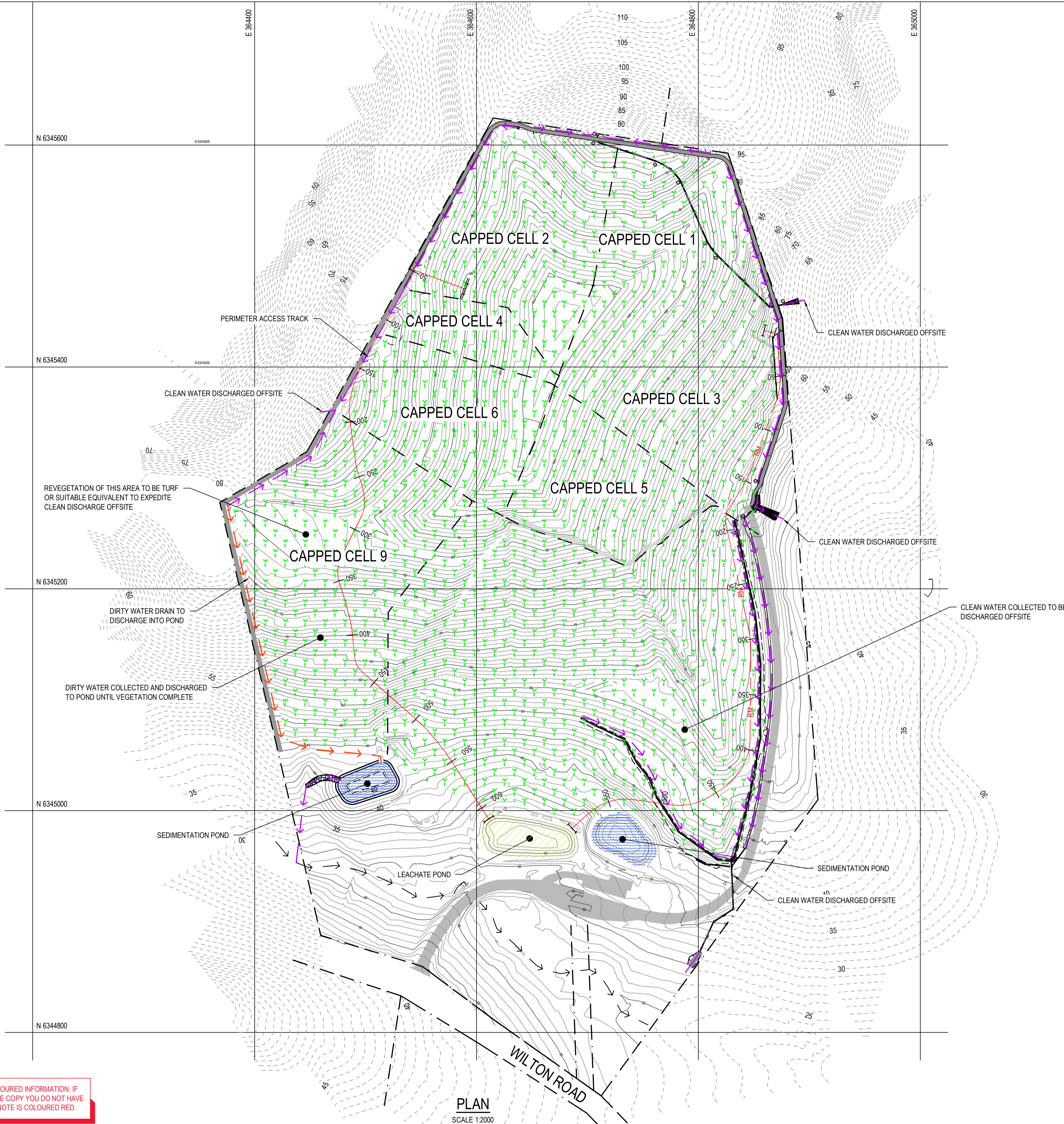
Appendices

Appendix A – Layout plan with landfill cells



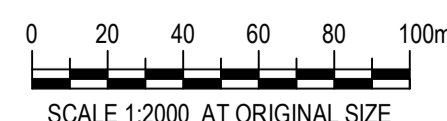
NOTES:
 1. FOR LEGEND AND GENERAL NOTES REFER TO DRAWING 22-16920-C7001.

- LEGEND:**
- APPROXIMATE STAGING BOUNDARIES
 - 60 — MAJOR DESIGN CONTOUR
 - MINOR DESIGN CONTOUR
 - → → CLEAN WATER COLLECTION DRAIN
 - → → DIRTY WATER COLLECTION DRAIN
 - — — DRAINAGE PIPE
 - RM — LEACHATE TRANSFER MAIN
 - → → EXISTING CREEK



THIS DRAWING INCLUDES COLOURED INFORMATION. IF YOU HAVE A BLACK AND WHITE COPY YOU DO NOT HAVE ALL THE INFORMATION. THIS NOTE IS COLOURED RED.

PLAN
SCALE 1:2000



GHD Tower, Level 3
 24 Honeysuckle Drive, Newcastle NSW 2300 Australia
 PO Box 5403 Hunter Rgn Mail Cent, NSW 2310
 T 61 2 4979 9599 F 61 2 4979 9988
 E ntmill@ghd.com W www.ghd.com

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Drawn	I. HAY	Designer	C. DAVIES
Drafting Check	PC. WONG*	Design Check	R. WILKES*
Approved (Project Director)	M. GEBHARD		
Date	19.02.16		
Scale	AS SHOWN		

Client	LAKE MACQUARIE CITY COUNCIL		
Project	AWABA WASTE MANAGEMENT FACILITY EXPANSION		
Title	FINAL LANDFORM PLAN		
Original Size	A1	Drawing No:	22-16920-C7068
		Rev:	D

FOR TENDER

Appendix B – Water balance results

Awaba Landfill



Water Balance	Existing	50%AEP	1977	
Active Tipping Face	5,300	m ²	Total	148,922 m ²
Intermediate Cover - Existing	143,622	m ²		
Intermediate Cover - Proposed - Flat - Bare	-	m ²		
Intermediate Cover - Proposed - Sloped - Grassed	-	m ²		
Final Cap	-	m ²		

Parameter	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total		Percent
	31	28	31	30	31	30	31	31	30	31	30	31	mm	m3	
Precipitation (mm)															
Rainfall (1977) (mm)	66.0	172.2	309.8	20.2	222.0	76.6	4.8	15.6	86.0	38.4	34.4	27.4	1073	159852	100%
Pan Evaporation															
Evaporation (1977) (mm)	205.6	133.6	121.6	107.6	73.2	66.0	76.0	93.2	104.6	161.0	178.6	251.4	1572	234164	146%
Runoff - Calculated using HELP (mm)															
Active Tipping Face	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Intermediate Cover - Existing	0.1	31.1	171.9	0.0	81.0	4.4	0.0	0.0	4.7	0.5	0.0	0.1	294	42166	27%
Intermediate Cover - Proposed - Flat - Bare	3.2	67.0	203.3	0.0	117.0	13.2	0.0	1.1	13.8	3.0	1.1	2.1	425	0	40%
Intermediate Cover - Proposed - Sloped - Grassed	0.2	34.5	177.4	0.0	84.4	5.4	0.0	0.1	5.9	0.7	0.0	0.3	309	0	29%
Final Cap	0.0	5.0	113.8	0.0	35.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	154	0	14%
Total Runoff (m3/month)	9	4459	24681	0	11628	632	0	1	671	65	0	20	42166		
Evapotranspiration - Calculated using HELP (mm)															
Active Tipping Face	64.4	50.7	58.7	13.2	40.5	42.6	11.4	8.2	45.9	41.9	39.4	15.3	432	2290	40%
Intermediate Cover - Existing	66.6	53.8	63.2	12.7	40.2	43.8	16.8	8.0	46.2	46.9	40.7	18.8	458	65737	43%
Intermediate Cover - Proposed - Flat - Bare	54.0	42.6	51.4	13.8	39.6	36.3	5.3	8.4	40.5	26.5	31.2	10.5	360	0	34%
Intermediate Cover - Proposed - Sloped - Grassed	66.8	54.1	63.4	12.7	40.2	43.7	17.2	8.0	46.2	46.1	41.4	18.3	458	0	43%
Final Cap	64.8	66.9	71.2	17.2	39.3	43.4	32.5	6.5	44.1	61.1	42.7	18.3	508	0	47%
Total Evapotranspiration (m3/month)	9911	8001	9384	1895	5987	6512	2476	1193	6881	6961	6050	2777	68027		
Infiltration - Calculated using HELP (mm)															
Active Tipping Face	11.8	45.7	277.0	50.0	74.0	115.5	26.5	0.0	16.6	20.2	0.0	0.0	637	3377	59%
Intermediate Cover - Existing	7.1	28.5	66.9	69.9	10.3	73.5	40.9	0.0	8.5	13.6	0.0	0.0	319	45854	30%
Intermediate Cover - Proposed - Flat - Bare	16.1	27.1	48.1	44.2	6.9	59.8	32.0	2.4	15.0	16.6	9.2	6	284	0	26%
Intermediate Cover - Proposed - Sloped - Grassed	6.2	29.0	63.4	62.7	10.5	71.2	38.8	0.0	8.1	12.1	0.6	0.0	303	0	28%
Final Cap	19.7	6.9	28.1	37.0	38.1	34.3	31.5	27.5	12.4	6.6	2.3	4.3	249	0	23%
Total Infiltration (m3/month)	1083	4338	11072	10308	1878	11170	6012	1	1314	2055	0	0	49231		
Groundwater Inflow (m3/month)	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Leachate Collected (m3/month)	1083	4338	11072	10308	1878	11170	6012	1	1314	2055	0	0	49,231		

Awaba Landfill



Water Balance	Existing	90%AEP	1974	
Active Tipping Face	5,300	m ²	Total	148,922 m ²
Intermediate Cover - Existing	143,622	m ²		
Intermediate Cover - Proposed - Flat - Bare	-	m ²		
Intermediate Cover - Proposed - Sloped - Grassed	-	m ²		
Final Cap	-	m ²		

Parameter	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total		Percent
	31	28	31	30	31	30	31	31	30	31	30	31	mm	m3	
Precipitation (mm)															
Rainfall (1974) (mm)	299.8	109.7	228.0	177.2	263.0	198.0	9.2	67.5	25.0	47.3	146.2	48.8	1620	241208	100%
Pan Evaporation															
Evaporation (1974) (mm)	157.2	136.2	128.8	89.2	67.4	53.0	87.4	98.6	118.6	138.8	159.6	214.0	1449	215757	89%
Runoff - Calculated using HELP (mm)															
Active Tipping Face	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Intermediate Cover - Existing	102.5	11.2	76.6	50.9	127.1	71.6	0.0	7.5	0.0	0.2	26.6	1.7	476	68344	29%
Intermediate Cover - Proposed - Flat - Bare	162.0	25.6	120.0	78.6	177.0	101.6	0.0	17.9	0.0	2.0	47.6	8.5	741	0	46%
Intermediate Cover - Proposed - Sloped - Grassed	109.8	13.2	81.1	55.2	130.2	74.7	0.0	8.6	0.0	0.3	29.8	2.4	505	0	31%
Final Cap	37.6	1.7	27.4	19.5	55.0	36.3	0.0	0.4	0.0	0.0	6.7	0.0	185	0	11%
Total Runoff (m3/month)	14727	1601	11007	7309	18257	10282	0	1070	0	26	3820	244	68344		
Evapotranspiration - Calculated using HELP (mm)															
Active Tipping Face	73.8	45.2	62.0	59.7	38.8	43.9	10.2	11.6	28.7	30.4	64.8	39.5	509	2695	31%
Intermediate Cover - Existing	76.1	45.4	64.1	59.3	45.1	43.8	13.6	11.4	33.3	34.8	67.5	42.9	537	77191	33%
Intermediate Cover - Proposed - Flat - Bare	59.1	46.3	53.0	55.9	32.8	38.0	8.5	11.7	21.7	31.0	53.6	27.7	439	0	27%
Intermediate Cover - Proposed - Sloped - Grassed	76.3	45.0	64.3	59.3	45.1	43.8	14.4	11.4	32.9	34.5	67.5	42.2	537	0	33%
Final Cap	82.7	59.9	70.8	58.5	50.7	43.5	29.7	11.1	48.5	27.7	77.4	58.9	619	0	38%
Total Evapotranspiration (m3/month)	11325	6766	9533	8828	6689	6528	2012	1699	4935	5159	10041	6373	79886		
Infiltration - Calculated using HELP (mm)															
Active Tipping Face	123.9	105.8	82.2	123.1	144.8	298.0	76.7	0.0	44.1	0.4	36.6	62.9	1098	5821	68%
Intermediate Cover - Existing	19.0	90.7	39.8	56.1	74.6	78.8	118.4	24.8	31.8	0.0	19.2	36.8	590	84736	36%
Intermediate Cover - Proposed - Flat - Bare	15.9	70.5	37.7	42.4	51.3	33.0	83.6	0.6	33.2	6.0	27.1	32	433	0	27%
Intermediate Cover - Proposed - Sloped - Grassed	18.3	88.3	39.1	53.8	69.1	72.8	115.1	21.6	30.1	0.0	18.6	35.5	562	0	35%
Final Cap	20.8	33.1	34.9	35.9	36.1	29.9	38.2	56.2	42.1	15.6	11.1	11.7	366	0	23%
Total Infiltration (m3/month)	3390	13590	6147	8716	11485	12891	17405	3559	4797	2	2952	5625	90558		
Groundwater Inflow (m3/month)	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Leachate Collected (m3/month)	3390	13590	6147	8716	11485	12891	17405	3559	4797	2	2952	5625	90,558		

Awaba Landfill

Water Balance

Stage 1 50%AEP 1977



Active Tipping Face	2,500	m ²	Total	165,463	m ²
Intermediate Cover - Existing	-	m ²			
Intermediate Cover - Proposed - Flat - Bare	17,500	m ²			
Intermediate Cover - Proposed - Sloped - Grassed	62,463	m ²			
Final Cap	83,000	m ²			

Parameter	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total		Percent	
	31	28	31	30	31	30	31	31	30	31	30	31	mm	m3		
Precipitation (mm)																
Rainfall (1977) (mm)	66.0	172.2	309.8	20.2	222.0	76.6	4.8	15.6	86.0	38.4	34.4	27.4	1073	177608	100%	
Pan Evaporation																
Evaporation (1977) (mm)	205.6	133.6	121.6	107.6	73.2	66.0	76.0	93.2	104.6	161.0	178.6	251.4	1572	129665	146%	
Runoff - Calculated using HELP (mm)																
Active Tipping Face	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%	
Intermediate Cover - Existing	0.1	31.1	171.9	0.0	81.0	4.4	0.0	0.0	4.7	0.5	0.0	0.1	294	0	27%	
Intermediate Cover - Proposed - Flat - Bare	3.2	67.0	203.3	0.0	117.0	13.2	0.0	1.1	13.8	3.0	1.1	2.1	425	7433	40%	
Intermediate Cover - Proposed - Sloped - Grassed	0.2	34.5	177.4	0.0	84.4	5.4	0.0	0.1	5.9	0.7	0.0	0.3	309	19290	29%	
Final Cap	0.0	5.0	113.8	0.0	35.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	154	12779	14%	
Total Runoff (m3/month)	67	3744	24084	0	10222	577	0	23	608	99	21	56	39501			
Evapotranspiration - Calculated using HELP (mm)																
Active Tipping Face	64.4	50.7	58.7	13.2	40.5	42.6	11.4	8.2	45.9	41.9	39.4	15.3	432	1080	40%	
Intermediate Cover - Existing	66.6	53.8	63.2	12.7	40.2	43.8	16.8	8.0	46.2	46.9	40.7	18.8	458	0	43%	
Intermediate Cover - Proposed - Flat - Bare	54.0	42.6	51.4	13.8	39.6	36.3	5.3	8.4	40.5	26.5	31.2	10.5	360	6302	34%	
Intermediate Cover - Proposed - Sloped - Grassed	66.8	54.1	63.4	12.7	40.2	43.7	17.2	8.0	46.2	46.1	41.4	18.3	458	28618	43%	
Final Cap	64.8	66.9	71.2	17.2	39.3	43.4	32.5	6.5	44.1	61.1	42.7	18.3	508	42157	47%	
Total Evapotranspiration (m3/month)	10653	9804	10917	2493	6570	7079	3893	1203	7370	8514	6776	2885	78158			
Infiltration - Calculated using HELP (mm)																
Active Tipping Face	11.8	45.7	277.0	50.0	74.0	115.5	26.5	0.0	16.6	20.2	0.0	0.0	637	1593	59%	
Intermediate Cover - Existing	7.1	28.5	66.9	69.9	10.3	73.5	40.9	0.0	8.5	13.6	0.0	0.0	319	0	30%	
Intermediate Cover - Proposed - Flat - Bare	16.1	27.1	48.1	44.2	6.9	59.8	32.0	2.4	15.0	16.6	9.2	6	284	4967	26%	
Intermediate Cover - Proposed - Sloped - Grassed	6.2	29.0	63.4	62.7	10.5	71.2	38.8	0.0	8.1	12.1	0.6	0.0	303	18920	28%	
Final Cap	19.7	6.9	28.1	37.0	38.1	34.3	31.5	27.5	12.4	6.6	2.3	4.3	249	20643	23%	
Total Infiltration (m3/month)	2335	2974	7829	7884	4129	8632	5666	2329	1838	1651	389	467	46123			
Groundwater Inflow (m3/month)	0	0	0	0	0	0	0	0	0	0	0	0	0			
Total Leachate Collected (m3/month)	2335	2974	7829	7884	4129	8632	5666	2329	1838	1651	389	467	46,123			

Awaba Landfill

Water Balance

Stage 1 90%AEP 1974



Active Tipping Face	2,500	m ²	Total	165,463	m ²
Intermediate Cover - Existing	-	m ²			
Intermediate Cover - Proposed - Flat - Bare	17,500	m ²			
Intermediate Cover - Proposed - Sloped - Grassed	62,463	m ²			
Final Cap	83,000	m ²			

Parameter	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total		Percent
	31	28	31	30	31	30	31	31	30	31	30	31	mm	m3	
Precipitation (mm)															
Rainfall (1974) (mm)	299.8	109.7	228.0	177.2	263.0	198.0	9.2	67.5	25.0	47.3	146.2	48.8	1620	268001	100%
Pan Evaporation															
Evaporation (1974) (mm)	157.2	136.2	128.8	89.2	67.4	53.0	87.4	98.6	118.6	138.8	159.6	214.0	1449	119473	89%
Runoff - Calculated using HELP (mm)															
Active Tipping Face	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Intermediate Cover - Existing	102.5	11.2	76.6	50.9	127.1	71.6	0.0	7.5	0.0	0.2	26.6	1.7	476	0	29%
Intermediate Cover - Proposed - Flat - Bare	162.0	25.6	120.0	78.6	177.0	101.6	0.0	17.9	0.0	2.0	47.6	8.5	741	12964	46%
Intermediate Cover - Proposed - Sloped - Grassed	109.8	13.2	81.1	55.2	130.2	74.7	0.0	8.6	0.0	0.3	29.8	2.4	505	31558	31%
Final Cap	37.6	1.7	27.4	19.5	55.0	36.3	0.0	0.4	0.0	0.0	6.7	0.0	185	15323	11%
Total Runoff (m3/month)	12814	1416	9438	6444	15792	9454	0	879	0	57	3253	298	59845		
Evapotranspiration - Calculated using HELP (mm)															
Active Tipping Face	73.8	45.2	62.0	59.7	38.8	43.9	10.2	11.6	28.7	30.4	64.8	39.5	509	1271	31%
Intermediate Cover - Existing	76.1	45.4	64.1	59.3	45.1	43.8	13.6	11.4	33.3	34.8	67.5	42.9	537	0	33%
Intermediate Cover - Proposed - Flat - Bare	59.1	46.3	53.0	55.9	32.8	38.0	8.5	11.7	21.7	31.0	53.6	27.7	439	7689	27%
Intermediate Cover - Proposed - Sloped - Grassed	76.3	45.0	64.3	59.3	45.1	43.8	14.4	11.4	32.9	34.5	67.5	42.2	537	33520	33%
Final Cap	82.7	59.9	70.8	58.5	50.7	43.5	29.7	11.1	48.5	27.7	77.4	58.9	619	51408	38%
Total Evapotranspiration (m3/month)	12854	8709	10973	9686	7700	7120	3539	1865	6528	5070	11737	8108	93889		
Infiltration - Calculated using HELP (mm)															
Active Tipping Face	123.9	105.8	82.2	123.1	144.8	298.0	76.7	0.0	44.1	0.4	36.6	62.9	1098	2746	68%
Intermediate Cover - Existing	19.0	90.7	39.8	56.1	74.6	78.8	118.4	24.8	31.8	0.0	19.2	36.8	590	0	36%
Intermediate Cover - Proposed - Flat - Bare	15.9	70.5	37.7	42.4	51.3	33.0	83.6	0.6	33.2	6.0	27.1	32	433	7581	27%
Intermediate Cover - Proposed - Sloped - Grassed	18.3	88.3	39.1	53.8	69.1	72.8	115.1	21.6	30.1	0.0	18.6	35.5	562	35120	35%
Final Cap	20.8	33.1	34.9	35.9	36.1	29.9	38.2	56.2	42.1	15.6	11.1	11.7	366	30349	23%
Total Infiltration (m3/month)	3453	9764	6206	7387	8571	8354	12016	6024	6066	1405	2650	3898	75796		
Groundwater Inflow (m3/month)	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Leachate Collected (m3/month)	3453	9764	6206	7387	8571	8354	12016	6024	6066	1405	2650	3898	75,796		

Awaba Landfill

Water Balance

Stage 2 50%AEP 1977



Active Tipping Face	2,500	m ²	Total	191,368	m ²
Intermediate Cover - Existing	-	m ²			
Intermediate Cover - Proposed - Flat - Bare	20,000	m ²			
Intermediate Cover - Proposed - Sloped - Grassed	51,568	m ²			
Final Cap	117,300	m ²			

Parameter	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total		Percent
	31	28	31	30	31	30	31	31	30	31	30	31	mm	m3	
Precipitation (mm)															
Rainfall (1977) (mm)	66.0	172.2	309.8	20.2	222.0	76.6	4.8	15.6	86.0	38.4	34.4	27.4	1073	205415	100%
Pan Evaporation															
Evaporation (1977) (mm)	205.6	133.6	121.6	107.6	73.2	66.0	76.0	93.2	104.6	161.0	178.6	251.4	1572	116465	146%
Runoff - Calculated using HELP (mm)															
Active Tipping Face	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Intermediate Cover - Existing	0.1	31.1	171.9	0.0	81.0	4.4	0.0	0.0	4.7	0.5	0.0	0.1	294	0	27%
Intermediate Cover - Proposed - Flat - Bare	3.2	67.0	203.3	0.0	117.0	13.2	0.0	1.1	13.8	3.0	1.1	2.1	425	8495	40%
Intermediate Cover - Proposed - Sloped - Grassed	0.2	34.5	177.4	0.0	84.4	5.4	0.0	0.1	5.9	0.7	0.0	0.3	309	15925	29%
Final Cap	0.0	5.0	113.8	0.0	35.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	154	18060	14%
Total Runoff (m3/month)	73	3708	26564	0	10794	557	0	25	578	99	24	58	42479		
Evapotranspiration - Calculated using HELP (mm)															
Active Tipping Face	64.4	50.7	58.7	13.2	40.5	42.6	11.4	8.2	45.9	41.9	39.4	15.3	432	1080	40%
Intermediate Cover - Existing	66.6	53.8	63.2	12.7	40.2	43.8	16.8	8.0	46.2	46.9	40.7	18.8	458	0	43%
Intermediate Cover - Proposed - Flat - Bare	54.0	42.6	51.4	13.8	39.6	36.3	5.3	8.4	40.5	26.5	31.2	10.5	360	7203	34%
Intermediate Cover - Proposed - Sloped - Grassed	66.8	54.1	63.4	12.7	40.2	43.7	17.2	8.0	46.2	46.1	41.4	18.3	458	23626	43%
Final Cap	64.8	66.9	71.2	17.2	39.3	43.4	32.5	6.5	44.1	61.1	42.7	18.3	508	59579	47%
Total Evapotranspiration (m3/month)	12281	11614	12797	2979	7580	8183	4832	1359	8480	10174	7868	3340	91488		
Infiltration - Calculated using HELP (mm)															
Active Tipping Face	11.8	45.7	277.0	50.0	74.0	115.5	26.5	0.0	16.6	20.2	0.0	0.0	637	1593	59%
Intermediate Cover - Existing	7.1	28.5	66.9	69.9	10.3	73.5	40.9	0.0	8.5	13.6	0.0	0.0	319	0	30%
Intermediate Cover - Proposed - Flat - Bare	16.1	27.1	48.1	44.2	6.9	59.8	32.0	2.4	15.0	16.6	9.2	6	284	5676	26%
Intermediate Cover - Proposed - Sloped - Grassed	6.2	29.0	63.4	62.7	10.5	71.2	38.8	0.0	8.1	12.1	0.6	0.0	303	15620	28%
Final Cap	19.7	6.9	28.1	37.0	38.1	34.3	31.5	27.5	12.4	6.6	2.3	4.3	249	29174	23%
Total Infiltration (m3/month)	2983	2961	8221	8580	5340	9182	6404	3280	2212	1787	484	630	52063		
Groundwater Inflow (m3/month)	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Leachate Collected (m3/month)	2983	2961	8221	8580	5340	9182	6404	3280	2212	1787	484	630	52,063		

Awaba Landfill

Water Balance

Stage 2 90%AEP 1974



Active Tipping Face	2,500	m ²	Total	191,368	m ²
Intermediate Cover - Existing	-	m ²			
Intermediate Cover - Proposed - Flat - Bare	20,000	m ²			
Intermediate Cover - Proposed - Sloped - Grassed	51,568	m ²			
Final Cap	117,300	m ²			

Parameter	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total		Percent
	31	28	31	30	31	30	31	31	30	31	30	31	mm	m3	
Precipitation (mm)	31 28 31 30 31 30 31 31 30 31 30 31														
Rainfall (1974) (mm)	299.8	109.7	228.0	177.2	263.0	198.0	9.2	67.5	25.0	47.3	146.2	48.8	1620	309959	100%
Pan Evaporation															
Evaporation (1974) (mm)	157.2	136.2	128.8	89.2	67.4	53.0	87.4	98.6	118.6	138.8	159.6	214.0	1449	107310	89%
Runoff - Calculated using HELP (mm)															
Active Tipping Face	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Intermediate Cover - Existing	102.5	11.2	76.6	50.9	127.1	71.6	0.0	7.5	0.0	0.2	26.6	1.7	476	0	29%
Intermediate Cover - Proposed - Flat - Bare	162.0	25.6	120.0	78.6	177.0	101.6	0.0	17.9	0.0	2.0	47.6	8.5	741	14816	46%
Intermediate Cover - Proposed - Sloped - Grassed	109.8	13.2	81.1	55.2	130.2	74.7	0.0	8.6	0.0	0.3	29.8	2.4	505	26054	31%
Final Cap	37.6	1.7	27.4	19.5	55.0	36.3	0.0	0.4	0.0	0.0	6.7	0.0	185	21655	11%
Total Runoff (m3/month)	13313	1395	9796	6710	16701	10139	0	842	0	58	3278	293	62525		
Evapotranspiration - Calculated using HELP (mm)															
Active Tipping Face	73.8	45.2	62.0	59.7	38.8	43.9	10.2	11.6	28.7	30.4	64.8	39.5	509	1271	31%
Intermediate Cover - Existing	76.1	45.4	64.1	59.3	45.1	43.8	13.6	11.4	33.3	34.8	67.5	42.9	537	0	33%
Intermediate Cover - Proposed - Flat - Bare	59.1	46.3	53.0	55.9	32.8	38.0	8.5	11.7	21.7	31.0	53.6	27.7	439	8788	27%
Intermediate Cover - Proposed - Sloped - Grassed	76.3	45.0	64.3	59.3	45.1	43.8	14.4	11.4	32.9	34.5	67.5	42.2	537	27674	33%
Final Cap	82.7	59.9	70.8	58.5	50.7	43.5	29.7	11.1	48.5	27.7	77.4	58.9	619	72652	38%
Total Evapotranspiration (m3/month)	15008	10390	12833	11187	9031	8228	4422	2150	7886	5721	13790	9739	110385		
Infiltration - Calculated using HELP (mm)															
Active Tipping Face	123.9	105.8	82.2	123.1	144.8	298.0	76.7	0.0	44.1	0.4	36.6	62.9	1098	2746	68%
Intermediate Cover - Existing	19.0	90.7	39.8	56.1	74.6	78.8	118.4	24.8	31.8	0.0	19.2	36.8	590	0	36%
Intermediate Cover - Proposed - Flat - Bare	15.9	70.5	37.7	42.4	51.3	33.0	83.6	0.6	33.2	6.0	27.1	32	433	8664	27%
Intermediate Cover - Proposed - Sloped - Grassed	18.3	88.3	39.1	53.8	69.1	72.8	115.1	21.6	30.1	0.0	18.6	35.5	562	28994	35%
Final Cap	20.8	33.1	34.9	35.9	36.1	29.9	38.2	56.2	42.1	15.6	11.1	11.7	366	42891	23%
Total Infiltration (m3/month)	4006	10116	7073	8138	9185	8669	12281	7717	7265	1957	2897	3991	83295		
Groundwater Inflow (m3/month)	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Leachate Collected (m3/month)	4006	10116	7073	8138	9185	8669	12281	7717	7265	1957	2897	3991	83,295		

Awaba Landfill

Water Balance

Stage 3 50%AEP 1977



Active Tipping Face	2,500	m ²	Total	197,653	m ²
Intermediate Cover - Existing	-	m ²			
Intermediate Cover - Proposed - Flat - Bare	23,500	m ²			
Intermediate Cover - Proposed - Sloped - Grassed	21,353	m ²			
Final Cap	150,300	m ²			

Parameter	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total		Percent
	31	28	31	30	31	30	31	31	30	31	30	31	mm	m3	
Precipitation (mm)															
Rainfall (1977) (mm)	66.0	172.2	309.8	20.2	222.0	76.6	4.8	15.6	86.0	38.4	34.4	27.4	1073	212161	100%
Pan Evaporation															
Evaporation (1977) (mm)	205.6	133.6	121.6	107.6	73.2	66.0	76.0	93.2	104.6	161.0	178.6	251.4	1572	74458	146%
Runoff - Calculated using HELP (mm)															
Active Tipping Face	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Intermediate Cover - Existing	0.1	31.1	171.9	0.0	81.0	4.4	0.0	0.0	4.7	0.5	0.0	0.1	294	0	27%
Intermediate Cover - Proposed - Flat - Bare	3.2	67.0	203.3	0.0	117.0	13.2	0.0	1.1	13.8	3.0	1.1	2.1	425	9981	40%
Intermediate Cover - Proposed - Sloped - Grassed	0.2	34.5	177.4	0.0	84.4	5.4	0.0	0.1	5.9	0.7	0.0	0.3	309	6594	29%
Final Cap	0.0	5.0	113.8	0.0	35.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	154	23140	14%
Total Runoff (m3/month)	79	3065	25673	0	9807	446	0	27	449	87	27	56	39716		
Evapotranspiration - Calculated using HELP (mm)															
Active Tipping Face	64.4	50.7	58.7	13.2	40.5	42.6	11.4	8.2	45.9	41.9	39.4	15.3	432	1080	40%
Intermediate Cover - Existing	66.6	53.8	63.2	12.7	40.2	43.8	16.8	8.0	46.2	46.9	40.7	18.8	458	0	43%
Intermediate Cover - Proposed - Flat - Bare	54.0	42.6	51.4	13.8	39.6	36.3	5.3	8.4	40.5	26.5	31.2	10.5	360	8463	34%
Intermediate Cover - Proposed - Sloped - Grassed	66.8	54.1	63.4	12.7	40.2	43.7	17.2	8.0	46.2	46.1	41.4	18.3	458	9783	43%
Final Cap	64.8	66.9	71.2	17.2	39.3	43.4	32.5	6.5	44.1	61.1	42.7	18.3	508	76340	47%
Total Evapotranspiration (m3/month)	12588	12334	13412	3211	7802	8422	5401	1361	8681	10890	8137	3428	95667		
Infiltration - Calculated using HELP (mm)															
Active Tipping Face	11.8	45.7	277.0	50.0	74.0	115.5	26.5	0.0	16.6	20.2	0.0	0.0	637	1593	59%
Intermediate Cover - Existing	7.1	28.5	66.9	69.9	10.3	73.5	40.9	0.0	8.5	13.6	0.0	0.0	319	0	30%
Intermediate Cover - Proposed - Flat - Bare	16.1	27.1	48.1	44.2	6.9	59.8	32.0	2.4	15.0	16.6	9.2	6	284	6669	26%
Intermediate Cover - Proposed - Sloped - Grassed	6.2	29.0	63.4	62.7	10.5	71.2	38.8	0.0	8.1	12.1	0.6	0.0	303	6468	28%
Final Cap	19.7	6.9	28.1	37.0	38.1	34.3	31.5	27.5	12.4	6.6	2.3	4.3	249	37382	23%
Total Infiltration (m3/month)	3501	2405	7400	8060	6305	8370	6383	4197	2428	1697	573	794	52112		
Groundwater Inflow (m3/month)	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Leachate Collected (m3/month)	3501	2405	7400	8060	6305	8370	6383	4197	2428	1697	573	794	52,112		

Awaba Landfill

Water Balance

Stage 3 90%AEP 1974



Active Tipping Face	2,500	m ²	Total	197,653	m ²
Intermediate Cover - Existing	-	m ²			
Intermediate Cover - Proposed - Flat - Bare	23,500	m ²			
Intermediate Cover - Proposed - Sloped - Grassed	21,353	m ²			
Final Cap	150,300	m ²			

Parameter	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total		Percent
	31	28	31	30	31	30	31	31	30	31	30	31	mm	m3	
Precipitation (mm)															
Rainfall (1974) (mm)	299.8	109.7	228.0	177.2	263.0	198.0	9.2	67.5	25.0	47.3	146.2	48.8	1620	320139	100%
Pan Evaporation															
Evaporation (1974) (mm)	157.2	136.2	128.8	89.2	67.4	53.0	87.4	98.6	118.6	138.8	159.6	214.0	1449	68605	89%
Runoff - Calculated using HELP (mm)															
Active Tipping Face	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Intermediate Cover - Existing	102.5	11.2	76.6	50.9	127.1	71.6	0.0	7.5	0.0	0.2	26.6	1.7	476	0	29%
Intermediate Cover - Proposed - Flat - Bare	162.0	25.6	120.0	78.6	177.0	101.6	0.0	17.9	0.0	2.0	47.6	8.5	741	17409	46%
Intermediate Cover - Proposed - Sloped - Grassed	109.8	13.2	81.1	55.2	130.2	74.7	0.0	8.6	0.0	0.3	29.8	2.4	505	10788	31%
Final Cap	37.6	1.7	27.4	19.5	55.0	36.3	0.0	0.4	0.0	0.0	6.7	0.0	185	27747	11%
Total Runoff (m3/month)	11805	1142	8671	5961	15201	9435	0	656	0	55	2767	251	55944		
Evapotranspiration - Calculated using HELP (mm)															
Active Tipping Face	73.8	45.2	62.0	59.7	38.8	43.9	10.2	11.6	28.7	30.4	64.8	39.5	509	1271	31%
Intermediate Cover - Existing	76.1	45.4	64.1	59.3	45.1	43.8	13.6	11.4	33.3	34.8	67.5	42.9	537	0	33%
Intermediate Cover - Proposed - Flat - Bare	59.1	46.3	53.0	55.9	32.8	38.0	8.5	11.7	21.7	31.0	53.6	27.7	439	10326	27%
Intermediate Cover - Proposed - Sloped - Grassed	76.3	45.0	64.3	59.3	45.1	43.8	14.4	11.4	32.9	34.5	67.5	42.2	537	11459	33%
Final Cap	82.7	59.9	70.8	58.5	50.7	43.5	29.7	11.1	48.5	27.7	77.4	58.9	619	93091	38%
Total Evapotranspiration (m3/month)	15639	11170	13414	11523	9456	8471	4996	2212	8567	5701	14492	10506	116147		
Infiltration - Calculated using HELP (mm)															
Active Tipping Face	123.9	105.8	82.2	123.1	144.8	298.0	76.7	0.0	44.1	0.4	36.6	62.9	1098	2746	68%
Intermediate Cover - Existing	19.0	90.7	39.8	56.1	74.6	78.8	118.4	24.8	31.8	0.0	19.2	36.8	590	0	36%
Intermediate Cover - Proposed - Flat - Bare	15.9	70.5	37.7	42.4	51.3	33.0	83.6	0.6	33.2	6.0	27.1	32	433	10180	27%
Intermediate Cover - Proposed - Sloped - Grassed	18.3	88.3	39.1	53.8	69.1	72.8	115.1	21.6	30.1	0.0	18.6	35.5	562	12006	35%
Final Cap	20.8	33.1	34.9	35.9	36.1	29.9	38.2	56.2	42.1	15.6	11.1	11.7	366	54958	23%
Total Infiltration (m3/month)	4194	8789	7177	7846	8469	7572	10355	8921	7860	2494	2797	3414	79889		
Groundwater Inflow (m3/month)	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Leachate Collected (m3/month)	4194	8789	7177	7846	8469	7572	10355	8921	7860	2494	2797	3414	79,889		

Awaba Landfill

Water Balance

Stage 4 50%AEP 1977



Active Tipping Face	2,500	m ²	Total	221,100	m ²
Intermediate Cover - Existing	-	m ²			
Intermediate Cover - Proposed - Flat - Bare	46,300	m ²			
Intermediate Cover - Proposed - Sloped - Grassed	-	m ²			
Final Cap	172,300	m ²			

Parameter	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total		Percent
	31	28	31	30	31	30	31	31	30	31	30	31	mm	m3	
Precipitation (mm)															
Rainfall (1977) (mm)	66.0	172.2	309.8	20.2	222.0	76.6	4.8	15.6	86.0	38.4	34.4	27.4	1073	237329	100%
Pan Evaporation															
Evaporation (1977) (mm)	205.6	133.6	121.6	107.6	73.2	66.0	76.0	93.2	104.6	161.0	178.6	251.4	1572	76733	146%
Runoff - Calculated using HELP (mm)															
Active Tipping Face	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Intermediate Cover - Existing	0.1	31.1	171.9	0.0	81.0	4.4	0.0	0.0	4.7	0.5	0.0	0.1	294	0	27%
Intermediate Cover - Proposed - Flat - Bare	3.2	67.0	203.3	0.0	117.0	13.2	0.0	1.1	13.8	3.0	1.1	2.1	425	19665	40%
Intermediate Cover - Proposed - Sloped - Grassed	0.2	34.5	177.4	0.0	84.4	5.4	0.0	0.1	5.9	0.7	0.0	0.3	309	0	29%
Final Cap	0.0	5.0	113.8	0.0	35.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	154	26527	14%
Total Runoff (m3/month)	148	3965	29024	0	11441	635	0	50	638	140	52	99	46192		
Evapotranspiration - Calculated using HELP (mm)															
Active Tipping Face	64.4	50.7	58.7	13.2	40.5	42.6	11.4	8.2	45.9	41.9	39.4	15.3	432	1080	40%
Intermediate Cover - Existing	66.6	53.8	63.2	12.7	40.2	43.8	16.8	8.0	46.2	46.9	40.7	18.8	458	0	43%
Intermediate Cover - Proposed - Flat - Bare	54.0	42.6	51.4	13.8	39.6	36.3	5.3	8.4	40.5	26.5	31.2	10.5	360	16674	34%
Intermediate Cover - Proposed - Sloped - Grassed	66.8	54.1	63.4	12.7	40.2	43.7	17.2	8.0	46.2	46.1	41.4	18.3	458	0	43%
Final Cap	64.8	66.9	71.2	17.2	39.3	43.4	32.5	6.5	44.1	61.1	42.7	18.3	508	87515	47%
Total Evapotranspiration (m3/month)	13816	13621	14798	3632	8713	9272	5869	1523	9587	11854	8905	3678	105269		
Infiltration - Calculated using HELP (mm)															
Active Tipping Face	11.8	45.7	277.0	50.0	74.0	115.5	26.5	0.0	16.6	20.2	0.0	0.0	637	1593	59%
Intermediate Cover - Existing	7.1	28.5	66.9	69.9	10.3	73.5	40.9	0.0	8.5	13.6	0.0	0.0	319	0	30%
Intermediate Cover - Proposed - Flat - Bare	16.1	27.1	48.1	44.2	6.9	59.8	32.0	2.4	15.0	16.6	9.2	6	284	13140	26%
Intermediate Cover - Proposed - Sloped - Grassed	6.2	29.0	63.4	62.7	10.5	71.2	38.8	0.0	8.1	12.1	0.6	0.0	303	0	28%
Final Cap	19.7	6.9	28.1	37.0	38.1	34.3	31.5	27.5	12.4	6.6	2.3	4.3	249	42854	23%
Total Infiltration (m3/month)	4169	2555	7761	8543	7077	8967	6976	4858	2870	1963	819	1031	57587		
Groundwater Inflow (m3/month)	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Leachate Collected (m3/month)	4169	2555	7761	8543	7077	8967	6976	4858	2870	1963	819	1031	57,587		

Awaba Landfill

Water Balance

Stage 4 90%AEP 1974



Active Tipping Face	2,500	m ²	Total	221,100	m ²
Intermediate Cover - Existing	-	m ²			
Intermediate Cover - Proposed - Flat - Bare	46,300	m ²			
Intermediate Cover - Proposed - Sloped - Grassed	-	m ²			
Final Cap	172,300	m ²			

Parameter	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total		Percent
	31	28	31	30	31	30	31	31	30	31	30	31	mm	m3	
Precipitation (mm)															
Rainfall (1974) (mm)	299.8	109.7	228.0	177.2	263.0	198.0	9.2	67.5	25.0	47.3	146.2	48.8	1620	358116	100%
Pan Evaporation															
Evaporation (1974) (mm)	157.2	136.2	128.8	89.2	67.4	53.0	87.4	98.6	118.6	138.8	159.6	214.0	1449	70701	89%
Runoff - Calculated using HELP (mm)															
Active Tipping Face	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Intermediate Cover - Existing	102.5	11.2	76.6	50.9	127.1	71.6	0.0	7.5	0.0	0.2	26.6	1.7	476	0	29%
Intermediate Cover - Proposed - Flat - Bare	162.0	25.6	120.0	78.6	177.0	101.6	0.0	17.9	0.0	2.0	47.6	8.5	741	34300	46%
Intermediate Cover - Proposed - Sloped - Grassed	109.8	13.2	81.1	55.2	130.2	74.7	0.0	8.6	0.0	0.3	29.8	2.4	505	0	31%
Final Cap	37.6	1.7	27.4	19.5	55.0	36.3	0.0	0.4	0.0	0.0	6.7	0.0	185	31808	11%
Total Runoff (m3/month)	13983	1481	10279	7004	17666	10955	0	887	0	94	3365	394	66108		
Evapotranspiration - Calculated using HELP (mm)															
Active Tipping Face	73.8	45.2	62.0	59.7	38.8	43.9	10.2	11.6	28.7	30.4	64.8	39.5	509	1271	31%
Intermediate Cover - Existing	76.1	45.4	64.1	59.3	45.1	43.8	13.6	11.4	33.3	34.8	67.5	42.9	537	0	33%
Intermediate Cover - Proposed - Flat - Bare	59.1	46.3	53.0	55.9	32.8	38.0	8.5	11.7	21.7	31.0	53.6	27.7	439	20344	27%
Intermediate Cover - Proposed - Sloped - Grassed	76.3	45.0	64.3	59.3	45.1	43.8	14.4	11.4	32.9	34.5	67.5	42.2	537	0	33%
Final Cap	82.7	59.9	70.8	58.5	50.7	43.5	29.7	11.1	48.5	27.7	77.4	58.9	619	106717	38%
Total Evapotranspiration (m3/month)	17177	12584	14807	12820	10356	9358	5534	2480	9426	6281	15976	11534	128332		
Infiltration - Calculated using HELP (mm)															
Active Tipping Face	123.9	105.8	82.2	123.1	144.8	298.0	76.7	0.0	44.1	0.4	36.6	62.9	1098	2746	68%
Intermediate Cover - Existing	19.0	90.7	39.8	56.1	74.6	78.8	118.4	24.8	31.8	0.0	19.2	36.8	590	0	36%
Intermediate Cover - Proposed - Flat - Bare	15.9	70.5	37.7	42.4	51.3	33.0	83.6	0.6	33.2	6.0	27.1	32	433	20056	27%
Intermediate Cover - Proposed - Sloped - Grassed	18.3	88.3	39.1	53.8	69.1	72.8	115.1	21.6	30.1	0.0	18.6	35.5	562	0	35%
Final Cap	20.8	33.1	34.9	35.9	36.1	29.9	38.2	56.2	42.1	15.6	11.1	11.7	366	63002	23%
Total Infiltration (m3/month)	4623	9242	7971	8454	8957	7429	10642	9709	8901	2976	3263	3638	85804		
Groundwater Inflow (m3/month)	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Leachate Collected (m3/month)	4623	9242	7971	8454	8957	7429	10642	9709	8901	2976	3263	3638	85,804		

Awaba Landfill



Water Balance	Final	50%AEP	1977	
Active Tipping Face	-	m ²	Total	221,100 m ²
Intermediate Cover - Existing	-	m ²		
Intermediate Cover - Proposed - Flat - Bare	-	m ²		
Intermediate Cover - Proposed - Sloped - Grassed	-	m ²		
Final Cap	221,100	m ²		

Parameter	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total		Percent	
	31	28	31	30	31	30	31	31	30	31	30	31	mm	m3		
Precipitation (mm)																
Rainfall (1977) (mm)	66.0	172.2	309.8	20.2	222.0	76.6	4.8	15.6	86.0	38.4	34.4	27.4	1073	237329	100%	
Pan Evaporation																
Evaporation (1977) (mm)	205.6	133.6	121.6	107.6	73.2	66.0	76.0	93.2	104.6	161.0	178.6	251.4	1572	0	146%	
Runoff - Calculated using HELP (mm)																
Active Tipping Face	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%	
Intermediate Cover - Existing	0.1	31.1	171.9	0.0	81.0	4.4	0.0	0.0	4.7	0.5	0.0	0.1	294	0	27%	
Intermediate Cover - Proposed - Flat - Bare	3.2	67.0	203.3	0.0	117.0	13.2	0.0	1.1	13.8	3.0	1.1	2.1	425	0	40%	
Intermediate Cover - Proposed - Sloped - Grassed	0.2	34.5	177.4	0.0	84.4	5.4	0.0	0.1	5.9	0.7	0.0	0.3	309	0	29%	
Final Cap	0.0	5.0	113.8	0.0	35.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	154	34041	14%	
Total Runoff (m3/month)	0	1110	25168	0	7730	33	0	0	0	0	0	0	34041			
Evapotranspiration - Calculated using HELP (mm)																
Active Tipping Face	64.4	50.7	58.7	13.2	40.5	42.6	11.4	8.2	45.9	41.9	39.4	15.3	432	0	40%	
Intermediate Cover - Existing	66.6	53.8	63.2	12.7	40.2	43.8	16.8	8.0	46.2	46.9	40.7	18.8	458	0	43%	
Intermediate Cover - Proposed - Flat - Bare	54.0	42.6	51.4	13.8	39.6	36.3	5.3	8.4	40.5	26.5	31.2	10.5	360	0	34%	
Intermediate Cover - Proposed - Sloped - Grassed	66.8	54.1	63.4	12.7	40.2	43.7	17.2	8.0	46.2	46.1	41.4	18.3	458	0	43%	
Final Cap	64.8	66.9	71.2	17.2	39.3	43.4	32.5	6.5	44.1	61.1	42.7	18.3	508	112301	47%	
Total Evapotranspiration (m3/month)	14316	14783	15745	3801	8696	9602	7177	1431	9748	13505	9448	4051	112301			
Infiltration - Calculated using HELP (mm)																
Active Tipping Face	11.8	45.7	277.0	50.0	74.0	115.5	26.5	0.0	16.6	20.2	0.0	0.0	637	0	59%	
Intermediate Cover - Existing	7.1	28.5	66.9	69.9	10.3	73.5	40.9	0.0	8.5	13.6	0.0	0.0	319	0	30%	
Intermediate Cover - Proposed - Flat - Bare	16.1	27.1	48.1	44.2	6.9	59.8	32.0	2.4	15.0	16.6	9.2	6	284	0	26%	
Intermediate Cover - Proposed - Sloped - Grassed	6.2	29.0	63.4	62.7	10.5	71.2	38.8	0.0	8.1	12.1	0.6	0.0	303	0	28%	
Final Cap	19.7	6.9	28.1	37.0	38.1	34.3	31.5	27.5	12.4	6.6	2.3	4.3	249	54991	23%	
Total Infiltration (m3/month)	4353	1519	6210	8174	8432	7585	6966	6090	2737	1466	507	952	54991			
Groundwater Inflow (m3/month)	0	0	0	0	0	0	0	0	0	0	0	0	0			
Total Leachate Collected (m3/month)	4353	1519	6210	8174	8432	7585	6966	6090	2737	1466	507	952	54,991			

Awaba Landfill



Water Balance	Final	90%AEP	1974	
Active Tipping Face	-	m ²	Total	221,100 m ²
Intermediate Cover - Existing	-	m ²		
Intermediate Cover - Proposed - Flat - Bare	-	m ²		
Intermediate Cover - Proposed - Sloped - Grassed	-	m ²		
Final Cap	221,100	m ²		

Parameter	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total		Percent
	31	28	31	30	31	30	31	31	30	31	30	31	mm	m3	
Precipitation (mm)															
Rainfall (1974) (mm)	299.8	109.7	228.0	177.2	263.0	198.0	9.2	67.5	25.0	47.3	146.2	48.8	1620	358116	100%
Pan Evaporation															
Evaporation (1974) (mm)	157.2	136.2	128.8	89.2	67.4	53.0	87.4	98.6	118.6	138.8	159.6	214.0	1449	0	89%
Runoff - Calculated using HELP (mm)															
Active Tipping Face	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Intermediate Cover - Existing	102.5	11.2	76.6	50.9	127.1	71.6	0.0	7.5	0.0	0.2	26.6	1.7	476	0	29%
Intermediate Cover - Proposed - Flat - Bare	162.0	25.6	120.0	78.6	177.0	101.6	0.0	17.9	0.0	2.0	47.6	8.5	741	0	46%
Intermediate Cover - Proposed - Sloped - Grassed	109.8	13.2	81.1	55.2	130.2	74.7	0.0	8.6	0.0	0.3	29.8	2.4	505	0	31%
Final Cap	37.6	1.7	27.4	19.5	55.0	36.3	0.0	0.4	0.0	0.0	6.7	0.0	185	40817	11%
Total Runoff (m3/month)	8318	380	6060	4320	12154	8019	0	77	0	0	1488	0	40817		
Evapotranspiration - Calculated using HELP (mm)															
Active Tipping Face	73.8	45.2	62.0	59.7	38.8	43.9	10.2	11.6	28.7	30.4	64.8	39.5	509	0	31%
Intermediate Cover - Existing	76.1	45.4	64.1	59.3	45.1	43.8	13.6	11.4	33.3	34.8	67.5	42.9	537	0	33%
Intermediate Cover - Proposed - Flat - Bare	59.1	46.3	53.0	55.9	32.8	38.0	8.5	11.7	21.7	31.0	53.6	27.7	439	0	27%
Intermediate Cover - Proposed - Sloped - Grassed	76.3	45.0	64.3	59.3	45.1	43.8	14.4	11.4	32.9	34.5	67.5	42.2	537	0	33%
Final Cap	82.7	59.9	70.8	58.5	50.7	43.5	29.7	11.1	48.5	27.7	77.4	58.9	619	136943	38%
Total Evapotranspiration (m3/month)	18294	13251	15654	12937	11219	9609	6567	2448	10715	6118	17107	13027	136943		
Infiltration - Calculated using HELP (mm)															
Active Tipping Face	123.9	105.8	82.2	123.1	144.8	298.0	76.7	0.0	44.1	0.4	36.6	62.9	1098	0	68%
Intermediate Cover - Existing	19.0	90.7	39.8	56.1	74.6	78.8	118.4	24.8	31.8	0.0	19.2	36.8	590	0	36%
Intermediate Cover - Proposed - Flat - Bare	15.9	70.5	37.7	42.4	51.3	33.0	83.6	0.6	33.2	6.0	27.1	32	433	0	27%
Intermediate Cover - Proposed - Sloped - Grassed	18.3	88.3	39.1	53.8	69.1	72.8	115.1	21.6	30.1	0.0	18.6	35.5	562	0	35%
Final Cap	20.8	33.1	34.9	35.9	36.1	29.9	38.2	56.2	42.1	15.6	11.1	11.7	366	80846	23%
Total Infiltration (m3/month)	4591	7329	7723	7935	7984	6614	8445	12423	9305	3460	2459	2578	80846		
Groundwater Inflow (m3/month)	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Leachate Collected (m3/month)	4591	7329	7723	7935	7984	6614	8445	12423	9305	3460	2459	2578	80,846		

Appendix C – Leachate pumping data

Discharge Rate from Quarry Cell into Main Leachate Storage Dam

Date	litres / min	litres / hour	litres / day	kl / day	ML / day
12.8.13	30	1,800	43,200	43.2	0.0432
		0	0	0	0
		0	0	0	0
		0	0	0	0
		0	0	0	0
		0	0	0	0
		0	0	0	0
		0	0	0	0
		0	0	0	0
		0	0	0	0
		0	0	0	0
		0	0	0	0
		0	0	0	0
		0	0	0	0
		0	0	0	0

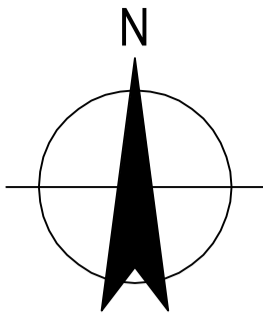
Leachate Discharge from Unlined Areas of Awaba Landfill

Date	Hour Metre		Annual Pump Hours	Annual Discharge		
	Pump 1	Pump 2		litres	kilo litres	mega litres
30-Jun-07	5,184.30	5,357.53				
30-Jun-08	7,477.87	7,862.74	4,798.78	19,195.12	19.20	0.0192
30-Jun-09	9,138.37	9,441.98	3,239.74	12,958.96	12.96	0.0130
30-Jun-10	10,907.21	11,314.42	3,641.28	14,565.12	14.57	0.0146
30-Jun-11	14,381.31	14,587.66	6,747.34	26,989.36	26.99	0.0270
30-Jun-12	18,479.90	18,305.16	7,816.09	31,264.36	31.26	0.0313
30-Jun-13	20,852.55	21,220.40	5,287.89	21,151.56	21.15	0.0212

Pump Rate litres / sec 4.00 4.00

Note: During times of high leachate generation (heavy rainfall) leachate enters the leachate pond via an overflow pipe (not pumped) and accordingly is not recorded.

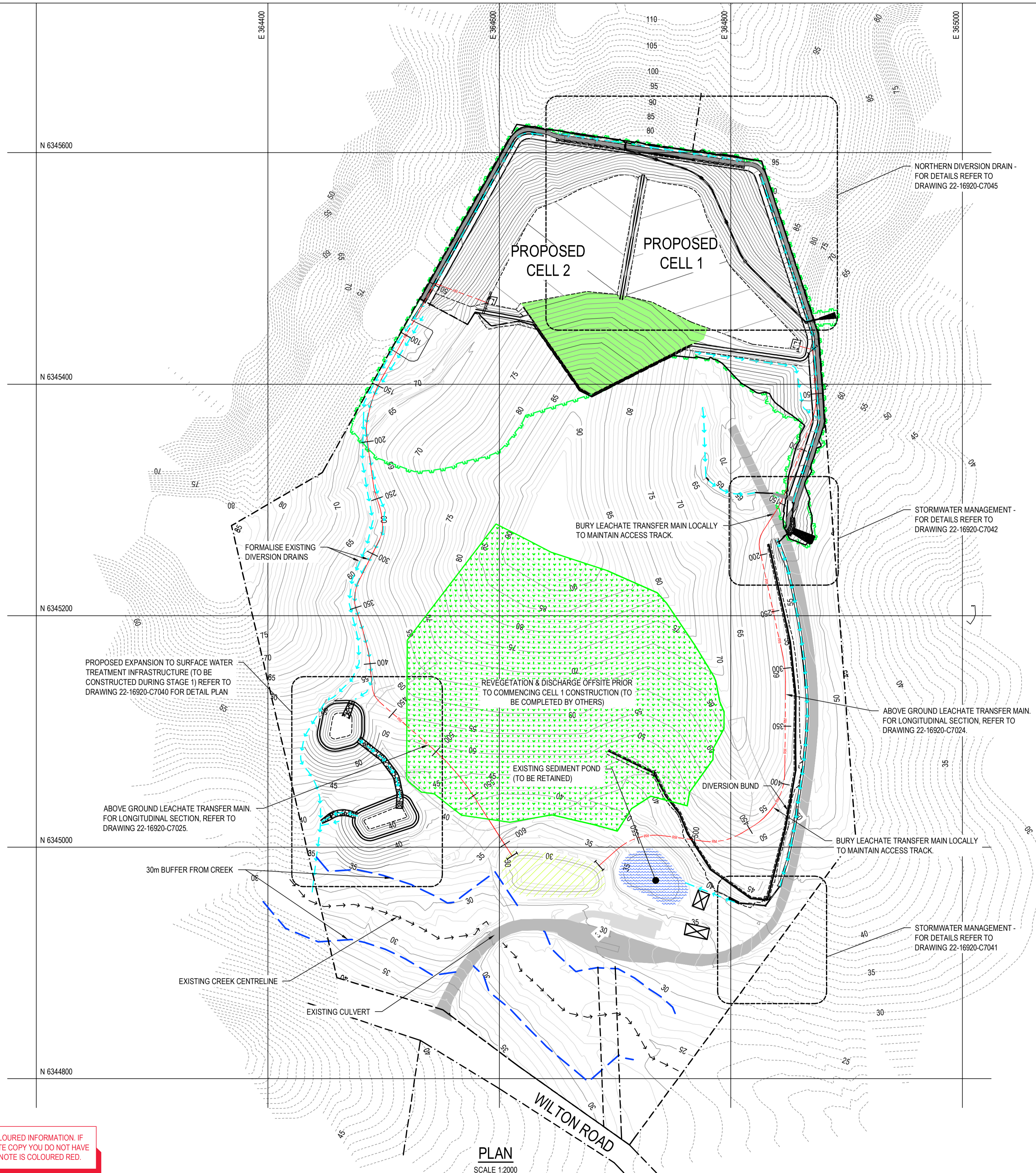
Appendix D – Proposed leachate barrier and collection system



NOTES:
 1. FOR LEGEND AND GENERAL NOTES REFER TO DRAWING 22-16920-C7001.

LEGEND:

- 60 — MAJOR DESIGN CONTOUR
- MINOR DESIGN CONTOUR
- TOP OF DESIGN BATTER
- - - - - TOE OF DESIGN BATTER/POND/BUND
- ▬ ACCESS TRACK
- → → → → STORMWATER DIVERSION DRAIN
- VEGETATION CLEARING LIMITS



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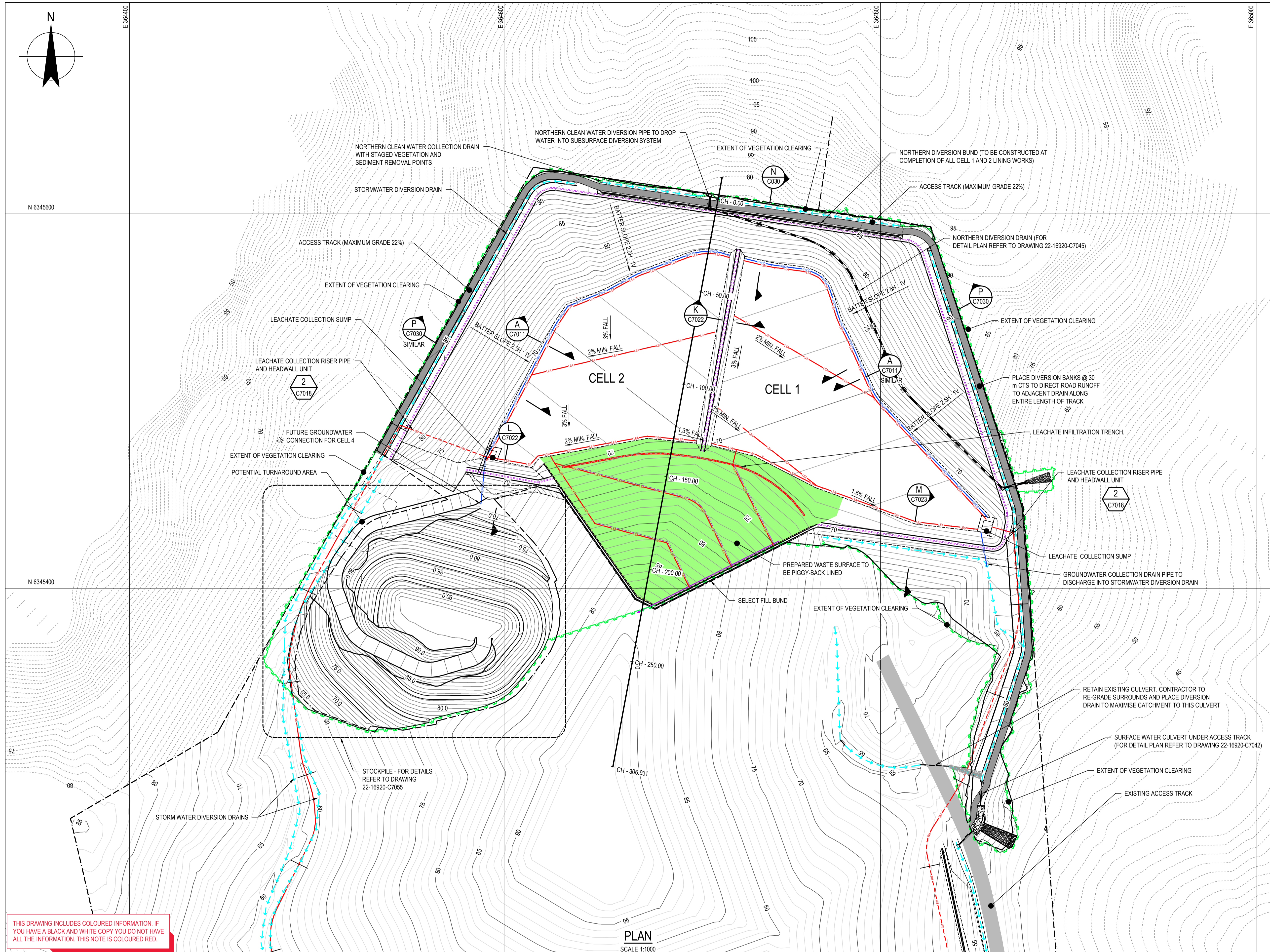
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Drafting Check	I. SMITH	Design Check	D. BARRETT
Approved (Project Director)	M. GEBHARD		
Date	17.02.16		
Scale	AS SHOWN		

Client	LAKE MACQUARIE CITY COUNCIL		
Project	AWABA WASTE MANAGEMENT FACILITY EXPANSION		
Title	GENERAL ARRANGEMENT		
Original Size	A1	Drawing No:	22-16920-C7003
Rev:	F		

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- NOTES:**
- FOR LEGEND AND GENERAL NOTES REFER TO DRAWING 22-16920-C7001.
 - CHAINAGES REFER TO LONGITUDINAL SECTION ON DRAWINGS 22-16920-C7005 AND CROSS SECTIONS ON DRAWINGS 22-16920-C7006 AND C7007.

- LEGEND:**
- 60 MAJOR DESIGN CONTOUR
 - MINOR DESIGN CONTOUR
 - TOP OF DESIGN BATTER
 - TOE OF DESIGN BATTER/POND/BUND
 - EXTENT OF CUT/FILL
 - ACCESS TRACK
 - STORMWATER DIVERSION DRAIN
 - LEACHATE COLLECTION TRENCH
 - LEACHATE TRANSFER MAIN
 - GROUND WATER COLLECTION DRAIN
 - DRAINAGE PIPE
 - ANCHOR TRENCH
 - PERFORATED LANDFILL GAS COLLECTION TRENCH (HORIZONTAL SYSTEM)
 - SOLID LANDFILL GAS COLLECTION PIPE
 - LEACHATE INFILTRATION TRENCH
 - EXTENT OF PIGGY BACK LINER AREA

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D	ISSUED TO CLIENT	IMH	AS*	MG*	02.05.14		
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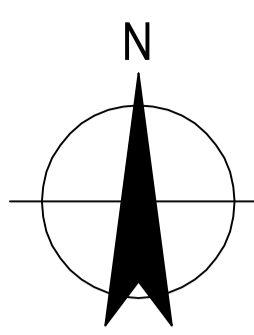
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Approved (Project Director)	M. GEBHARD	Date	17.02.16
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Project	AWABA WASTE MANAGEMENT FACILITY EXPANSION
Title	CELLS 1 & 2 - GENERAL ARRANGEMENT
Original Size	A1
Drawing No:	22-16920-C7004
Rev:	G



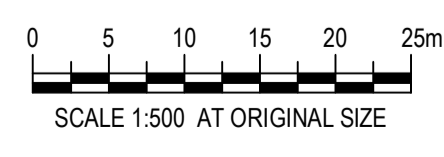
NOTES:
 1. FOR LEGEND AND GENERAL NOTES REFER TO DRAWING 22-16920-C7001.

- LEGEND:**
- MAJOR DESIGN CONTOUR
 - MINOR DESIGN CONTOUR
 - TOP OF DESIGN BATTER
 - TOE OF DESIGN BATTER/POND/BUND
 - EXTENT OF CUT/FILL
 - ACCESS TRACK
 - LEACHATE COLLECTION TRENCH
 - LEACHATE TRANSFER MAIN
 - ANCHOR TRENCH
 - EXTENT OF PIGGY BACK LINER AREA
 - GEOSYNTHETIC CLAY LINER 1.0m VERTICAL UP SIDESLOPE
 - GEOSYNTHETIC CLAY LINER TO LIMIT EMERGENCY STORAGE-(CELL 1-RL69.5m AHD)-(CELL 2-RL70.5m AHD)
 - LEACHATE INFILTRATION TRENCH



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 Date 17.02.16

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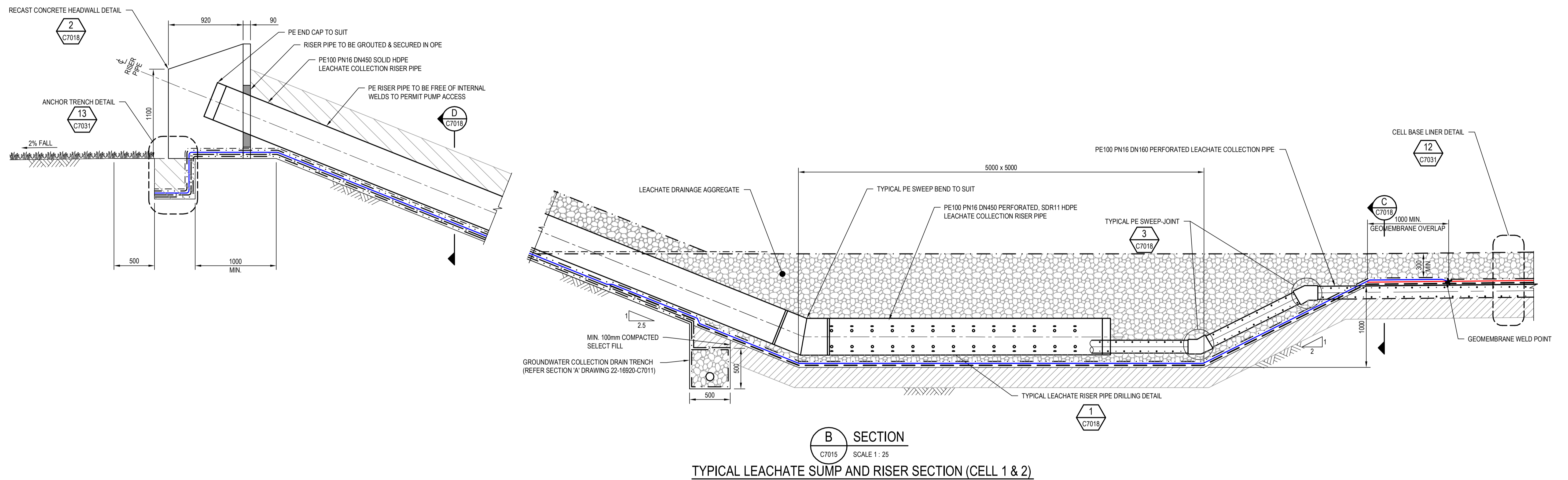
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Client **LAKE MACQUARIE CITY COUNCIL**
 Project **AWABA WASTE MANAGEMENT FACILITY EXPANSION**
 Title **CELLS 1 & 2 - LEACHATE COLLECTION SYSTEM - LAYOUT PLAN**

Original Size **A1** Drawing No: **22-16920-C7015** Rev: **F**

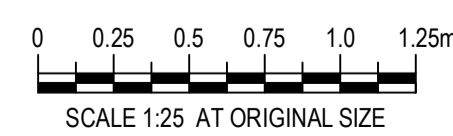
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- NOTES:**
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 - ALL DIMENSIONS SHOWN ARE IN MILLIMETRES.
 - CONTRACTOR TO PROCURE LEACHATE PUMP AND DESIGN CONNECTION WITH LEACHATE TRANSFER MAIN AS PER REQUIREMENTS OF TECHNICAL SPECIFICATION.



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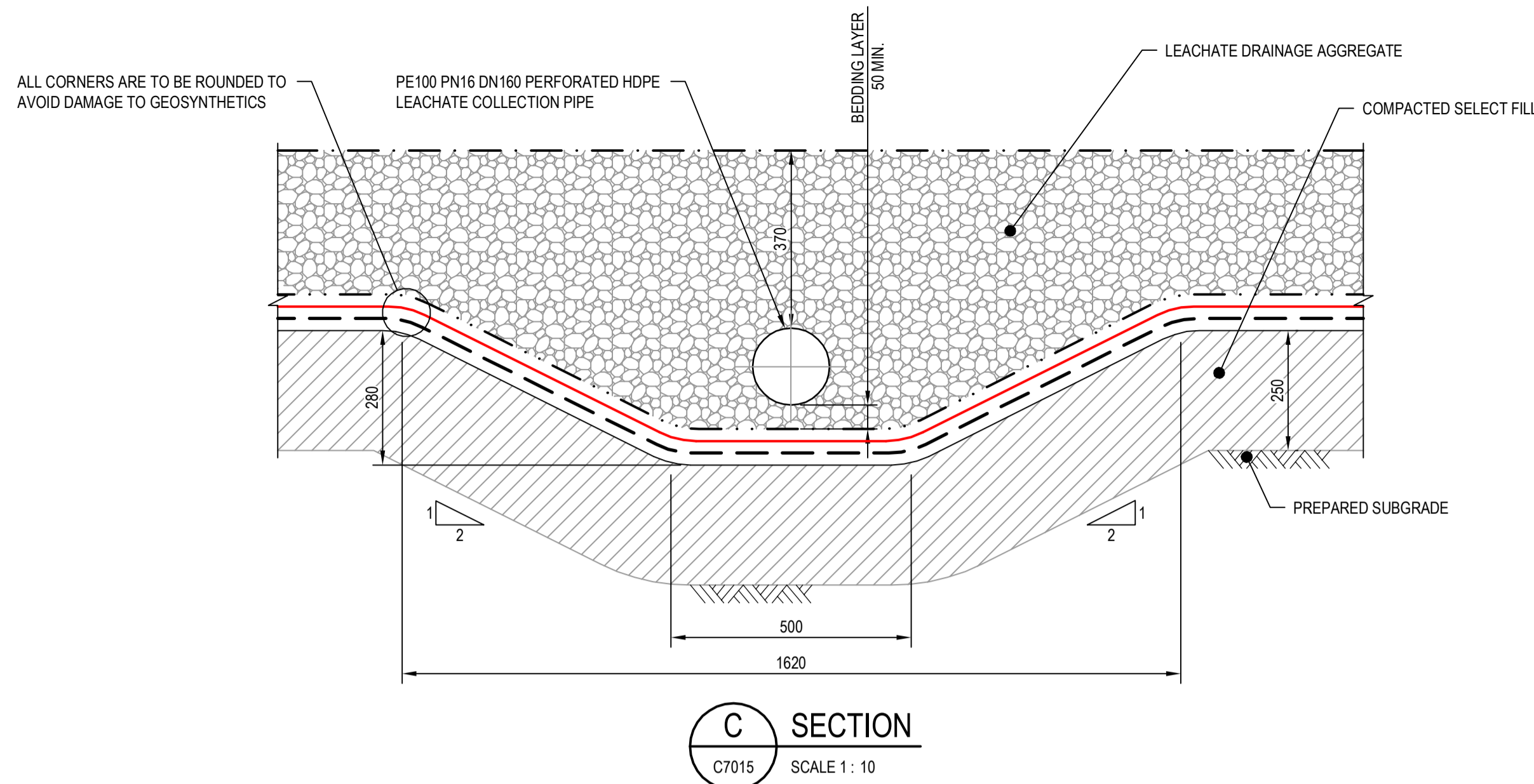


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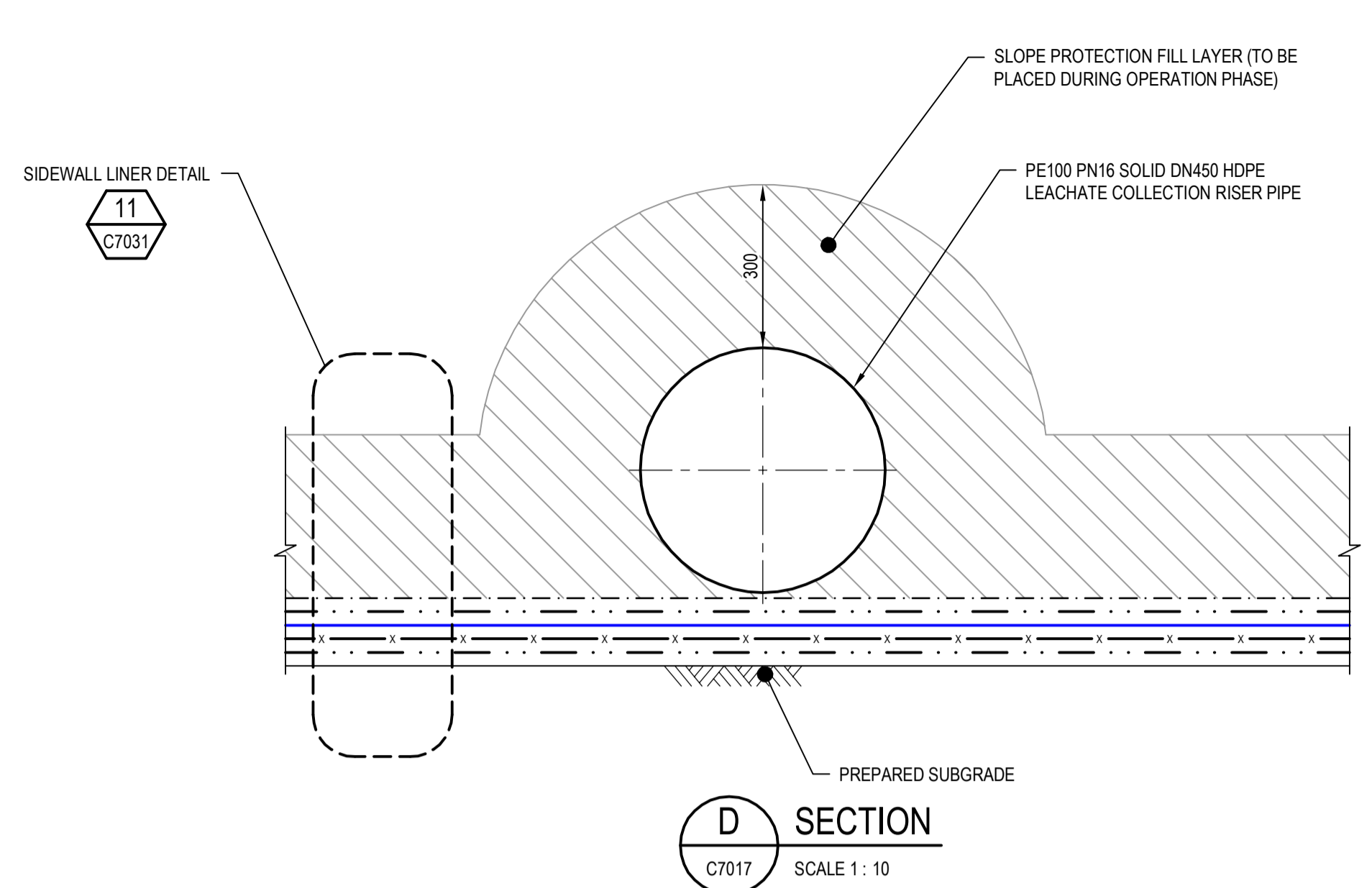
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Project	AWABA WASTE MANAGEMENT FACILITY EXPANSION
Title	LEACHATE COLLECTION SYSTEM - TYPICAL SECTIONS & DETAILS - SHEET 1 OF 2
Original Size	A1
Drawing No:	22-16920-C7017
Rev:	H

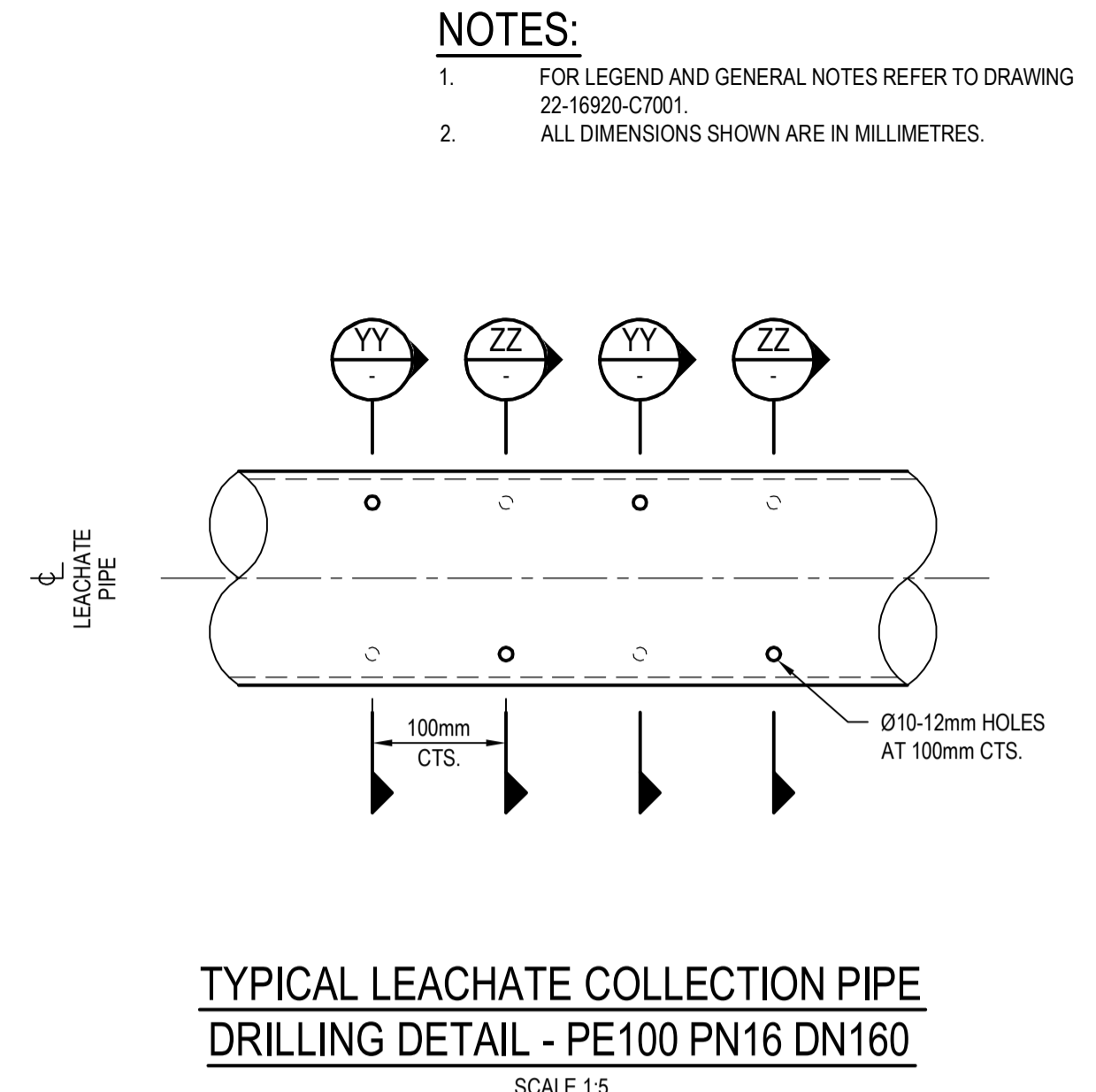
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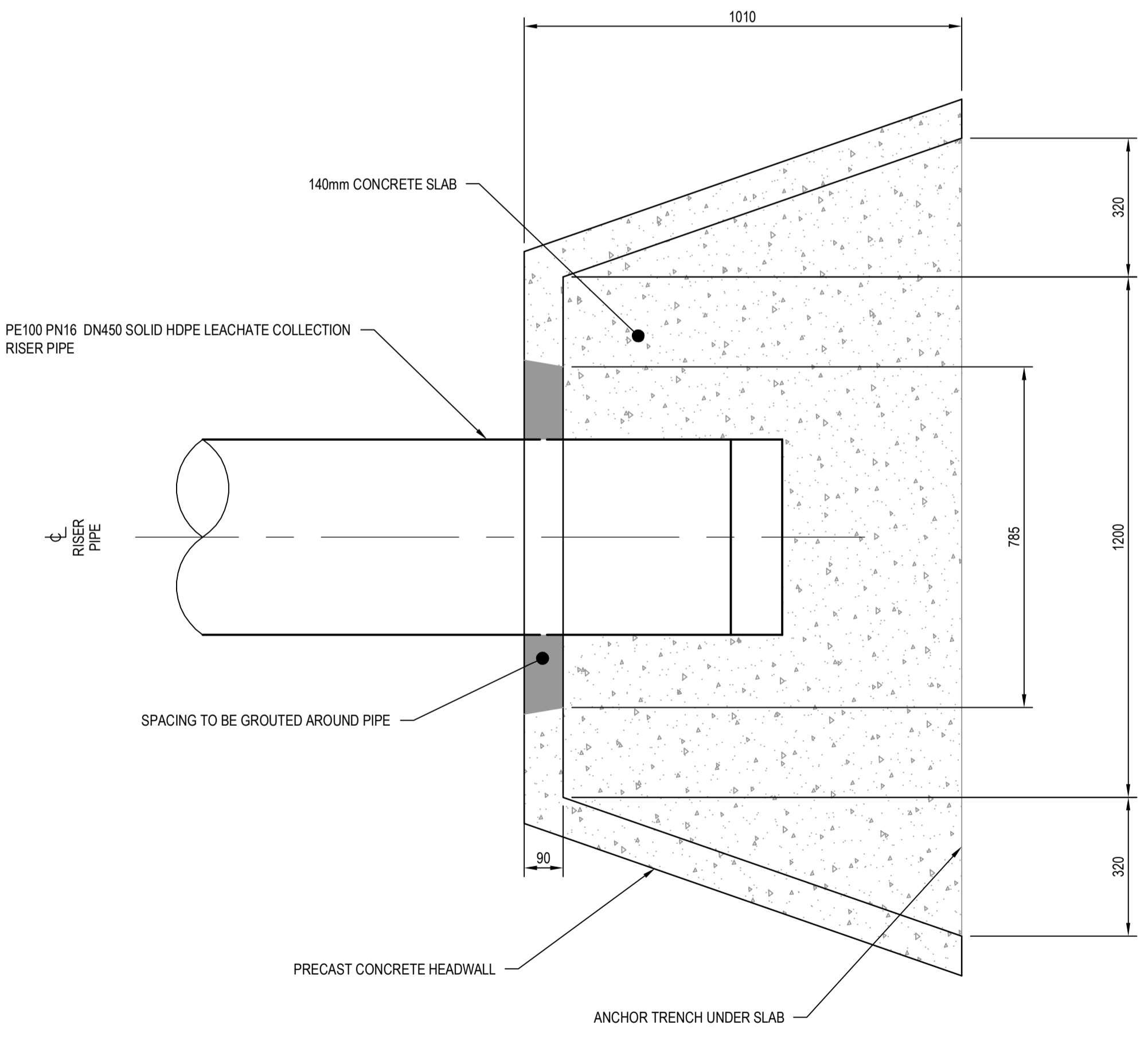
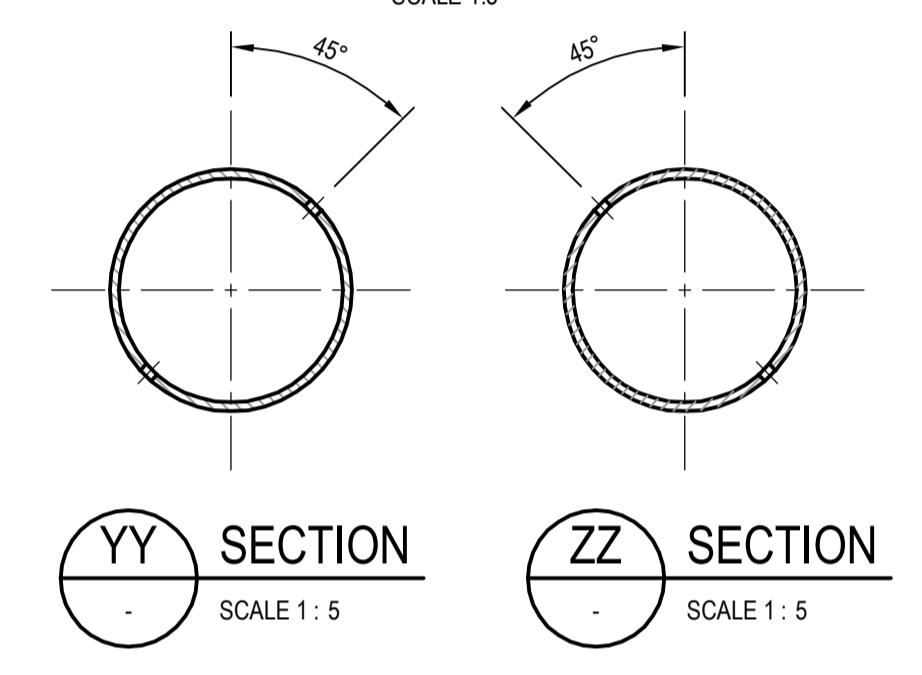
C SECTION
C7015 SCALE 1:10
TYPICAL LEACHATE COLLECTION TRENCH



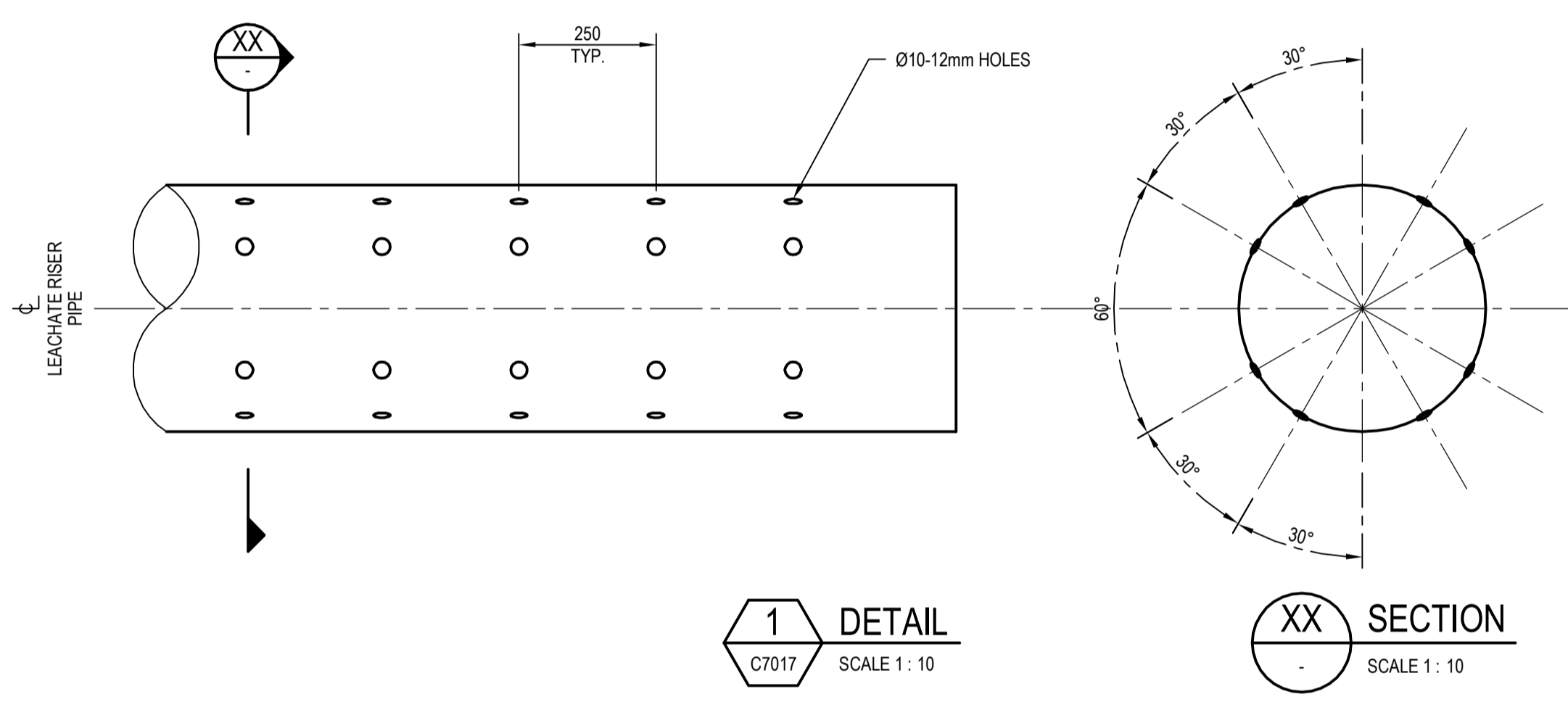
D SECTION
C7017 SCALE 1:10
TYPICAL LEACHATE COLLECTION RISER PIPE RISER



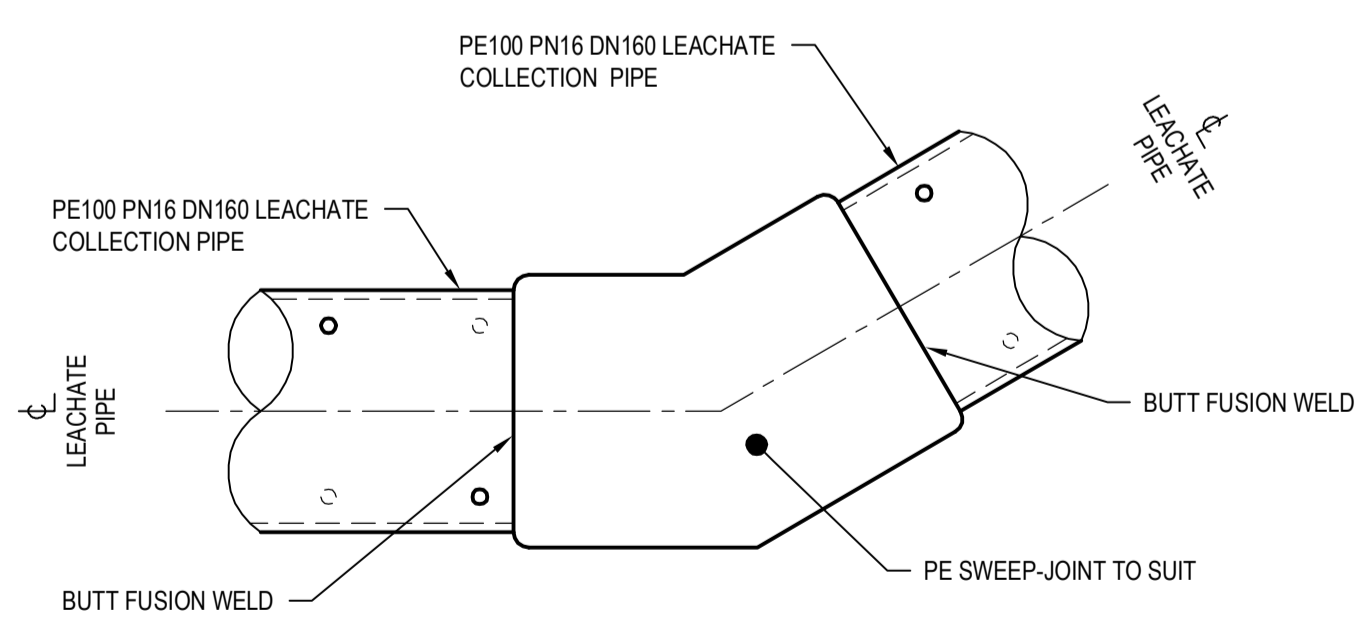
TYPICAL LEACHATE COLLECTION PIPE DRILLING DETAIL - PE100 PN16 DN160
SCALE 1:5



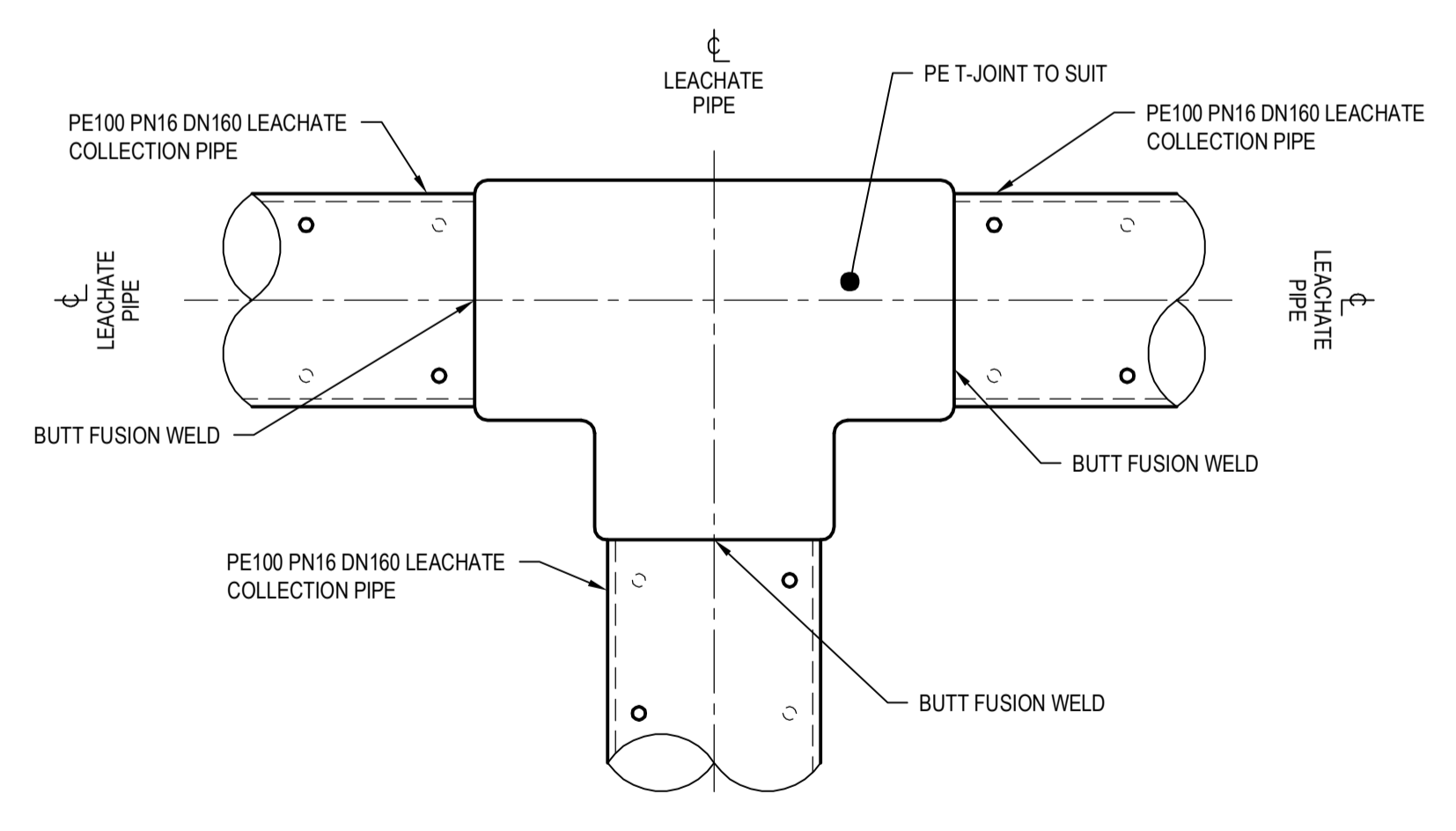
2 DETAIL
C7004 SCALE 1:10
PRECAST CONCRETE HEADWALL UNIT



1 DETAIL
C7017 SCALE 1:10
TYPICAL LEACHATE RISER PIPE DRILLING DETAIL - PE100 PN16 DN450



3 DETAIL
C7015 SCALE 1:5
TYPICAL LEACHATE COLLECTION PIPE PE SWEEP-JOINT

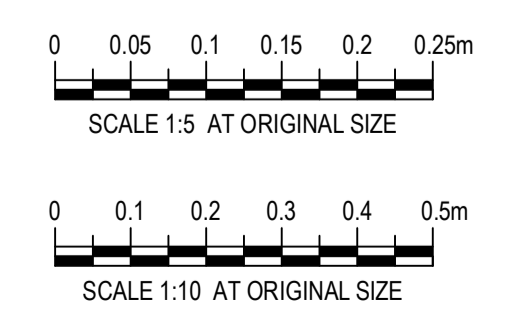


4 DETAIL
C7015 SCALE 1:5
TYPICAL LEACHATE COLLECTION PIPE PE T-JOINT

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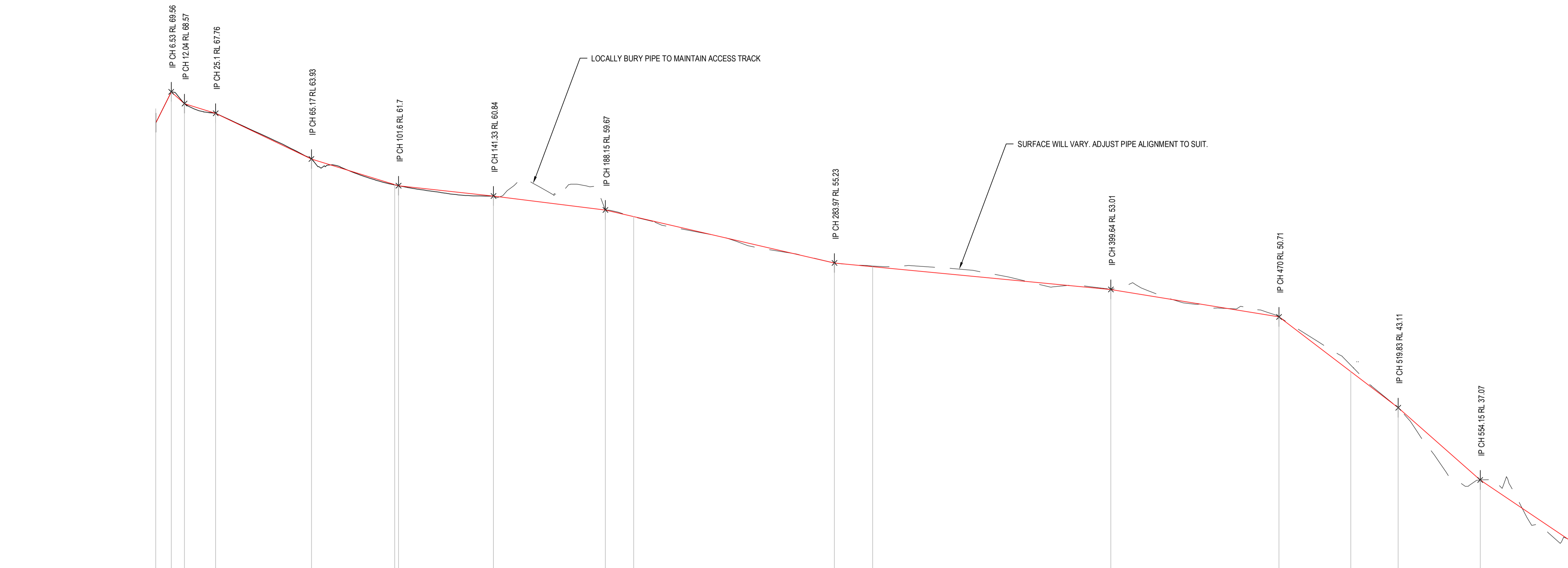


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	Approved (Project Director) M. GEBHARD	Date 17.02.16
	Scale AS SHOWN	This Drawing must not be used for Construction unless signed as Approved

Client	LAKE MACQUARIE CITY COUNCIL
Project	AWABA WASTE MANAGEMENT FACILITY EXPANSION
Title	LEACHATE COLLECTION SYSTEM - TYPICAL SECTIONS & DETAILS - SHEET 2 OF 2
Original Size	A1
Drawing No:	22-16920-C7018
Rev:	F

FOR TENDER



DATUM RL. 28.00

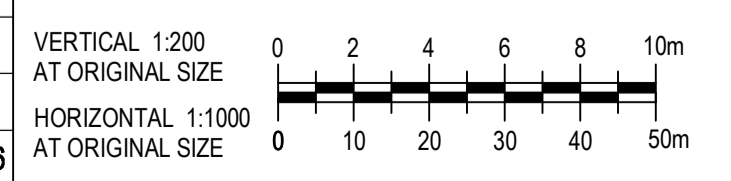
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HORIZONTAL ALIGNMENT	L=11.89m	L=38.56m	L=21.23m R=50.00m	L=68.64m	L=15.17m R=70.00m	L=23.46m	L=15.66m R=20.00m	L=94.95m	L=22.23m R=100.00m	L=78.44m	L=34.02m R=50.00m	L=19.96m							
DESIGN INVERT LEVEL	66.982	69.555	69.511	68.569	67.760	63.931	61.794	61.195	60.836	59.667	59.118	55.227	54.921	53.014	50.714	46.38	43.113	37.066	32.094
SURFACE LEVEL	66.98	69.56	69.51	68.57	67.76	63.93	61.76	61.70	60.83	59.67	59.09	55.23	54.97	53.01	50.71	46.69	43.11	37.07	32.09
CHAINAGE	0.00	6.53	19.59	32.65	72.72	113.25	152.91	247.86	363.81	442.25	512.08	551.94	571.90	625.91	676.62	723.31	766.42	803.49	835.58

LONGITUDINAL SECTION - EASTERN LEACHATE TRANSFER MAIN
SCALE 1:1000 HOR 1:200 VER

THIS DRAWING INCLUDES COLOURED INFORMATION. IF YOU HAVE A BLACK AND WHITE COPY YOU DO NOT HAVE ALL THE INFORMATION. THIS NOTE IS COLOURED RED.

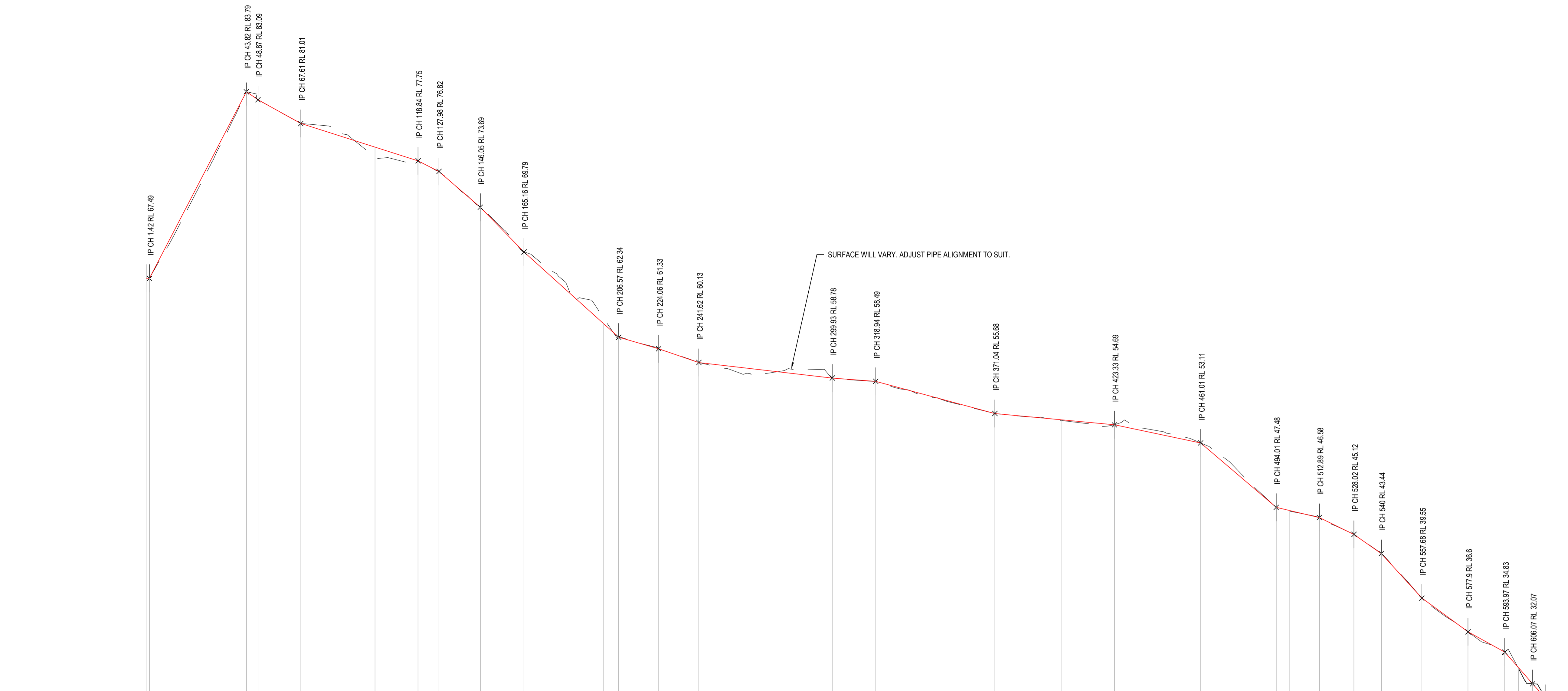
FOR TENDER

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR TENDER		CB	AS*	MG*	12.02.16



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	Approved (Project Director) M. GEBHARD	Date 17.02.16
	Scale AS SHOWN	This Drawing must not be used for Construction unless signed as Approved

Client	LAKE MACQUARIE CITY COUNCIL
Project	AWABA WASTE MANAGEMENT FACILITY EXPANSION
Title	LEACHATE TRANSFER SYSTEM LONGITUDINAL SECTION 1
Original Size	A1
Drawing No:	22-16920-C7024
Rev:	A



	0.00	1.42	43.82	47.97	67.61	100.00	118.84	127.98	146.05	165.16	200.00	206.57	224.06	241.62	299.93	318.94	371.04	400.00	423.33	461.01	494.01	500.00	512.89	528.02	540.00	557.68	577.90	593.97	600.00	606.07	611.91
VERTICAL ALIGNMENT			L=42.4m G=38.46%	L=4.19m G=4.58%	L=18.75m G=-11.06%	L=51.23m G=6.36%	L=9.14m G=-10.16%	L=18.07m G=-17.34%	L=19.11m G=-20.41%	L=41.41m G=18%	L=17.48m G=-5.77%	L=17.56m G=-6.85%	L=58.31m G=-2.32%	L=19.02m G=-1.51%	L=52.1m G=5.4%	L=52.3m G=-1.89%	L=37.68m G=4.2%	L=33m G=-17.06%	L=18.88m G=4.72%	L=15.13m G=9.7%	L=11.96m G=-14.0%	L=17.68m G=22%	L=20.22m G=-14.58%	L=16.07m G=-1.04%	L=12.41m G=-22.83%	L=5.84m G=-22.01%					
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DESIGN INVERT LEVEL	67.50	67.486	65.79	63.602	61.014	78.953	77.754	76.825	73.692	69.793	63.523	62.341	61.332	60.130	58.779	58.491	55.679	55.132	54.691	53.107	47.477	47.194	46.585	45.118	43.441	39.552	36.604	34.828	33.453	32.068	30.782
SURFACE LEVEL	67.50	67.49	65.79	63.60	61.01	78.14	77.75	76.82	73.70	69.79	63.99	62.34	61.33	60.13	58.78	58.49	55.67	55.06	54.69	53.11	47.48	47.14	46.59	45.12	43.44	39.55	36.60	34.83	33.38	32.07	30.78
CHAINAGE	0.00	1.42	43.82	47.97	67.61	100.00	118.84	127.98	146.05	165.16	200.00	206.57	224.06	241.62	299.93	318.94	371.04	400.00	423.33	461.01	494.01	500.00	512.89	528.02	540.00	557.68	577.90	593.97	600.00	606.07	611.91

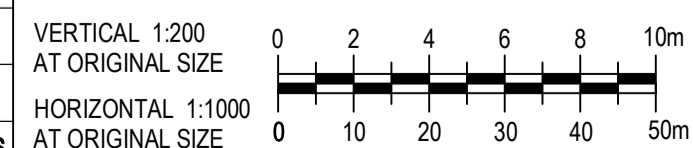
LONGITUDINAL SECTION - WESTERN LEACHATE TRANSFER MAIN

SCALE 1:1000 HOR 1:200 VER

THIS DRAWING INCLUDES COLOURED INFORMATION. IF YOU HAVE A BLACK AND WHITE COPY YOU DO NOT HAVE ALL THE INFORMATION. THIS NOTE IS COLOURED RED.

FOR TENDER

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	ISSUE FOR TENDER		CB	AS*	MG*	12.02.16



GHD Tower, Level 3
24 Honeysuckle Drive, Newcastle NSW 2300 Australia
PO Box 5403 Hunter Rgn Mail Cent, NSW 2310
T 61 2 4979 9999 F 61 2 4979 9988
E ntmial@ghd.com W www.ghd.com

DO NOT SCALE	Drawn	C. BODE	Designer	J. DAWES
	Drafting Check	I. SMITH	Design Check	D. BARRETT
	Approved (Project Director)	M. GEBHARD		
	Date	17.02.16		
Scale	AS SHOWN			

Client	LAKE MACQUARIE CITY COUNCIL
Project	AWABA WASTE MANAGEMENT FACILITY EXPANSION
Title	LEACHATE TRANSFER SYSTEM LONGITUDINAL SECTION 2
Original Size	A1
Drawing No:	22-16920-C7025
Rev:	A

Appendix E – Design drawings: Quarry cell

GENERAL NOTES

- 1 THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION AND/OR WITH SUCH OTHER WRITTEN INSTRUCTIONS THAT SHALL BE ISSUED DURING THE COURSE OF CONSTRUCTION. ANY DISCREPANCY OR VARIATION SHALL BE REFERRED TO THE SUPERINTENDENT OR SUPERINTENDENTS REPRESENTATIVE BEFORE PROCEEDING WITH THE WORK.
- 2 THE DRAWINGS ARE A DIAGRAMMATIC REPRESENTATION OF THE WORK TO BE CARRIED OUT ONLY AND DIMENSIONS SHALL NOT BE OBTAINED BY SCALING
- 3 ALL LEVELS SHALL BE OBTAINED FROM ESTABLISHED BENCH MARKS ONLY. STANDARD DATUM FOR ALL DRAWINGS IS AUSTRALIAN HEIGHT DATUM (A.H.D.).
- 4 ALL CONSTRUCTION IS TO BE IN ACCORDANCE WITH THE SPECIFICATION AND PLANS, SPECIFICATIONS TAKE PRECEDENCE.
- 5 DIVERSION OF WATER AND THE PROTECTION OF WORKS IS THE CONTRACTORS RESPONSIBILITY.
- 6 THE CONTRACTOR IS RESPONSIBLE FOR LOCATING PRIOR TO COMMENCEMENT OF WORK AND PROTECTING DURING WORK, ALL EXISTING UNDERGROUND AND OVERHEAD SERVICES WITHIN THE SITE.
- 7 THE CONTRACTOR MUST ENSURE SUPERINTENDENT OR SUPERINTENDENTS REPRESENTATIVES APPROVAL OF MATERIALS PRIOR TO DELIVERY TO SITE.
- 8 SCOUR PROTECTION, SUB SOIL DRAINAGE AND UNSUITABLE SUB-GRADE REPLACEMENT SHALL BE AT THE DIRECTION OF THE SUPERINTENDENT OR THE SUPERINTENDENTS REPRESENTATIVE.
- 9 NO ADDITIONAL OR P.C. WORKS SHALL BE UNDERTAKEN WITHOUT THE SUPERINTENDENTS OR SUPERINTENDENTS REPRESENTATIVES APPROVAL.
- 10 CONTRACTOR TO PROVIDE ALL SURVEY SETOUT, AND WAE FROM ELECTRONIC DATA. WAE SURVEY TO BE CERTIFIED BY REGISTERED SURVEYOR
- 11 FOR SURVEY INFORMATION REFER LMCC REF: 0409DES. - SURVEY DATA FILE OF AWABA WASTE MANAGEMENT FACILITY. NOTE: SETOUT IS TO LOCAL CO-ORDINATES.
- 12 CONTRACTOR TO EXERCISE CARE AND TAKE PRECAUTIONS TO ENSURE CONSTRUCTION ACTIVITIES DO NOT AFFECT ACCESS & OPERATIONS. CONFIRM WITH SUPERINTENDENT OR SUPERINTENDENTS REPRESENTATIVE.
- 13 PROVIDE TRAFFIC CONTROLS AND SUBMIT TRAFFIC CONTROL PLAN TO AS 1742.3 TO SUPERINTENDENT PRIOR TO WORK. PROVIDE CONTROLS AND TEMPORARY WORKS.
- 14 STORM WATER PIPE WORK INSTALLATION TO AS 3725, AS 3500.3 AND MANUFACTURER'S RECOMMENDATIONS
- 15 WHERE AREAS OUTSIDE THE WORKS FOOTPRINT ARE DISTURBED, CONTRACTOR TO RESTORE THESE AREAS TO ORIGINAL CONDITION.

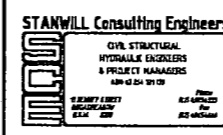

ROAD PAVEMENT AND EARTHWORKS

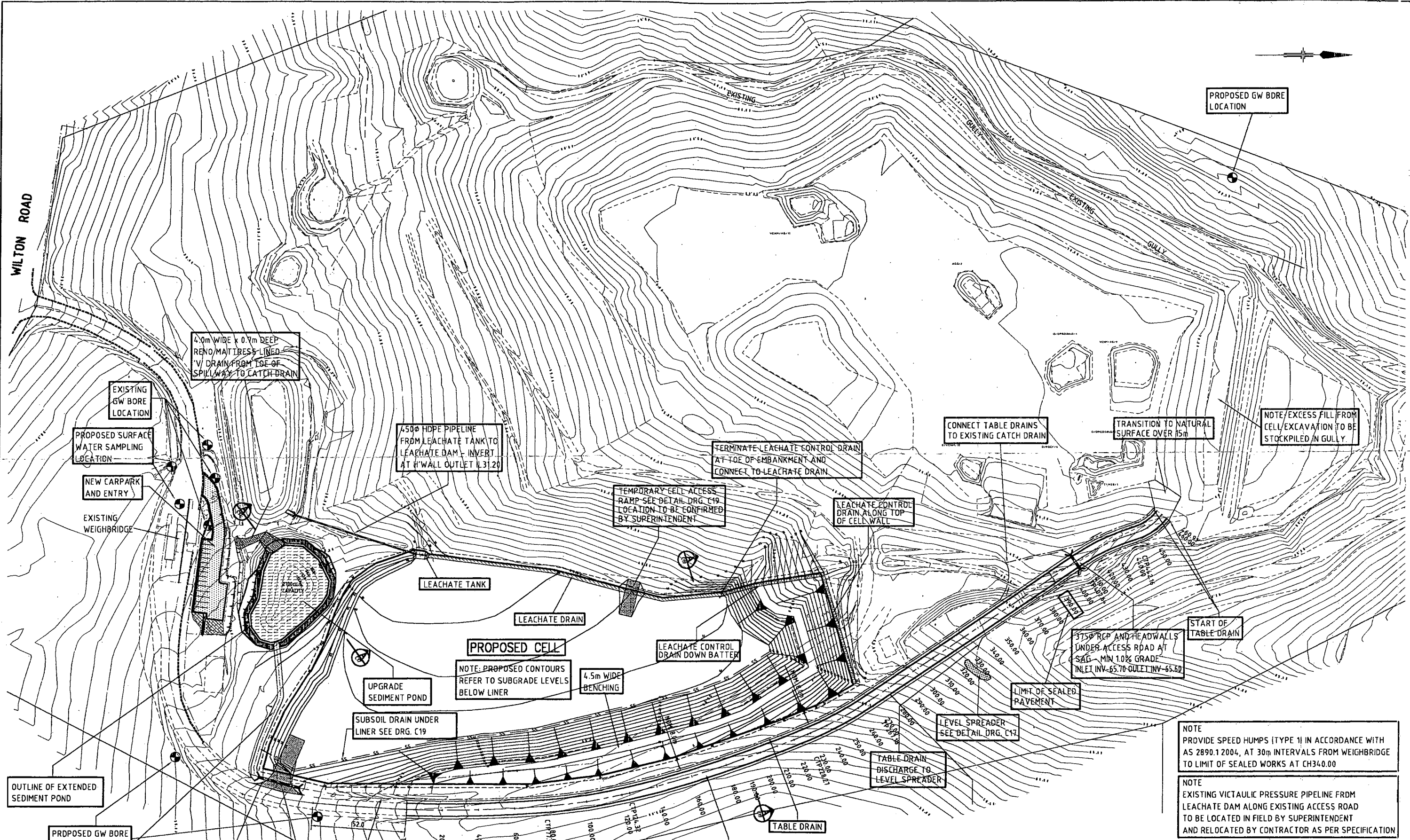
- 1 REFER GEOTECHNICAL REPORT BY RCA AUSTRALIA - REF. No.3980-004/0
- 2 EARTHWORKS AND PAVEMENTS TO BE CONSTRUCTED AND TESTED IN ACCORDANCE WITH THE SPECIFICATION.
- 3 UTILISE EQUIPMENT AND METHODS TO PROTECT EXISTING STRUCTURES.
- 4 SUB-GRADE DEFLECTION SHALL BE CONFIRMED BY THE CONTRACTOR BY PROOF ROLL. SUPERINTENDENT OR SUPERINTENDENTS REPRESENTATIVE TO APPROVE. SUBGRADE REPLACEMENT MAY BE INSTRUCTED. RIP ROCK SUB-GRADE TO 250mm. DRY OVERWET SUBGRADE.
- 5 COMPACTION AT ROAD PAVEMENT TO BE:
 BASECOURSE - 98% MODIFIED (A.S. 1289 - 5.2.1)
 SUB BASE - 95% MODIFIED (A.S. 1289 - 5.2.1)
 SUBGRADE - 100% STANDARD (A.S. 1289 - 5.1.1)
- 6 MATERIALS:
 - 2 COAT BITUMEN SEAL TO SPECIFICATION
 - BASECOURSE CBR (10 DAYS)
 80% MIN PI 6% MAX IN ACCORDANCE WITH SPECIFICATION
 - SUB BASE CBR (10 DAYS)
 30% MIN PI 12% MAX IN ACCORDANCE WITH SPECIFICATION
 - SUBGRADE REPLACEMENT CBR 10%
- 7 PAVEMENT THICKNESS:
 - CAR PARK
 - 2 COAT BITUMEN SEAL
 - 100mm BASECOURSE
 - 100mm SUB BASE
 - 100mm SELECT SUBGRADE
 - ACCESS ROAD (SEALED TO CH390.00)
 - 2 COAT BITUMEN SEAL
 - 150mm BASECOURSE
 - 150mm SUB BASE
 - 150mm SELECT SUBGRADE
 - ACCESS ROAD (UNSEALED FROM CH390.00 TO CH460.91)
 150mm NATURAL GRAVEL WITH
 CBR >30% AND PI GREATER THAN 10%
 AND LESS THAN 15%
 - 300mm RIPPED SANDSTONE FROM
 CELL EXCAVATION
 - PROOF ROLLED SUBGRADE

SCANNED
27 JAN 2005

SCHEDULE OF DRAWINGS			
DRAWING No	DESCRIPTION	DRAWING No	DESCRIPTION
C01	CIVIL WORKS NOTE SHEET	C13	PROPOSED ACCESS ROAD CROSS SECTIONS SHEET 5 OF 8
C02	GENERAL ARRANGEMENT	C14	PROPOSED ACCESS ROAD CROSS SECTIONS SHEET 6 OF 8
C03	CARPARKING AND ASSOCIATED WORKS GENERAL ARRANGEMENT	C15	PROPOSED ACCESS ROAD CROSS SECTIONS SHEET 7 OF 8
C04	CO-ORDINATED SETOUT	C16	PROPOSED ACCESS ROAD CROSS SECTIONS SHEET 8 OF 8
C05	CARPARK SETOUT	C17	EXTENDED SEDIMENT POND TYPICAL SECTION AND OTHER DRAINAGE DETAILS
C06	CELL SETOUT	C18	EROSION AND SEDIMENT CONTROL PLAN
C07	PROPOSED ACCESS ROAD LONGITUDINAL SECTION SHEET 1 OF 2	C19	PROPOSED CELL LINING DETAILS TEMPORARY CELL ACCESS RAMP DETAIL
C08	PROPOSED ACCESS ROAD LONGITUDINAL SECTION SHEET 2 OF 2	C20	LEACHATE TANK TANK PLAN AND SECTION
C09	PROPOSED ACCESS ROAD CROSS SECTIONS SHEET 1 OF 8	C21	LEACHATE CONTROL DRAIN - TYPICAL DETAIL WATER MONITORING WELL DETAILS
C10	PROPOSED ACCESS ROAD CROSS SECTIONS SHEET 2 OF 8	C22	PROPOSED SEDIMENT POND AND CELL SETOUT SCHEDULE OF COORDINATES AND LEVELS
C11	PROPOSED ACCESS ROAD CROSS SECTIONS SHEET 3 OF 8		
C12	PROPOSED ACCESS ROAD CROSS SECTIONS SHEET 4 OF 8		

CDT-DWG-A3H-001/1

 <p>STANWILL Consulting Engineers CIVIL, STRUCTURAL, HYDRAULIC ENGINEERS & PROJECT MANAGERS AUST. REG. NO. 121 011 11 BENTLEY STREET NEWCASTLE NSW 2300</p>	 <p>RCA AUSTRALIA GEOTECHNICAL • ENVIRONMENTAL</p>	<p>AWABA WASTE MANAGEMENT FACILITY CIVIL WORKS NOTE SHEET</p>
SCE JOB NO: 6220	CLIENT Lake Macquarie City Council	PROJECT No 3980
DESIGNED:	DRAWN BY DAW	SCALE AS SHOWN
APPROVED:	APPROVED BY <i>R</i>	DATE 19.1.05
		DRAWING No C01 REV B
		OFFICE NEWCASTLE



PROPOSED GW BORE LOCATION

4.0m WIDE x 0.7m DEEP RENO MATTRESS LINED V-DRAIN FROM TOE OF SPIG WAY TO CATCH DRAIN

EXISTING GW BORE LOCATION

PROPOSED SURFACE WATER SAMPLING LOCATION

NEW CARPARK AND ENTRY

EXISTING WEIGHBRIDGE

450 RCP PIPELINE FROM LEACHATE TANK TO LEACHATE DAM - INVERT AT HWALL OUTLET (L31.2)

TERMINATE LEACHATE CONTROL DRAIN AT TOE OF EMBANKMENT AND CONNECT TO LEACHATE DRAIN

TEMPORARY CELL ACCESS RAMP SEE DETAIL DRG. C19 LOCATION TO BE CONFIRMED BY SUPERINTENDENT

CONNECT TABLE DRAINS TO EXISTING CATCH DRAIN

TRANSITION TO NATURAL SURFACE OVER 15m

NOTE/EXCESS FILL FROM CELL/EXCAVATION TO BE STOCKPILED IN GULLY

LEACHATE CONTROL DRAIN ALONG TOP OF CELL WALL

LEACHATE TANK

LEACHATE DRAIN

PROPOSED CELL

NOTE: PROPOSED CONTOURS REFER TO SUBGRADE LEVELS BELOW LINER

4.5m WIDE BENCHING

LEACHATE CONTROL DRAIN DOWN BATTER

UPGRADE SEDIMENT POND

SUBSOIL DRAIN UNDER LINER SEE DRG. C19

375 RCP AND HEADWALLS UNDER ACCESS ROAD AT SAG - MIN 1.0% GRADE INLET INV-65.70 OULET INV-65.60

START OF TABLE DRAIN

LIMIT OF SEALED PAVEMENT

LEVEL SPREADER SEE DETAIL DRG. C17

NOTE PROVIDE SPEED HUMPS (TYPE 1) IN ACCORDANCE WITH AS 2890.1 2004, AT 30m INTERVALS FROM WEIGHBRIDGE TO LIMIT OF SEALED WORKS AT CH340.00

NOTE EXISTING VICTAULIC PRESSURE PIPELINE FROM LEACHATE DAM ALONG EXISTING ACCESS ROAD TO BE LOCATED IN FIELD BY SUPERINTENDENT AND RELOCATED BY CONTRACTOR AS PER SPECIFICATION

OUTLINE OF EXTENDED SEDIMENT POND

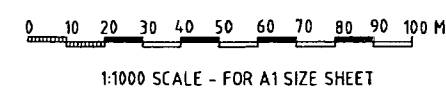
PROPOSED GW BORE LOCATION - SEE DETAIL DRG C21

REROUTE TABLE DRAIN TO DISCHARGE INTO SEDIMENT POND SEE DETAIL DRG. C17

375 RCP AND HEADWALLS UNDER CELL ACCESS INLET INV. 43.0 OULET INV. 40.2

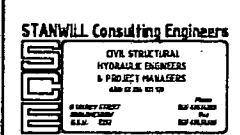
JOIN TO EXISTING TABLE DRAIN

9.0m WIDE CELL ACCESS ENTRY NOM. LENGTH - 32m PAVEMENT DESIGN AS PER UNSEALED ACCESS ROAD REF. PROFILE - DRG. C07



PROPOSED ACCESS ROAD

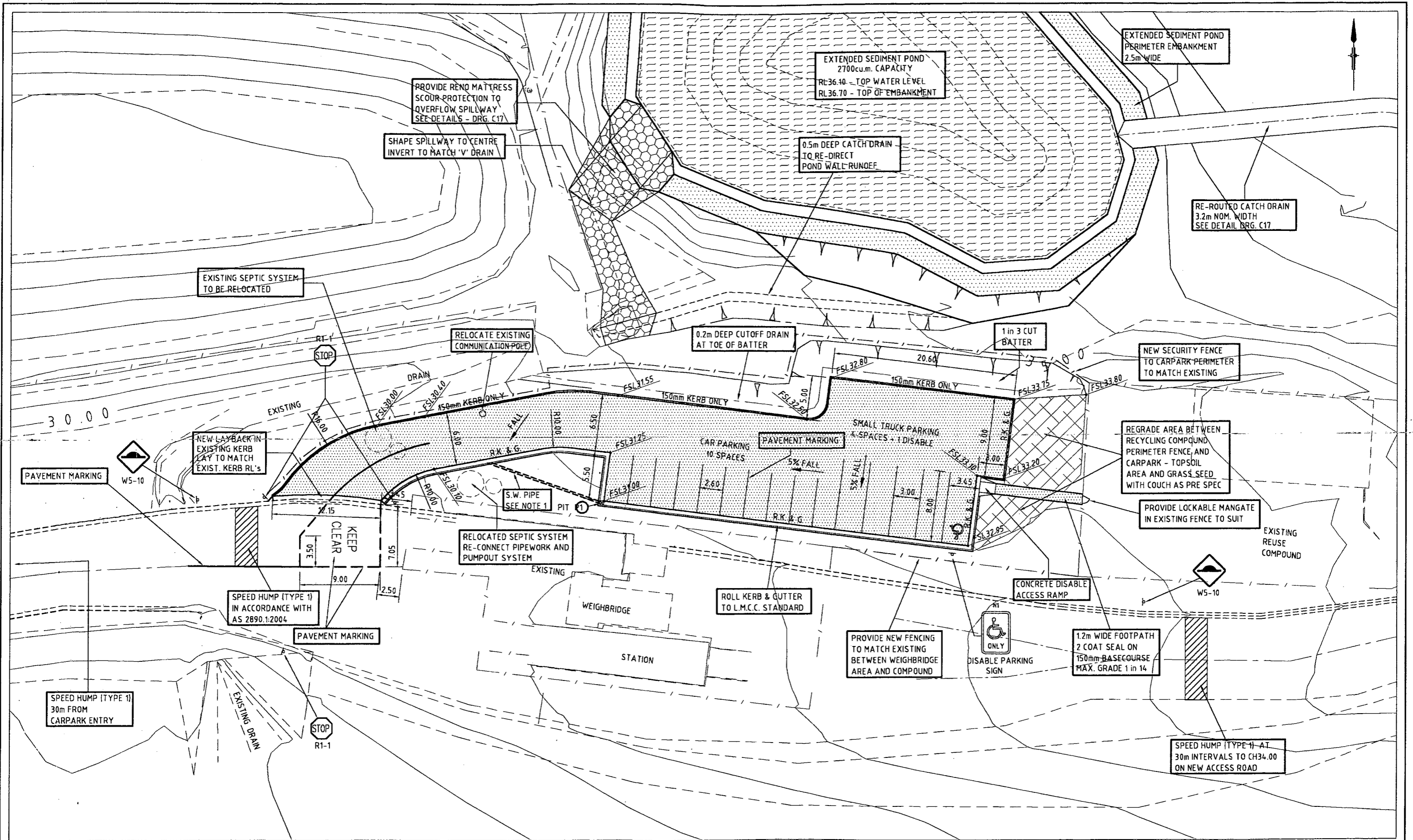
TABLE DRAIN DISCHARGE TO LEVEL SPREADER



AWABA WASTE MANAGEMENT FACILITY GENERAL ARRANGEMENT

SCE JOB NO: 6220	CLIENT Lake Macquarie City Council	PROJECT No 3980
DESIGNED:	DRAWN BY GJP	SCALE AS SHOWN
APPROVED:	APPROVED BY [Signature]	DATE 19.1.05
		DRAWING No CO2 REV E
		OFFICE NEWCASTLE

CDT-DWG-A3H-001/1

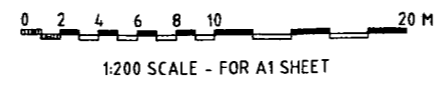


LEGEND

- SEALED CARPARK AND ACCESS - REFER NOTES DRG.C01
- 450SQ. PRECAST CONC. S.I. PIT - LIGHT DUTY GRATE WITH 2 x 100Ø OUTLETS - IL30.60
- FINISHED PAVEMENT LEVELS - LIP OF KERB / TOE OF KERB ONLY
- NOTE 1: 2 x 100Ø uPVC Class SN8 PIPES - 13.5m LONG
PIT OUTLET - IL30.60 GUTTER OUTLET - IL30.40 NOM.

LINEMARKING

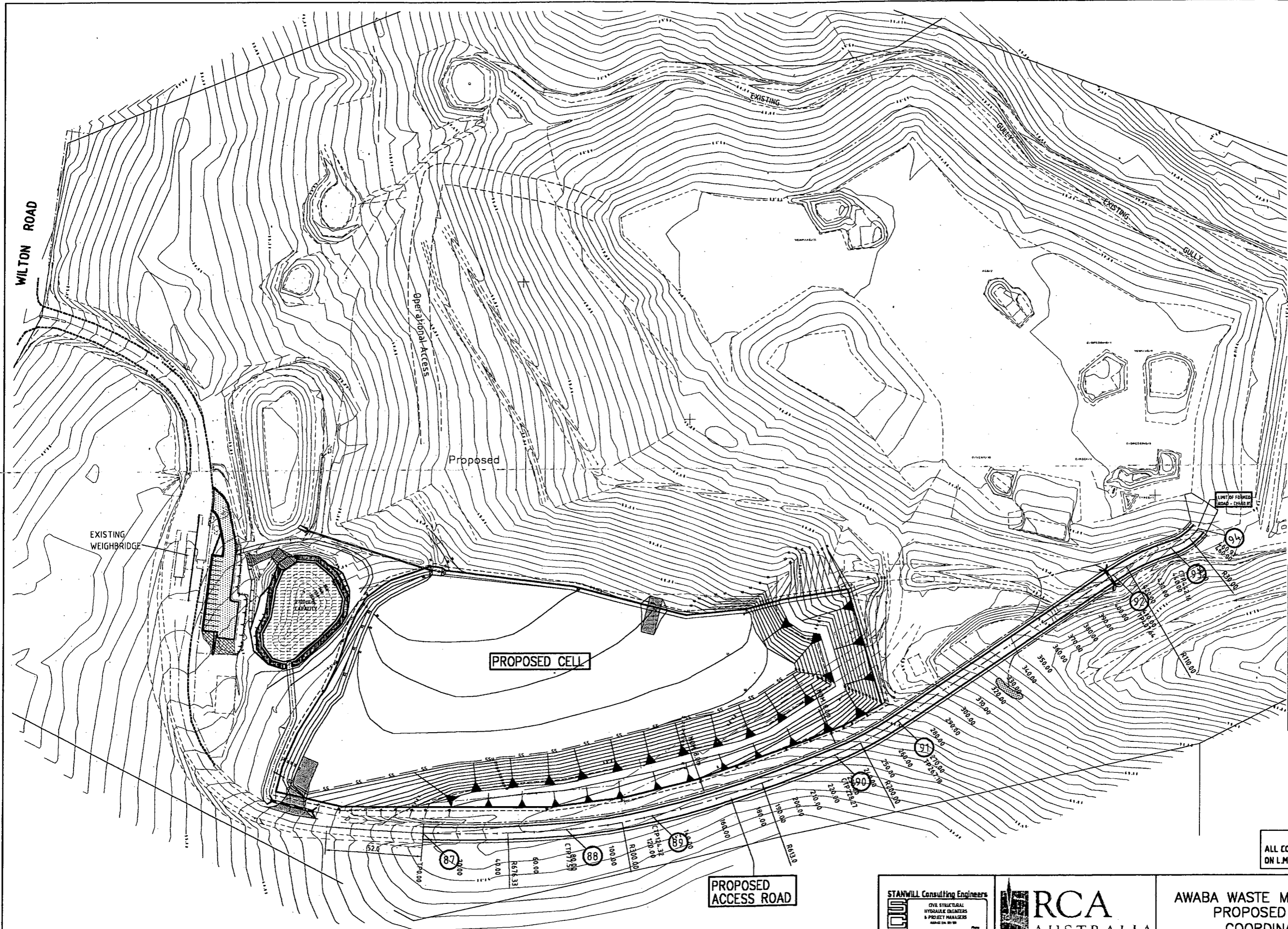
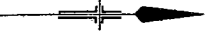
- 1 LINEMARKING & SIGNAGE TO AS1742.1 & AS2890.1 & 5
- 2 CARPARKING SPACES DELINEATED BY UNBROKEN LANE LINES
- 3 LINEMARKING SHALL BE WHITE U.N.O.
- 4 ADVISORY SPEED RESTRICTION SIGNS TO BE INSTALLED AS DIRECTED BY THE SUPERINTENDENT OR SUPERINTENDENTS REPRESENTATIVE.



ALL DISTURBED AREAS TO BE GRASSED STABILISED COUCH SEEDED. DRAINS TO BE COUCH TURFED.

 CIVIL, STRUCTURAL, HYDRAULIC ENGINEERS & PROJECT MANAGERS 10/11 WILSON STREET, NEWCASTLE NSW 2300 PH: 081 422 2222	 GEOTECHNICAL • ENVIRONMENTAL		AWABA WASTE MANAGEMENT FACILITY PROPOSED CARPARKING AND ASSOCIATED WORKS GENERAL ARRANGEMENT	
	CLIENT Lake Macquarie City Council		PROJECT No 3980	
	SCE JOB NO: DESIGNED: APPROVED:	DRAWN BY GJP APPROVED BY	SCALE AS SHOWN DATE 19.1.05	DRAWING No C03 REV C OFFICE NEWCASTLE

COT-DWG-A5H-001/1

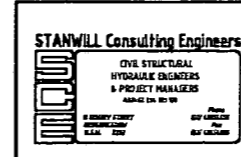
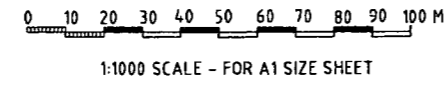


SCHEDULE OF COORDINATES

No.	COORDINATES	DESCRIPTION
87	E 1336.403 N 966.000	ACCESS ROAD CENTRELINE
88	E 1334.637 N 1043.505	ACCESS ROAD CENTRELINE
89	E 1327.286 N 1089.627	ACCESS ROAD CENTRELINE
90	E 1294.547 N 1188.165	ACCESS ROAD CENTRELINE
91	E 1275.825 N 1222.205	ACCESS ROAD CENTRELINE
92	E 1196.503 N 1338.123	ACCESS ROAD CENTRELINE
93	E 1181.752 N 1369.220	ACCESS ROAD CENTRELINE
94	E 1171.358 N 1384.416	ACCESS ROAD CENTRELINE LIMIT OF FORMED ROAD

NOTE: COORDINATED SETOUT POINTS 95 TO 99 NOT USED

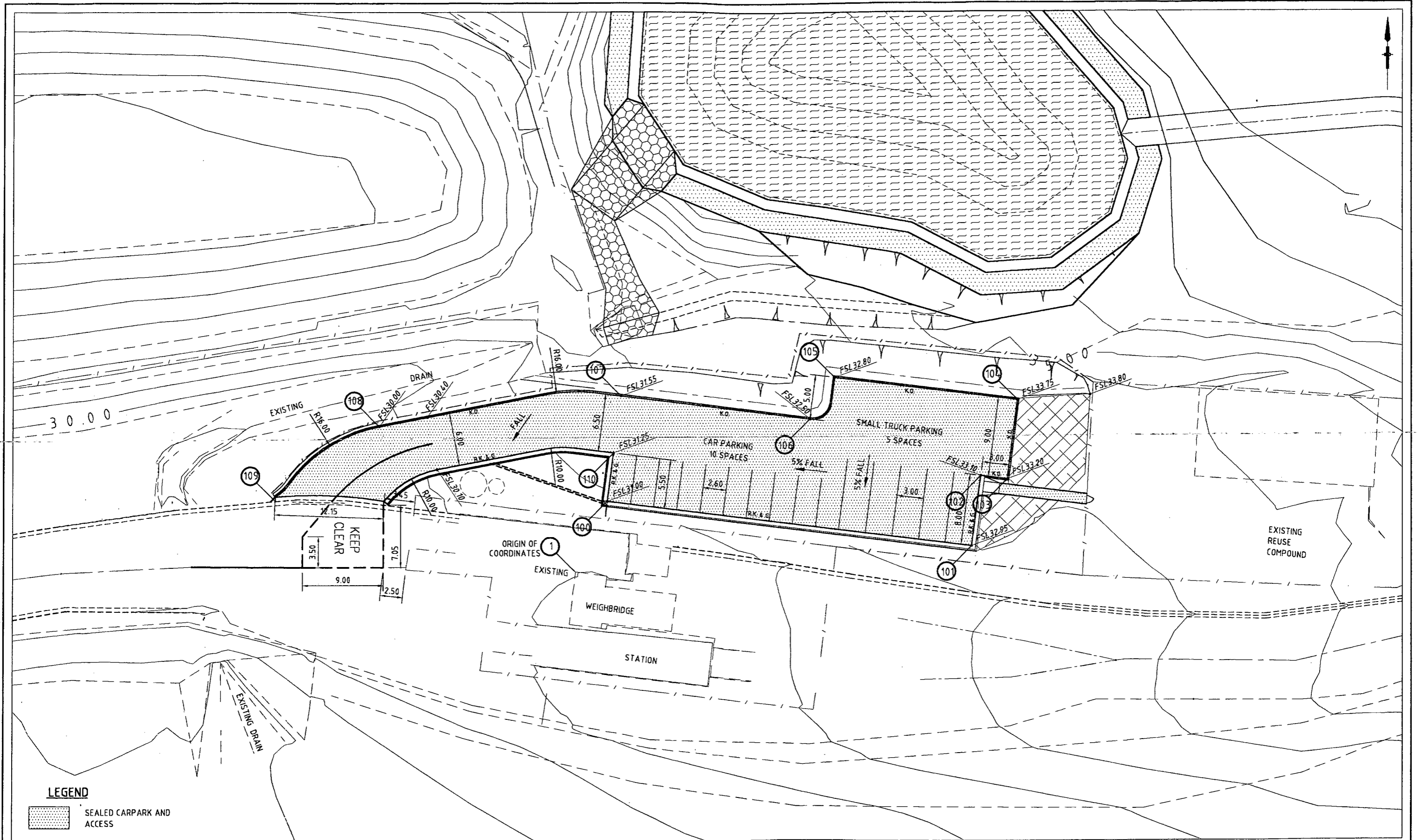
NOTE
ALL COORDINATES ON LOCAL GRID ESTABLISHED
ON L.M.C.'s SURVEY DATA FILE - AWABA04.ASS



AWABA WASTE MANAGEMENT FACILITY
PROPOSED ACCESS ROAD
COORDINATED SETOUT

SCE JOB NO: 6220	CLIENT Lake Macquarie City Council	PROJECT No 3980
DESIGNED:	DRAWN BY GJP	SCALE AS SHOWN
APPROVED:	APPROVED BY [Signature]	DATE 19.1.05
		DRAWING No C04 REV B
		OFFICE NEWCASTLE

COT-DWG-A3H-001/1

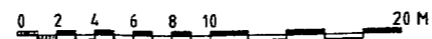


LEGEND

SEALED CARPARK AND ACCESS

SCHEDULE OF COORDINATES

No.	COORDINATES	DESCRIPTION	No.	COORDINATES	DESCRIPTION
1	E 1181.265 N 864.163	ORIGIN-N/W CNR WEIGHBRIDGE BLDG.	105	E 1210.149 N 866.105	TOE OF KERB ONLY - CARPARK
100	E 1184.804 N 852.169	LIP OF KERB - CARPARK	106	E 1207.399 N 861.412	TOE OF KERB ONLY - CARPARK
101	E 1225.461 N 847.034	LIP OF KERB - CARPARK	107	E 1185.307 N 864.075	TOE OF KERB ONLY - CARPARK
102	E 1226.483 N 854.971	LIP OF KERB - CARPARK	108	E 1159.362 N 860.631	TOE OF KERB ONLY - CARPARK
103	E 1225.459 N 854.595	TOE OF KERB ONLY - CARPARK	109	E 1147.619 N 852.194	TOE OF KERB ONLY - CARPARK
104	E 1230.587 N 863.524	TOE OF KERB ONLY - CARPARK	110	E 1185.493 N 857.626	LIP OF KERB - CARPARK



1:200 SCALE - FOR A1 SHEET

NOTE
ALL COORDINATES ON LOCAL GRID ESTABLISHED ON L.M.C.'s SURVEY DATA FILE - AWABA04.ASS

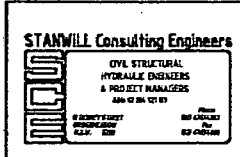
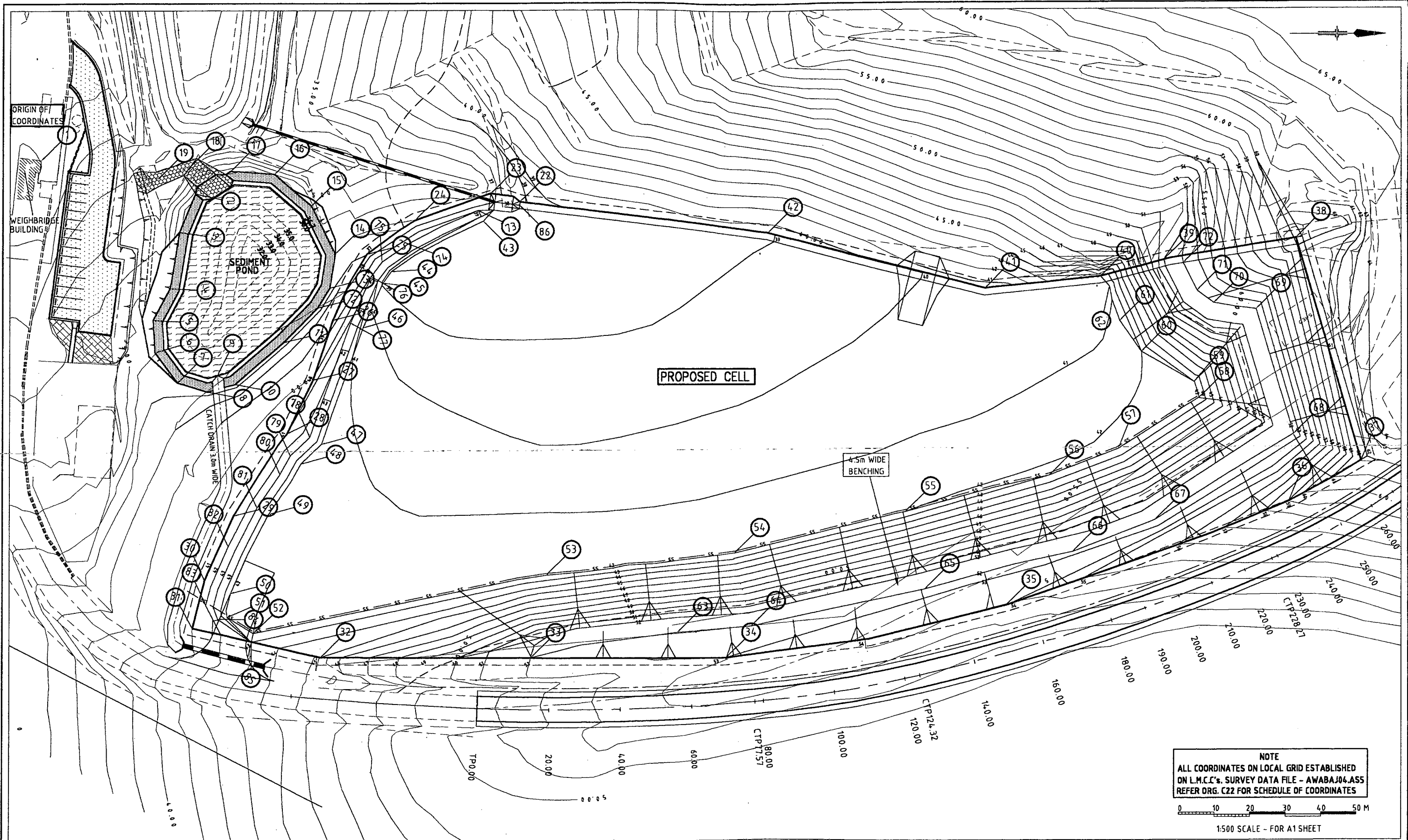
FINISHED PAVEMENT LEVEL
LIP OF KERB / TOE OF KERB ONLY



**AWABA WASTE MANAGEMENT FACILITY
PROPOSED CARPARKING
AND ASSOCIATED WORKS
COORDINATED SETOUT**

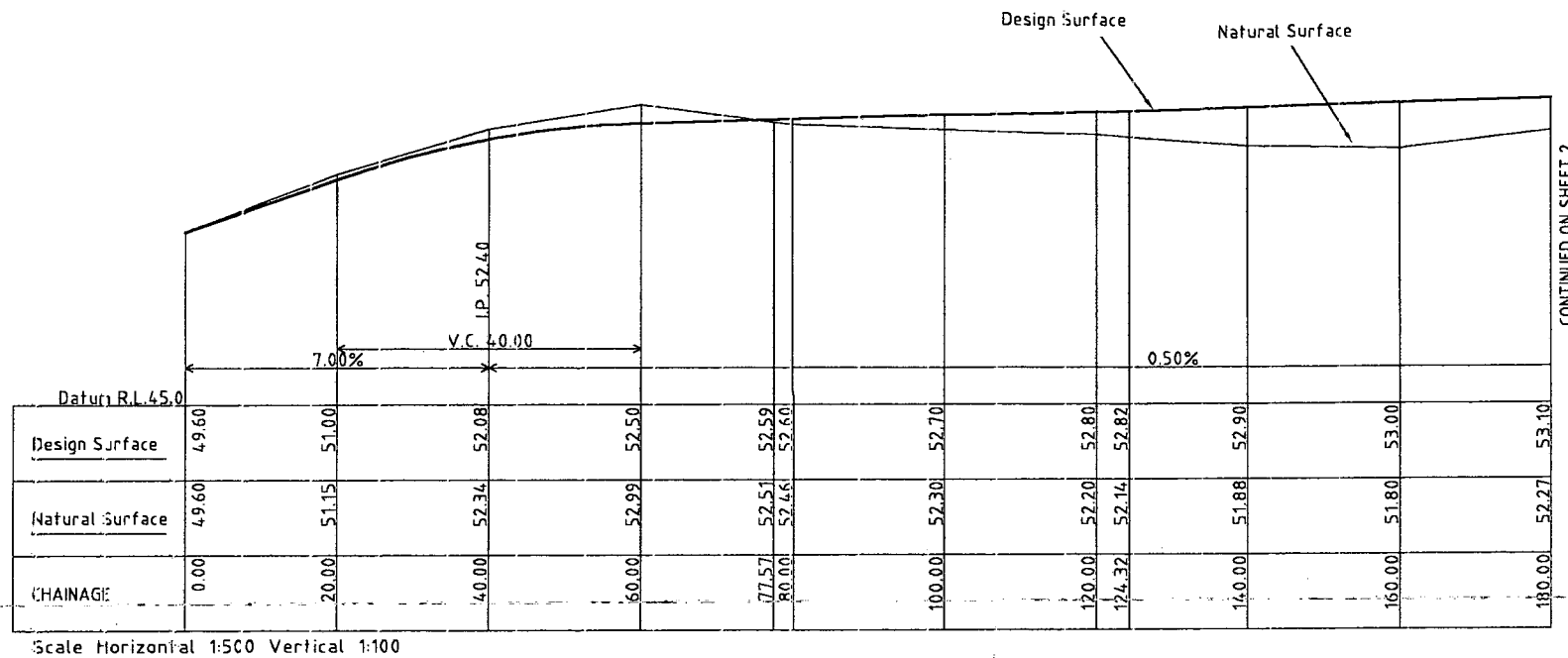
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DESIGNED:	DRAWN BY GJP	SCALE	AS SHOWN
APPROVED:	APPROVED BY	DATE	19.1.05
		DRAWING No	C05 REV B
		OFFICE	NEWCASTLE

CD1-DWG-A3H-001/1



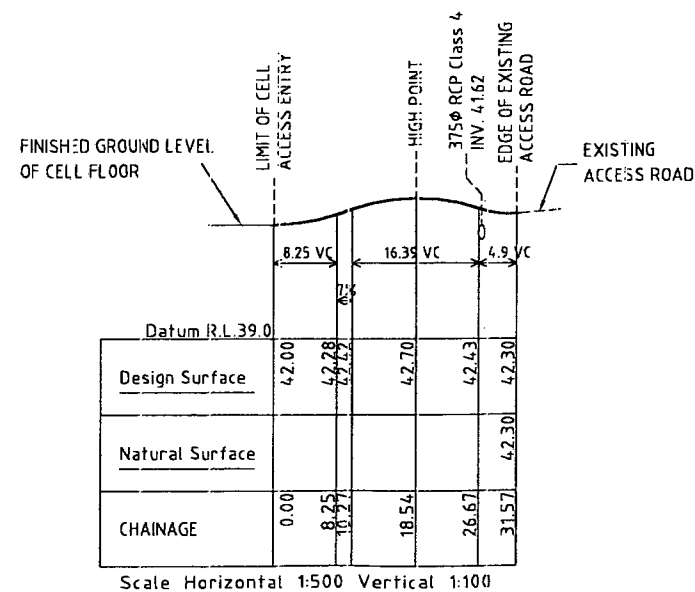
**AWABA WASTE MANAGEMENT FACILITY
PROPOSED CELL AND SEDIMENT POND
COORDINATED SETOUT**

SCE JOB NO: 6220	CLIENT Lake Macquarie City Council	PROJECT No 3980
DESIGNED:	DRAWN BY GJP	SCALE AS SHOWN
APPROVED:	APPROVED BY <i>R</i>	DATE 19.1.05
		DRAWING No C06 REV B
		OFFICE NEWCASTLE



ACCESS ROAD LONGITUDINAL SECTION

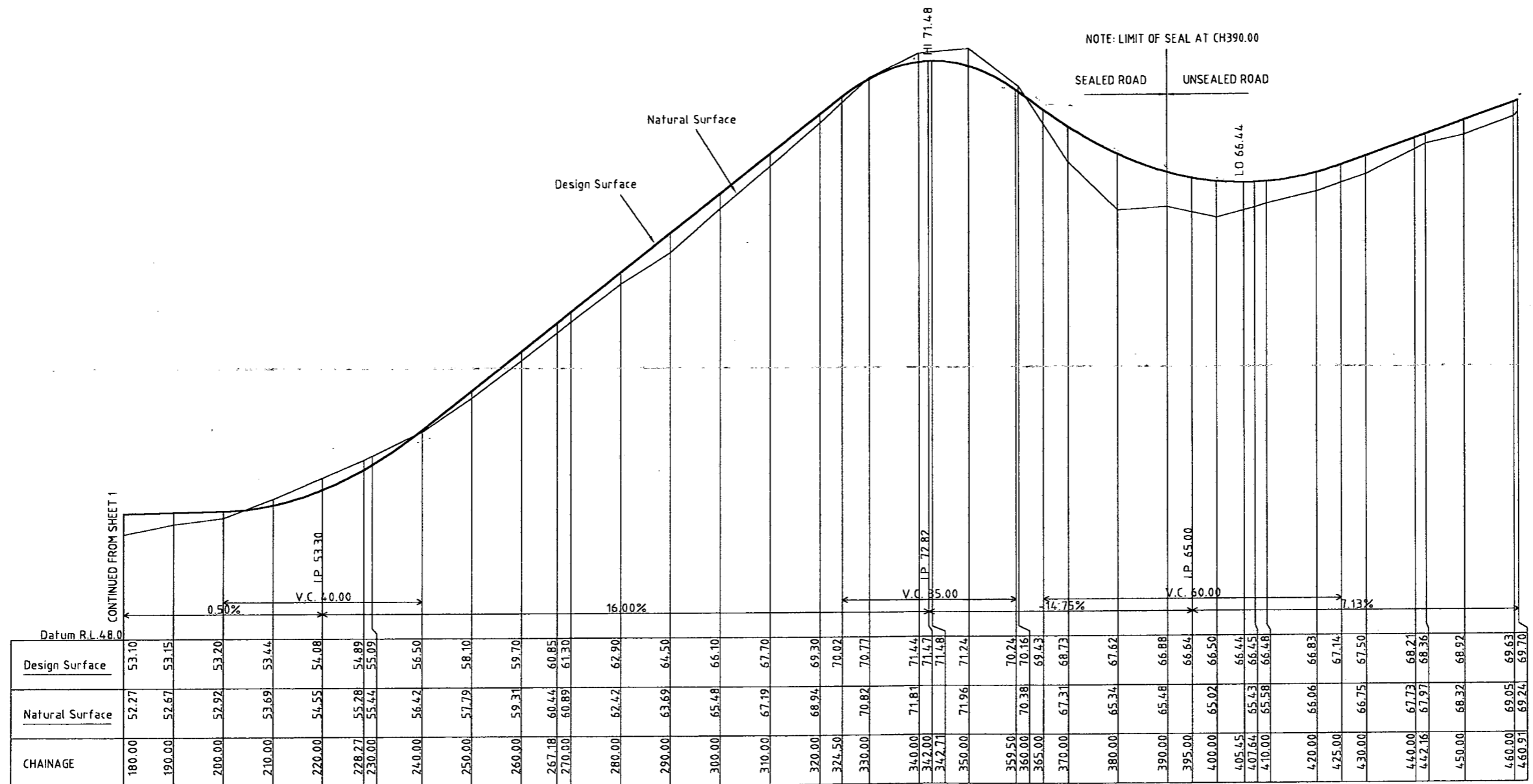
CONTINUED ON SHEET 2



CELL ACCESS ENTRY PROFILE

<p>STANWILL Consulting Engineers CIVIL STRUCTURAL HYDRAULIC ENGINEERS & PROJECT MANAGERS 10/11-12/13-14/15-16/17-18/19-20/21-22/23-24/25-26/27-28/29-30/31-32/33-34/35-36/37-38/39-40/41-42/43-44/45-46/47-48/49-50/51-52/53-54/55-56/57-58/59-60/61-62/63-64/65-66/67-68/69-70/71-72/73-74/75-76/77-78/79-80/81-82/83-84/85-86/87-88/89-90/91-92/93-94/95-96/97-98/99-100/101-102/103-104/105-106/107-108/109-110/111-112/113-114/115-116/117-118/119-120/121-122/123-124/125-126/127-128/129-130/131-132/133-134/135-136/137-138/139-140/141-142/143-144/145-146/147-148/149-150/151-152/153-154/155-156/157-158/159-160/161-162/163-164/165-166/167-168/169-170/171-172/173-174/175-176/177-178/179-180/181-182/183-184/185-186/187-188/189-190/191-192/193-194/195-196/197-198/199-200/201-202/203-204/205-206/207-208/209-210/211-212/213-214/215-216/217-218/219-220/221-222/223-224/225-226/227-228/229-230/231-232/233-234/235-236/237-238/239-240/241-242/243-244/245-246/247-248/249-250/251-252/253-254/255-256/257-258/259-260/261-262/263-264/265-266/267-268/269-270/271-272/273-274/275-276/277-278/279-280/281-282/283-284/285-286/287-288/289-290/291-292/293-294/295-296/297-298/299-300/301-302/303-304/305-306/307-308/309-310/311-312/313-314/315-316/317-318/319-320/321-322/323-324/325-326/327-328/329-330/331-332/333-334/335-336/337-338/339-340/341-342/343-344/345-346/347-348/349-350/351-352/353-354/355-356/357-358/359-360/361-362/363-364/365-366/367-368/369-370/371-372/373-374/375-376/377-378/379-380/381-382/383-384/385-386/387-388/389-390/391-392/393-394/395-396/397-398/399-400/401-402/403-404/405-406/407-408/409-410/411-412/413-414/415-416/417-418/419-420/421-422/423-424/425-426/427-428/429-430/431-432/433-434/435-436/437-438/439-440/441-442/443-444/445-446/447-448/449-450/451-452/453-454/455-456/457-458/459-460/461-462/463-464/465-466/467-468/469-470/471-472/473-474/475-476/477-478/479-480/481-482/483-484/485-486/487-488/489-490/491-492/493-494/495-496/497-498/499-500/501-502/503-504/505-506/507-508/509-510/511-512/513-514/515-516/517-518/519-520/521-522/523-524/525-526/527-528/529-530/531-532/533-534/535-536/537-538/539-540/541-542/543-544/545-546/547-548/549-550/551-552/553-554/555-556/557-558/559-560/561-562/563-564/565-566/567-568/569-570/571-572/573-574/575-576/577-578/579-580/581-582/583-584/585-586/587-588/589-590/591-592/593-594/595-596/597-598/599-600/601-602/603-604/605-606/607-608/609-610/611-612/613-614/615-616/617-618/619-620/621-622/623-624/625-626/627-628/629-630/631-632/633-634/635-636/637-638/639-640/641-642/643-644/645-646/647-648/649-650/651-652/653-654/655-656/657-658/659-660/661-662/663-664/665-666/667-668/669-670/671-672/673-674/675-676/677-678/679-680/681-682/683-684/685-686/687-688/689-690/691-692/693-694/695-696/697-698/699-700/701-702/703-704/705-706/707-708/709-710/711-712/713-714/715-716/717-718/719-720/721-722/723-724/725-726/727-728/729-730/731-732/733-734/735-736/737-738/739-740/741-742/743-744/745-746/747-748/749-750/751-752/753-754/755-756/757-758/759-760/761-762/763-764/765-766/767-768/769-770/771-772/773-774/775-776/777-778/779-780/781-782/783-784/785-786/787-788/789-790/791-792/793-794/795-796/797-798/799-800/801-802/803-804/805-806/807-808/809-810/811-812/813-814/815-816/817-818/819-820/821-822/823-824/825-826/827-828/829-830/831-832/833-834/835-836/837-838/839-840/841-842/843-844/845-846/847-848/849-850/851-852/853-854/855-856/857-858/859-860/861-862/863-864/865-866/867-868/869-870/871-872/873-874/875-876/877-878/879-880/881-882/883-884/885-886/887-888/889-890/891-892/893-894/895-896/897-898/899-900/901-902/903-904/905-906/907-908/909-910/911-912/913-914/915-916/917-918/919-920/921-922/923-924/925-926/927-928/929-930/931-932/933-934/935-936/937-938/939-940/941-942/943-944/945-946/947-948/949-950/951-952/953-954/955-956/957-958/959-960/961-962/963-964/965-966/967-968/969-970/971-972/973-974/975-976/977-978/979-980/981-982/983-984/985-986/987-988/989-990/991-992/993-994/995-996/997-998/999-1000</p>	<p>RCA AUSTRALIA GEOTECHNICAL • ENVIRONMENTAL</p>	AWABA WASTE MANAGEMENT FACILITY PROPOSED ACCESS ROAD LONGITUDINAL SECTION SHEET 1 OF 2 AND CELL ACCESS ENTRY PROFILE		
		SCE JOB NO: 6220	CLIENT Lake Macquarie City Council	PROJECT No 3980
		DESIGNED:	DRAWN BY GJP	SCALE AS SHOWN
APPROVED:	APPROVED BY <i>[Signature]</i>	DATE 19.1.05	OFFICE NEWCASTLE	

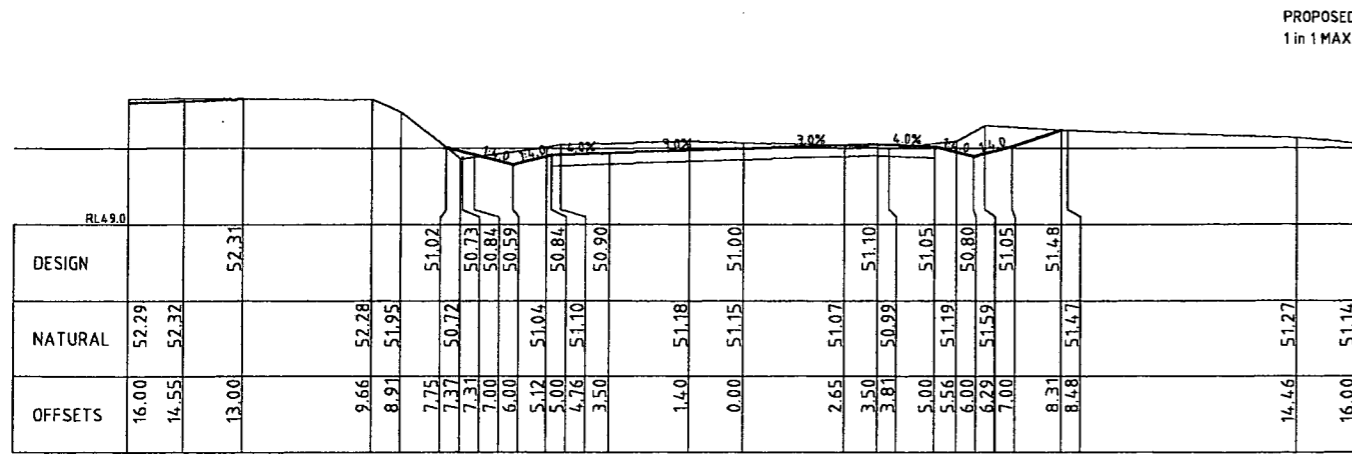
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ACCESS ROAD LONGITUDINAL SECTION

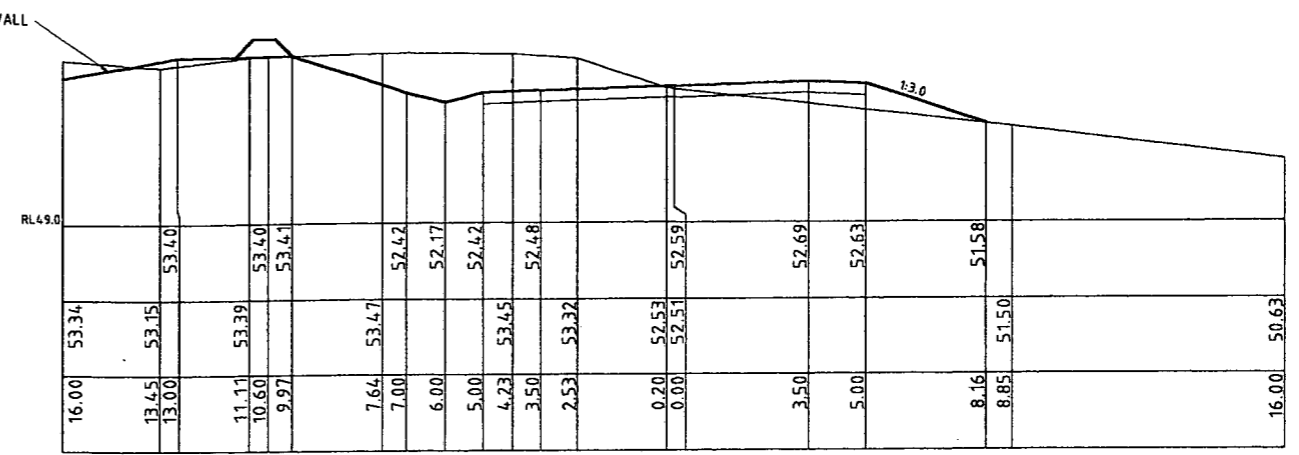
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		<p>SCE JOB NO: 6220</p>	<p>CLIENT Lake Macquarie City Council</p>	<p>PROJECT No 3980</p>
		<p>DESIGNED:</p>	<p>DRAWN BY GJP</p>	<p>SCALE AS SHOWN</p>
<p>APPROVED:</p>	<p>APPROVED BY <i>R</i></p>	<p>DATE 19.1.05</p>	<p>OFFICE NEWCASTLE</p>	



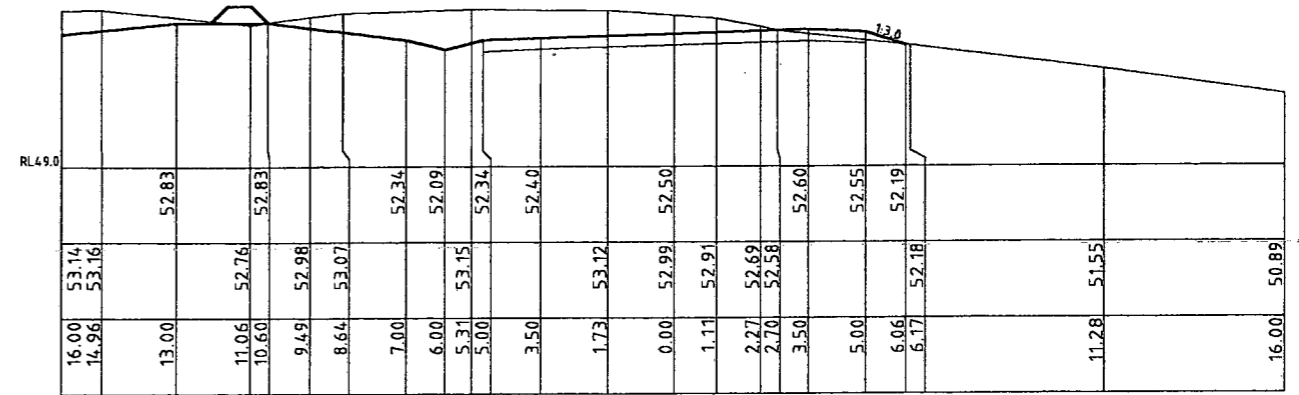
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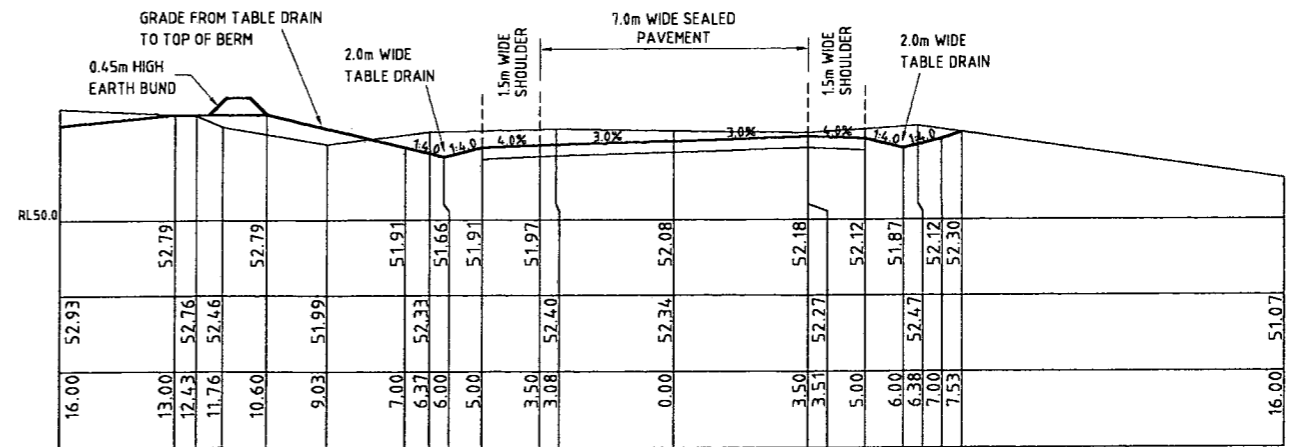
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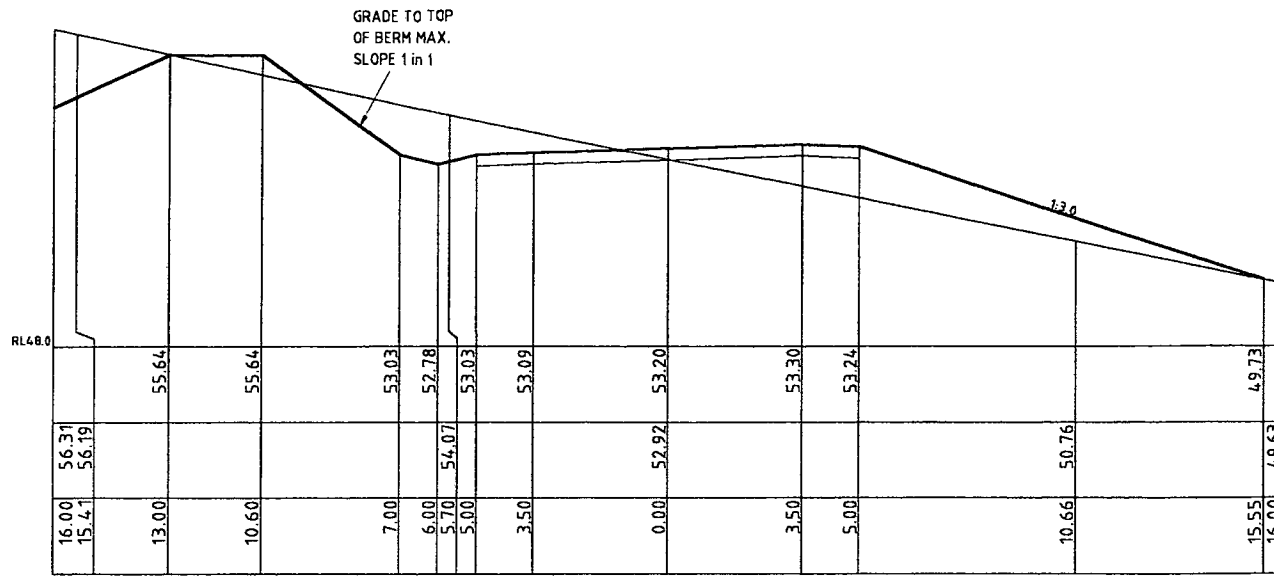
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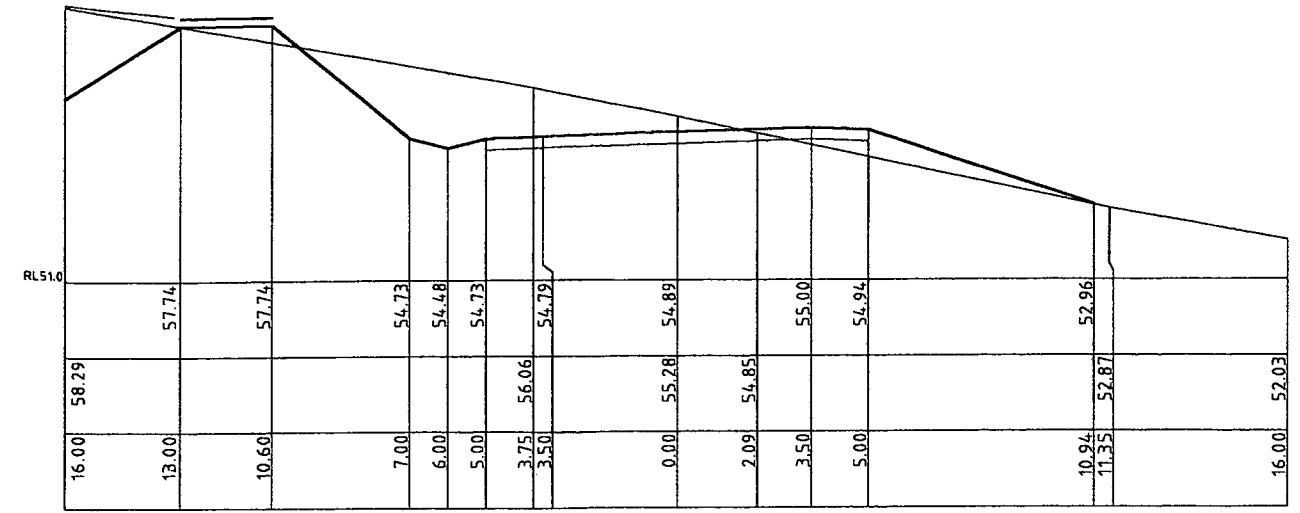
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<p>STANWILL Consulting Engineers CIVIL, STRUCTURAL, HYDRAULIC ENGINEERS & PROJECT MANAGERS 40th St, NSW, AUSTRALIA</p>	<p>RCA AUSTRALIA GEOTECHNICAL • ENVIRONMENTAL</p>	<p>AWABA WASTE MANAGEMENT FACILITY PROPOSED ACCESS ROAD CROSS SECTIONS SHEET 1 OF 8</p>	
		<p>SCE JOB NO: CLIENT Lake Macquarie City Council PROJECT No 3980</p>	<p>DESIGNED: DRAWN BY GJP SCALE 1 : 100 DRAWING No CO9 REV 0</p>
<p>APPROVED: APPROVED BY [Signature] DATE 19.1.05 OFFICE NEWCASTLE</p>			

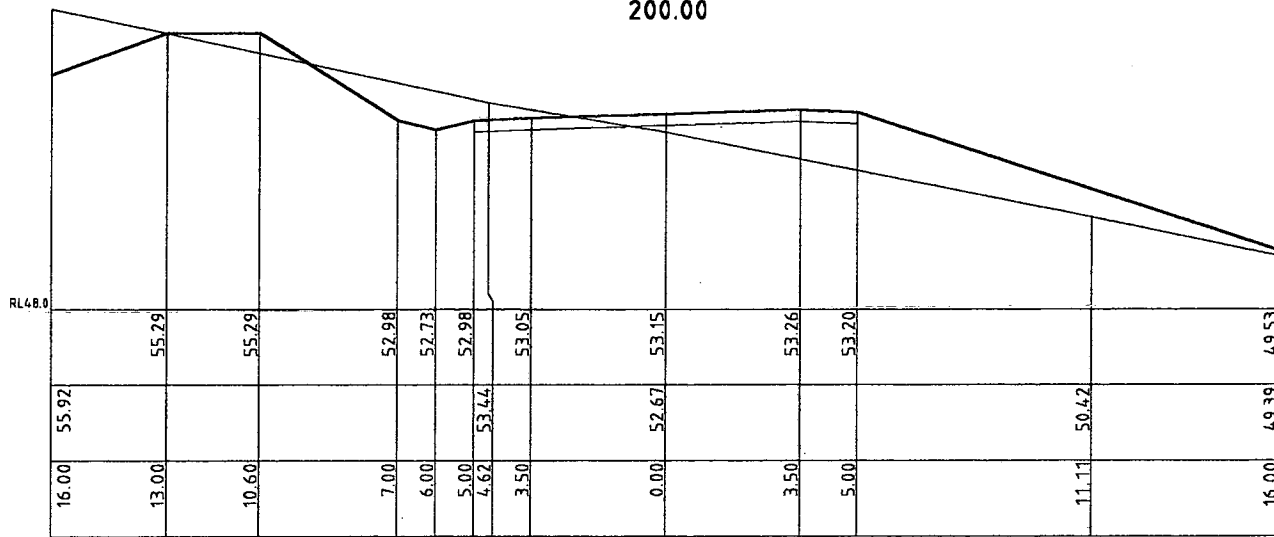
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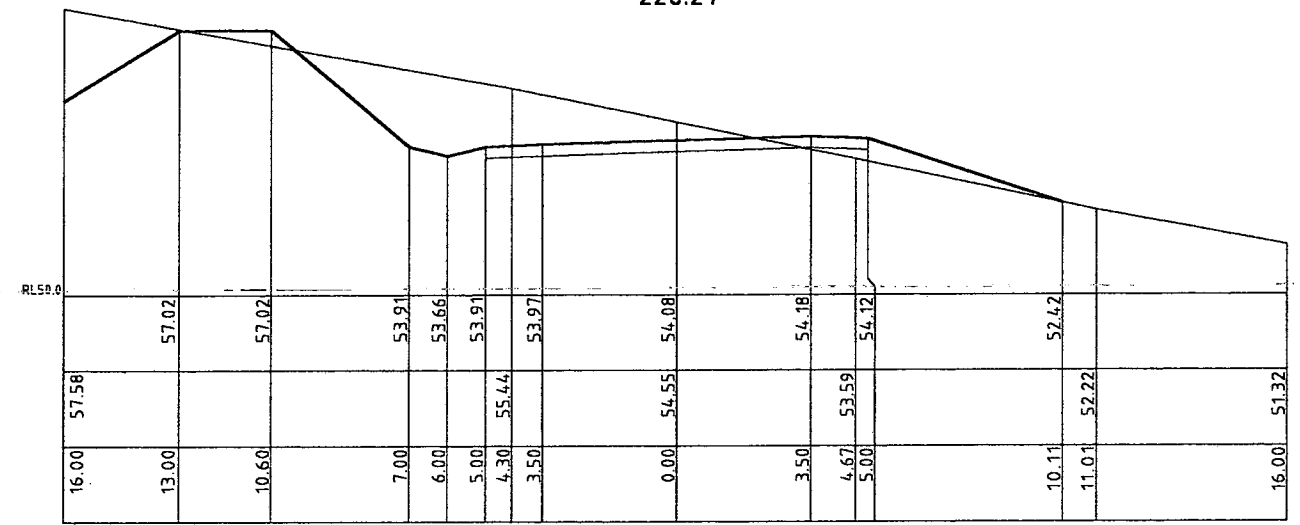
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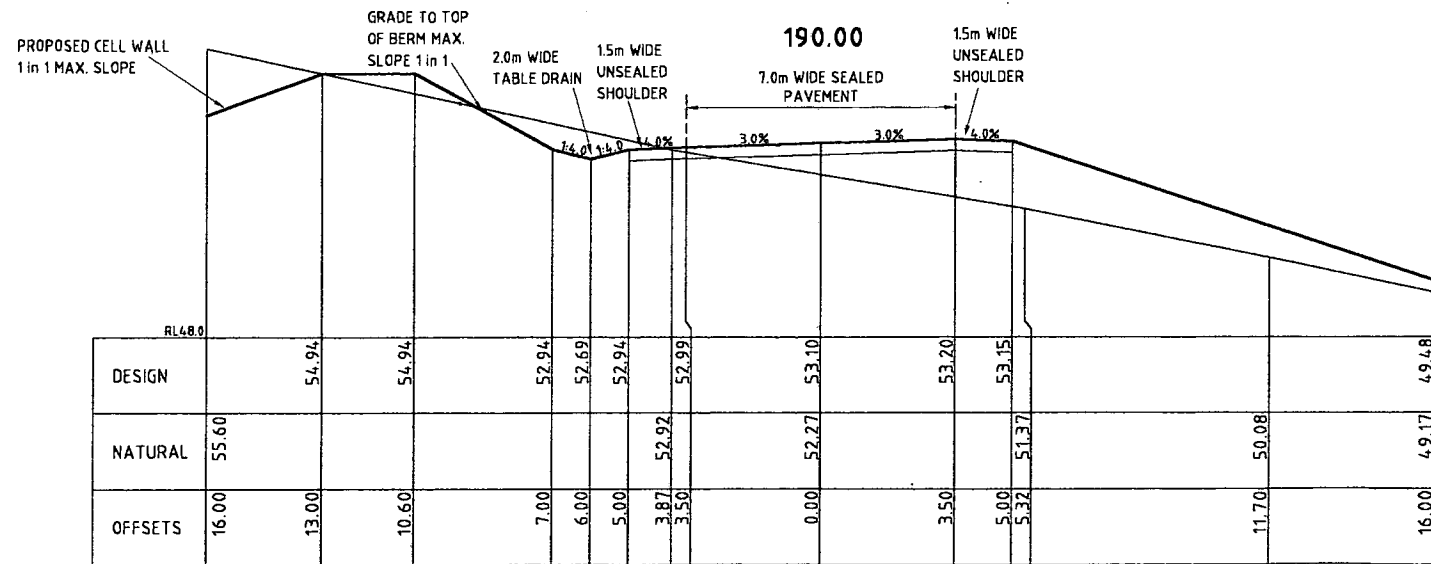
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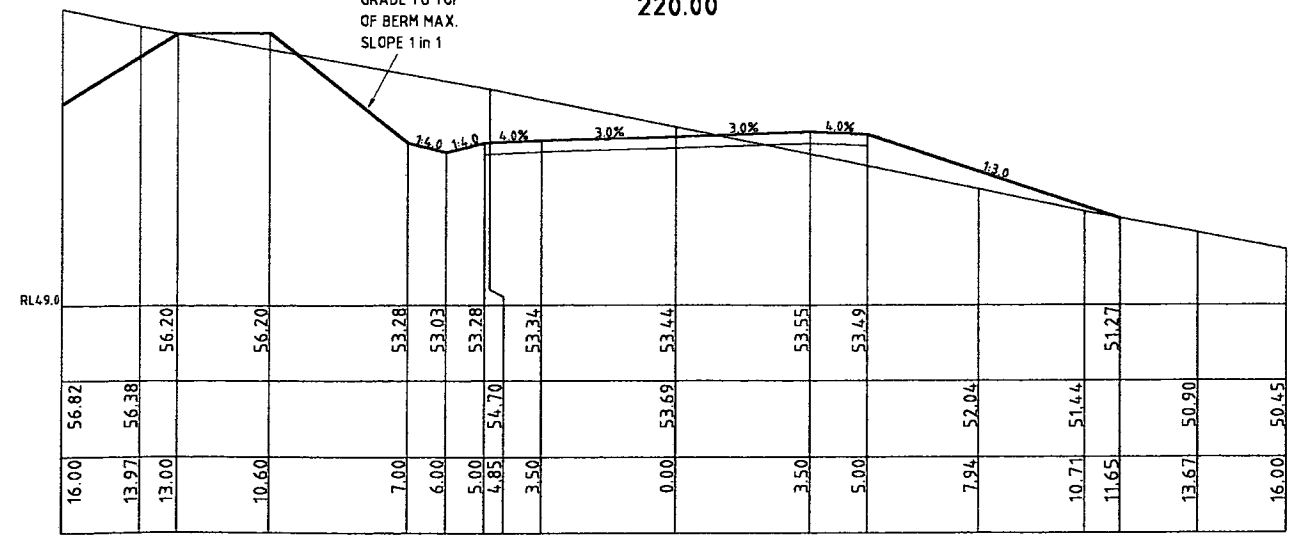
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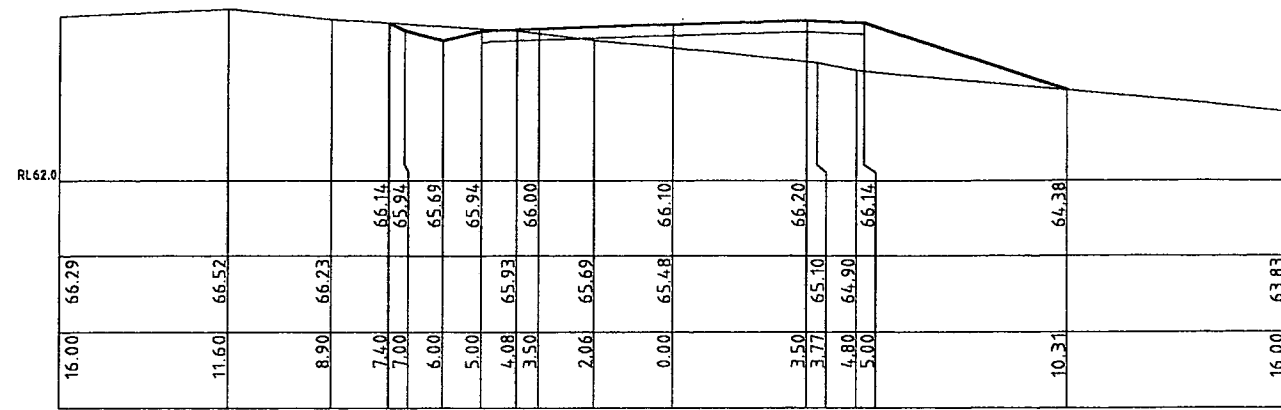


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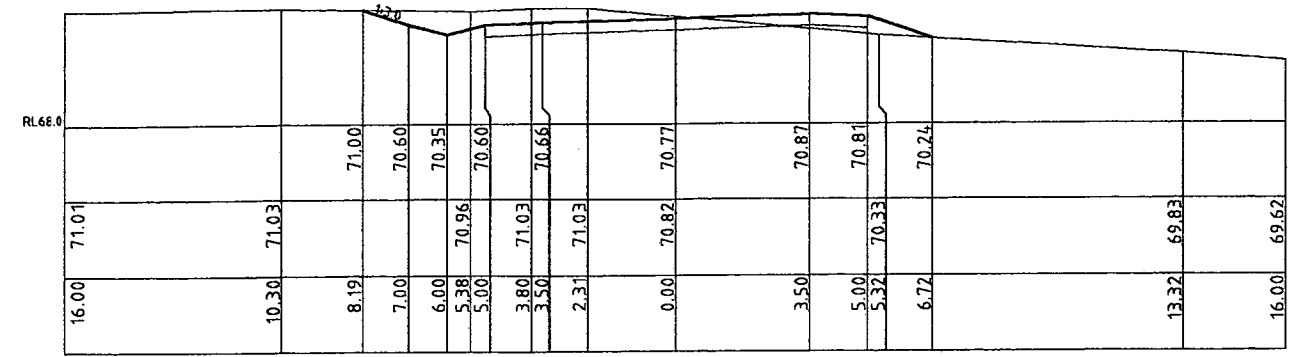
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		CLIENT Lake Macquarie City Council	PROJECT No 3980
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APPROVED:	APPROVED BY <i>R</i>	DATE 19.1.05	OFFICE NEWCASTLE

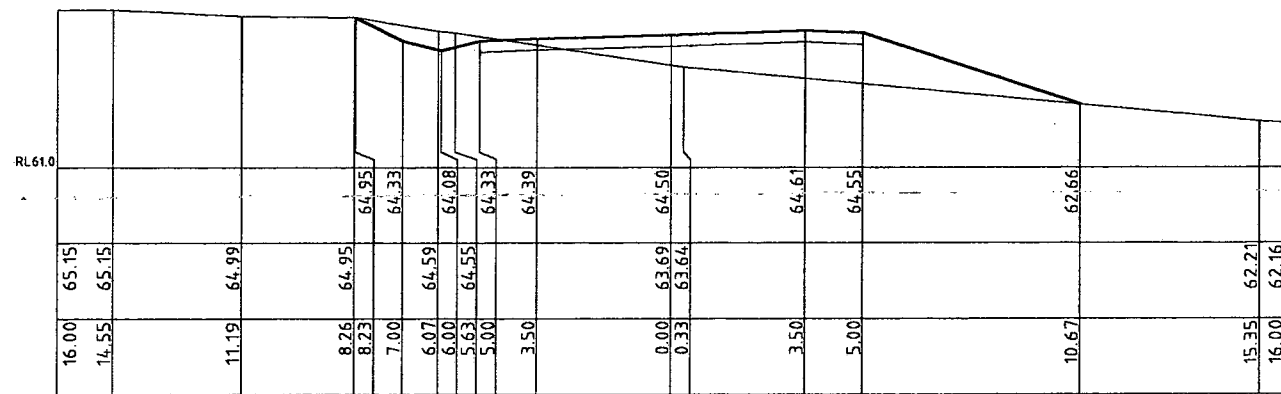
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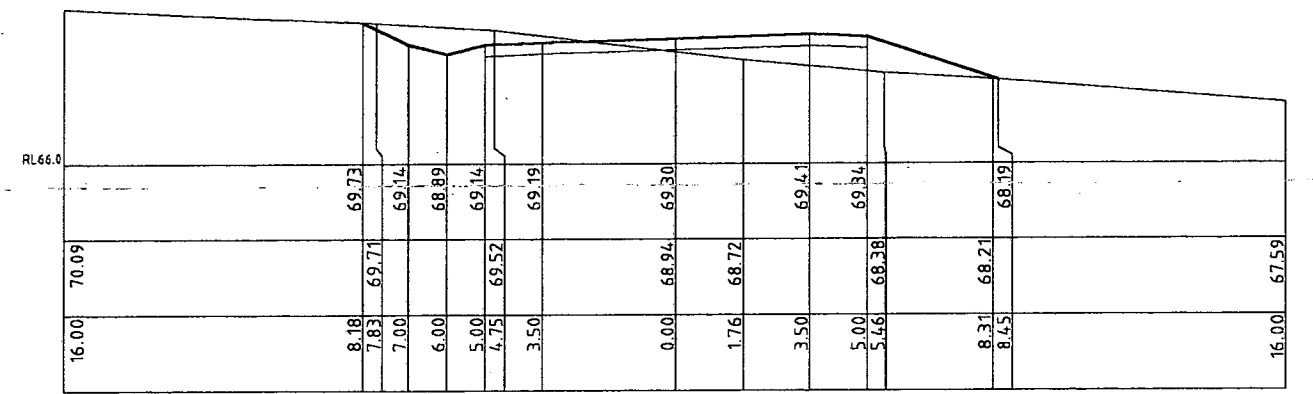
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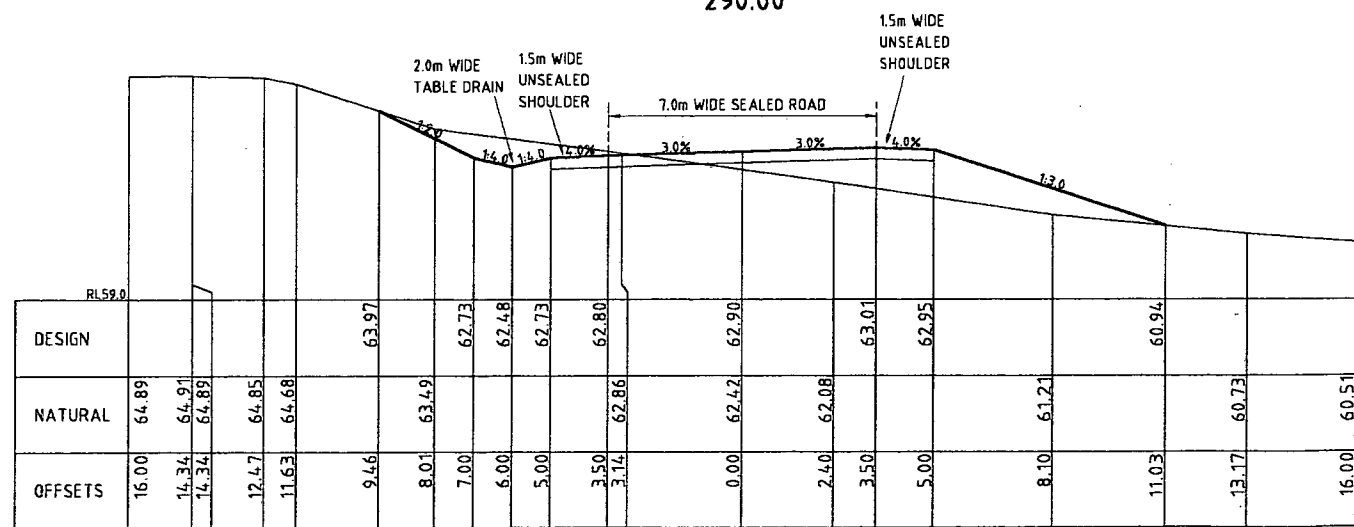
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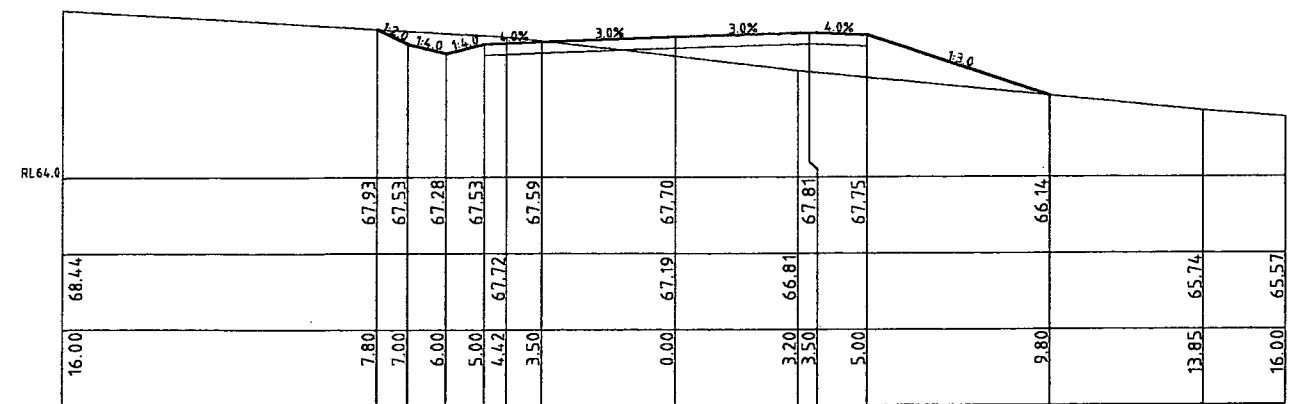
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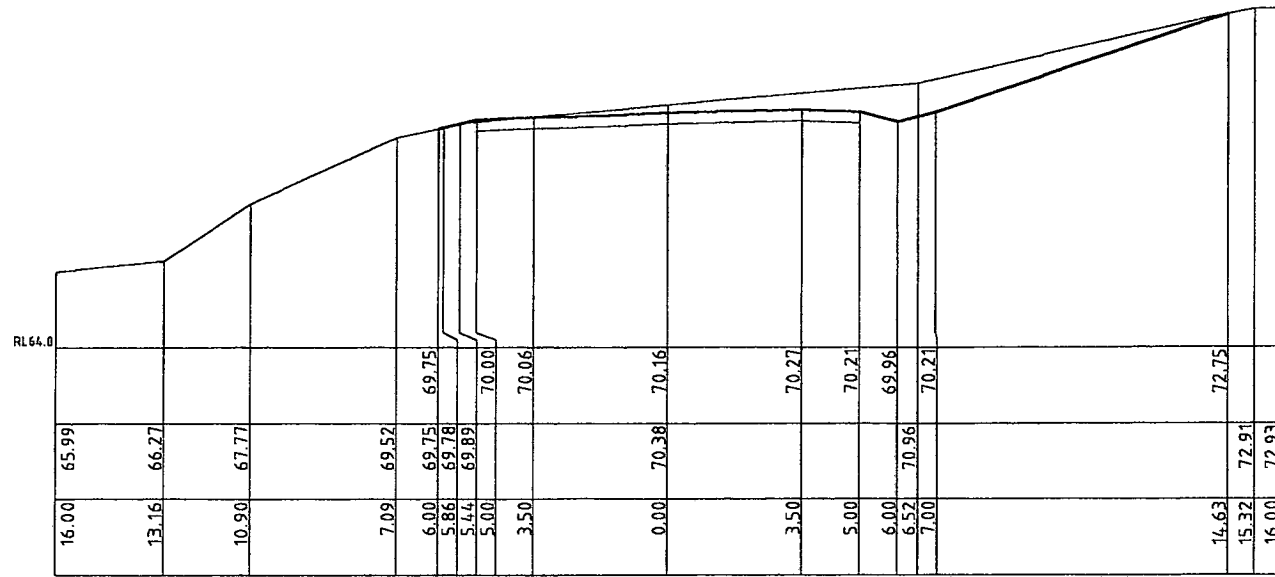


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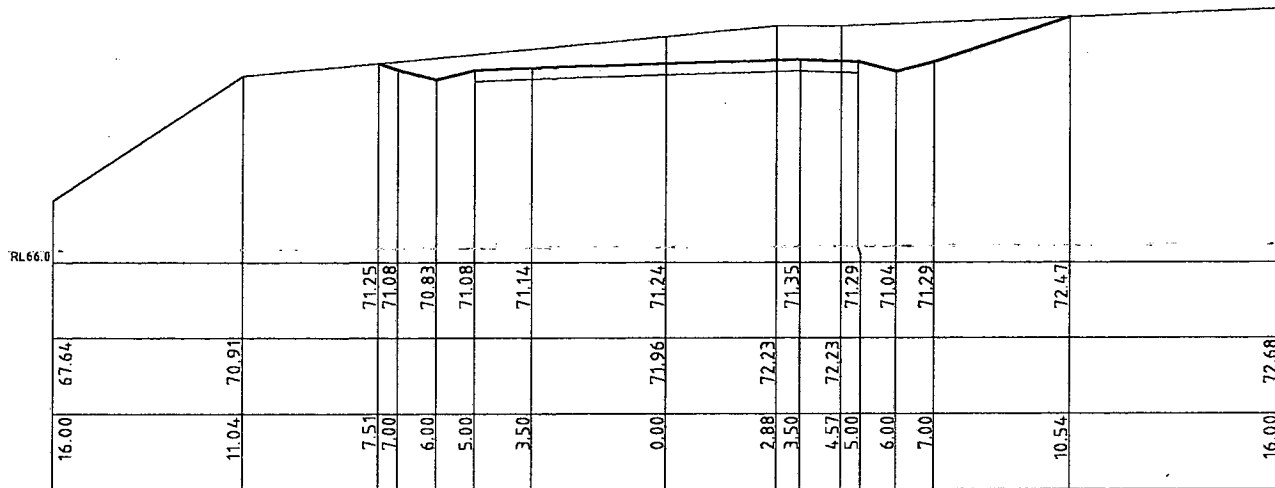
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		CLIENT Lake Macquarie City Council	PROJECT No 3980
SCE JOB NO:	DRAWN BY GJP	SCALE 1 : 100	DRAWING No C13 REV B
DESIGNED:	APPROVED BY <i>R</i>	DATE 19.1.05	OFFICE NEWCASTLE

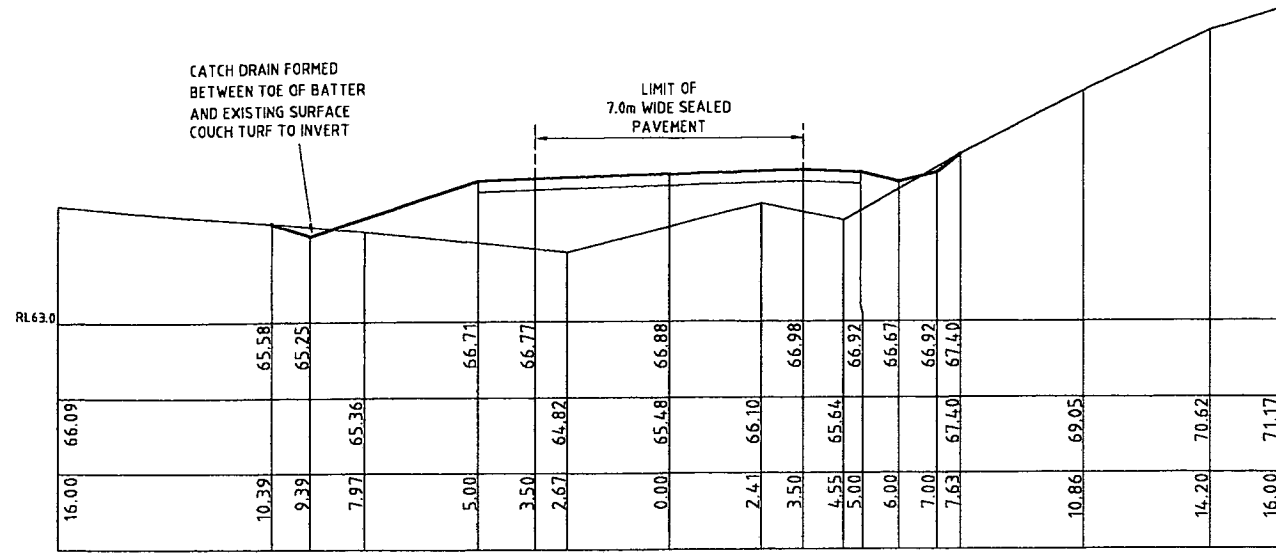
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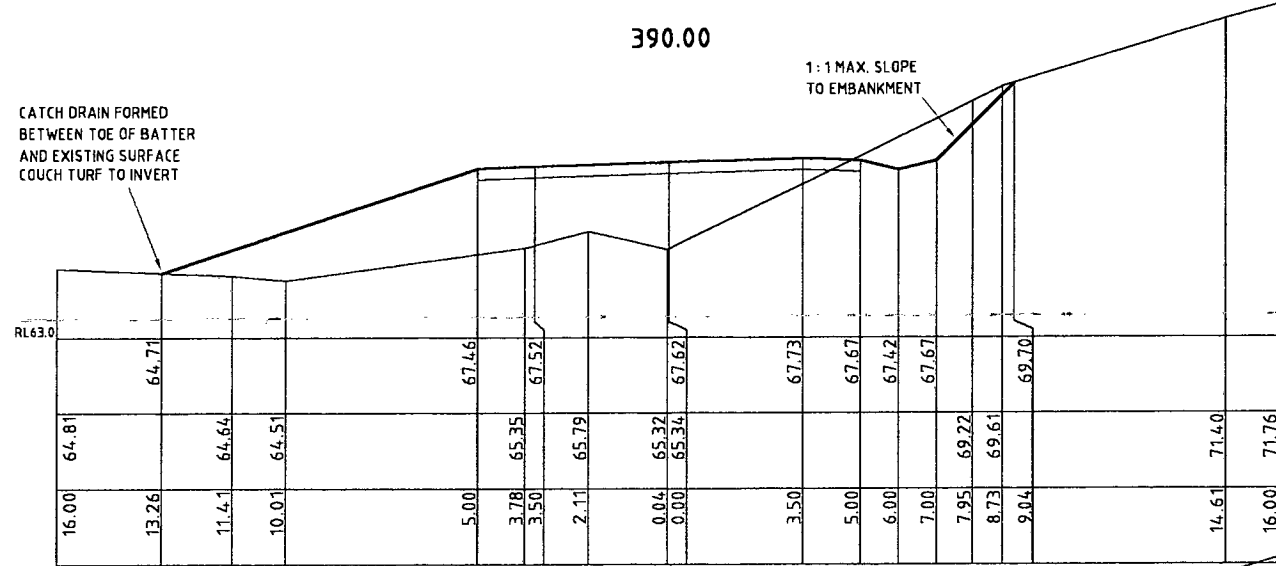
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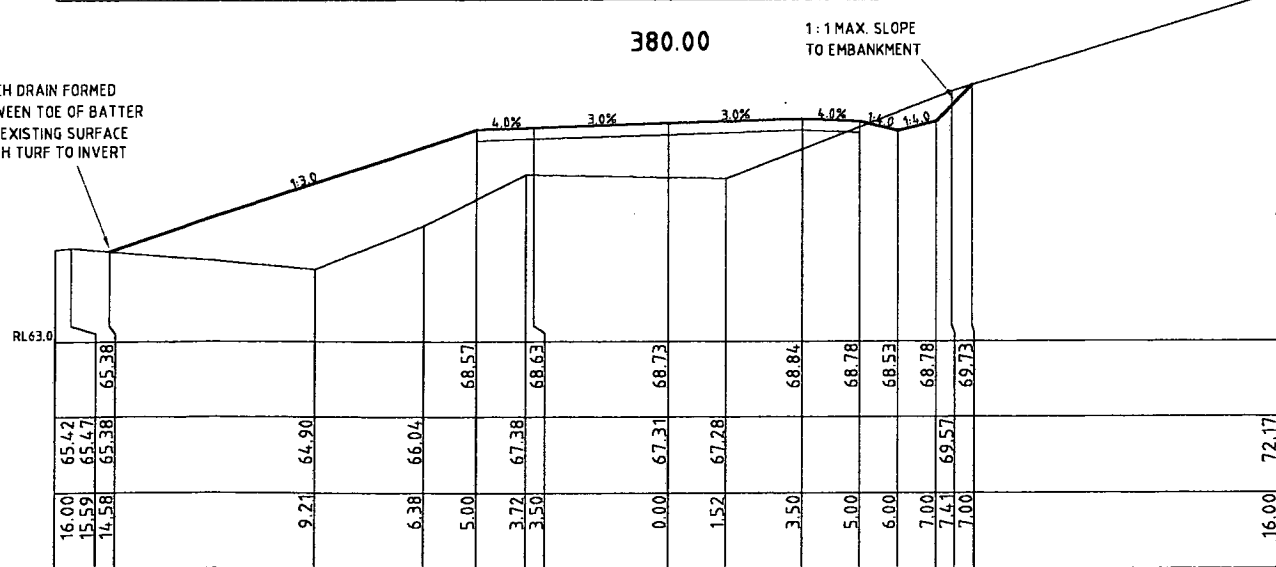
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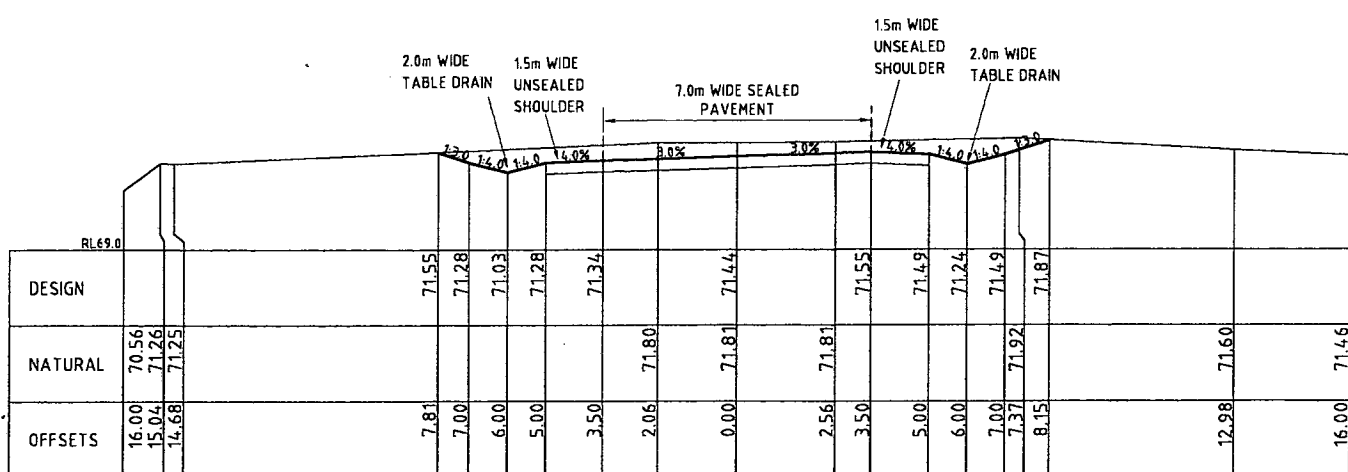
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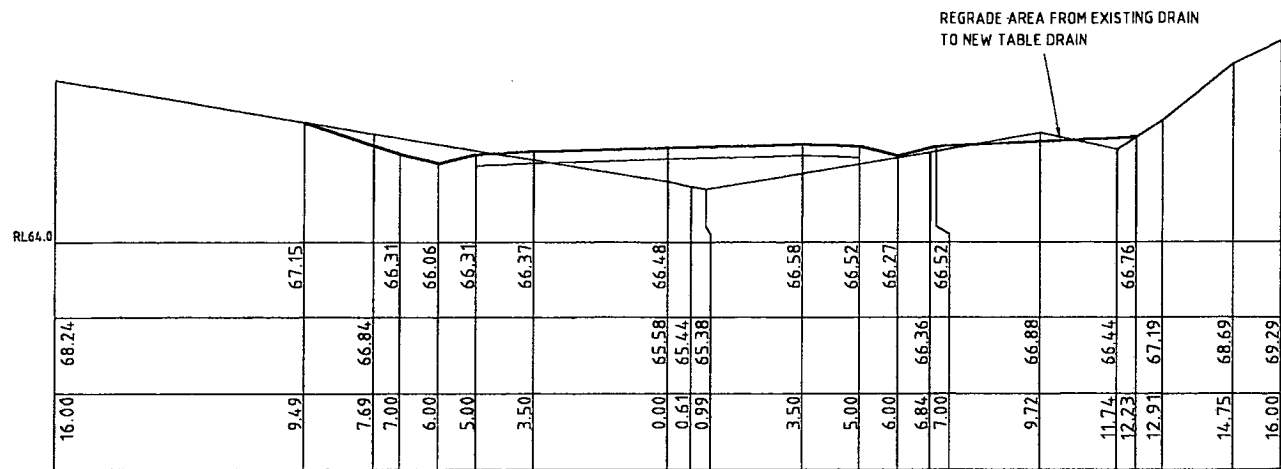


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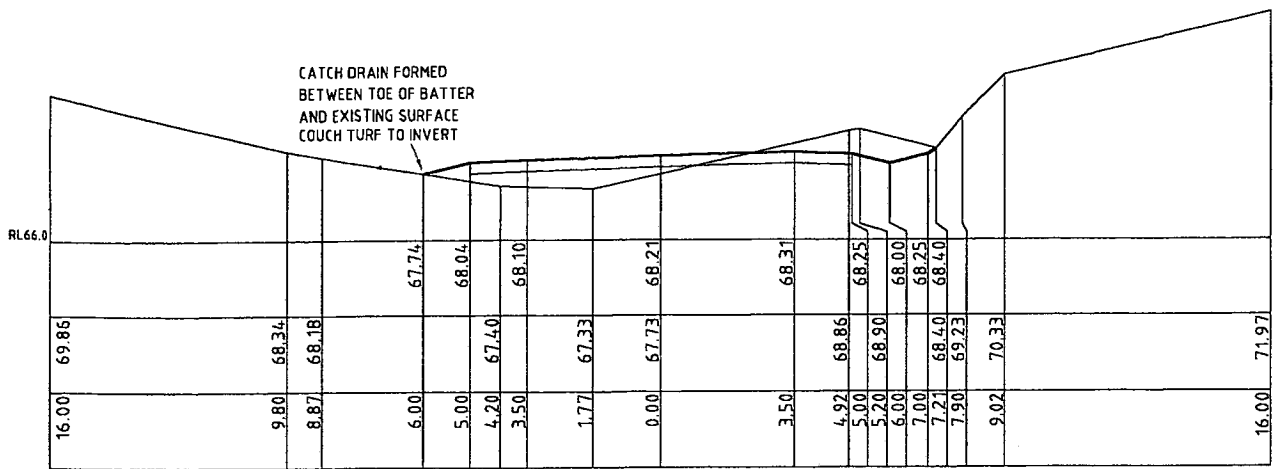
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<p>STANWILL Consulting Engineers CIVIL, STRUCTURAL, HYDRAULIC ENGINEERS & PROJECT MANAGERS JAN 19 2012</p>	<p>RCA AUSTRALIA GEOTECHNICAL • ENVIRONMENTAL</p>	<p>AWABA WASTE MANAGEMENT FACILITY PROPOSED ACCESS ROAD CROSS SECTIONS SHEET 6 OF 8</p>	
		<p>SCE JOB NO: CLIENT Lake Macquarie City Council PROJECT No 3980</p>	<p>DESIGNED: DRAWN BY GJP SCALE 1 : 100 DRAWING No C14 REV A</p>
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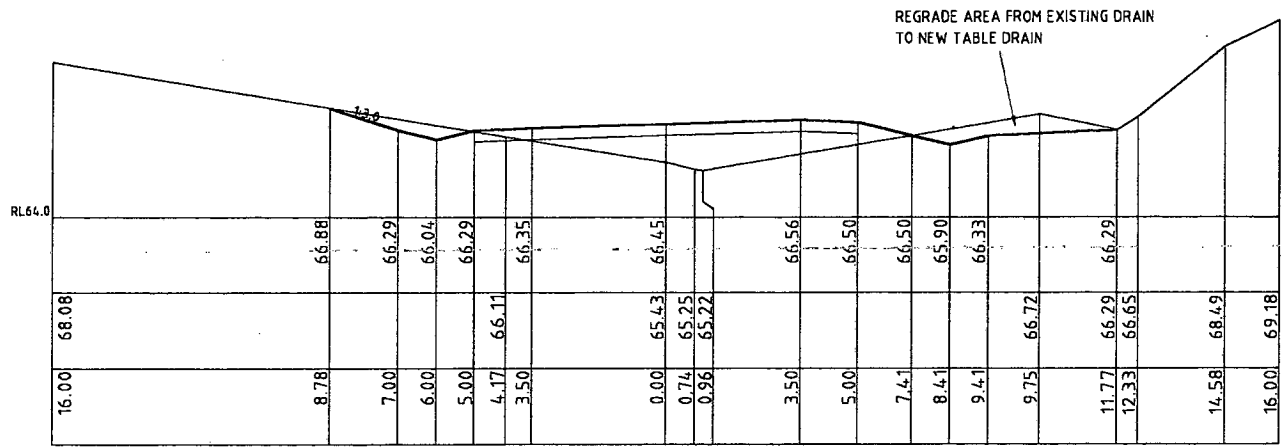
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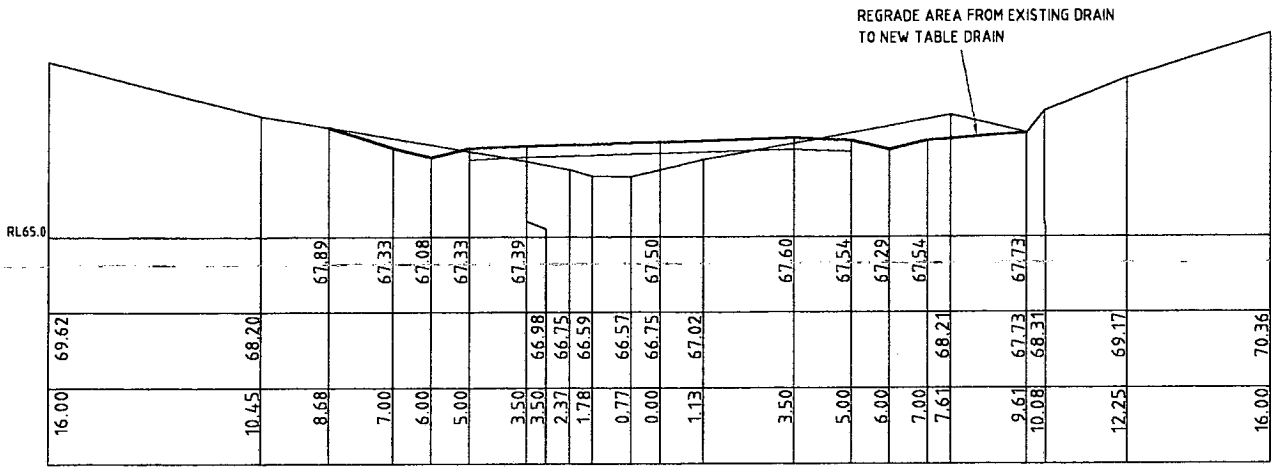
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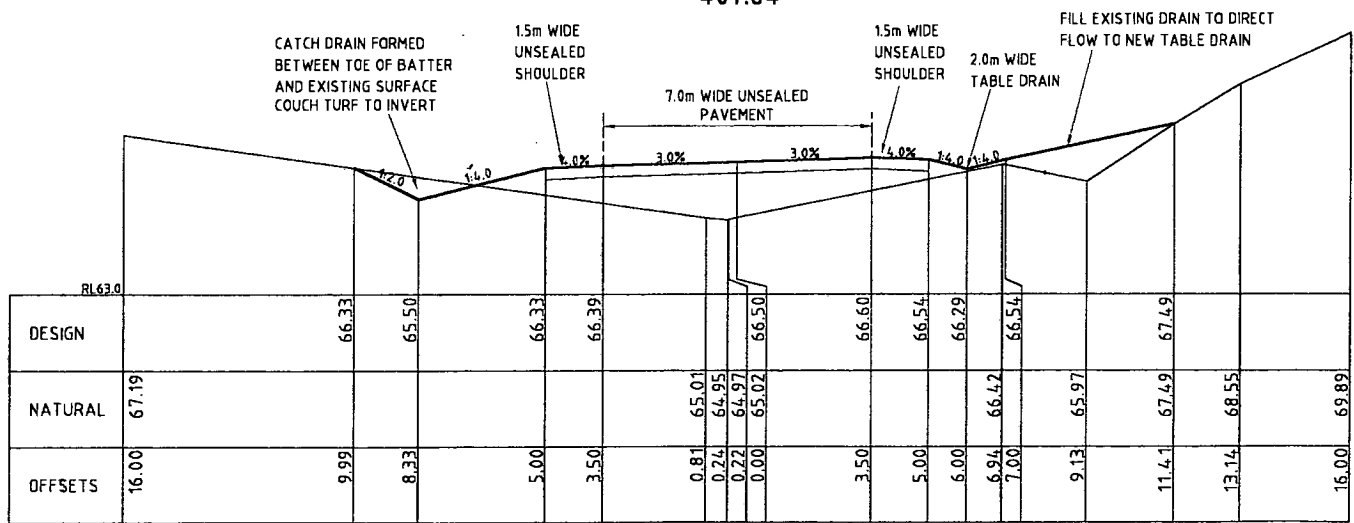
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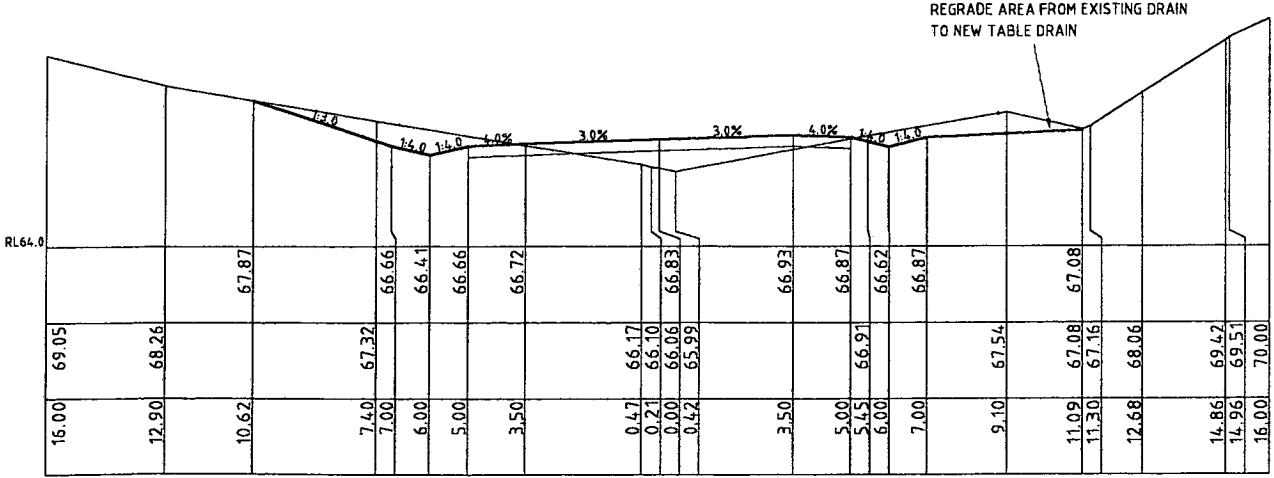
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<p>STANWILL Consulting Engineers CIVIL, STRUCTURAL, HYDRAULIC ENGINEERS & PROJECT MANAGERS MEMBERS OF THE ENGINEERING BOARD OF AUSTRALIA</p>	<p>RCA AUSTRALIA GEOTECHNICAL • ENVIRONMENTAL</p>	<p>AWABA WASTE MANAGEMENT FACILITY PROPOSED ACCESS ROAD CROSS SECTIONS SHEET 7 OF 8</p>		
		<p>SCE JOB NO:</p>	<p>CLIENT Lake Macquarie City Council</p>	<p>PROJECT No 3980</p>
		<p>DESIGNED:</p>	<p>DRAWN BY GJP</p>	<p>SCALE 1 : 100</p>
<p>APPROVED:</p>	<p>APPROVED BY <i>R</i></p>	<p>DATE 19.1.05</p>	<p>DRAWING No C15 REV B</p>	
			<p>OFFICE NEWCASTLE</p>	




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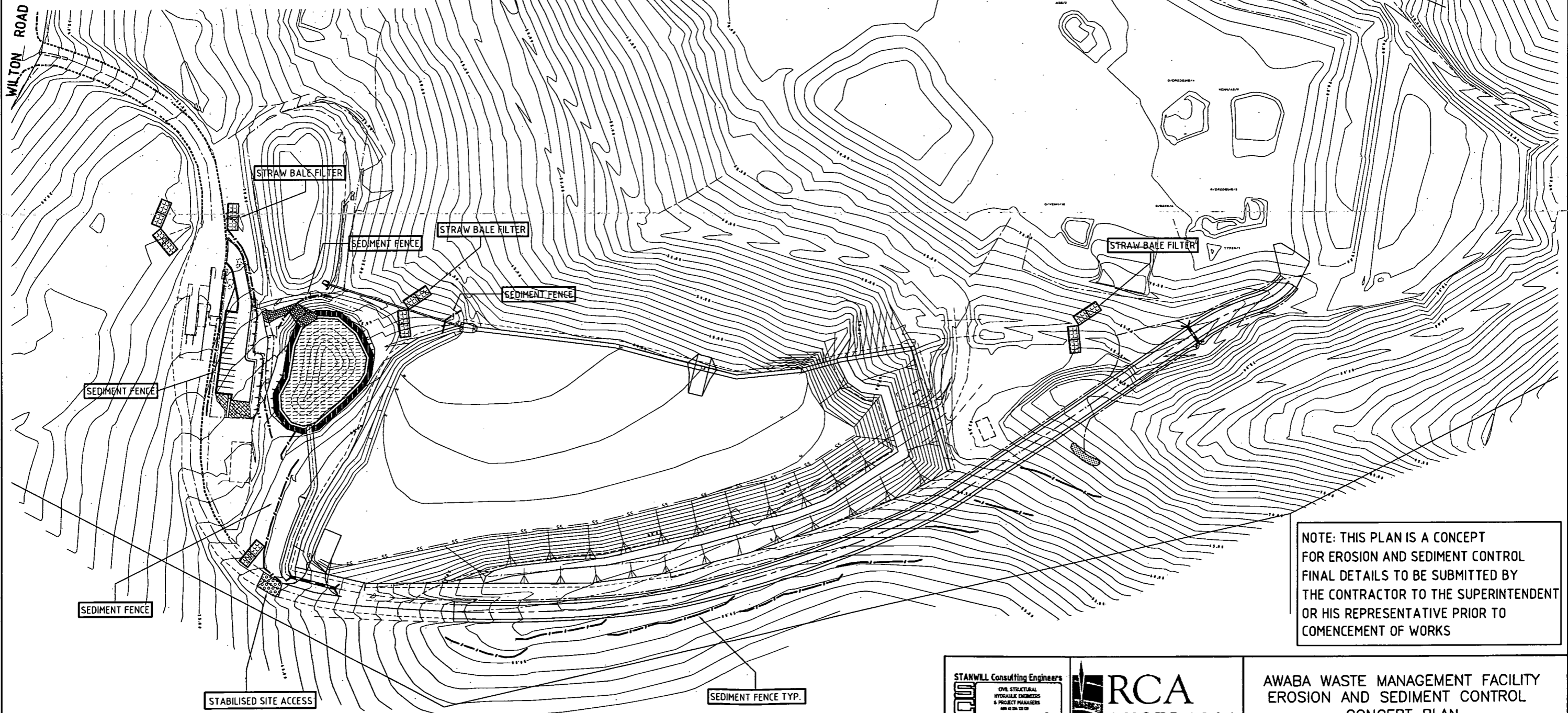
EROSION & SEDIMENT NOTES

1. PROVIDE EROSION AND SEDIMENT CONTROL MEASURES DURING CONSTRUCTION CONFORMING TO N.S.W. DEPT. OF HOUSING MANAGING URBAN STORMWATER MANUAL 2004 INCLUDING SILT FENCING AT PERIMETER FLOWPATHS.
2. PROVIDE AND MAINTAIN PERMANENT GRASSING AS PER SPECIFICATION AS SOON AS POSSIBLE AFTER CONSTRUCTION. STAGE WORKS AS NECESSARY.
3. GRASS SPECIES SHALL BE AS PER SPECIFICATION.
4. ALL PERIMETER CONTROL DEVICES ARE TO BE INSTALLED PRIOR TO WORK COMMENCING AND BE MAINTAINED DURING CONSTRUCTION. LOCATE SEDIMENT FENCE WITHIN WORKS BOUNDARY.
5. MINIMISE SITE DISTURBANCE. CONTRACTOR TO DEFINE ACCESS, STOCKPILE AND OTHER AREAS PRIOR TO WORK COMMENCING.
6. PROVIDE MEASURES AT STOCKPILES TO DIVERT CLEAN WATER AND COLLECT SEDIMENT DOWNSTREAM, LOCATE STOCKPILES AWAY FROM STORMWATER FLOWS.
7. MAINTAIN TEMPORARY STRUCTURES AND DESILT DURING WORKS. ADJUST CONTROLS TO SUIT STAGING AND PROGRESS.
8. REMOVE TEMPORARY MEASURES AFTER COMPLETION OF CONSTRUCTION AND STABILISATION OF WORKS.

LEGEND

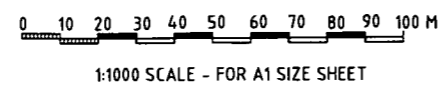
REFER TO DOH MANAGING URBAN STORMWATER MANUAL 2004




-  SEDIMENT FENCE TO SD 6-8
-  STRAW BALE FILTER TO SD 6-7
-  STABILISED SITE ACCESS TO SD 6-14

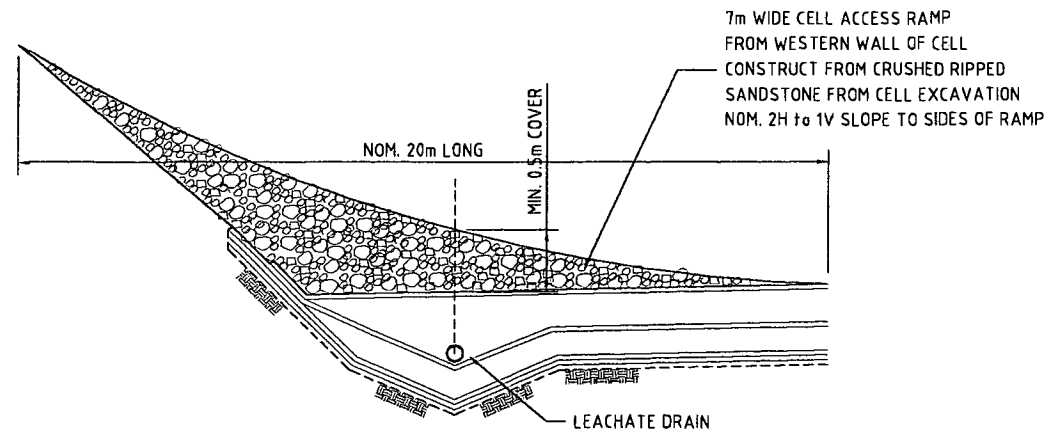


NOTE: THIS PLAN IS A CONCEPT FOR EROSION AND SEDIMENT CONTROL FINAL DETAILS TO BE SUBMITTED BY THE CONTRACTOR TO THE SUPERINTENDENT OR HIS REPRESENTATIVE PRIOR TO COMMENCEMENT OF WORKS

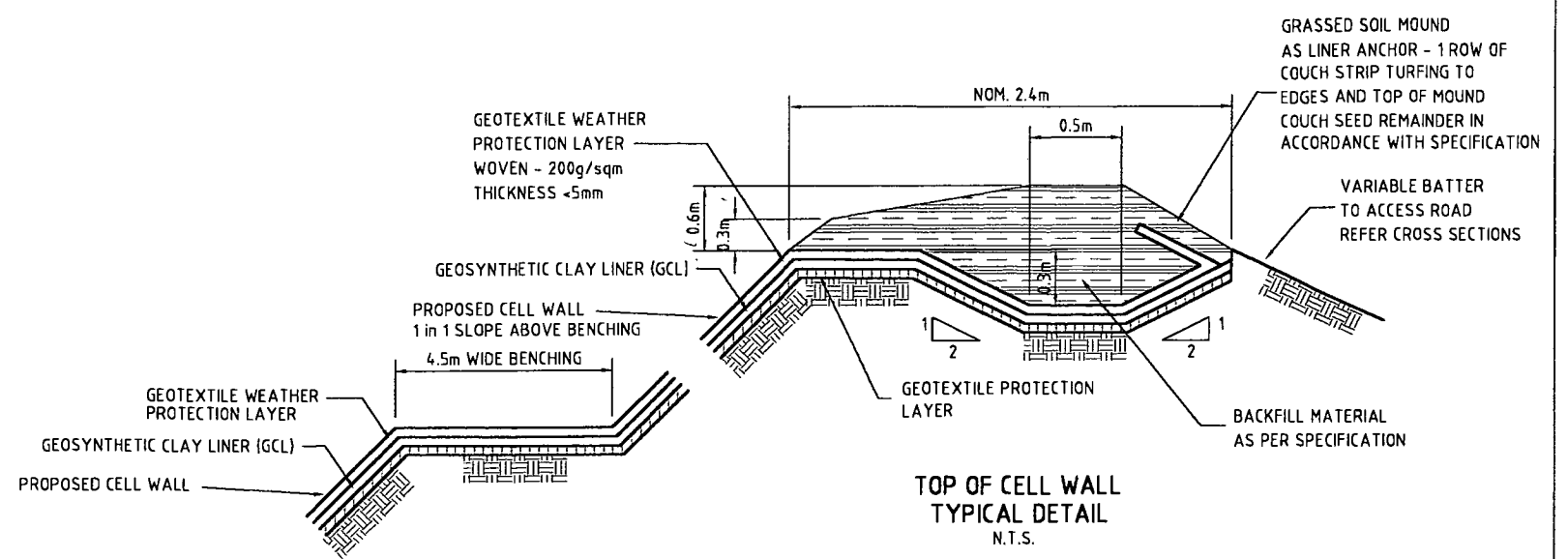
CDT-DWG-A3H-001/1



 <p>STANWILL Consulting Engineers CIVIL, STRUCTURAL, HYDRAULIC ENGINEERS & PROJECT MANAGERS 14 ARCADE STREET, NEWCASTLE NSW 2300 PH: 081 422 2222 FAX: 081 422 2223 WWW.STANWILL.COM.AU</p>	 <p>RCA AUSTRALIA GEOTECHNICAL • ENVIRONMENTAL</p>	AWABA WASTE MANAGEMENT FACILITY EROSION AND SEDIMENT CONTROL CONCEPT PLAN		
		SCE JOB NO: 6220	CLIENT Lake Macquarie City Council	PROJECT No 3980
		DESIGNED:	DRAWN BY DAW	SCALE AS SHOWN
APPROVED:	APPROVED BY 	DATE 19.1.05	OFFICE NEWCASTLE	

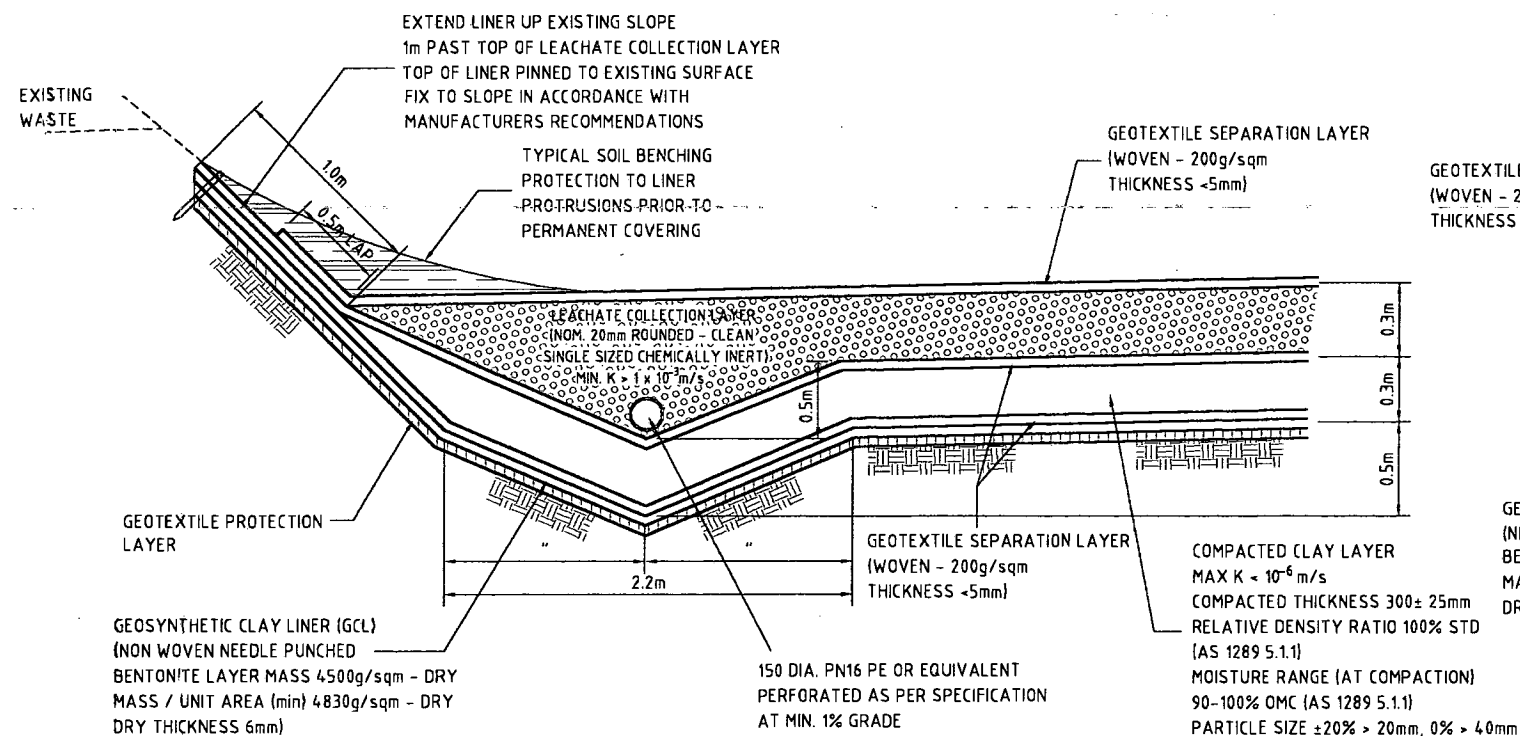


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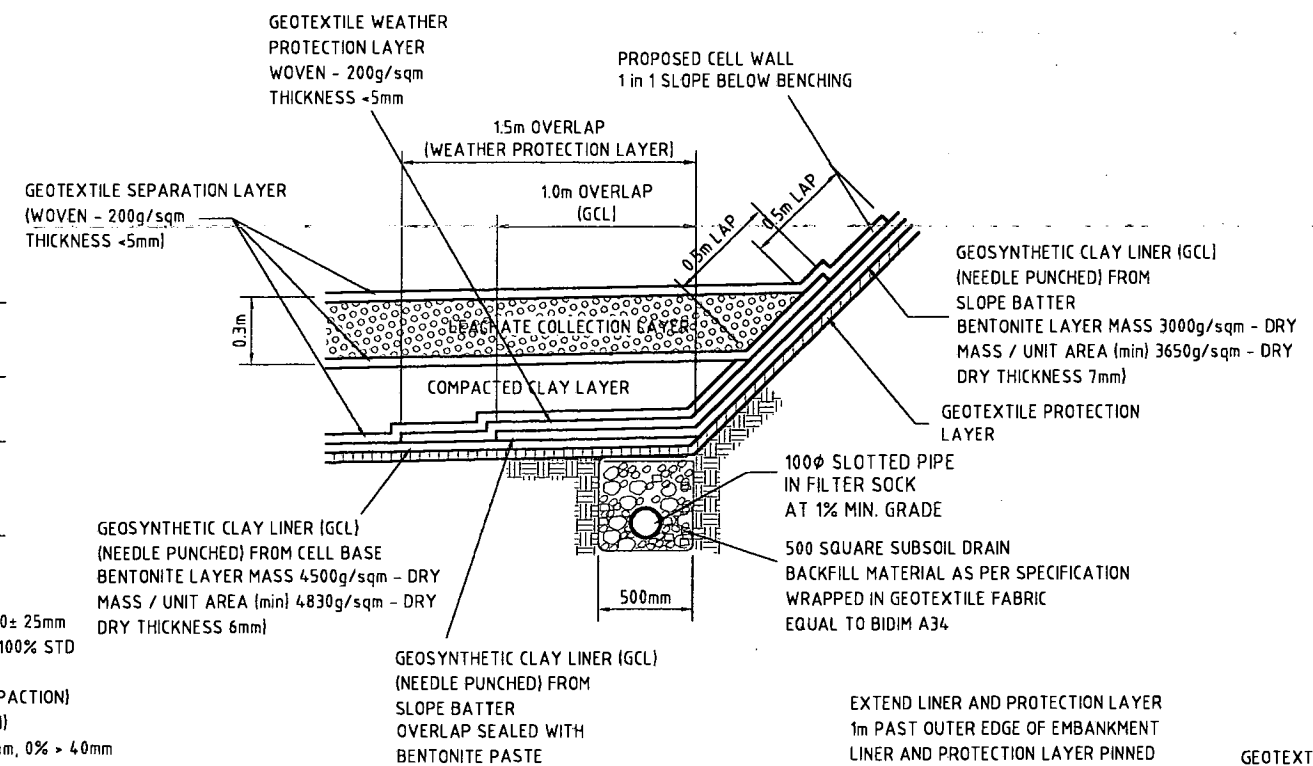


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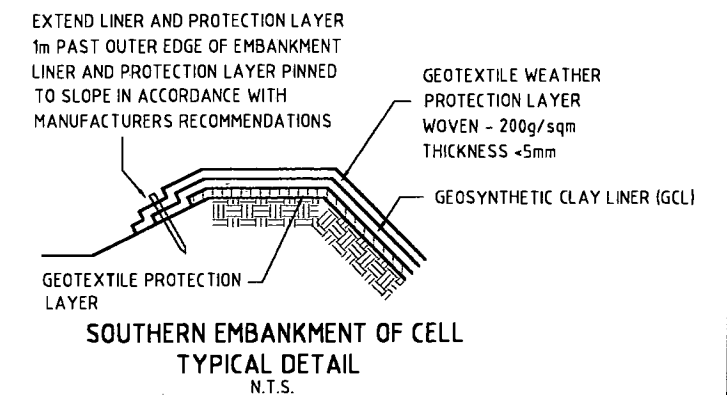
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**LEACHATE DRAIN
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**TOE OF CELL WALL
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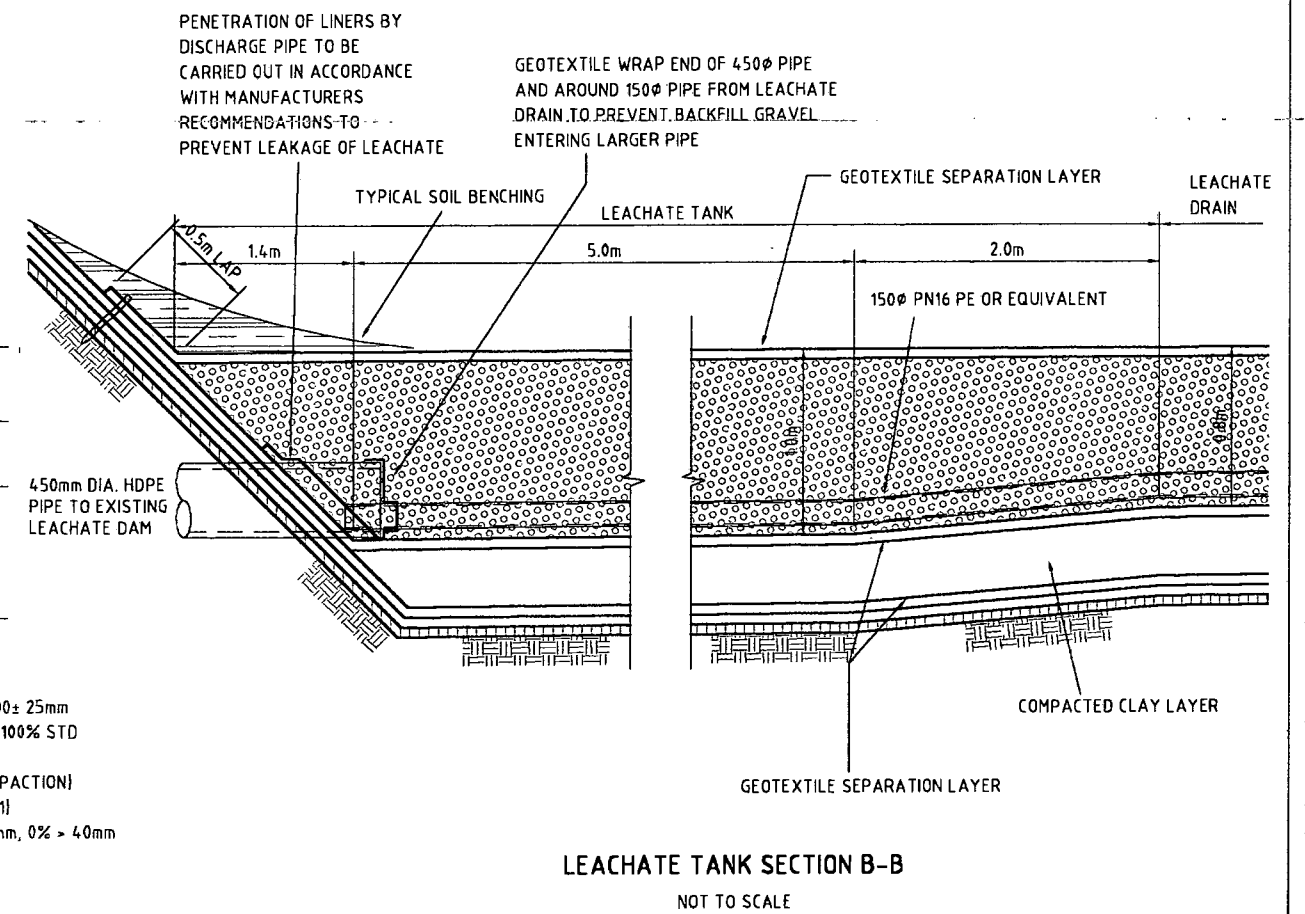
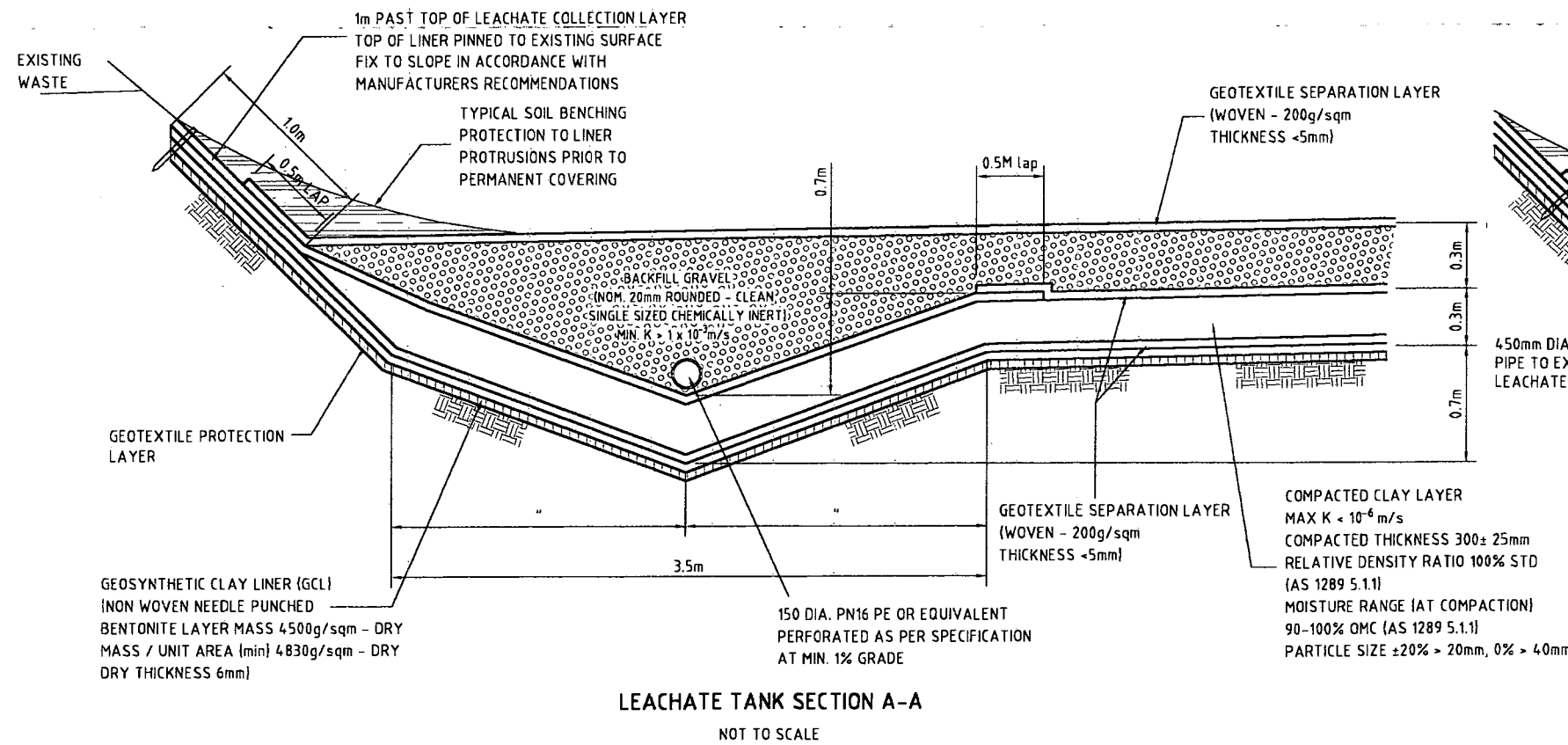
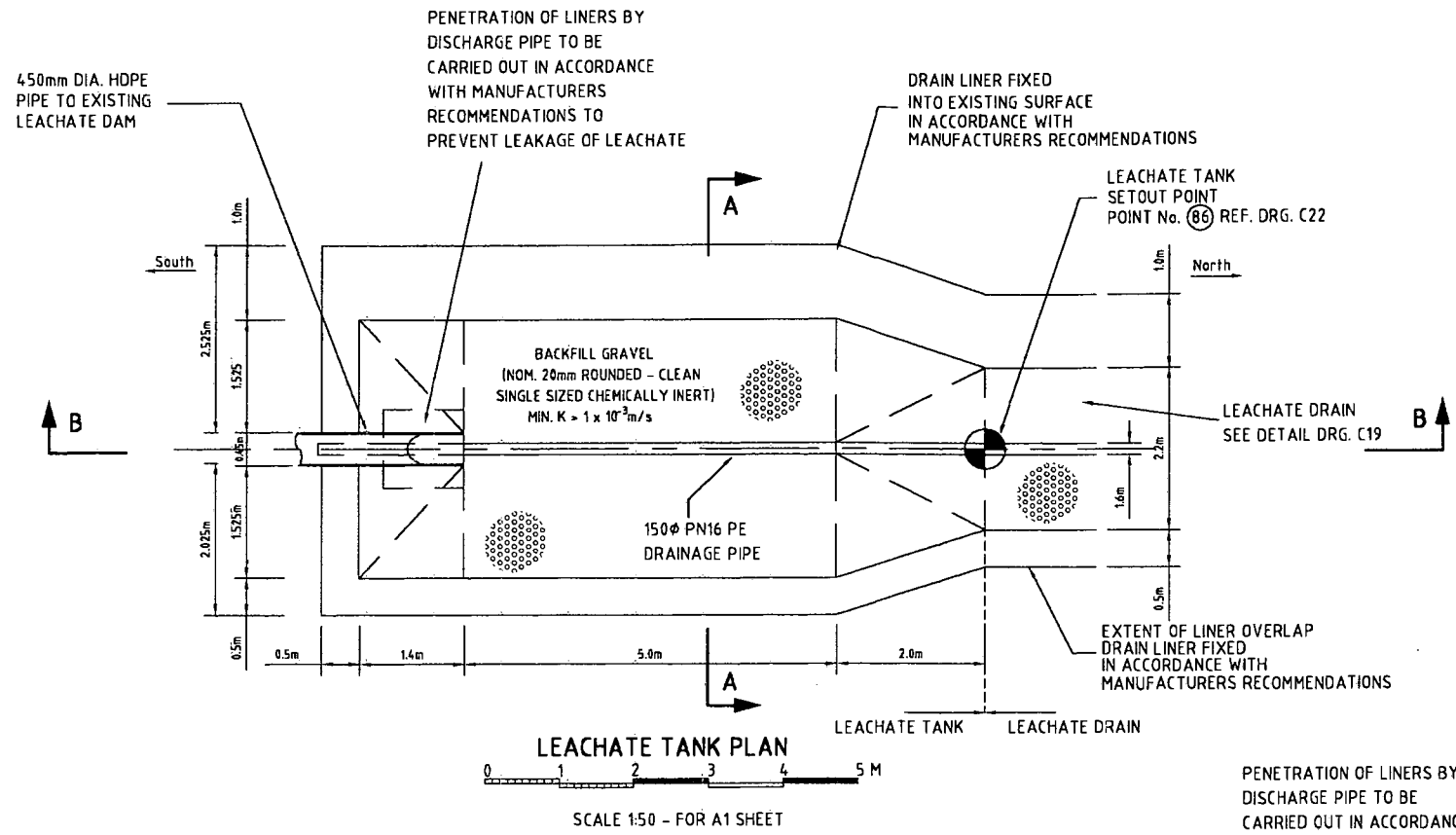


**SOUTHERN EMBANKMENT OF CELL
TYPICAL DETAIL**
N.T.S.



**AWABA WASTE MANAGEMENT FACILITY
PROPOSED CELL TYPICAL SECTION
LINING DETAILS
TEMPORARY CELL ACCESS RAMP DETAIL**

SCE JOB NO:	CLIENT Lake Macquarie City Council	PROJECT No 3980
DESIGNED:	DRAWN BY SMA	SCALE AS SHOWN
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		DRAWING No C19 REV B
		OFFICE NEWCASTLE



CDT-DWG-A3H-001/1

 CIVIL, STRUCTURAL, HYDRAULIC ENGINEERS & PROJECT MANAGERS 400-00-0010 10/10-10/10	 GEOTECHNICAL • ENVIRONMENTAL	AWABA WASTE MANAGEMENT FACILITY LEACHATE TANK TANK PLAN AND SECTION	
		CLIENT Lake Macquarie City Council	PROJECT No 3980
		DESIGNED: SMA	DRAWING No C20 REV B
APPROVED: P	SCALE AS SHOWN	DATE 19.1.05	OFFICE NEWCASTLE

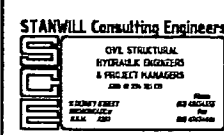

SEDIMENT POND
SCHEDULE OF COORDINATES

No.	COORDINATES	R.L.	DESCRIPTION	No.	COORDINATES	R.L.	DESCRIPTION	No.	COORDINATES	R.L.	DESCRIPTION	No.	COORDINATES	R.L.	DESCRIPTION
1	E 1181.265 N 844.163		ORIGIN - N/W CNR WEIGHBRIDGE BLDG.	7	E 1244.189 N 882.218	36.70	TOP OF SEDIMENT POND WALL	13	E 1217.444 N 924.680	36.70	TOP OF SEDIMENT POND WALL	19	E 1186.414 N 876.791	31.70	INVERT - 4m WIDE x 0.7m DEEP DRAIN
2	E 1190.766 N 887.136	36.70	TOP OF SEDIMENT POND WALL	8	E 1246.773 N 890.605	36.70	TOP OF SEDIMENT POND WALL	14	E 1207.838 N 926.133	36.70	TOP OF SEDIMENT POND WALL	20			SETOUT POINT DELETED
3	E 1201.637 N 882.659	36.70	TOP OF SEDIMENT POND WALL	9	E 1242.159 N 893.386	36.10	INVERT OF CATCH DRAIN OUTLET	15	E 1194.255 N 919.527	36.70	TOP OF SEDIMENT POND WALL	21			SETOUT POINT DELETED
4	E 1217.505 N 880.081	36.70	TOP OF SEDIMENT POND WALL	10	E 1244.643 N 898.266	36.70	TOP OF SEDIMENT POND WALL	16	E 1185.255 N 909.224	36.70	TOP OF SEDIMENT POND WALL				
5	E 1226.473 N 875.335	36.70	TOP OF SEDIMENT POND WALL	11	E 1237.858 N 911.756	36.70	TOP OF SEDIMENT POND WALL	17	E 1184.406 N 896.951	36.70	TOP OF SEDIMENT POND WALL				
6	E 1235.623 N 875.931	36.70	TOP OF SEDIMENT POND WALL	12	E 1223.071 N 921.288	36.70	TOP OF SEDIMENT POND WALL	18	E 1183.127 N 885.604	32.30	INVERT - 4m WIDE x 0.7m DEEP DRAIN				

PROPOSED CELL
SCHEDULE OF COORDINATES

No.	COORDINATES	R.L.	DESCRIPTION	No.	COORDINATES	R.L.	DESCRIPTION	No.	COORDINATES	R.L.	DESCRIPTION	No.	COORDINATES	R.L.	DESCRIPTION
22	E 1193.196 N 977.734	38.00	WESTERN EDGE OF PROPOSED CELL	34	E 1322.237 N 1035.398	53.00	TOP OF CELL EMBANKMENT	46	E 1228.703 N 933.894	40.40	TOE OF CELL EMBANKMENT	58	E 1248.927 N 1167.638	43.00	TOE OF CELL EMBANKMENT
23	E 1190.844 N 969.567	38.00	WESTERN EDGE OF PROPOSED CELL	35	E 1307.435 N 1113.601	54.00	TOP OF CELL EMBANKMENT	47	E 1261.636 N 922.420	41.30	TOE OF CELL EMBANKMENT	59	E 1244.512 N 1166.318	43.00	TOE OF CELL EMBANKMENT
24	E 1198.426 N 948.443	37.00	TOP OF CELL EMBANKMENT	36	E 1278.258 N 1192.903	59.00	TOP OF CELL EMBANKMENT	48	E 1267.193 N 916.701	41.40	TOE OF CELL EMBANKMENT	60	E 1235.899 N 1151.368	42.00	TOE OF CELL EMBANKMENT
25	E 1207.885 N 934.989	37.00	TOP OF CELL EMBANKMENT	37	E 1266.783 N 1213.235	62.00	TOP OF CELL EMBANKMENT	49	E 1281.482 N 907.647	41.60	TOE OF CELL EMBANKMENT	61	E 1227.152 N 1145.316	41.40	TOE OF CELL EMBANKMENT
26	E 1226.537 N 925.509	38.70	TOP OF CELL EMBANKMENT	38	E 1203.827 N 1194.860	60.00	TOP OF CELL EMBANKMENT	50	E 1303.709 N 897.163	42.00	TOE OF CELL EMBANKMENT	62	E 1217.411 N 1142.416	41.00	TOE OF CELL EMBANKMENT
27	E 1243.465 N 920.009	40.00	TOP OF CELL EMBANKMENT	39	E 1209.981 N 1157.642	52.00	WESTERN EDGE OF PROPOSED CELL	51	E 1310.504 N 896.128	42.00	TOE OF CELL EMBANKMENT	63	E 1314.914 N 1021.945	52.00	OUTER EDGE OF BENCHING
28	E 1258.674 N 912.830	41.00	TOP OF CELL EMBANKMENT	40	E 1214.603 N 1139.943	41.00	WESTERN EDGE OF PROPOSED CELL	52	E 1315.098 N 903.498	42.00	TOE OF CELL EMBANKMENT	64	E 1313.344 N 1042.349	52.00	OUTER EDGE OF BENCHING
29	E 1281.849 N 897.928	41.00	TOP OF CELL EMBANKMENT	41	E 1217.779 N 1107.608	40.40	WESTERN EDGE OF PROPOSED CELL	53	E 1298.763 N 985.198	42.00	TOE OF CELL EMBANKMENT	65	E 1302.873 N 1090.846	52.00	OUTER EDGE OF BENCHING
30	E 1300.108 N 889.827	41.00	TOP OF CELL EMBANKMENT	42	E 1201.946 N 1046.916	39.00	WESTERN EDGE OF PROPOSED CELL	54	E 1292.618 N 1037.759	42.00	TOE OF CELL EMBANKMENT	66	E 1292.403 N 1132.175	52.00	OUTER EDGE OF BENCHING
31	E 1313.444 N 886.491	41.00	TOP OF CELL EMBANKMENT	43	E 1198.745 N 967.527	38.10	TOE OF CELL EMBANKMENT	55	E 1280.990 N 1085.487	43.00	TOE OF CELL EMBANKMENT	67	E 1283.503 N 1155.194	52.00	OUTER EDGE OF BENCHING
32	E 1321.898 N 922.269	45.00	TOP OF CELL EMBANKMENT	44	E 1212.849 N 941.820	38.80	TOE OF CELL EMBANKMENT	56	E 1270.774 N 1125.669	43.00	TOE OF CELL EMBANKMENT	68	E 1259.232 N 1194.226	52.00	OUTER EDGE OF BENCHING
33	E 1322.179 N 980.870	52.00	TOP OF CELL EMBANKMENT	45	E 1216.150 N 939.398	38.95	TOE OF CELL EMBANKMENT	57	E 1263.319 N 1144.951	43.00	TOE OF CELL EMBANKMENT	69	E 1223.918 N 1183.664	52.00	OUTER EDGE OF BENCHING
												70	E 1222.181 N 1171.741	52.00	OUTER EDGE OF BENCHING
												71	E 1218.687 N 1166.980	52.00	OUTER EDGE OF BENCHING
												72	E 1210.903 N 1163.090	52.00	OUTER EDGE OF BENCHING
												73	E 1195.684 N 966.096	39.00	TOP OF 2.2m WIDE CELL EMBANKMENT
												74	E 1205.062 N 946.495	39.65	TOP OF 2.2m WIDE CELL EMBANKMENT
												75	E 1210.167 N 939.198	39.85	TOP OF 2.2m WIDE CELL EMBANKMENT
												76	E 1214.290 N 936.173	40.00	TOP OF 2.2m WIDE CELL EMBANKMENT
												77	E 1227.342 N 930.450	41.40	TOP OF 2.2m WIDE CELL EMBANKMENT
												78	E 1259.610 N 919.195	43.00	TOP OF 2.2m WIDE CELL EMBANKMENT
												79	E 1264.926 N 913.725	43.00	TOP OF 2.2m WIDE CELL EMBANKMENT
												80	E 1270.182 N 910.841	43.00	TOP OF 2.2m WIDE CELL EMBANKMENT
												81	E 1279.599 N 904.453	43.00	TOP OF 2.2m WIDE CELL EMBANKMENT
												82	E 1290.563 N 896.426	43.00	TOP OF 2.2m WIDE CELL EMBANKMENT
												83	E 1307.156 N 890.179	43.00	TOP OF 2.2m WIDE CELL EMBANKMENT
												84	E 1311.074 N 893.578	43.00	TOP OF 2.2m WIDE CELL EMBANKMENT
												85	E 1317.397 N 903.006	43.00	TOP OF 2.2m WIDE CELL EMBANKMENT
												86	E 1194.188 N 977.608	38.00	SETOUT POINT - LEACHATE TANK

NOTE: ALL LEVELS ARE FINISHED SURFACE LEVELS
PRIOR TO PLACEMENT OF GEOTEXTILE PROTECTION
LAYERS AND CELL LINERS

 <p>STANWILL Consulting Engineers CIVIL, STRUCTURAL, HYDRAULIC ENGINEERS & PROJECT MANAGERS SINCE 1971 MEMBERS OF THE ENGINEERING COUNCIL OF AUSTRALIA</p>	 <p>RCA AUSTRALIA GEOTECHNICAL • ENVIRONMENTAL</p>	AWABA WASTE MANAGEMENT FACILITY PROPOSED SEDIMENT POND AND CELL SETOUT SCHEDULE OF COORDINATES AND LEVELS			
		SCE JOB NO:	CLIENT Lake Macquarie City Council	PROJECT No	3980
		DESIGNED:	DRAWN BY GJP	SCALE	DRAWING No C22 REV A
APPROVED:	APPROVED BY <i>R</i>	DATE	19.1.05	OFFICE	NEWCASTLE

GHD

Level 3 GHD Tower 24 Honeysuckle Drive Newcastle NSW 2300
PO Box 5403 Hunter Region Mail Centre NSW 2310
T: (02) 4979 9999 F: (02) 4979 9988 E: ntmail@ghd.com

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	C. Nivison-Smith	R. Wilkes	<i>R. Wilkes</i>	M. Gebhard	<i>M. Gebhard</i>	06/05/2014
1	C. Nivison-Smith	R. Wilkes	<i>R. Wilkes</i>	M. Gebhard	<i>M. Gebhard</i>	16/07/2014
2	C. Nivison-Smith	D. Barrett	<i>David Barrett</i>	M. Gebhard	<i>M. Gebhard</i>	25/02/2016

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Appendix **D**
Surface Water Management Plan



Lake Macquarie City Council
Awaba Waste Management Facility
Surface Water Management Plan

Revision 2

February 2016

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- Appendix A – Erosion and sediment control plan
- Appendix B – Fill-out plan drawings
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1. Introduction

1.1 General

Lake Macquarie City Council (Council) engaged GHD Pty Ltd (GHD) to prepare a Surface Water Management Plan (this plan) for the Awaba Waste Management Facility (the site).

1.2 Purpose of this plan

The purpose of this plan is to provide for future surface water management at the site and address the requirements of Schedule 4, Condition 17 of the Project Approval (PA) and Environment Protection Licence 5873 (the EPL), Licence Variation Date 24 February 2014.

Erosion and sediment control (GHD, 2013) is addressed in a separate plan and included in Appendix A.

1.3 Scope of this plan

The scope of this plan is to satisfy the requirements of the Project Approval (Schedule 4 of application no.10_0139) as summarised below:

Table 1-1 Stormwater approval conditions addressed by this report

Condition Number	Details	Where Addressed in this Report
16	<i>The Proponent shall ensure that all licensed surface water discharges from the Site comply with discharge limits (volume and quality) set for the Project in any EPL or relevant provisions of the POEO Act:</i>	<i>Section 5, Section 6, & Appendix A</i>
17	<i>The Proponent shall:</i> <i>(a) design and install the stormwater management and collection system generally in accordance with the conceptual design in the EA (as shown in Appendix 5), applicable Australian Standards and industry standard best practice guidelines;</i> <i>(b) ensure that the system capacity has been designed in accordance with the Blue Book Volumes 1 and 2B;</i> <i>(c) divert existing clean surface water around operational areas of the Site;</i> <i>(d) direct all sediment laden water in overland flow away from the leachate management system;</i> <i>(e) ensure peak stormwater discharge rates from the site at each stage of the project do not exceed predevelopment values; and</i> <i>(f) prevent cross contamination of clean and sediment or leachate laden water,</i> <i>to the satisfaction of the Director-General..</i>	<i>Appendix B & Appendix C</i> <i>Appendix A & Appendix C</i> <i>Section 5</i> <i>Section 5</i> <i>Section 5</i> <i>Section 5</i>

Condition Number	Details	Where Addressed in this Report
19	<p>The Proponent shall prepare and implement a Soil, Water and Leachate Management Plan for the Project. The Plan shall be prepared by a suitably qualified and experienced expert in consultation with LMCC, the NOW and the EPA and be submitted to the Director-General for approval prior to the commencement of Operations. The Plan shall include:</p> <p><i>(d) The Proponent shall prepare a stormwater management plan that:</i></p> <ul style="list-style-type: none"> - <i>is consistent with the guidance in the latest version of the Blue Book Volume 1 and Volume 2B;</i> - <i>includes final detailed design specifications for the stormwater management and collection system; and</i> - <i>demonstrates how the requirements of Condition 17 of Schedule 4 have been addressed;</i> 	<p>Section 5 & Appendix A</p> <p>Appendix B</p> <p>This Report</p>

1.4 Reliance

In preparing this plan the following documents and correspondence were relied upon:

- Managing Urban Stormwater: Soils and Construction – Volume 1 (Landcom, 2004)
- Bureau of Meteorology Climate Data, (Bureau of Meteorology, 2013)
- Managing Urban Stormwater: Soils and Construction – Volume 2B, Waste landfills (Department of Environment and Climate Change NSW, 2008)
- Environment Protection Licence 5873. (NSW EPA, 2013)
- Project Approval, Schedule 1 - Application No: 10_0139 (Department of Planning and Infrastructure, 2013)
- Awaba Waste Management Facility - Water Quantity and Quality Assessment (Cardno, 2011)
- Additions to Awaba Waste Management Facility - Environmental Assessment (Reference 600308/Rep2744v4) (Cardno, 2012)
- Additions to Awaba Waste Management Facility – Submissions Report and Revised Statement of Commitments (Reference 600308) (Cardno, 2013)
- Extension of Awaba Landfill Facility Wilton Road, Awaba, Geotechnical Services, Ref 12403/1-AA Final (Geotechnique 13 December 2011)

2. Site characteristics

2.1 Location, access and footprint

The site is situated within the Lake Macquarie Local Government Area (LGA), which covers an area of approximately 645 square km in the Hunter region of NSW, Australia. The estimated population in the LGA is 202,347 (City of Lake Macquarie Annual Report 2012/2013).

The site is located off Wilton Road, Awaba, approximately 1.2 km south-east of the township of Awaba and 4 km west of the suburb of Toronto. Access to the site is via Wilton Road. The location of the site is shown in Figure 2-1.

The majority of the expansion works are situated within Lot 372 DP 723259, which has an area of 32.5 ha including the existing landfill operations. Approximately 23.5 ha comprise the existing facilities and the majority of the remaining 9 ha comprises natural bushland. The components of the expansion works that will be located outside of Lot 372 DP 723259 include a sewer pipeline which connects the site and Rathmines No. 6 WWPS for leachate disposal and intersection upgrade at the intersection of Wilton and Wangi Roads.

2.2 History

Prior to operation as a landfill, the area consisted of undisturbed natural bushland. Development consent was granted in 1986 to operate as a landfill catering for household wastes, privately transported residential rubbish, construction and municipal wastes and some industrial wastes. Approximately 20 ha of the site was devoted to the landfill and supporting infrastructure as part of the original project approval in 1986. This expanded to the current 23.5 ha in 1995 to allow for extension of the facility (Cardno, 2012). A lined cell was established in an existing quarry on the eastern portion of the site in 2006-07 and has been subsequently filled.

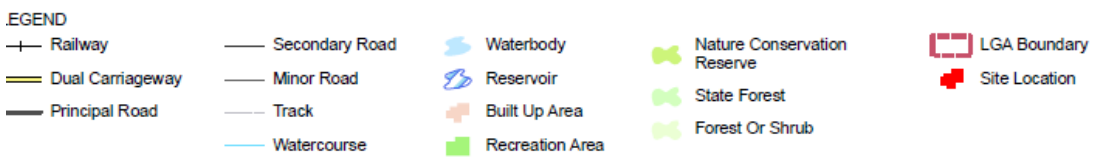


Figure 2-1 Awaba Waste Management Facility

2.3 Climate

The average annual climatic data for the area is summarised in Table 2-1 below. The data source is from the Bureau of Meteorology for the Nobbys Signal Station (Station Number 061055).

Table 2-1 Mean annual climatic data for Awaba area
(Bureau of Meteorology, 2013)

Parameter	Mean Min. Temp (°C)	Mean Max Temp (°C)	Mean rainfall (mm)	Monthly Evaporation (mm) ¹
Jan	19.2	25.6	88.4	214
Feb	19.3	25.4	107.9	175
Mar	18.3	24.7	119.7	152
Apr	15.3	22.8	115.9	114
May	12.0	20.0	117.0	84
Jun	9.7	17.5	117.0	75
Jul	8.4	16.7	94.3	81
Aug	9.2	18.0	73.6	112
Sep	11.4	20.2	72.5	141
Oct	14.0	22.1	72.9	171
Nov	16.1	23.5	70.5	189
Dec	18.0	24.9	81.1	223
Annual	14.2	21.8	1132.6	1730

2.4 Topography and hydrology

Regional

The landscapes across the site belong to the Awaba Group (aw), which is characterised by rolling low hills on predominantly coarse grained sediments of the Narrabeen Group and Newcastle coal measures in the Awaba hills. Local relief is of 20 m to 80 m and slope gradient is usually 10 % to 25 % with some localised steep slopes up to 60%. Drainage lines are narrow and incised. The limitations in this landscape include steep slope (localised), mass movement (localised), very high erosion hazard, shallow and stony soils, strongly acidic soils with low fertility (Geotechnique, 2011).

Local

The site is situated on undulating terrain and the highest point of the site is 82.6 m AHD, with the site sloping down from the north-west to the south-east (Cardno, 2011). Local topography is typical of the landforms throughout the lower Hunter Region.

¹ Evaporation data is based on Williamstown RAAF station (061078)

2.5 Soils, geology and hydrogeology

2.5.1 Soils

Topsoil/fill materials at the site are predominantly sandy and comprise fine to coarse grained clayey silty sand, silty sand, gravelly clayey sand and gravelly silty sand with some low to medium plasticity sandy silt and sandy silty clay. Residual soils are also predominantly sandy and comprise fine to coarse grained and medium dense to dense clayey sand, silty sand, clayey gravelly sand, gravelly silty sand and gravelly sand with bands of low to medium plasticity and stiff to hard silty clay and sandy clay, with cobbles at places.

Borehole and test pit logs at the site show that the combined thickness of topsoil / fill and residual soils across proposed new cell areas varies from approximately 0.2 m to 1.5 m (Geotechnique, 2011).

2.5.2 Geology

The geotechnical investigation for the Environmental Assessment (Geotechnique, 2011) suggests that based on the Geological Map of Sydney, Geological Series Sheets S1 56-5, Third Edition, 1966 (Scale 1:250,000), bedrock at the site is anticipated to be Newcastle Coal Measures (Pn) comprising shale, sandstone, conglomerate, tuff, chert and coal seams. Bedrock across the site varies from sandstone to conglomerate. Bedrock is assessed to be extremely to distinctly weathered to borehole and test pit termination depths.

NSW Mine Subsidence Board advised that the proposed landfill cells are underlain by coal seams, which are likely to be mined sometime in the future by Centennial Coal Company Limited, who owns the mining lease.

2.5.3 Hydrogeology

Investigation undertaken (Geotechnique, 2011) indicates groundwater was not reached via the constructed boreholes and test pits (to a depth of 2.7 – 3.2 m). The one exception was a borehole (BH4) adjacent to an existing dam, with the level corresponded to the level in the dam at the time of the investigation. The conclusion from Geotechnique was that groundwater is unlikely to be encountered at less than 3.0 meters below existing ground surface except in close proximity to existing dams.

2.6 Flora and fauna

2.6.1 Flora

The threatened flora species *Tetradlea juncea* (Black-eyed Susan) is located within the direct footprint of the works. *Tetradlea juncea* is listed as vulnerable under both the Threatened Species Conservation Act 1995 and the EPBC Act. It was determined that 2,302 *Tetradlea juncea* plants will need to be removed to facilitate the proposed works.

Due to the location of *Tetradlea juncea* over the site, it is not possible to avoid or minimise impacts on this species due to the expansion works. LMCC will ensure that a restrictive covenant burdening Lot 463 DP 1138964 be registered in favour of the Minister for Planning and Infrastructure, to offset the proposed AWMF development.

No Endangered Ecological Communities were identified at the site.

2.6.2 Fauna

No threatened fauna species were considered to be significantly impacted by the expansion works. (Cardno, 2012)

2.7 Heritage

Investigations conducted by Insight Heritage and Niche as part of the Environmental Assessment identified Aboriginal artefacts within the expansion footprint. In order to manage heritage during the expansion works, Council will develop a Cultural Heritage Management Plan in partnership with Aboriginal stakeholders which will be implemented for the construction phase of the project.

2.8 Zoning

Table 2-2 outlines key land use zoning of the site and surrounds.

Table 2-2 Key land use zonings (Cardno, 2012)

Location	LEP 2004 (In Force) Zoning		LEP 2011 (Draft) Zoning	
The site	9	Natural Resources	SP1	Infrastructure (Waste or Resource Management Facility)
Surrounding bushland	9	Natural Resources	E2	Environmental Conservation
	7 (2)	Conservation (Secondary)		
Awaba village	2 (1)	Residential Zone	R2	Low Density Residential
Wilton Road and immediate surrounds	5	Infrastructure	SP2	Infrastructure
	6(2)	Tourism and Recreation	RE2	Private Recreation
	7(2)	Conservation (Secondary)	E2	Environmental Conservation
			RU2	Rural Landscape

2.9 Existing services and infrastructure

Existing site facilities and infrastructure include:

- Gatehouse with two weighbridges, entry and exit lanes, security compound and security monitoring system
- Machinery compound
- Reuse centre
- Leachate collection ponds (2), bunded irrigation areas and leachate recirculation system
- Sediment collection ponds (3)
- Roads and access, drains and berms, fences, gates and signs
- General waste processing area
- Garden waste receiving and processing area
- Landfill compactor, traxcavator loaders and other operational equipment
- Pumps
- Landfill gas collection infrastructure and combustion engines

2.10 Waste operations

Key operations at the site are summarised in Table 2-3.

Table 2-3 Key operations at the site (Cardno, 2012))

Waste Aspect	Operations
Waste Handling and Recovery	Waste arrives at the site from a variety of sources, including Council collection vehicles, waste collection contractors, and waste self-hauled by businesses and residents. Upon entering the site, the waste is classified and charged in accordance with a number of categories.
	There is currently a community recycling centre at the site, in the southern portion of the existing site. Batteries, oil, dry recyclables, e-waste and household problem waste can be dropped at the centre on site prior to proceeding to the main tip face. Council also have procedures in place to scavenge metals from the tip face for metal recycling.
	Green waste is currently tipped separately at the site. Green waste processing is currently undertaken under contract using an excavator to load a mobile shredder on site. Green waste processing at the site currently involves shredding and stockpiling the green waste material then transferring it offsite for use and/or composting.
	Street sweepings, dredging and seaweed, along with fill that is purchased by the site is also tipped separately and then used as cover material. There is currently no separate tipping point for construction and demolition (C&D) waste or hazardous waste; it is all tipped at the main tip face.
	Council currently undertake litter patrols to manage stray litter.
Active tip face	The active tipping face is currently accessed by both private/commercial vehicles as well as Council waste vehicles.
	The active tipping face is sprayed with daily cover at the end of each day.
Leachate management	Existing leachate management system includes collection of leachate within the recently constructed cells, pumping to a leachate evaporation pond.
Landfill gas	Landfill gases are currently captured and utilised to generate electricity on site, which is then fed back into the grid. Gas flaring is used only as a fall back option when the generator is not operational
Waste Monitoring	Council currently collects waste volume and waste stream information for the site and compiles it on a monthly basis.
	Council currently commissions periodic independent audits of the waste entering the site and of the domestic kerbside mobile garbage bins in the Lake Macquarie LGA.
	The volume of landfill gas flared and captured for electricity generation is recorded on a monthly basis and reported to Council on a six monthly basis. The percentage of methane (CH ₄) in the landfill gas is also measured and reported for the reporting month.

2.11 Waste characteristics

The site is an EPA licensed solid waste landfill. The license permits waste defined by the NSW Government's EPA (1996) guidelines as Solid Waste Class 1 to be disposed at the site. A Solid Waste Class 1 landfill is permitted to accept all non-hazardous solid waste including putrescible wastes and other wastes that are approved by the EPA.

The site currently receives approximately 100,000 tonnes of waste annually, with an expected increase by approximately 1% to 1.2% each year. However, with the introduction of additional recycling and recovery initiatives this is not expected to lead to an actual increase in waste quantities to be disposed of. Council currently collects information on the volumes of numerous different specific waste streams received at the site, compiled on a monthly basis. These specific waste streams are then categorised into the following three primary waste streams:

- Municipal Solid Waste (MSW):
 - Household weekly bin collection
 - Parks and gardens waste
 - Bulk domestic waste kerbside collections
 - Self-hauled residential waste
- Commercial and Industrial (C&I) waste
- Construction and Demolition (C&D) waste

Table 2-4 shows the total waste landfilled per annum, based on data from the 2003/04 financial year to the 2009/10 financial year, both excluding and including the cover material used to cap the landfill.

Table 2-4 Tonnage and composition of landfilled waste (Cardno, 2012)

Financial year	MSW		C&I		C&D		Total (T/yr) (ex. Cover material)	Total (T/yr) (inc. Cover material)
	(T/yr)	(% of Total)	(T/yr)	(% of Total)	(T/yr)	(% of Total)		
2003/04	74,246	45%	14,134	9%	75,490	46%	163,870	200,736
2004/05	77,940	66%	14,540	12%	25,436	22%	117,917	152,680
2005/06	79,625	67%	12,489	10%	27,145	23%	119,258	160,778
2006/07	81,579	73%	12,831	12%	16,740	15%	111,149	158,828
2007/08	90,203	76%	10,725	9%	17,262	15%	118,191	150,230
2008/09	82,311	82%	8,950	9%	9,276	9%	100,537	120,795
2009/10	80,198	85%	6,976	7%	7,034	7%	94,208	109,233

Data provided within Table 2-5 is sourced from the Greenhouse Gas Model provided by LMCC. Note, these values are per calendar year.

Table 2-5 Tonnage and composition of landfilled waste

Calendar year	MSW		C&I		C&D		Total (T/yr) (ex. Cover material) ²	Total (T/yr) (inc. Cover material)
	(T/yr)	(% of Total)	(T/yr)	(% of Total)	(T/yr)	(% of Total)		
2007	80,933	61	32,487	24	19,282	15	-	125,403
2008	81,484	51	39,215	25	38,705	24	-	148,347
2009	78,529	60	25,348	19	26,905	21	99,120	122,136
2010	76,560	59	22,360	17	30,954	24	91,570	121,003
2011	77,634	68	21,061	18	15,915	14	94,447	109,291
2012	79,528	64	25,756	21	18,667	15	98,136	116,477
2013	82,214	71	4,943	4	28,691	25	94,150	106,829

² Includes transferred green waste and inert material

3. Existing surface water management

3.1 General

This section provides an overview of the existing surface water management at the site.

3.2 Landfill

The existing surface water management system is designed to divert all upstream water around the site and capture all runoff from disturbed areas of the site, prior to treatment and controlled release into the unnamed creek along the southern boundary. The sedimentation ponds have overflow devices in place to control discharge during heavy or prolonged rainfall events.

The clean water system comprises two drains along the western portion of the site and an additional drain along the eastern boundary. The system is maintained to ensure drains are stabilised to prevent scouring and sediment generation, enabling clean water discharge to downstream bushland.

The internal drainage controls are established with the intention of capturing runoff from the partially rehabilitated areas, directing the surface water to the three sedimentation ponds. These basins are monitored quarterly for pollutants and allowed to discharge offsite once TSS levels comply with the EPL.

3.3 Buildings and infrastructure

The current building and infrastructure of the site consist of paved roads, car park, the weigh station, the resource recovery centre and the equipment shed all centred around the south eastern section of the site. Stormwater from these areas discharges into a pit and pipe system and outlets into the creek to the south of the site. The existing sediment pond, located behind the existing car park, also discharges into this system via a swale located on to the north of the entry road and into the waterway via a 600 mm diameter culvert.

3.4 Sedimentation ponds

A description of the design and operational details (extracted from the Water Quantity and Quality Assessment Report (Cardno, 2011) of the sedimentation ponds are summarised in Table 3-1.

There are two licensed discharge points, from sediment pond 2 and 4 into the downstream water course.

Table 3-1 2011 Sedimentation pond operational capacity (includes 300 mm freeboard)³

Sedimentation pond	Catchment (ha)	Surface area (m ²)	Storage depth (m)	Storage capacity (m ³)
No. 2	4.83	1,400	2.4	3,345
No. 3	5.12	460	0.6	269
No. 4	2.11	320	0.6	192
No. 5	3.29	755	1.05	795

³ Storage depths taken from information from Chase Burke and Harvey 2012. Storage capacity for Ponds 1 and 2 taken from survey by Chase Burke and Harvey 2012. Storage capacity for Ponds 3-6 estimated assuming 1 in 2 batter slopes.

Since the 2011 report, sediment pond 4 has been decommissioned. There are currently three operating sedimentation ponds, with an approximate catchment as indicated in Table 3-2. Sediment pond No. 1, in the location of the previous No. 5 pond, will be expanded to cater for the increased catchment area. The vegetated area between ponds 2 and 3, approximately 1.5 hectares in size, discharges directly to the southern water course.

Table 3-2 Current sedimentation pond catchment

Sedimentation pond	Catchment (ha)
No. 2	8.5
No. 3	1.4
No. 1 (previously No. 5)	4.0

The pond locations are shown in the below Figure 3-1.

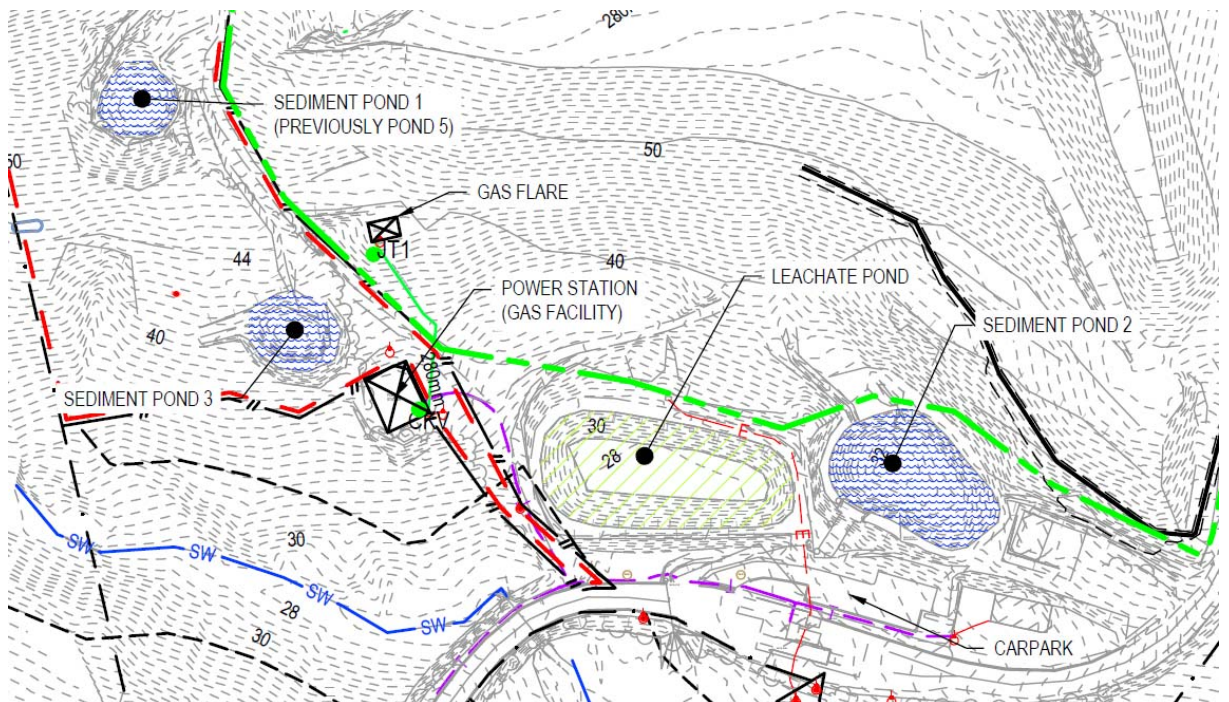


Figure 3-1 Sediment pond layout

3.5 Existing erosion and sediment control

Based on the 2006 updated LEMP, existing control measures used on site include:

- Sediment dams used for dust control
- Diversion drains and bunds installed to reflect ongoing change of site topography
- Fabric filter fences along intervals of drains
- Application of mulch to cleared areas
- Revegetation of cleared areas
- Stabilisation of exposed areas within 30 days

3.6 Environmental monitoring and reporting

Monitoring and reporting at the site is currently undertaken based on the EPL requirements. Requirements include the quarterly and/or yearly monitoring and recording of pollutants (Refer to EPL, Clause M2.1).

The locations of the monitoring points are provided in the EPL, Clause P1. There are four points, two of which are on-site sediment ponds and the remaining two points monitor the upstream and downstream conditions of an unnamed natural water course running along the south-eastern edge of the site.

4. Surface water management basis

4.1 General

This section details the basis for ongoing surface water management at the site.

4.2 Regulatory requirements

There are three primary documents which will regulate surface water management at the site. These are:

1. *Managing Urban Stormwater: Soils and Construction*, in particular volumes:
 - “Managing Urban Stormwater: Soils and Construction – Volume 1” (Landcom, 2004)
 - “Managing Urban Stormwater: Soils and Construction – Volume 2B, Waste Landfills” (Department of Environment and Climate Change NSW, 2008)
2. The EPL (No. 5873)
3. The Project Approval Conditions, Schedule 4 (Department of Planning and Infrastructure, 2013)

4.2.1 Managing Urban Stormwater: Soils and Construction

Managing Urban Stormwater: Soils and Construction (Department of Environment and Climate Change NSW, 2008) requirements relevant to the site have been summarised in Table 4-1.

Table 4-1 Site characteristics and constraints

Characteristic	Data source ⁴	Value/Rating
Total catchment area / total site area (landfill activities) / total disturbed area	Staging Drawings included in Appendix B	Refer staging plans (Appendix B) and design calculations (Appendix C)
Mean annual rainfall ⁵	Bureau of Meteorology	1155 mm
Mean annual open water evaporation ⁶	Bureau of Meteorology	1572 mm
Rainfall zone	Figure 4.9 Vol. 1	1
Rainfall erosivity ⁷	Appendix A, Vol. 1	2810
Soil erodibility	App C, T17, Vol. 1(Awaba)	0.011 (K-factor)
Length of operation	Assumed	> 3 years
Soil hydrologic group	App C, T17, Vol. 1 (Awaba)	Type B/C
Soil texture classification	Assumed	Type D/F
Disturbed land gradient	Site survey	3 – 33%
Potential erosion hazard (existing)	Figure 4.6, vol. 1	High
Proposed landfill batter gradient	Landfill design	33%

⁴ Data Source from Landcom,(2004) unless noted otherwise.

⁵ Rainfall data was obtained using a composition of the following station's: 061322 - Toronto WWTP, 061376 – Eraring, 061012 - Cooranbong (Avondale)

⁶ Evaporation data sourced from station 061351 – Peats Ridge (Waratah Road)

⁷ Using 2 yr, 6 hr ARI event from 33.025S, 151.550E

Characteristic	Data source ⁴	Value/Rating
Proposed landfill platform gradient	Landfill design	5%
Sensitivity of receiving environment	Table 6.1, vol. 2	Standard
Retention ponds volume requirement: Type D/F (operation)	Table 6.3, vol. 1	5-day 90th percentile event = 58.7 mm
Hydraulic capacity of run-on drainage	Assumed	10 year ARI of design storm event
Non-erosive hydraulic capacity of temporary drainage (erosion) controls ⁸	Table 6.1, vol. 2	20 year ARI of design storm event
Structural requirements of temporary sediment control measures ⁹	Table 6.1, vol. 2	Withstand 20 year ARI of design storm event
Structural requirements of sediment retention pond embankment and spillway	Table 6.1, vol. 2	Withstand 50 year ARI of design storm event
Volumetric runoff coefficient (disturbed)	Table F2, vol. 1	0.63 (Type C Soil)
Peak flow runoff coefficient	Table F3, vol. 1	0.86 (Type C Soil)

4.2.2 Environment protection licence

The EPL conditions relevant to surface water management are:

Condition L2.4 Water and/or Land Concentration Limits

POINT 6,7

Pollutant	Units of Measure	100 percentile concentration limit
Total suspended solids	milligrams per litre	50

Condition L2.5 Exceedances of the concentration limits for TSS in condition L2.3 (assumed to refer to above Condition L2.4) are permitted at the following points for the duration of the overflow: 6 & 7, whenever a wet weather overflow is occurring due to stormwater events greater than or equal to a 90th percentile 5 day rainfall duration.

Condition O5.1 The sedimentation basins and leachate holding dams must be maintained to ensure that their design capacity is available for the storage of stormwater/leachate.

Condition O5.2 The perimeter of the areas where waste has been 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 storm event.

Condition O5.3 The drainage from all areas at the premises which will liberate suspended solids when stormwater runs over these areas must be diverted into the sedimentation basins detailed in Figure 1 of Appendix 23 of the LEMP.

Condition O6.3 Surface drainage must be diverted away from any areas where waste is being or has been landfilled.

⁸ e.g. diversion banks, perimeter banks, catch drains, level spreaders, check dams, batter drains and chutes.

⁹ e.g. sediment fences, stacked rock sediment traps etc.

4.3 Catchment drainage and flooding requirements

Discharge of waters off-site should be through appropriate means to ensure no increase in peak pre-development discharge levels. Where discharge is to previously unaffected areas, the determination of pre development levels will be taken at the first junction with existing surface water infrastructure i.e. drainage channel or culverts.

All on-site drainage will be directed to sediment ponds to ensure controlled disposal off-site following adequate treatment.

4.4 Dam safety committee requirements

No dams are proposed onsite for the interim works. Therefore there are no requirements for reporting to the Dam Safety Committee.

4.5 Ongoing site development

Ongoing development of the site is required to provide future capacity for landfilling. Concept staging was established as part of the initial development strategy, the staging has been further developed (Appendix B) and has been used as the basis for future surface water management.

The drawings contained in Appendix B outline the various development works and their timing relative to cell filling and development works. In summary:

- Cell development (including excavation, lining, filling and rehabilitation) is undertaken in a progressive manner starting in the northernmost extents of the site, filling down gradient to the south, resulting in a continuous landform.
- Progressive development of surface water, leachate management, landfill gas and access road systems will complement the proposed staging.
- Redesign of various site infrastructure currently located within the southern area below the current landfill footprint will allow increased resource recovery. Surface water management of this infrastructure has not been included as part of this surface water management plan.

4.6 Constraints to surface water management

- The proposed transfer station and associated infrastructure surface water management has been developed to capture only the surface water that falls within it. Therefore, any overflows from the landfill will exceed the capacity of the southern infrastructure.
- The site accepts waste year-round so earthworks must continue during rainfall periods.
- Due to ongoing filling operations, filling, revegetation, relining over revegetation will need to occur.
- The layout of the site is such that works will be undertaken within drainage paths from time to time.
- Clean water and dirty water pathways will intersect and require management to avoid cross contamination.
- Infrastructure should be located outside the 100 year flood levels.
- Cover material from excavated landfill cells is stockpiled onsite resulting in a large stockpile that produces increased sediment loads.
- As filling progresses the cell access points will change. Dynamic sediment control measures will be required to reflect the changing haul route alignments.

- Discharge over the previously undisturbed western ridge line will occur as the landfilling reaches final height.
- The site receives run-on from offsite that is currently diverted through proposed future landfill cells.

4.7 Opportunities for surface water management

- The Awaba landfill expansion works provide an opportunity to alter catchment areas, upgrade existing infrastructure and provide new infrastructure.
- Progressive diversion of surface water can take place as cell rehabilitation works continue.
- Temporary sedimentation ponds can be constructed in future cell expansion areas reducing excessive excavation.
- Surface water control measures can be constructed throughout the site particularly around trafficked and operational areas.
- A clean water diversion drain located to the west and east can control discharge offsite.
- Retarding basins positioned at off-site discharge points will control discharge peak flows.
- Providing dedicated stockpile sedimentation management can provided initial treatment before further treatment is provided at other site ponds.
- Future sedimentation ponds can complement existing ponds including the potential to be used as a two stage settling sequence to prevent excess disturbance of sediments.
- Disturbed areas can be significantly reduced over the life of the site by revegetating final and/or intermediate capped areas. The progression of the landfill will allow previous cells to be revegetated around the exterior batters.
- Sealed and/or revegetated areas could be diverted away from the sedimentation ponds.

5. Surface water management strategy

5.1 General

This section details the surface water management principles and site specific strategy for achieving these principles.

5.2 Surface water management principles

According to Vol. 2 of *Managing Urban Stormwater: Soils and Construction* the goal for surface water management is:

‘to ensure that there is no pollution of surface or ground waters. Current best-practice erosion and sediment control techniques are, however, unlikely to achieve this goal, due to the limited effectiveness of most of these techniques. An appropriate management objective is therefore to take all reasonable measures (i.e. implement best-practice) to minimise water-quality impacts from erosion and sedimentation.

Given the limited effectiveness of techniques for retaining eroded sediment, a strong emphasis should be placed on pollution prevention through erosion control, rather than relying on treatment techniques to capture these sediments.’

Therefore, with the objective of not polluting surface waters paramount, the following principles will provide the basis for surface water management at the site:

- Minimise erosion and sediment generation at the source
- Maintain discharge levels to pre-development values
- Divert runoff from disturbed areas through sediment basins prior to discharge offsite

5.3 General surface water management strategy

To achieve these principles the following general strategy has been developed to provide a framework for the development and assessment of the site-specific strategy in the following sections:

- Minimising volume of clean surface water running onto the site from off site.
- Minimising the extent of disturbed areas.
- Minimising surface water from running onto disturbed areas of the site by staging operations and, where necessary, utilising surface water diversion drains and bunds for disposal and processing areas.
- Minimising erosion of disturbed areas by utilising at source control measures.
- Ensuring all surface water runoff from disturbed areas of the site is managed prior to reuse or discharge offsite.
- Ensuring all erosion and sediment controls are properly maintained by implementing an inspection and monitoring schedule.
- Separating ‘clean’ and ‘dirty’ water, where possible.
- Fast-track rehabilitation of capped areas to expedite diversion off-site.
- Installation of retarding features for discharge offsite to control peak flow discharge.

- Providing surface water drainage in the trafficked impervious areas.
- Providing staff education and adopting strategies for early identification of potential surface water issues.

5.4 Stage 1 Strategy – Initial Construction

Stage 1 describes the initial construction works required to commence the landfill expansion project, including the construction of Cells 1 and 2. The stormwater management works required for Stage 1 include:

- Construction of the south-western sediment pond arrangement, which comprises two linked sediment ponds. The northerly pond (primary) is located within the footprint of future Cell 9, and will be decommissioned once construction works for Cell 9 commence. The southerly pond (secondary) is located outside of the landfill footprint and will be in service permanently. The sizing of this south-western sediment pond arrangement is based on the following:
 - During Stage 2 (development of Cells 3 and 4) (refer to Drawing C7061), the anticipated catchment is 6.3 ha, with a required storage for the 5 day 90th percentile rainfall depth of 3,500 m³. To account for this, expand the primary pond to 2,400 m³ of storage below a 750 mm freeboard, allowing the majority of rainfall events to be captured and treated in this pond, leaving the below pond for overflow storage during larger events (including the above mentioned design storm). An overflow will be constructed from the primary pond to the secondary pond.
 - During Stage 4 (development of Cell 9) (refer to Drawing C7066), the anticipated catchment is 4.0 ha, with a required storage for the 5 day 90th percentile rainfall depth of 2,200 m³. During the construction of Cell 9, the northern pond will be removed, leaving the south pond as the only treatment. To account for this, the pond has been expanded to provide 2,200 m³ of storage below a 750 mm freeboard. Therefore, the combination of both ponds, required during Stage 2, is 4,600 m³. This additional 1,100 m³ of storage will provide capacity for larger events and also the opportunity to pump from the south east pond to assist in maintaining its capacity.
- Final filling and rehabilitation of the southern portions of the site (lined quarry cell) should be completed/under completion, with the intent to discharge these catchments directly offsite prior to any stormwater runoff from Cells 1 and 2.
- Excavation and lining of Cell 1, followed by Cell 2.
- Construction of temporary sediment ponds to capture runoff during construction works of Stage 1. The proposed location is in the lower most corner of Cells 1 and 2. This should be confirmed by the contractor prior to undertaking any works.
- Construction of clean water diversion system for the offsite northern catchment. This will involve a subsurface pipe being installed beneath the eastern sidewall of Cell 1, allowing clean water to be conveyed from the north of the site to a discharge point to the east outside the landfill footprint. Since the discharge from the off-site northern catchment already discharges to the east of the site, no net increase to the flow downstream of the site is anticipated.
- Diversion drains along the west ridgeline to allow capture of runoff generated from future capping. A drain will be constructed along the edge of Cells 2 and 4, initially discharging into the current clean water channel along the west of the site (this will continue until runoff from the cap begins to contribute).

- Diversion drains along the east ridgeline to allow capture of runoff generated from future capping. The east drainage line will be constructed along Cells 1 and 3, where it is piped under the main access track, to flow along an open channel to the south east sedimentation pond. Due to the limited capacity of the southern-most surface water drains and subsequent risk of flooding to infrastructure such as the weighbridge and buildings, the following management measures are proposed to be implemented:
 - A “splitter junction” has been proposed along the east drain at the south end of Cell 3, just prior to the culvert under the road leading to the downstream sedimentation pond.
 - This junction has a restricted inlet pit and a high-flow spillway. The restricted inlet pit (Pit 5\2) will take all storm events under 5 year ARI to the sedimentation pond. It will also convey the first flush of all storm events towards the sedimentation pond. As the flows increase, the restricted inlet will cause water to back up, whereby it will overtop the high-flow spillway, discharging directly offsite to the east. The discharge offsite will only occur for a short duration, high intensity storms after the first flush has been conveyed to the sedimentation pond. This arrangement is considered to deliver a suitable sediment retention solution whilst minimising risk of flooding to site buildings and infrastructure.
- The drain through Cell 9 has also been sized in this stage. The size is based on the probable maximum requirement during Stage 3. This involves the cap runoff from Cells 2, 4 and 6, the existing surface of Cell 9.

5.4.1 Peak discharge

All sediment laden surface water within the works is intended to exit the site via constructed sediment basins. No drainage works will result in discharge to previously unaffected areas.

5.4.2 Required surface water management infrastructure

A brief summary of the required surface water infrastructure is provided in Table 5-1. For detailed calculations refer to Appendix C.

Table 5-1 Stage 1 infrastructure

Item	Catchment (ha)	Duration of disturbance (yrs)	ARI / design event	Required volume ¹⁰ (m ³)	Required capacity (m ³ /s)
South west sediment ponds	6.3	>3	90 th	3,500	-
South east sediment pond ¹¹	5.2	>3	90 th	2,900	-
Cell 1 sediment pond	2.9	<1	90 th	1,650	-
Cell 2 sediment pond	2.7	<1	90 th	1,500	-
West drain	2.6	>3	20	-	1.0

¹⁰ Excludes freeboard

¹¹ Scenario based on rehabilitation of Cell 7 and 8 sufficient to direct runoff offsite, Cell 1 rehabilitated and discharging directly offsite.

Item	Catchment (ha)	Duration of disturbance (yrs)	ARI / design event	Required volume ¹⁰ (m ³)	Required capacity (m ³ /s)
East drain	2.1	>3	20	-	0.8
Cell 9 drain	7.2	>3	20	-	2.1

5.5 Stage 2 strategy – Construction of cells 3 and 4

Stage 2, shown on DWG 22-16920-C7062 (Appendix B), depicts the period of works during construction of cells 3 and 4 as well as completion of filling and capping of cells 1 and 2. The works include:

- Application of final capping profile to Cell 1 and 2, including revegetation of final surface. Drains to convey this surface water have been developed during the previous Stage.
- Construction of diversion drains over the cap of Cell 1 and 2, intended to divert future capped areas towards the south east and south west ponds during rehabilitation. These drains will be placed as needed to control discharge off the slopes. A guide to capacity has been included in this stage based on a 2.0 hectare catchment, with the rehabilitation period of under 12 months.
- Based on the existing topography and anticipated design, the runoff during Cell 3 construction will grade to existing drains located at the south east corner connection with Cell 5. Minor runoff from Cell 5 will flow towards Cell 3. To manage this, construction of drainage infrastructure will include bunds along the south of Cell 3 to divert waters from Cell 5 towards the south east corner towards the pipe discharging directly offsite (placed during Stage 1 works).

5.5.1 Peak discharge

The surface water management within this stage of works is intended to exit the site via constructed sediment basins. No drainage works will result in discharge to previously undisturbed areas.

5.5.2 Required surface water management infrastructure

A brief summary of the required surface water infrastructure is provided in Table 5-2. The information is intended to provide an estimate of the sizing required. These estimates should be reviewed during the detailed design for each stage of works. For detailed calculations refer to Appendix C.

Table 5-2 Stage 2 additional infrastructure

Item	Catchment (ha)	Duration of disturbance (yrs)	Ari/design event	Required volume (m ³)	Required capacity (m ³ /s)
General cap diversion bunds	2.0	<1	5	-	0.45
Bund between Cell 3 and 5	0.8	>3	20	-	0.4

5.6 Stage 3 strategy – Construction of cells 5 and 6

Stage 3, shown on DWG 22-16920-C7064 (Appendix B), depicts the period of works during construction of cells 5 and 6 as well as completion of filling and capping of cells 3 and 4. The works include:

- Extension of final capping profile from Cell 1 and 2 extending into 3 and 4, including revegetation of final surface. Drains to convey this surface water have been developed during the initial construction phase.
- Extension of the diversion drain network over the cap of Cell 1 to 4, intended to divert future capped areas towards the south east and south west ponds during rehabilitation. There is also the option to divert clean water from rehabilitated sections directly off-site, reducing the capacity requirements of drainage and ponds.
- Based on the existing topography and anticipated design, the runoff during Cell 5 construction will predominantly grade to existing drains located at the south east corner. Minor runoff from Cell 5 may flow towards Cell 7, depending on final landform of current filling. To manage this, construction of drainage infrastructure will include bunds along the south of Cell 5 to prevent discharge of sediment laden waters into Cell 7.

5.6.1 Peak discharge

The surface water management within this stage of works is intended to exit the site via constructed sediment basins. No drainage works will result in discharge to previously undisturbed areas.

5.6.2 Required surface water management infrastructure

A brief summary of the required surface water infrastructure is provided in Table 5-3. The information is intended to provide an estimate of the sizing required. These estimates should be reviewed during the detailed design for each stage of works. For detailed calculations refer to Appendix C.

Table 5-3 Stage 3 additional infrastructure

Item	Catchment (ha)	Duration of disturbance (yrs)	Ari / design event	Required volume (m ³)	Required capacity (m ³ /s)
Bund between Cell 5 and 7	0.8 ¹²	>3	20	-	0.4

5.7 Stage 4 strategy – Construction of cell 9

Stage 4, shown on DWG 22-16920-C7066 (Appendix B), depicts the period of works during construction of cell 9 as well as completion of filling and capping of cells 5 and 6. The works include:

- Final capping profile from Cell 1 extending into Cells 5 and 6, including revegetation of final surface. Drains to convey this surface water have been developed during the initial construction phase.
- Extension of the diversion drain network over the capped portions of the Site, intended to divert future capped areas towards the south east and south west ponds during

¹² Estimate only, final landform contours not yet available.

rehabilitation. Clean water from rehabilitated sections should now be discharging directly off-site, reducing the capacity requirements of drainage and ponds.

- Based on the existing topography and anticipated design, the runoff during Cell 9 (note Cells 7 and 8 have been removed from works) construction will predominantly grade to the south of the Cell, where the existing sedimentation pond may be used to capture runoff.
- Runoff from the intermediate capped slopes along the south of Cell 6 will flow towards Cell 9. The construction of Cell 9 will be required to manage the inflows into the works area.

5.7.1 Peak discharge

With the construction of Cell 9 underway, the previous drainage path for Cell 2, 4 and 6 has now been decommissioned. During this stage, two options for managing surface water include:

- Discharge to the west of the Site to previously undisturbed catchments. Conceptual modelling has indicated an increase in post development discharge levels under the adjacent Newstan-Eraring Private Coal Road. To account for this, the detailed design phase for Cell 9 should consider the following scenarios:
 - Divert all catchment to a central point and construct one main retarding basin at this point to attenuate the peak flow to pre-development value, via low flow and high flow outlets.
 - Divert catchments in phases, with smaller retarding basins and separate discharge points along the ridgeline, using low flow and high flow outlets.
 - Construct in-line detention ponds along the gully, with a single discharge point at the end of the treatment train.
 - Construct a detention pond at the base of the ridge, immediately prior to the Newstan-Eraring Private Coal Road culvert.
 - Investigate sensitivity of down-stream waterways to determine effect of higher peak flow discharge, seek approval to allow this flow with additional stream stabilisation if required.
- Construct a diversion structure, similar to the northern diversion works, capturing flows at the low point along the perimeter drain (approximate west boundary of Cell 6/9), construct pipeline to convey flows under Cell 9, discharging either directly to the creek, or through the sedimentation pond.

5.7.2 Required surface water management infrastructure

In consideration of the options presented in 5.7.1, if proposing to construct a single retarding basin of capacity below spillway of 2,000 m³ and low flow outlet of 0.1 m³/s at the discharge location to the West (at intersection of Cell 6/9). A single basin with performance characteristics as shown in Table 5-4 would result in only minor increase, of three percent, to the pre development peak flow during the 100-year ARI.

The runoff values are shown in Figure 5-1. The minor increase to peak flow can be reduced further/eliminated through an increase of the pond capacity and raising the low flow outlet above the base of the pond, providing a storage volume prior to any discharge. This will require manually draining the pond between each storm event to restore the initial capacity below the low flow outlet. This could be done through pumping the water or operation of a release valve at the base of the pond.

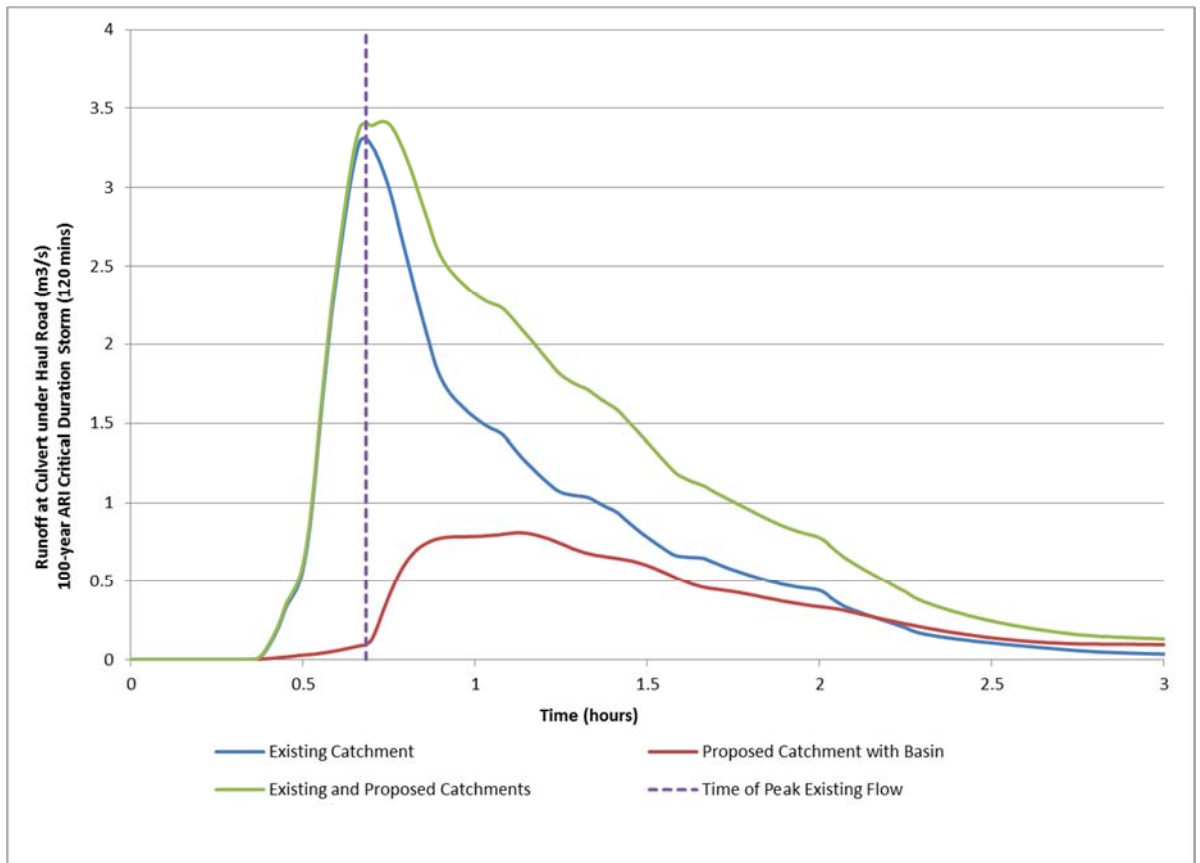


Figure 5-1 Runoff through downstream culvert

Table 5-4 Stage 4 infrastructure

	Existing downstream catchment	Resultant catchment with no detention pond	Resultant catchment with 2000 m ³ detention pond	Increase to pre-development (no pond/pond) (%)
Catchment Area (ha)	16.1	21.5	21.5	33.5/33.5
1-year ARI Peak Flow Rate (m ³ /s)	0.58	0.97	0.65	67/12
10-year ARI Peak Flow Rate (m ³ /s)	1.65	3.26	1.72	98/4
100-year ARI Peak Flow Rate (m ³ /s)	3.31	5.91	3.42	79/3
Detention Storage Volume Below Spill Level (m ³)	-	-	2000	
Capacity of Low Flow Outlet(s) when water level is at spill level (m ³ /s)	-	-	0.1	

5.8 Stage 5 strategy – Completion of cell 9

Stage 5, shown on DWG 22-16920-C7067 (Appendix B), depicts the final period of works in filling and capping of cell 9. The works include:

- Extension of final capping profile from Cell 1 through to 9, including revegetation of final surface. The majority of drains to convey this surface water have been developed during the initial construction phase.
- Construction of final perimeter drains around the extents of Cell 9 to direct runoff to the western discharge points and also the south west pond.
- Extension of the diversion drain network over the final cap surface. Diverting clean, rehabilitated portions directly offsite, and areas undergoing rehabilitation to existing sediment ponds.
- Reducing the size of the south west pond to reflect the reduced catchment capacity. This will also allow expansion of Cell 9 filling area.

5.8.1 Peak discharge

The remaining surface water network within the works (following diversion to the west) is intended to exit the site via constructed sediment basins. No drainage works will result in discharge to previously unaffected areas.

5.8.2 Required surface water management infrastructure

A brief summary of the required surface water infrastructure is provided in Table 5-5. The information is intended to provide an estimate of the sizing required. These estimates should be reviewed during the detailed design for each stage of works. For detailed calculations refer to Appendix C.

Table 5-5 Stage 5 infrastructure

Item	Catchment (ha)	Duration of disturbance (yrs)	Ari / design event	Required volume (m ³)	Required capacity (m ³ /s)
Secondary south western pond	4.0	>3	90 th	2,250	-
Perimeter drain Cell 9	1.0	>3	20	-	0.5

6. General surface water management works

6.1 General

This section contains general instructions for the development of required infrastructure throughout the operation, closure and post closure of the site.

6.2 General instruction

Site operators and any contractors will ensure that all surface water management works are undertaken as instructed in this plan and constructed following the relevant guidelines set out in the *Managing Urban Stormwater: Soils and Construction*.

Works should be scheduled for a forecast dry weather period. Once commenced, works must be completed without delay in order to minimise the risk of significant rainfall during construction. All subcontractors will be informed of their responsibilities in reducing the potential for soil erosion and pollution to down-slope areas.

6.3 Land disturbance

All proposed erosion and sediment control measures will be implemented before disturbing any new areas, including the installation of sediment fencing or alternative controls down-slope of any areas that do not drain toward the 'dirty' water treatment areas. Sediment fencing will be installed in accordance with the Blue book vol. 1: standard drawing 6-8.

Prior to clearing, the limits of disturbance will be clearly and visibly marked. All operations will be planned to ensure that there is minimal land disturbance outside the limits to be cleared.

Land disturbance will be minimised by clearing the smallest practical area of land ahead of earthworks and leaving this disturbed for the shortest possible time.

6.4 Site access roads

Roads will be constructed to ensure surface drainage is optimised and stabilised, thereby reducing roadside erosion and sedimentation. Cross-fall drainage structures and mitre drainage will be implemented for the entire length of the roads. Crowning will generally be implemented on any steeper sections of the roads. Out-fall drainage will be constructed where the road traverses small-fill batter areas, and in-fall drainage will occur where the road traverses larger-fill batter areas. Road runoff will be intercepted at regular intervals to reduce runoff velocity in each mitre drain. Drain spacing will not exceed 50 m.

All main access roads will be sealed. Rock check dams will be constructed as necessary.

6.5 Vehicle access

Vehicles shall only travel on designated access roads to prohibit unnecessary site disturbance.

Additional site access roads to work areas shall be temporary and be laid out by Council or their Representative.

Temporary barrier fencing shall be installed at the discretion of Council or their Representative to ensure traffic control and prohibit unnecessary site disturbance.

6.6 Dust control

Unsealed, trafficable surfaces, material stockpiles and other disturbed areas not subject to revegetation shall be kept damp as required to control dust using recycled water from the sediment control pond(s), or by using a water tanker.

6.7 Stockpile management

During the operational phase, the emphasis will be on maximising the direct transfer of materials and minimising the need for stockpiling. However, there will still be a need for an active stockpiling area for storage of topsoil and excess soil and clay.

Stockpiles will be placed so as to avoid impediment of drainage lines. Stockpiles will be managed in accordance with the Blue Book vol. 1: standard drawing 4-1.

Specific requirements for soil stockpile management are set out below:

- A diversion bank will be constructed up-slope of stockpiles to divert overland flow around the stockpiles.
- Stockpiles must be appropriately protected from concentrated surface flow and excessive up-slope surface water surface flows.
- Loss of soil material from the stockpiles is to be minimised by means of sediment fences installed in accordance with the Blue book vol. 1: standard drawing 6-8.
- Stockpiles must be located at least 2 m from any hazardous area, retained vegetation, or concentrated drainage line and shall not impede natural or constructed surface drainage lines.
- The stockpile surfaces should have a generally even surface that is as 'rough' as possible, to assist in runoff control and seed retention and germination.
- If stockpiling of topsoil for more than three months is required, a maximum stockpile height of two metres and a batter slope of 2:1 will be maintained to preserve biological viability and reduce soil deterioration.
- Due to the nature of the soils, runoff from the stockpile areas will be directed to a dedicated stockpile sedimentation pond before overflowing to other site sedimentation ponds for further treatment, preventing untreated runoff from leaving the site.
- If relevant, to maintain organic matter, the topsoil material will be rotated through the stockpile so that it is not retained for longer than 12 months.
- A suitable flow diversion system must be established immediately up-slope of a stockpile of erodible material that has the potential to cause environmental harm if displaced, if the up-slope catchment area draining to the stockpile exceeds 1500 m².

6.8 Water diversion and conveyance

6.8.1 Clean water (run-on)

Run-on from areas of the site where soils and vegetation have not been disturbed is considered to be 'clean' run-on. Clean water diversion banks will be required at various stages of the project to divert clean run-on away from disturbed areas and sedimentation ponds. The channel bed and side slopes will be stabilised using grasses sown promptly at the completion of earthworks or lined with shotcrete or rip rap as required. Additional sediment control measures will be implemented prior to establishment of stabilising vegetation or lining to prevent untreated runoff from leaving the site.

All clean water diversion and conveyance structures will be constructed according to the design parameters in Appendix C.

6.8.2 Disturbed water (run-off)

Runoff from disturbed areas of the site will be directed into the sedimentation ponds. Types of surface water diversion and conveyance structures that may be required include:

- **Cross-slope diversion banks** with grades of about one per cent. These banks will be generally constructed in accordance with the typical design for earth bank (low flow) or earth bank (high flow) contained in the Blue Book vol. 1: standard drawings 5-5 and 5-6.
- **Down-slope channels.** Because these channels are permanent fixtures once the landfill operation is complete they are to be lined (typically with a freeform concrete mattress, geosynthetic drain or similar).

All disturbed water diversion and conveyance structures will be constructed according to the design parameters in Chapter 5.

6.8.3 Rock check dams

Rock check dams shall be constructed inline in high flow drain paths and at the entrance points to drainage channels from disturbed area in accordance with the Blue book vol. 1: standard drawing 5-4. Figure 6-1 illustrates a typical inline rock check dam. Figure 6-2 illustrates a typical rock check dam from a large disturbed area.



Figure 6-1 Typical in-line rock check dam



Figure 6-2 Typical drain entrance rock check dam from large disturbed area

6.9 Sedimentation pond management

Sedimentation ponds should be drained as soon as possible following rainfall and sediment regularly removed to maintain overall site capacity.

A Sedimentation Pond Management Procedure has been developed to provide a guide on the measures to be adopted for the management of sedimentation ponds onsite. The document is included in Appendix D. The management of the ponds should include the following key points:

- Pond capacity should be reviewed monthly and after any large rainfall event with removal of silt to occur when sediment storage zone reaches capacity.
- Installation of depth indicating markers within all stilling and sedimentation ponds to indicate maximum sediment storage zone and capacity remaining in ponds.
- Outflow drainage channels from all ponds are to be inspected to ensure adequate capacity and identify and correct any erosion.
- Runoff from areas that are likely to generate high sediment loads (i.e. stockpiles) shall be directed into the designated sedimentation ponds.
- When using a petrol pump to drain the ponds, the pump shall be placed within a “bunded platform” to capture any spills from both operation and refuelling activities.

6.10 Establishment of final landform

During placement of material, temporary machinery work on batters will be carried out so as to minimise susceptibility to erosion, using techniques such as ‘track walking’ a machine up and down the slope (refer Figure 6-3).



Figure 6-3 Track-walked slope (Landcom, 2004 Figure 4.3a)

The final landform will have the following features:

- The final landform will be as per the approved fill plan. Where the final landform slopes exceed 1 in 5 (V:H) specific engineering controls may be required to ensure they are stable and to control erosion.
- Berm drains will be constructed across contours every 25 metres of slope length.
- The landform will be free draining, with flows directed towards sedimentation ponds and diverted to natural drainage channels after areas are fully rehabilitated (with ground cover of at least 70 per cent).
- Stable drainage will be constructed to drain water from the landform areas including grass-lined channels and reinforced channel lining on steeper channel sections.

The final landform will then be revegetated as soon as practicable (no more than two weeks) after final capping and placement of topsoil.

6.11 Surface preparation for final rehabilitation

Before final soil preparation, the surface is to be ripped to a depth of approximately 20 cm to allow better root penetration by the plants to ensure rapid establishment and growth of vegetation. Where possible, the surface is covered with topsoil using a suitable machine to minimise compaction. Topsoil/mulch mix will be spread along the contour of completed batters to minimise erosion by dumping at the top of slopes and grading downwards and across the contour. Once the topsoil/mulch is spread, vehicle traffic will be prevented from entering the area.

Gypsum and/or lime may be applied to the final surface using broadcasting machinery immediately prior to sowing. The ameliorants will be incorporated to a nominal depth of 300 mm.

Topsoil that has been stored separately from subsoil material will be re-spread on the surface of the batters and upper surface of the landfill so that the organic layer, containing any seed or vegetation, is returned to the surface.

Topsoil will be spread to a minimum depth of:

- 50 mm on areas where the slope is *more* than 1 in 4 (V:H).

- 75 mm on areas where the slope is *less* than 1 in 4 (V:H).
- Re-spread topsoil will be levelled to achieve an even surface, avoiding a compacted or an over-smooth finish. A sterile cover crop will be applied to assist with initial soil stabilisation.
- Mulch material will generally be applied across the rehabilitated area to stabilise bare soils. Mulches that meet Australian Standard *AS4454-203 composts, soil conditioners, and mulches (unrestricted)* will be preferred. All disturbed areas should be stabilised as soon as possible following completion of works on that area.

6.12 Vegetation establishment

Revegetation of disturbed areas is an integral component of the site surface water management and, as such, progressive revegetation of disturbed areas will be undertaken as soon as possible after disturbance. The condition of revegetation works will be visually monitored and any if any of the sections of planting show evidence of poor health professional advice should be sought. Any revegetation that fails should be replanted.

Sowing time for re-vegetation activities will generally be undertaken in spring and autumn, although opportunistic re-vegetation will be practiced if areas become available for sowing in summer and winter.

After surface soil amelioration and tillage is completed for any given area, re-vegetation will commence as soon as practicable. The proposed method of sowing will be via conventional spreading using agricultural broadcasting equipment.

Slope stabilising techniques such as hydroseeding and straw mulching, will be undertaken on slopes exceeding 1 in 4 for enhancement of pasture germination.

Fertilizer application will be undertaken simultaneously with both tree and pasture seeding. Maintenance fertilising will be conducted as required. Fertiliser type and application rates will be determined by prior soil analysis, if required.

Signage should be installed near the revegetation works to advise all construction equipment and materials are not allowed to enter the site.

6.13 Site induction

Environmental matters shall be highlighted in the site induction for all personnel including subcontractors. The site induction shall include issues relating to erosion minimisation, sediment control and water quality. Staff shall be made aware of their responsibilities under relevant environmental legislation.

6.14 Staff training

Site staff and managers should be trained to consider surface water pollution in everyday landfilling operations and planning, and could include ensuring landfill operators understand:

- The requirements of the EPA and the EPL.
- The role of site practices and measures implemented, including waste cover practices (including daily, intermediate and final cover), infiltration and leachate generation.
- The factors that affect surface water and erosion, including large disturbed areas, poor site grading and vegetation.
- Construction and maintenance of erosion and sediment control measures.

- Development of a fact sheet of key requirements to address to improve surface water management.
- Development of maintenance checklists including timeframes to complete each checklist.

All landfill supervisors should also have achieved the TAFE Certificate IV in landfill operations. The existing landfill management plan should be updated to reflect any changes in training requirements.

7. Inspection, maintenance and monitoring

7.1 Inspection

Council or their representative shall make a visual inspection in accordance with the requirements of the procedures and checklists in section 7.2:

- At least weekly
- Immediately before completion of each item of work
- Immediately following rainfall events in excess of 15 mm in any 24 hour period

Records of inspections and other requirements stipulated in the procedures and checklists shall be maintained.

7.2 Maintenance

The following procedures and checklists will be implemented to ensure the site is managed in accordance with statutory requirements:

- Weekly and Post Rainfall Environmental Inspection Checklist (refer Appendix D)
- Sedimentation Pond Management Procedure (refer Appendix D)

If required, maintenance activities will be carried out to repair/reinstate any damaged surface water management measures in accordance with the *Managing Urban Stormwater: Soils and Construction* as soon as practical.

Sedimentation ponds will be inspected after any significant rainfall (more than 15 mm in a day) in order to maintain the effectiveness of sedimentation ponds for sediment retention. Each pond will be emptied and cleaned of sediment build-up, annually, to restore surface water holding capacities. The frequency of clean-out will be reviewed, as required.

As part of statutory 'diligence and care' responsibilities, the Operations Manager will maintain records required under the above checklists and procedures. Data to be maintained will include:

- Volume and intensity of any rainfall events
- Water quality monitoring records
- Sediment pond management form data requirements

Checklists, procedures and all records will be kept onsite and made available to any authorised person on request. In addition to the checklists and procedures the Operations Manager will maintain a daily diary to record any additional information.

7.3 Monitoring

To assist with the collection of opportunistic surface-water samples, a collection of appropriate sample bottles will be retained and readily accessible onsite. The Operations Manager and his delegates will be trained in the collection, handling and dispatch of water samples for analysis.

Water-quality monitoring at the locations specified in the EPL will be undertaken in accordance with the requirements of the EPL.

Annual reporting of surface-water quality will be conducted. Changes in water-quality parameters from baseline values will be identified and further assessment will be undertaken, if required.

Monitoring of sedimentation ponds will be undertaken in accordance with the requirements of the EPL.

As indicated in Section 5.3, Council should allow for potential (and likely) changes to the EPL in developing the current monitoring strategy.

7.4 Reporting

For each sampling event, water quality results will be compared against assessment criteria defined in the EPL. Any exceedance of criteria will trigger an investigation to determine the cause of the exceedance and preparation of a corrective action report to re-establish appropriate controls, if required.

The reporting of all monitoring and measurement will be undertaken in accordance with the EPL, including notification of monitoring and investigation results to external organisations, if required. All required results will be reported in the Annual Return to EPA.

Results, including any actual or potential significant off site impacts on people or the biophysical environment will also be reported to EPA as soon as practicable after any incident.

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Appendices

Appendix A – Erosion and sediment control plan



Lake Macquarie City Council
Awaba Waste Management Facility
Erosion and Sediment Control Plan

Revision 1

July 2014

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Appendices

Appendix A – Erosion and Sediment Control Measures

1. Introduction

1.1 General

Lake Macquarie City Council (Council) engaged GHD Pty Ltd (GHD) to prepare an Erosion and Sediment Control Plan (plan) for the Awaba Waste Management Facility (the site).

1.2 Purpose of this plan

The purpose of this plan is to provide guidance for the erosion and sediment control (ESC) measures to be implemented and maintained during the ongoing construction and management of the site.

Prior to undertaking any ESC works, the person undertaking the works should make themselves aware of any design drawings and proposed future expansion plans of the site. This plan should also be read in conjunction with the Surface Water Management Plan (SWMP) for the site.

1.3 Scope of this plan

The scope of this plan is to satisfy the requirements of the Project Approval (Schedule 4 of application no.10_0139) and summarised below:

Table 1-1 Approval Conditions relating to Erosion and Sediment Control

Condition number	Details
14	<p>The Proponent shall:</p> <ul style="list-style-type: none">(a) minimise any soil loss through erosion on Site.(b) set aside any topsoil won on Site for the proposed revegetation and rehabilitation of the Site.(c) ensure that any topsoil stockpiles on Site are suitably managed to ensure that the topsoil in these stockpiles can be beneficially used in the proposed revegetation and rehabilitation of the Site.
19(b)	<p>The Proponent shall prepare and implement a Soil, Water and Leachate Management Plan for the Project. The Plan shall be prepared by a suitably qualified and experienced expert in consultation with LMCC, the NOW and the EPA and be submitted to the Director-General for approval prior to the commencement of Operations. The Plan shall include:</p> <ul style="list-style-type: none">(b) an erosion and sediment control plan that:<ul style="list-style-type: none"><input type="checkbox"/> is consistent with the requirements of the latest version of the Blue Book Volume 1 and Volume 2B.<input type="checkbox"/> identifies activities on Site that could cause soil erosion and generate sediment.<input type="checkbox"/> describes the measures that will be implemented to:<ul style="list-style-type: none">i. minimise soil erosion and the transport of sediment to downstream waters, including the location, function and capacity of any erosion and sediment control structures and maintain these structures over time.ii. ensure that any topsoil stockpiles on Site are suitably managed to ensure that the topsoil in these stockpiles can be beneficially used in the proposed revegetation and rehabilitation of the Site.

To demonstrate that the project can satisfy the requirements of the approval conditions the following have been detailed in this report

- Objectives of the minimisation of potential erosion conditions and the management of potentially sediment laden runoff.
- Identification of activities on Site that may cause soil loss and generate sediment.
- Description of the proposed ESC features and rationale for their selection.
- Typical details of the types of ESC works to be implemented within the waste placement zone.
- Typical details of the types of ESC works to be implemented during construction of the main infrastructure, including weighbridge, wheel wash, waste transfer station, car parks, buildings and main access roads.
- A schedule of works to identify when and where specific ESC measures shall be utilised.
- Maintenance and monitoring requirements to be undertaken for specific controls.

1.4 Reliance

The following documents have been relied upon:

- Project Approval (Application No: 10_0139) Schedules 1-5.
- Landcom manual "Managing Urban Stormwater: Soils and Construction – Volume 1" (4th Ed., 2004), the "Blue Book".
- Department of Environment and Climate Change NSW "Managing Urban Stormwater: Soils and Construction – Volume 2B, Waste landfills" (2008).
- IECA Best Practice Erosion and Sediment Control (2008).

1.5 Assumptions

The following assumptions have been made in preparing this Plan:

- Survey data received from LMCC (Received 05 September 2013), is of a sufficient quality that will allow any features of the land that will affect stormwater flow to be evident.
- The Plan is to be read in conjunction with the Stormwater Management Plan and the Water Balance Assessment for the project.
- This report will be used to provide guidance for the development of the Construction Environmental Management Plan where ESC will need to be included.

2. Erosion and sediment control objectives

2.1 ESC objectives

The objective of this plan is to minimise the extent of erosion and sediment transportation during staging of landfilling activities and initial construction of site infrastructure. The emphasis will be to restrict movement of soil and vegetation particles, and mitigate the impacts of the works on the receiving environment. To achieve this objective, the adopted ESC strategy for the works shall encompass:

- Minimising stormwater (volume and velocity) from running onto downstream works by appropriate staging of the work and, where necessary, utilising existing site or temporary stormwater diversion drains and bunds.
- Minimising erosion of disturbed areas by utilising erosion control measures.
- Maximising the potential for stormwater runoff from disturbed areas of the site to be treated to an acceptable standard prior to reuse or discharge offsite, by utilising the indicated sediment control measures.
- Minimising the amount of stormwater runoff discharged from the site by maximising reuse on-site.
- Management of all erosion and sediment controls so that they are properly maintained by implementing an inspection and monitoring schedule.
- Manage stockpiles so that they are appropriately constructed and managed to maximise reuse of topsoil.
- Providing stormwater devices in the trafficked areas.

2.2 Stormwater quality objectives

In accordance with the conditions of the EPA Licence (EPL 5873), any surface water discharged from the site shall meet qualitative and quantitative discharge limits as defined Section L2 of the licence, as defined below for clarity:

- L2.1 For each monitoring/discharge point or utilisation area specified in the table below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.
- L2.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table. (see Table 2-1 below)
- L2.4 Water and/or Land Concentration Limits

Table 2-1 Points 6 and 7 Concentration Limits

Pollutant	100 percentile concentration limit	Units of measure
Total suspended solids	50	mg/L

- L2.5 Exceedances of the concentration limits for TSS in condition L2.3 are permitted at the following points for the duration of the overflow:
- 6 and 7, whenever a wet weather overflow is occurring due to stormwater events greater than or equal to a 90th percentile 5 day rainfall duration.

3. Erosion and sediment generating activities

3.1 General

There are a number of typical activities that will occur within the site during the construction and operation phases of the land fill that will increase the risk for erosion and sediment generation. These key construction and operation stages are discussed in detail in the Surface Water Management Plan but typically grouped into the following two stages:

- Construction of key site infrastructure including the new amenities and car park area, the weighbridge, transfer area and wheel wash as well as the new paved roads linking the new infrastructure.
- The staged construction, filling and rehabilitation of landfill cells for the remaining life of the facility.

The general aim for the plan and ultimately the staging of the proposed works is to reduce the need for extensive management structures by:

- Staging the works in a manner that capitalises on proposed and existing features.
- Reducing the areas of exposed soils to an absolute minimum in particular the length of exposed slopes.
- Maximising clean water diversion off site/away from exposed areas of the site catchments.

3.2 During infrastructure construction works

The infrastructure construction works will involve the construction of the facilities and roadways associated with the site. These works will be undertaken at the start of the project and typically last for 6 to 9 months (subject to final construction staging and landfill operation constraints).

3.2.1 Activities

The activities and aspects of the works that have potential to lead to erosion, sediment transport, siltation and contamination of natural waters occurring during the infrastructure works include:

- Clearing and earthworks undertaken for the construction of the site infrastructure (incl. wheel wash, transfer station, weigh bridge and site amenities).
- Works within drainage paths, including depressions and waterways which would result due to road construction, culvert and drainage outlets.
- Stockpiling and subsequent placement of excavated materials undertaken for fill activities. This would be critical for the proposed works in the vicinity of the transfer station and the proposed AWT access road due to the proximity of the waterway.
- Loss of material during hauling from cut areas to fill areas of the site.
- High Traffic areas off paved roadways where soils are not stabilised and soil particles are ground via excessive tracks and vehicle movements resulting in highly mobile and fine grained becoming easily dislodged in windy conditions or rainfall.
- Inadequate maintenance of environmental control measures.

3.2.2 Potential impacts

The potential impacts on the receiving environment relate to erosion of disturbed areas or stockpiles and sediment transportation offsite. Potential adverse impacts can include:

- Loss of topsoil in flow paths of overland surface water
- Increased water turbidity
- Decreased levels of dissolved oxygen
- Changed pH and salinity levels
- Smothering of stream beds and aquatic vegetation
- Reduction in aquatic habitat diversity
- Increased maintenance costs
- Decrease in waterway capacity leading to increased flood levels and durations

3.3 During landfilling works

The landfilling of the site is anticipated to last approximately 20 years with each cell being active for approximately 3-4 years. The activities and potential impacts for this ongoing operation of the landfill site are summarised below.

3.3.1 Activities

The activities and aspects of the works during landfilling that have potential to lead to erosion, sediment transport, siltation and contamination of natural waters include:

- Clearing and earthworks undertaken for the construction of the next landfill cell or the closure of the previous cell.
- Work areas of active cells that have not been stabilised.
- Vegetation removal, including stripping back temporary caps prior to piggy back lining.
- Opening up of a new cell that will impact on drainage paths, including depressions and waterways.
- Stockpiling of excavated materials resulting from the opening up of another landfill cell.
- Loss of material while hauling soil across the site.
- Realignment of diversion drains and changes to catchment boundaries.
- High traffic areas off paved roadways where soils are not stabilised and soil particles are ground to become more mobile via excessive tracks and vehicle movements.
- Inadequate maintenance of environmental control measures.

3.3.2 Potential impacts

The potential impacts on the receiving environment relate to erosion of disturbed areas or stockpiles and sediment transportation offsite. Potential adverse impacts can include:

- Loss of topsoil in flow paths of overland surface water occurring during capping or clearing works within the landfill.
- Increased water turbidity.
- Decreased levels of dissolved oxygen.
- Changed pH and salinity levels.

- Smothering of stream beds and aquatic vegetation.
- Reduction in aquatic habitat diversity.
- Increased maintenance costs.
- Decrease in waterway capacity leading to increased flood levels and durations. .

4. Erosion and sediment control devices

The proposed ESC works required to minimise erosion and capture sediments are summarised below. The works have been divided into the two main phases of the project consisting of the construction of the site infrastructure works and then the works associated with the landfill.

4.1 During infrastructure construction works

4.1.1 Description of measure and justification

The following erosion and sediment control measures will be utilised during the infrastructure construction works phase. Detailed description and standard drawings for the controls are included in Appendix A.

Table 4-1 Construction Erosion and Sediment Control Measures

ESC Element	Description	Justification	Use
Construction Exit	Steel Shaker Grate	Shakes loose dust from vehicles exiting the site minimising deposition on surrounding roads.	At the exit point from the construction/works site.
Dust Control (Water Carts)	Water Carts to wet exposed areas.	Minimise soils being blown off site from exposed areas.	On all exposed areas during dry windy conditions.
Sediment Fencing	Woven or non-woven fabric fence.	Small flow length areas where there are no concentrated flow paths.	Typically used at the toe of stockpiles and fill batters.
Diversion Drain with Rock Check Dams	Excavated Earth Channels for the Diversion of Clean or dirty water. Rock check dams to manage channel velocities and precipitate out coarse sediment.	Management of concentrated flow paths.	Clean Water – Upslope of exposed areas Dirty Water – Downslope of exposed areas with diversions to appropriate sediment management device.
Sediment Ponds	Pond to contain sediment laden stormwater to allow for the precipitation of sediments prior to discharge of site.	Management of sediments from large exposed catchments.	End of diversion channels for large exposed catchments.
Rock Filter Dams	Rock Filter to capture and filter out sediments prior to discharge.	Management of sediments from small to medium exposed catchments and final treatment at the outlet of sediment basins.	Used at the end of diversion channels where catchments are too small for a sediment pond or space constraints limit a full size sediment basin.

4.2 During landfilling works

4.2.1 Description of measure and justification

The following erosion and sediment control measures will be utilised during the landfilling works phase. The specific locations and sizing of particular infrastructure will be determined during the detailed design phase of each stage of works.

Table 4-2 Landfilling Erosion and Sediment Control Measures

ESC Element	Description	Justification	Use
Construction Exit	Steel Shaker Grate	Shakes loose dust from vehicles exiting the site minimising deposition on surrounding roads.	At the exit point from the construction site.
Dust Control (Water Carts)	Water Carts to wet exposed areas.	Minimise soils being blown off site from exposed areas.	On all exposed areas during dry windy conditions.
Sediment Fencing	Woven or non-woven fabric fence.	Small flow length areas where there are no concentrated flow paths.	Used at the toe of stockpiles and fill batters.
Diversion Drain with Rock Check Dams	Excavated Earth Channels for the Diversion of Clean or dirty water. Rock check dams to manage channel velocities and precipitate out coarse sediment.	Management of concentrated flow paths.	Clean Water – Upslope of exposed areas Dirty Water – Downslope of exposed areas with diversions to permanent sediment ponds.
Sediment Ponds	Pond to contain sediment laden stormwater to allow for the precipitation of sediments prior to discharge of site.	Management of sediments from large exposed catchments.	End of diversion channels for large exposed catchments.
Outlet Energy Dissipaters/Level Spreaders	Rock lining and baffles at the outlet of concentrated flow areas (pipes, culverts and channels)	Prevents scouring at high energy concentrated flow areas.	Outlets of pipes, headwalls and clean water channels.

5. Stockpile management

5.1 General

As part of the ongoing development of the landfill there will be periods where there will be significant volumes of surplus soils material that will be required to be stockpiled. This typically would be the result of the new landfill cell being opened up prior to the old cell from being capped and rehabilitated. During this phase, the management of the potential sediment material will be critically important to minimise the potential for significant sediment material being exported from the site but also to maintain the effectiveness of the other site measures in particular the downstream sediment basins.

The following controls and practices should be adhered to during stockpile works.

5.1.1 Erosion controls

- Disturbance to ground cover in close vicinity of the work site should be avoided.
- Machinery movements should track parallel to the slope as much as practicable to avoid creating preferential flow paths.
- Soft ground cover such as mulch or geosynthetic mats should be used to cover exposed surfaces along embankments of the diversion if work on that area has been interrupted for an extended length of time. Where areas experience concentrated flow conditions, the ground cover should be suitably stabilised to avoid being washed out.
- Areas experiencing erosion shall be stabilised and rehabilitated as soon as practicable.
- Erosion protection (such as vegetation, rip-rap, etc.) should be established immediately following completion of final earthworks.

5.1.2 Placing of felled trees and mulched stockpiles

Felled trees should be placed in flatter areas of the clearing works, parallel to contours and stabilised to reduce the risk of rolling downslope. Stockpiled mulch from trees and vegetation should have a bund placed around the upstream end to divert flows around the stockpile, with a sediment fence on the downslope to capture any contaminants.

Stockpiles of mulched trees and vegetation should be removed as soon as practicable to reduce leaching of nutrients into downstream waterways as the stockpile breaks down.

5.1.3 General Soil stockpiling

- Material that is excavated during the construction works should not be stored in close vicinity of waterways nor under the drip zone of any trees that are to be retained.
- Small stockpiles of materials may be left on grassed areas and covered, or surrounded by a sediment fence or bund.
- Short term stockpiles should be either watered or lightly mulched to reduce dust generation.
- Long term stockpiles should be mulched or revegetated for erosion control and reduction of dust generation.

- Soil stockpiles shall not impede natural or constructed surface drainage lines.
- A suitable flow diversion system must be established immediately up-slope of a stockpile of erodible material that has the potential to cause environmental harm if displaced, if the up-slope catchment area draining to the stockpile exceeds 1500 m².

5.1.4 Topsoil stockpiling

For stockpiles that are intended to be reused for rehabilitation, specifically those that contain valuable seed content the following should be considered:

- The top 50 mm topsoil should be stockpiled in windrows of height not exceeding one metre.
- The underlying 50 – 100 mm soil should be stockpiled in piles no greater than 2.0 metres.
- Stockpiles that are stored for longer than 12 months will experience degradation of seed quality and nutrient quality. Therefore, stockpiling of topsoil will only be successful where re-use can be undertaken in the following 12 months.

5.1.5 Weed management

- Given the capacity of weed species to spread, removal should be undertaken using the appropriate methods. Care should be taken in order to reduce the dispersal of weed seed.
- Any weed species within the project area are to be destroyed.
- Ensure that any construction plant equipment that operates or travels from areas contaminated with exotic flora to a non-infested area is washed down prior to leaving the site.

6. Inspection, maintenance and monitoring

6.1 Inspection

A self-auditing program shall be implemented during onsite activities based on a regular visual check of site conditions. A suitable member of the team shall be designated to make a visual check of site conditions:

- At least weekly.
- Immediately before completion of each item of work.
- Immediately following rainfall events in excess of 15 mm in any one 24 hour period.
- The self-audit shall:
 - Record the condition of all soil and water management structures.
 - Observe cleared areas to ensure no concentrating of flows is occurring.
 - Observe the perimeter of any energy dissipating and velocity controlling structures to ensure no scouring or undermining is occurring.
 - Record maintenance requirements (if any) for each soil and water management structures.
- Proper drainage of the site shall be maintained. To this end, drains shall be checked to ensure that they are operating as intended, especially that:
 - Ponds are emptied as soon as practicable following a rainfall event, subject to attaining the required levels of TSS for stormwater discharge as detailed in the EPL.
 - No low points exist which can be overtopped in a large storm event.
 - Areas of erosion are repaired (e.g. lined with suitable material), and/or velocity of flow is reduced by appropriate arrangements such as upstream energy dissipation structures, small check dams, or installation of additional diversions upslope.
 - Blockages and sediment build-ups are cleared.

6.2 Maintenance

General maintenance requirements should include:

- Any sand/soil/spoil materials placed within 2 m of areas with high velocity water flows shall be relocated.
- Recently stabilised lands shall be checked to ensure that any erosion hazard has been effectively reduced. Any repairs shall be initiated as appropriate.
- Additional erosion and/or sediment control works shall be constructed as necessary to ensure the desired protection is given to downslope lands and waterways.
- Changes to the ESCP shall be made where the ESCP proves to be inadequate in practice or is subjected to changes in conditions at the work site or elsewhere in the catchment.
- Erosion and sediment control measures shall be maintained in a functioning condition, until all earthwork activities in the affected areas are completed and stabilised.
- Ponds shall be flocculated if required to achieve EPL dictated TSS levels and discharge to receiving waterways should occur within 5 days of the runoff generating rainfall event.

6.3 Monitoring

Sediment laden waters within the site are all directed to sediment ponds. Prior to discharge from the sediment pond to receiving waterways, the pond is to be sampled for pollutants and TSS in accordance with the EPL. Identification of any pollutants or TSS above the allowable concentration limit will require notification to the EPA as identified within the EPL, under the Clause: *Notification of Environmental Harm*.

7. Bibliography

Catchments & Creeks. (n.d.). *Standard Drawings*. Retrieved 10 23, 2013, from Catchments & Creeks: <http://www.catchmentsandcreeks.com.au/STDdrawings.html>

Landcom. (2004). *Managing Urban Stormwater: Soils and Construction*.

Appendices

Appendix A – Erosion and Sediment Control Measures

Sediment fencing

Sediment fences (Figure 2) consist of a woven (for coarse sediment removal) or non-woven (all sediment removal) fabric fence placed along a line of constant elevation to intercept sheet flow and allows settlement of particles ponding on the up slope side. The fence can also be placed at a slight down gradient, with regular 'returns' placed to allow periodic ponding of the water.

The placement of sediment fencing is primarily to remove coarse sediments. The placement of the fencing is downslope of any disturbed areas and will assist in capture of the sediments prior to flows entering either downstream water ways or sedimentation ponds located onsite.

Spill-through weir

As part of the sediment fence placement, spill-through weirs (should be placed to allow high rainfall events to overtop the fence in controlled segments. The weir is typically a lower segment of the fence, with erosion control features such as a fabric lined outlet chute for areas where discharge is down a steepened area or a rock splash pad for flatter areas to reduce scouring during overtopping.

The spill through weir will act as a method to relieve pressure against the fence during high flow periods, where due to silt or vegetation build up, the water is not able to filter through the fence at a suitable rate.



Figure 1 Spill-through weir outlet options (catchments and creeks)

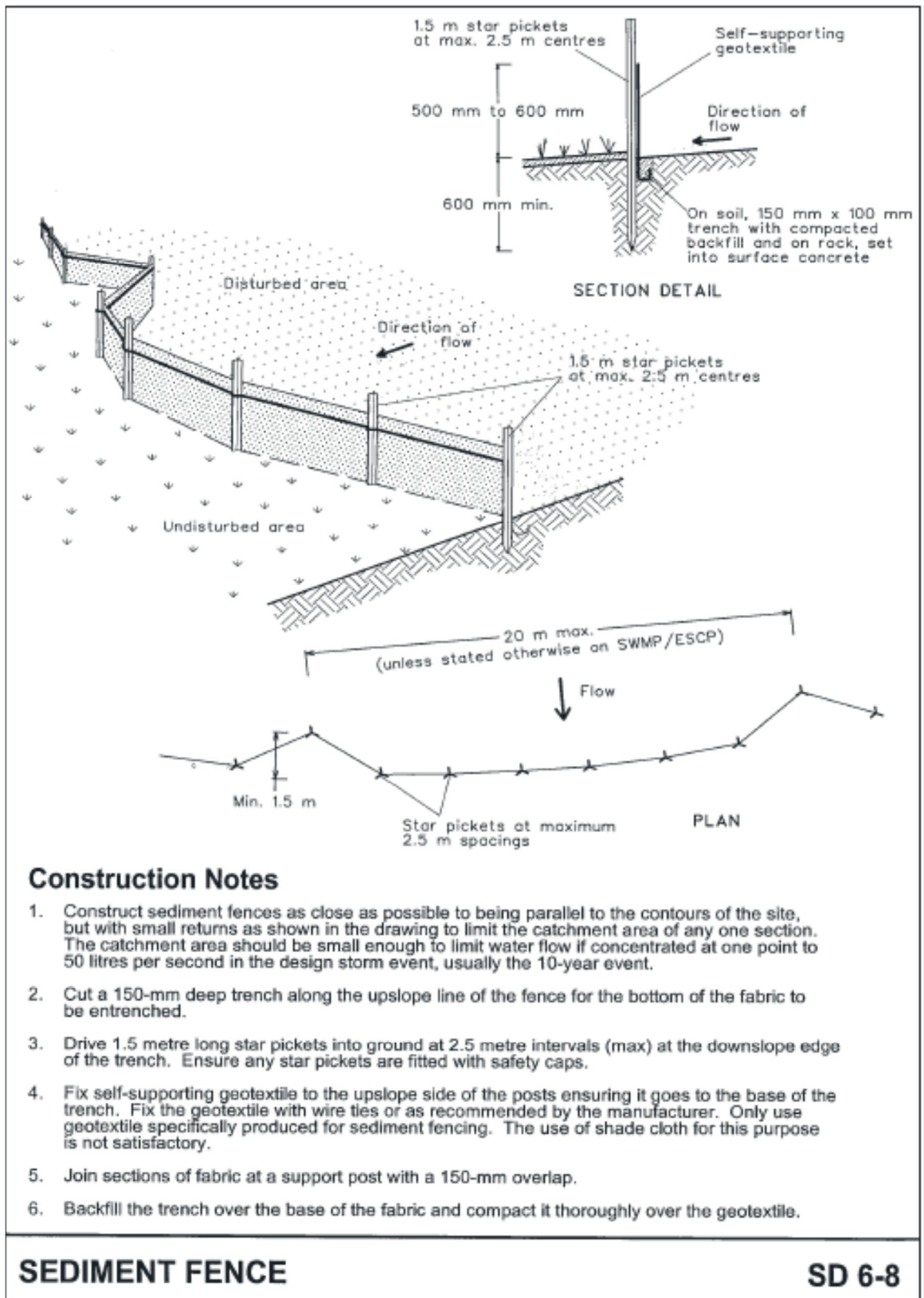


Figure 2 Sediment Fence Detail (Landcom, 2004)

Diversion drain

A diversion drain (Figure 3) is used to capture sheet flow and divert it via a concentrated flow path. If the flow is from undisturbed or revegetated areas, the drain should be stabilised (to reduce scouring) and will allow discharge directly off-site. For disturbed areas, the drain should direct stormwater to a sedimentation pond. The diversion of disturbed areas will prevent sediment and vegetation (high nutrient content) laden flows from entering downstream water ways without prior treatment. The construction of the drains will be formed via excavation of a small channel, with the excavated material being placed on the downslope side to further increase the diversion capacity.

Rock Check Dams

Check Dams (Figure 4) are structures placed perpendicular to concentrated flow paths to aid in controlling flow velocities. They may also, through upstream ponding, remove sediments from the flow. However, this collected sediment needs to be cleared as part of the monitoring and maintenance works prior to the next flow to avoid being disturbed.

The spacing of check dams should be such that the crest of the downstream dam is at the level of the toe of the upstream dam. This will be sufficient to reduce the velocities and potential scouring of the drain. This spacing will vary based on the grade of the drain. When constructing these features, it is important to ensure that high flow events will still pass over and through the centre of the feature. The design should not promote stormwater to spill out or overtop the sides of the drain.

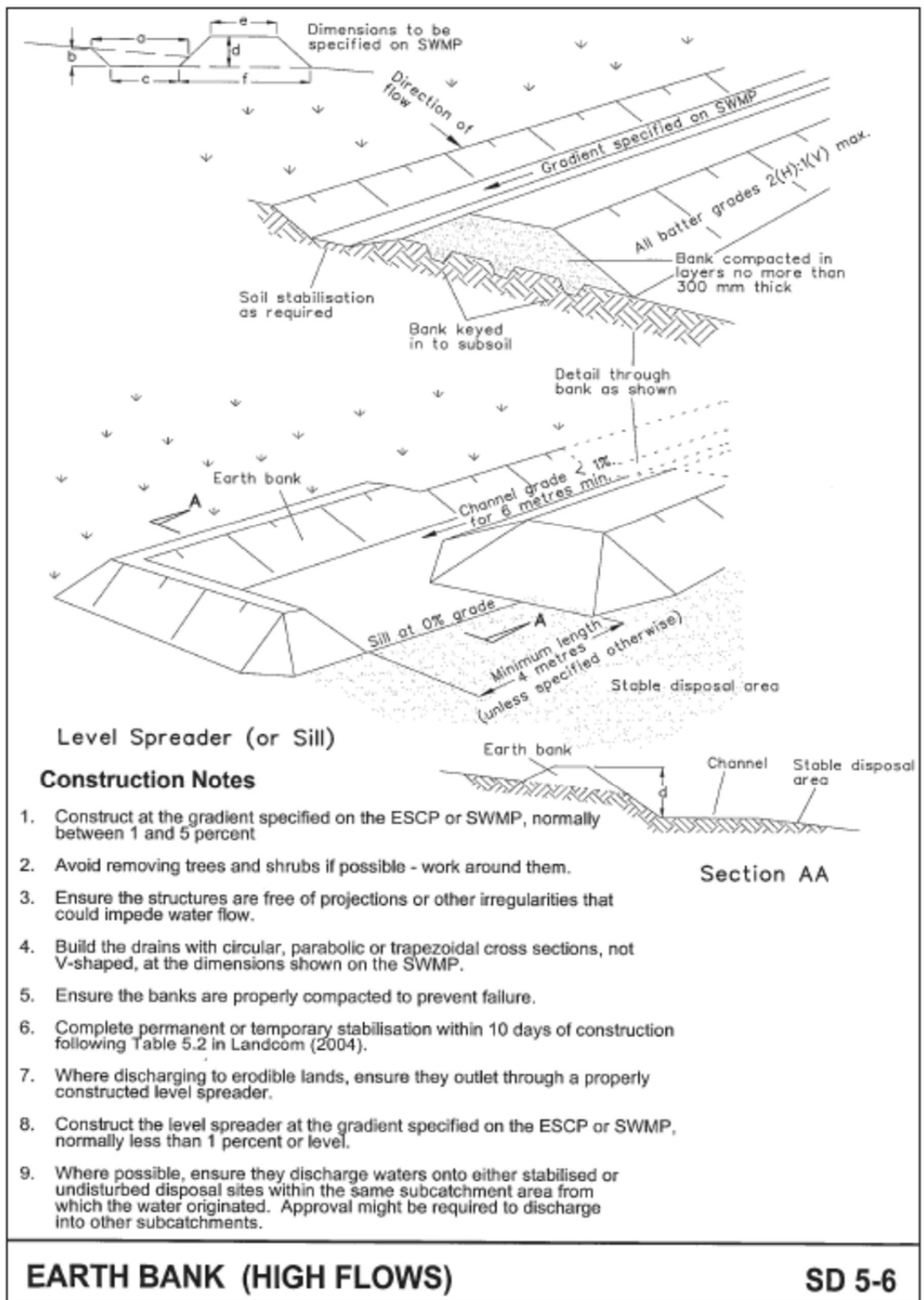
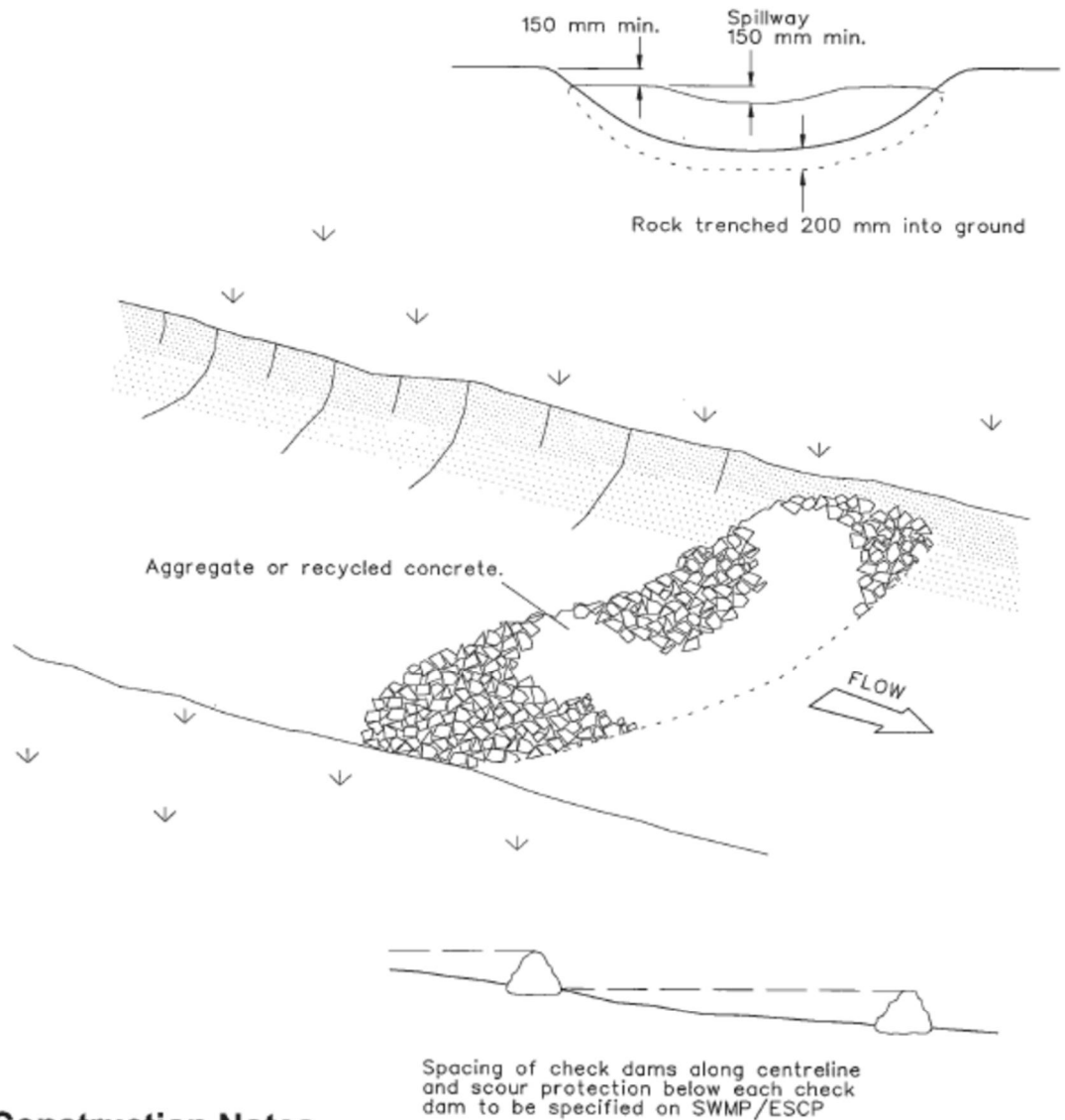


Figure 3 Diversion (Earth Bank) Detail (Landcom, 2004)



Construction Notes

1. Check dams can be built with various materials, including rocks, logs, sandbags and straw bales. The maintenance program should ensure their integrity is retained, especially where constructed with straw bales. In the case of bales, this might require their replacement each two to four months.
2. Trench the check dam 200 mm into the ground across its whole width. Where rock is used, fill the trenches to at least 100 mm above the ground surface to reduce the risk of undercutting.
3. Normally, their maximum height should not exceed 600 mm above the gully floor. The centre should act as a spillway, being at least 150 mm lower than the outer edges.
4. Space the dams so the toe of the upstream dam is level with the spillway of the next downstream dam.

ROCK CHECK DAM

SD 5-4

Figure 4 Check Dam Detail (Landcom, 2004)

Outlet energy dissipaters

Energy dissipaters (Figure 5) and level spreaders are primarily rock or fabric lined segments at the discharge point of collection drains that slow the velocity of the flow either by energy dissipating structures such as rocks or spreading the flow over a larger plan area and encouraging sheet flow conditions.

Runoff captured via diversion drains will result in concentrated flows, with increased velocities and increased scour potential. To minimise scour potential and in some cases, revert the flow back to sheet flow, energy dissipaters/level spreaders will be adopted. These features may be used at the discharge point of clean flow diversion drains, allowing a wider spreading of the flow prior to entry into downstream waterways.

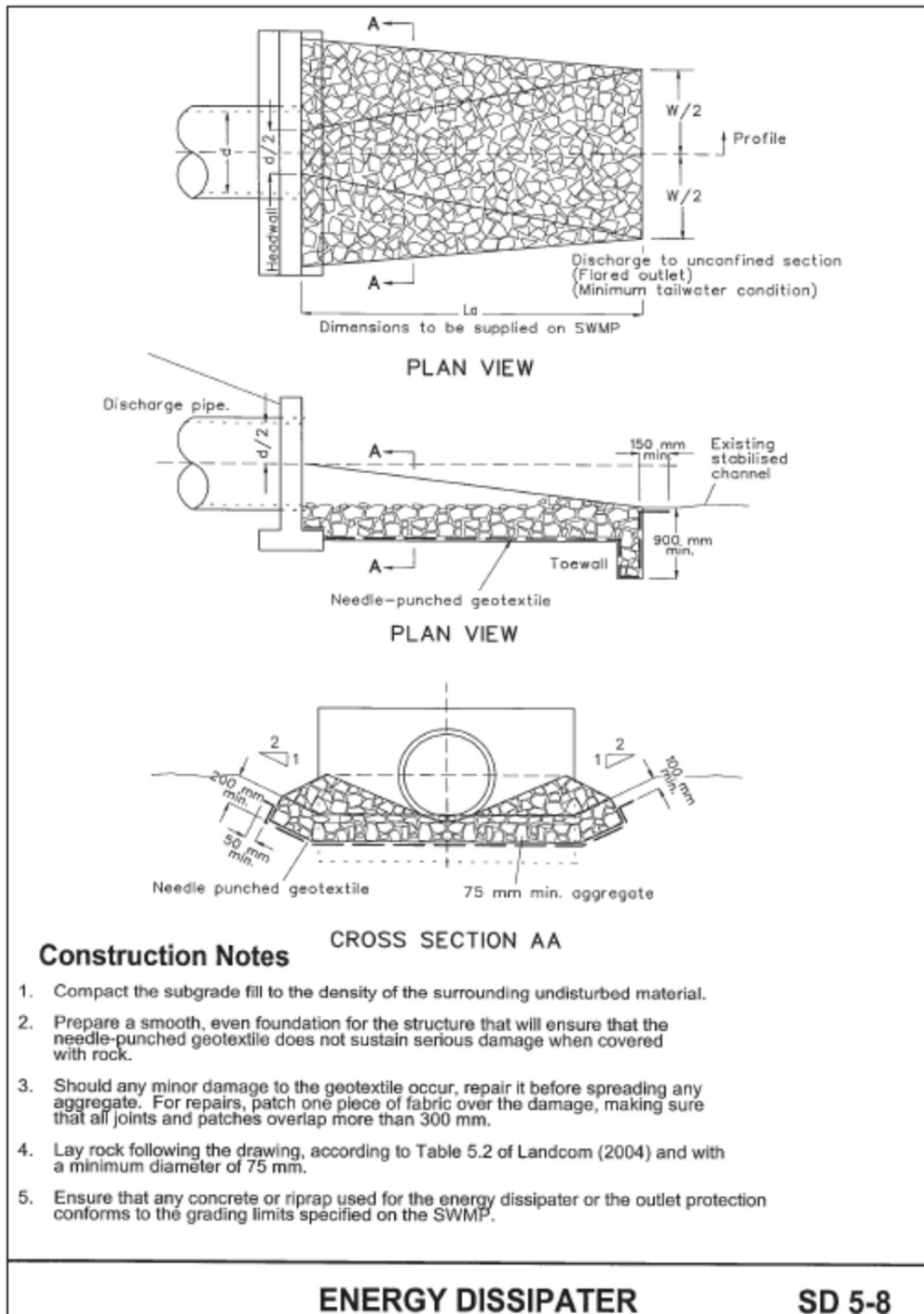


Figure 5 Energy Dissipater Detail (Landcom, 2004)

Dust control

Throughout construction and operation phases, site personnel and users of the site may carry out activities in a manner that will generate emission of dust from the premises. To reduce this impact, daily maintenance activities should include periodic wetting of haul roads, access tracks, short term stockpiles as well as all general cleared areas. The site personnel are responsible for ensuring a suitable water source is available for this operation.

For longer term stockpiles (if required), the dust control should include measures such as mulching or revegetation of the batters.

Sediment ponds

Sediment ponds (Figure 6) should be used as a final process along the treatment train prior to discharge of waters offsite. The sediment pond should not be relied upon as the sole source of sediment control. The pond will allow capture of large volumes of runoff from the site and settlement of large grained sediments within the pond. For fine grained particle, flocculation may need to be used to decrease detention time requirements. This process involves mixing a flocculent into the pond, promoting clumping of particle and faster settlement times. The pond will also allow recording of TSS levels prior to discharge of waters offsite, allowing the site to report / manage pollutant levels.

Rock filter dams

A rock filter dam is a stone embankment designed to help capture sediment in natural or constructed drainage ways. This practice can also be used as a fore bay to a sediment basin to help capture coarser particles of sediment.

The rock filter dams will be located at the downstream of diversion channels and will also act as an outlet to the sediment ponds.

The final sizing and location of the ESC device used during the infrastructure construction phase along with its location and function will be determined once the configuration and staging of the project has been finalised during detailed design.

Details of a typical rock filter dam are included in Figure 7.

Cross banks

A cross bank is a raised mound perpendicular to the road. The device aims to capture flows and direct to drainage swales or level spreaders helping manage the risk of erosion along the track. The devices are only to be used in low speed environments in unsealed roads. For details for cross banks refer to Figure 8.

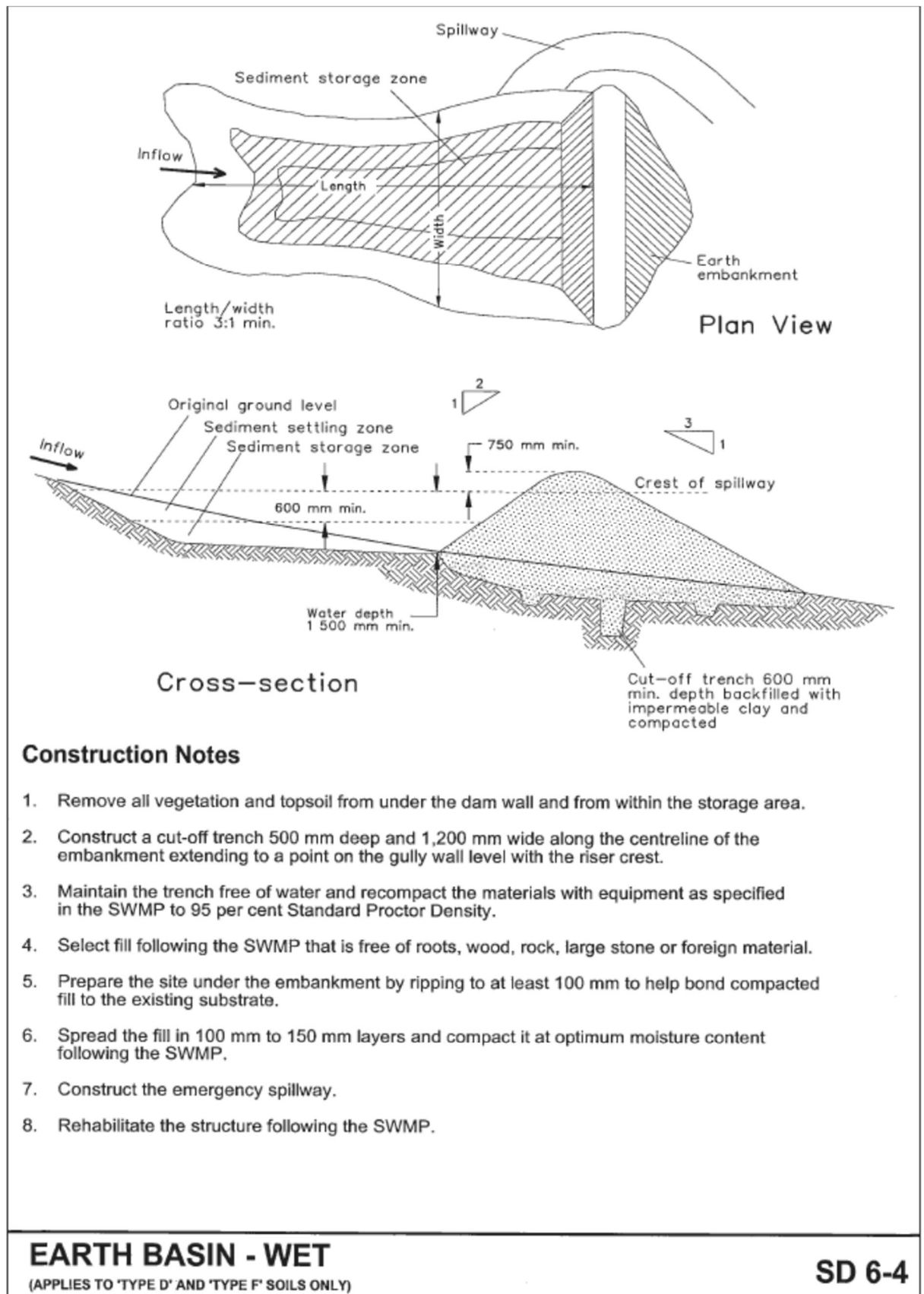


Figure 6 Sediment Basin Detail (Landcom, 2004)

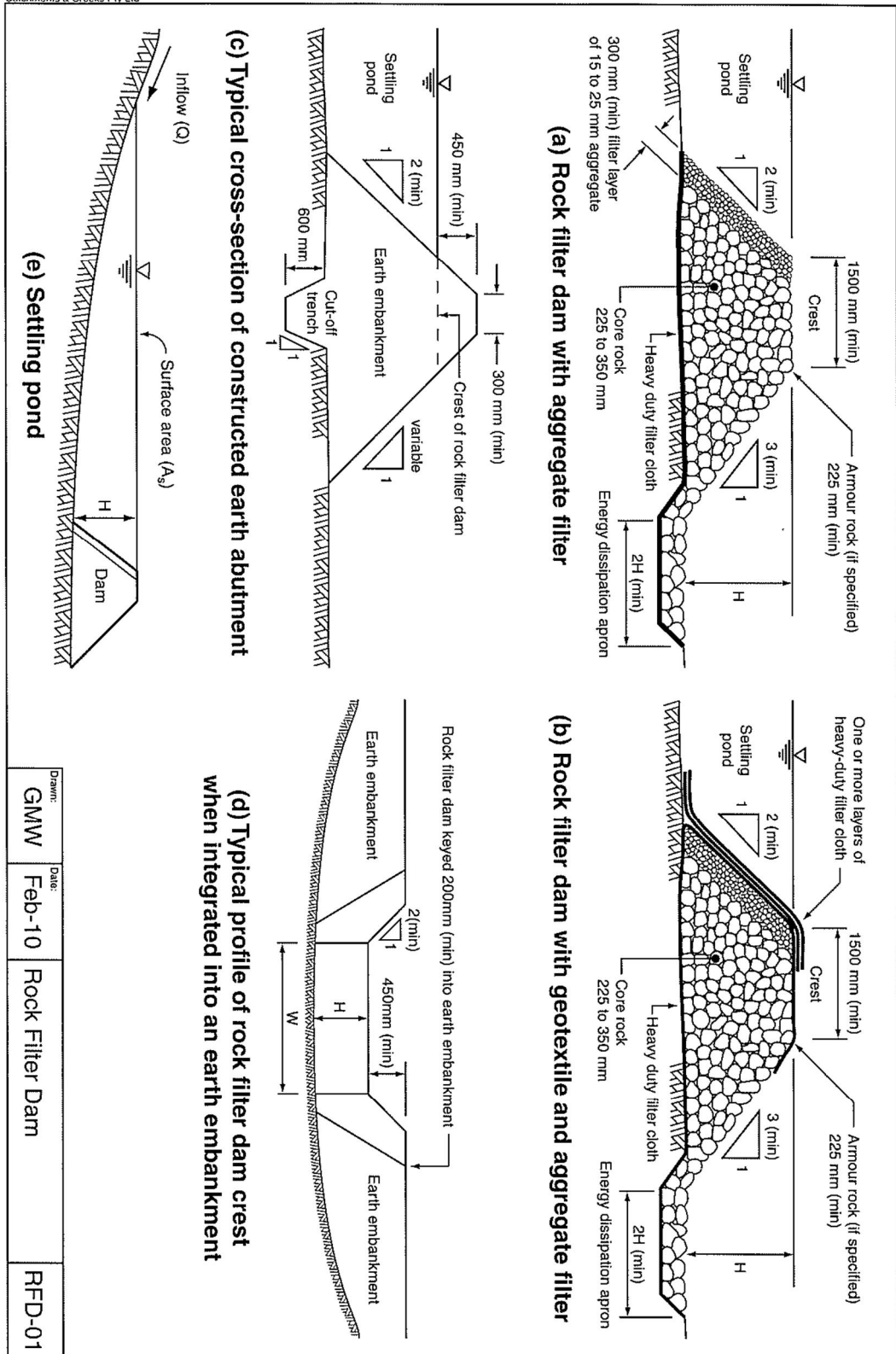


Figure 7 Rock Filter Dams (Catchments & Creeks)

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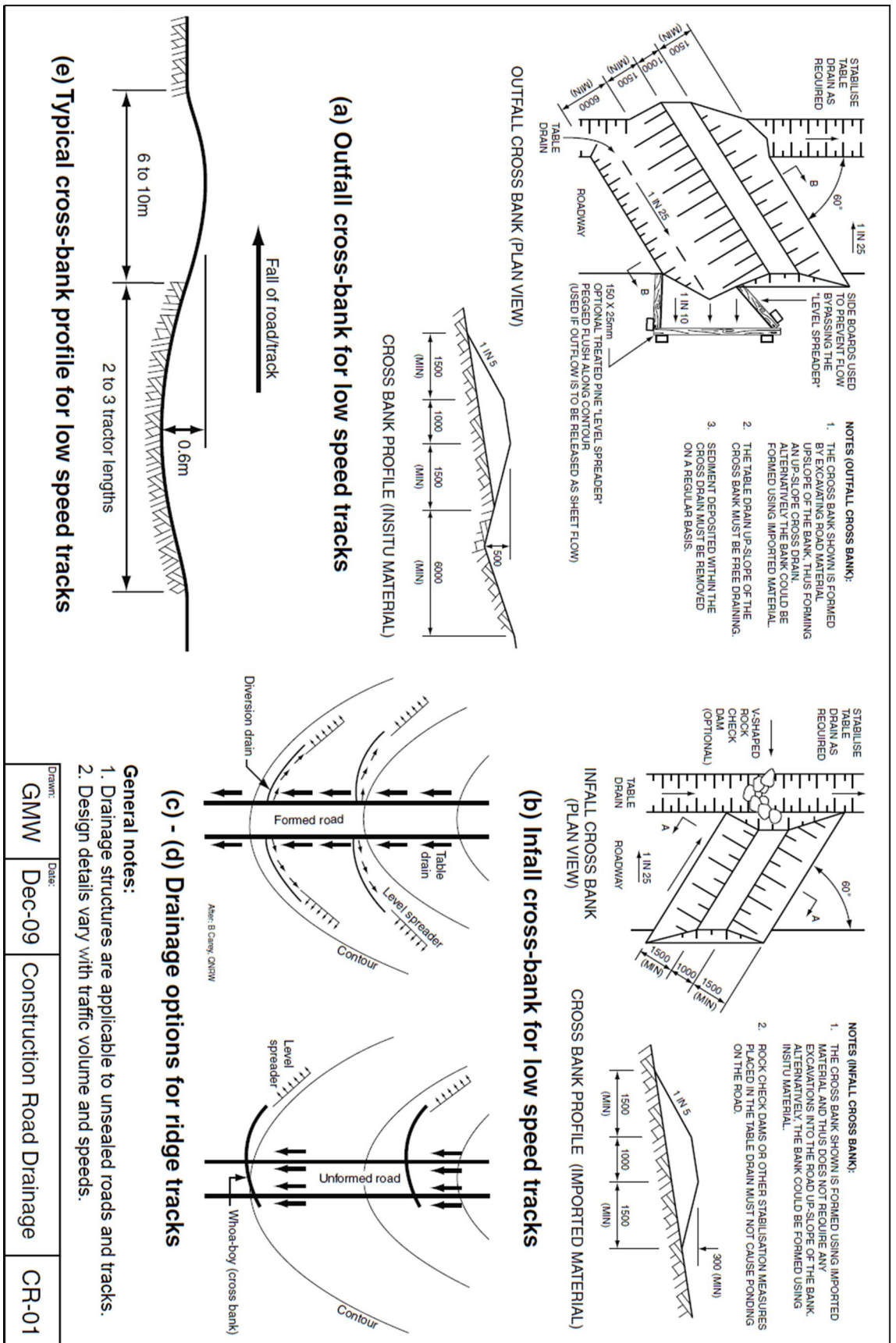


Figure 8 Cross bank details

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GHD

Level 3 GHD Tower 24 Honeysuckle Drive Newcastle NSW 2300
PO Box 5403 Hunter Region Mail Centre NSW 2310
T: (02) 4979 9999 F: (02) 4979 9988 E: ntlmail@ghd.com

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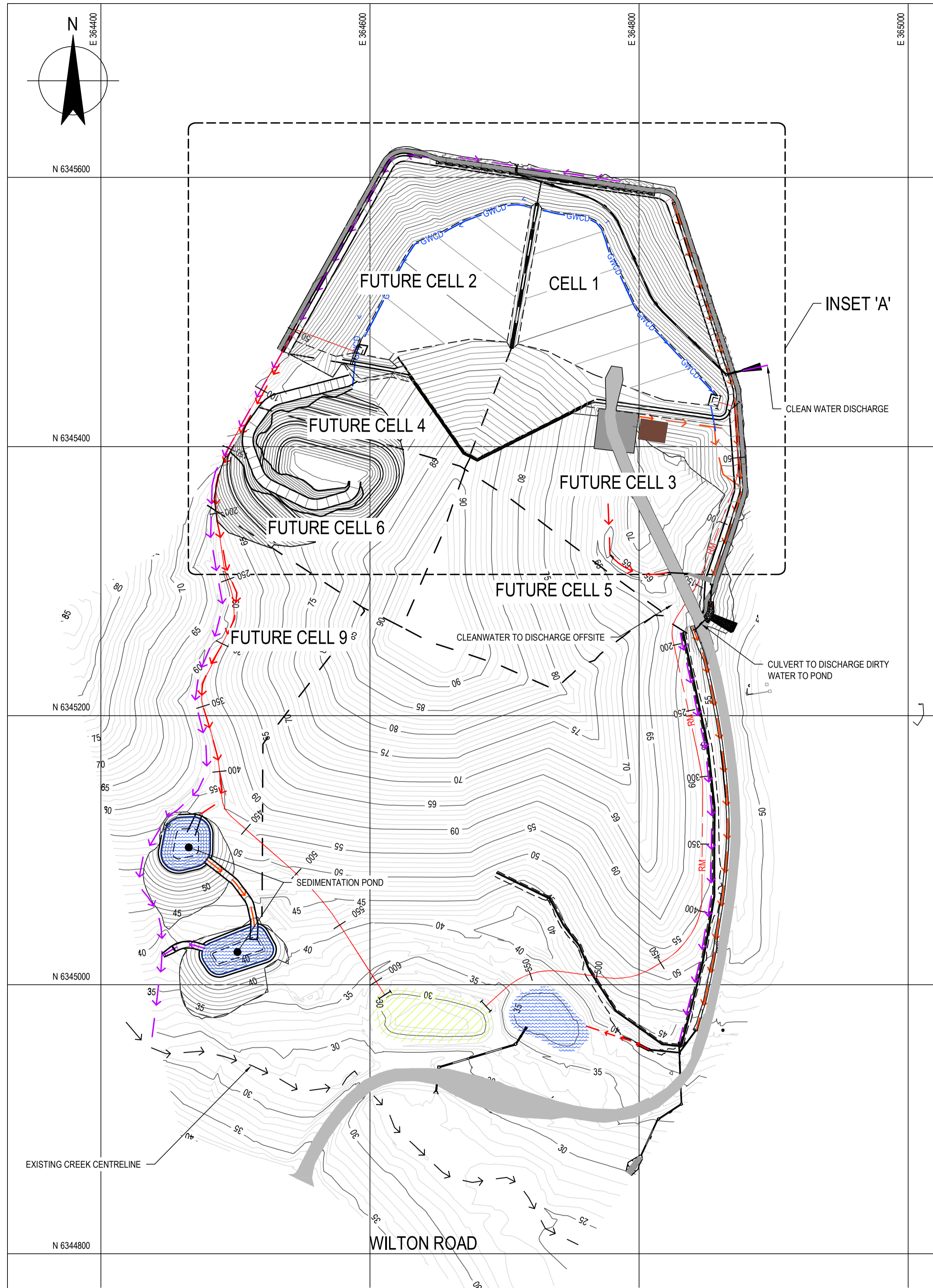
Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	J. Bernardi	R. Wilkes	<i>R. Wilkes</i>	M. Gebhard	<i>M. Gebhard</i>	17/04/2014
1	C. Davies	R. Wilkes	<i>R. Wilkes</i>	M. Gebhard	<i>M. Gebhard</i>	15/07/2014

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Appendix B – Fill-out plan drawings

DWG: 22-16920-C7061 – C7069



PLAN
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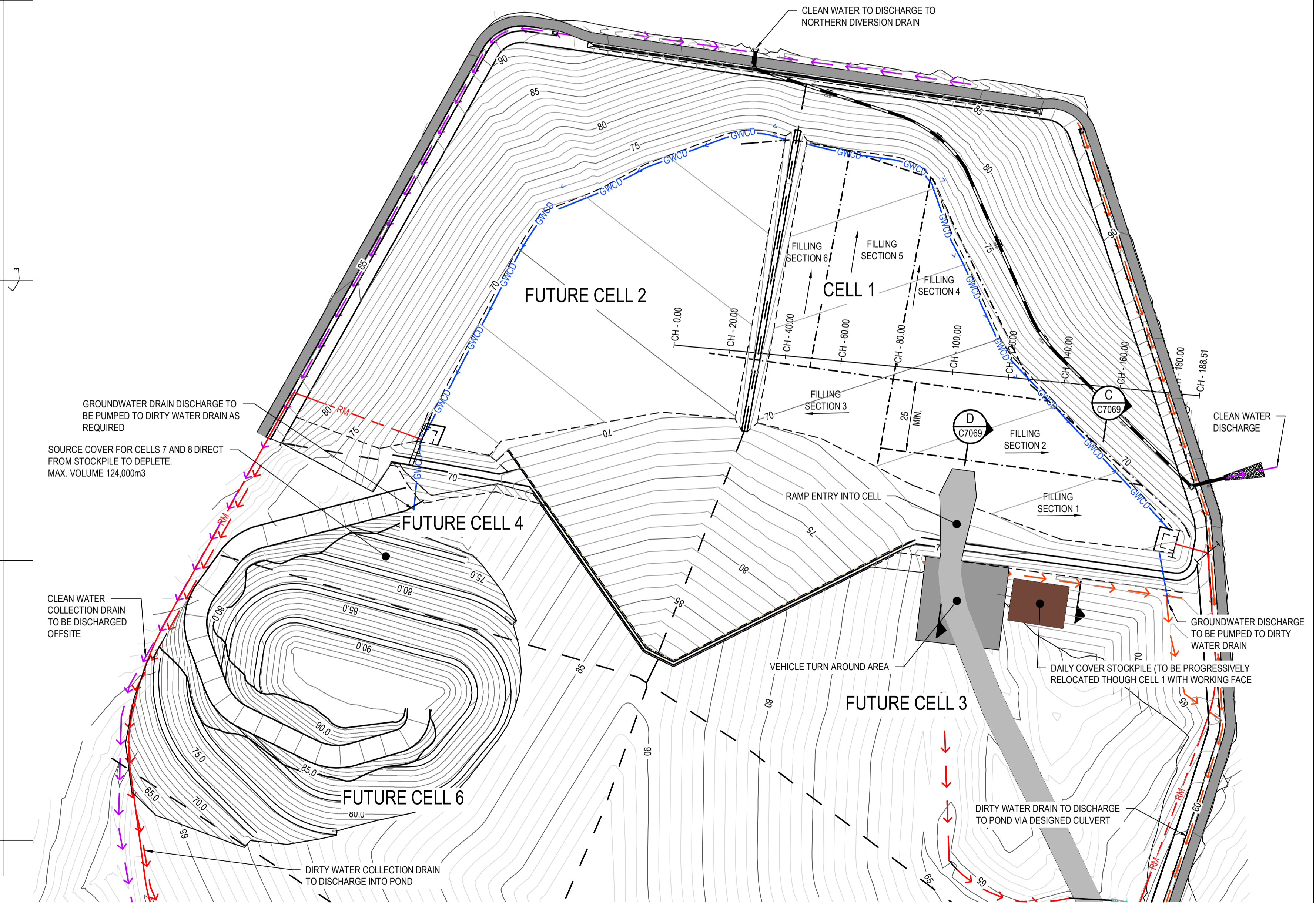
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CELL 1 LONGITUDINAL SECTION

SCALE 1000V:1000H



NOTE:

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INSET 'A'
SCALE 1:1000

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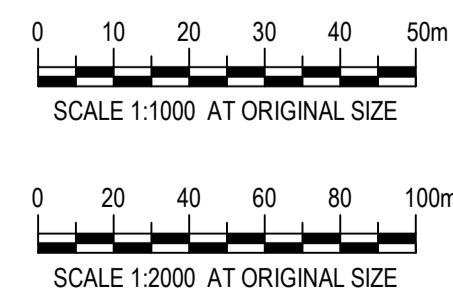
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- MINOR DESIGN CONTOUR
- TOP OF DESIGN BATTER
- APPROXIMATE FILLING SECTION BOUNDARY
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- → → DIRTY WATER COLLECTION DRAIN
- → → GWCD → GROUND WATER COLLECTION DRAIN
- DRAINAGE PIPE
- RM --- LEACHATE TRANSFER MAIN
- → → EXISTING CREEK

FOR TENDER

D	ISSUED FOR TENDER	CB	KR*	MG*	19.02.16
C	RE-ISSUED TO CLIENT	RJC	AS*	MG*	09.12.15
B	ISSUED AS FINAL TO CLIENT (NOT FOR CONSTRUCTION)	IMH	AS*	MG*	14.07.14
A	ISSUED TO CLIENT	IMH	AS*	MG*	06.05.14
No	Revision	Note:	* Indicates signatures on original issue of drawing or last revision of drawing		
Drawn	Job Manager	Project Director	Date		



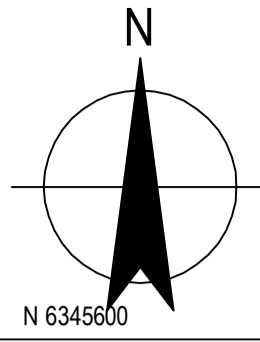
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24 Honeysuckle Drive, Newcastle NSW 2300 Australia
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Drafting Check	PC. WONG*	Design Check	R. WILKES*
Approved (Project Director)	M. GEBHARD	Date	19.02.16
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

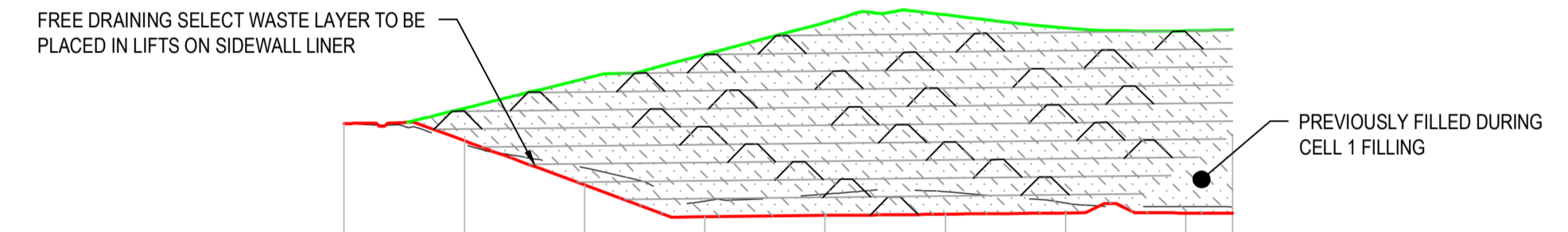
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Rev:	D



N 6345600

NOTES:
 1. FOR LEGEND AND GENERAL NOTES REFER TO DRAWING 22-16920-C7001.

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 - MINOR DESIGN CONTOUR
 - TOP OF DESIGN BATTER
 - TOE OF DESIGN BATTER/POND/BUND
 - APPROXIMATE FILLING SECTION BOUNDARY
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 - DRAINAGE PIPE
 - RM — LEACHATE TRANSFER MAIN



DATUM RL. 54.00

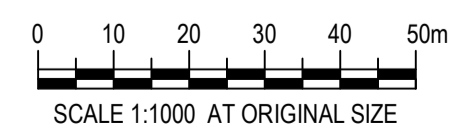
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 SCALE 1000V:1000H

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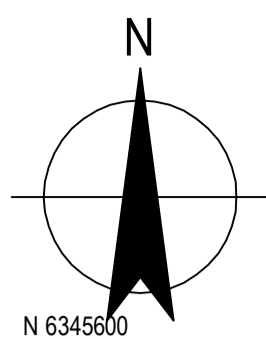
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Approved (Project Director)	M. GEBHARD		
Date	19.02.16		
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FOR TENDER

Client **LAKE MACQUARIE CITY COUNCIL**
 Project **AWABA WASTE MANAGEMENT FACILITY EXPANSION**
 Title **CELL 2 - FILLING PLAN & LONGITUDINAL SECTION**

Original Size **A1** Drawing No: **22-16920-C7062** Rev: **D**



N 6345600

NOTES:
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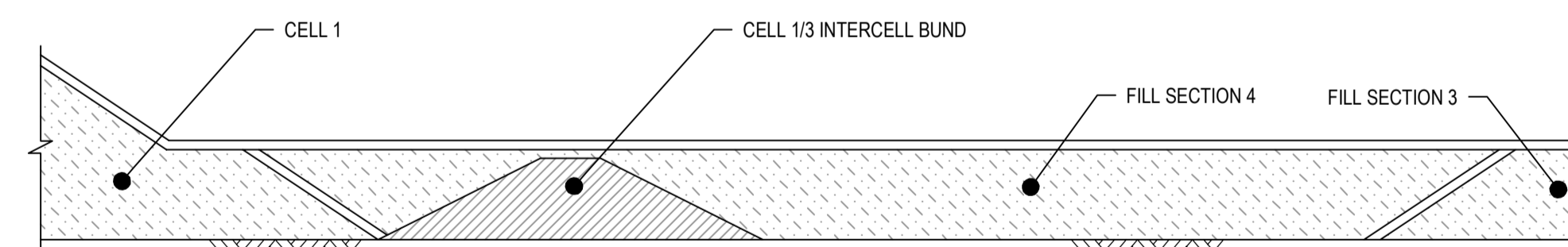
- LEGEND:**
- APPROXIMATE STAGING BOUNDARIES
 - 60 MAJOR DESIGN CONTOUR
 - MINOR DESIGN CONTOUR
 - TOP OF DESIGN BATTER
 - TOE OF DESIGN BATTER/POND/BUND
 - APPROXIMATE FILLING SECTION BOUNDARY
 - CLEAN WATER COLLECTION DRAIN
 - DIRTY WATER COLLECTION DRAIN
 - DRAINAGE PIPE
 - RM LEACHATE TRANSFER MAIN



DATUM RL. 49.00

CELL 3 TOP OF CAP	69.38	62.95	83.17	82.93	82.30	81.96	81.76	81.10	80.51
CELL 3 DESIGN SURFACE	70.75	66.97	64.50	64.77	65.37	65.85	66.47	68.13	67.55
EXISTING SURFACE LEVEL	70.75	66.97	65.73	66.58	69.37	71.59	76.22	78.62	81.06
LEVEL DIFFERENCE CUT - / FILL +	0	0	-1.23	-1.81	4	-5.74	-9.95	-10.48	-7.27
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00
									171.40

CELL 3 LONGITUDINAL SECTION
SCALE 1000V:1000H



A SECTION
SCALE 1: 200

TYPICAL CELL 1/3 FILLING SECTION

NOTE:
1. LIFT 1 ONLY IS SHOWN IN PLAN VIEW. REFER TO LONGITUDINAL SECTION FOR OTHER LIFTS.

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SCALE 1:1000



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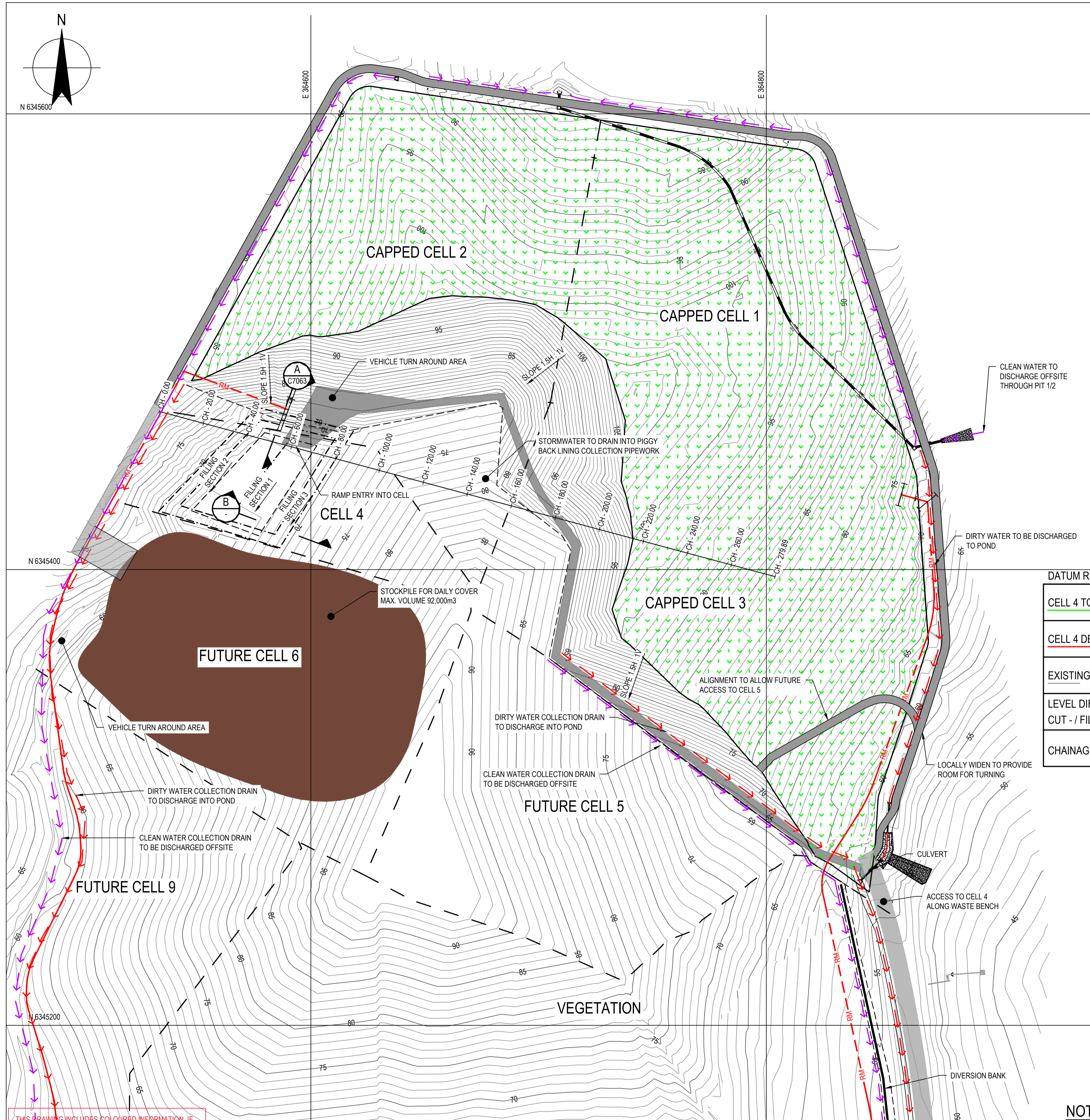
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Drafting Check	PC. WONG*	Design Check	R. WILKES*
Approved (Project Director)	M. GEBHARD		
Date	19.02.16		
Scale	AS SHOWN		

FOR TENDER

Client **LAKE MACQUARIE CITY COUNCIL**
Project **AWABA WASTE MANAGEMENT FACILITY EXPANSION**
Title **CELL 3 - CONCEPT FILLING PLAN & LONGITUDINAL SECTION**

Original Size **A1** Drawing No: **22-16920-C7063** Rev: **D**

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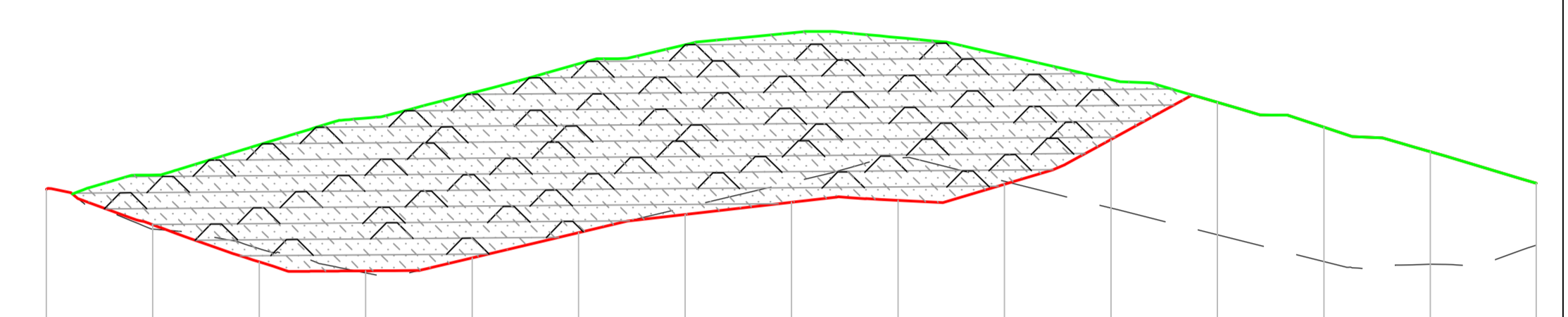


NOTES:
 1. FOR LEGEND AND GENERAL NOTES REFER TO DRAWING 22-16920-C7001.

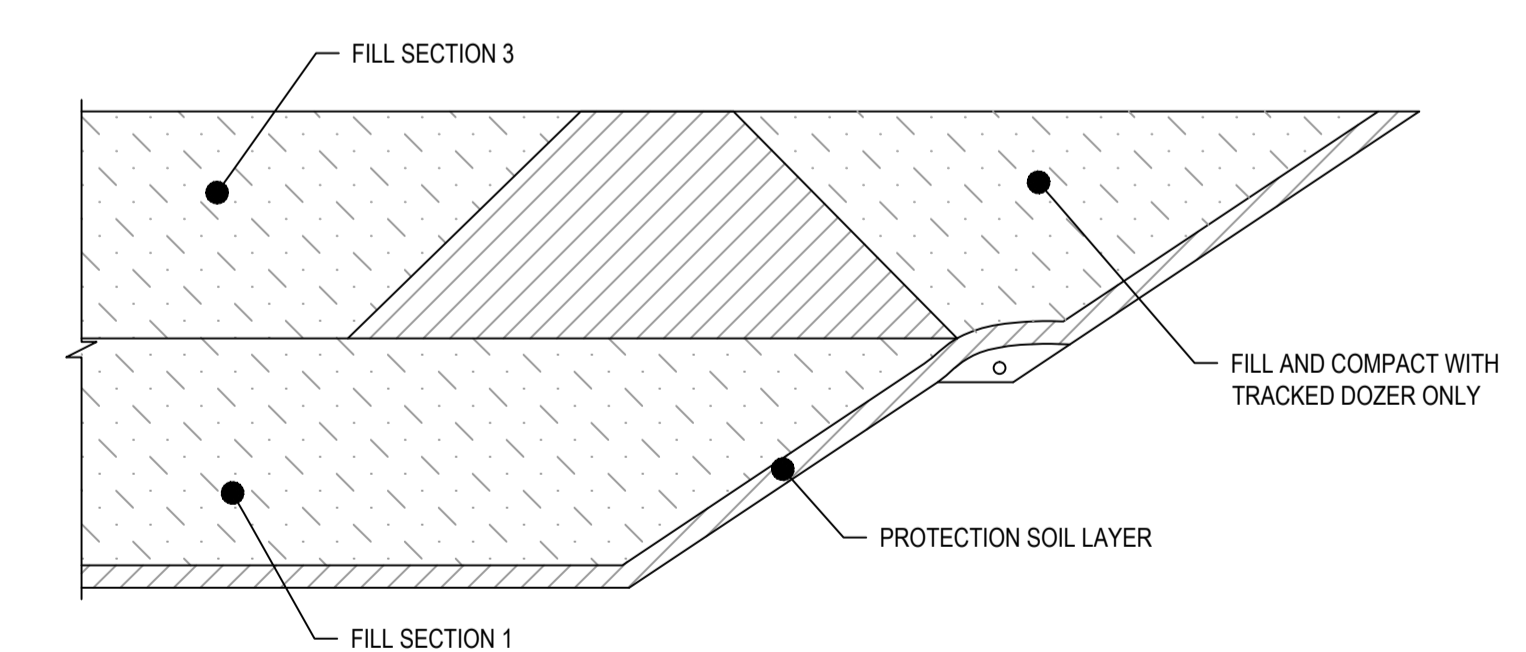
- LEGEND:**
- APPROXIMATE STAGING BOUNDARIES
 - 60 MAJOR DESIGN CONTOUR
 - MINOR DESIGN CONTOUR
 - TOP OF DESIGN BATTER
 - TOE OF DESIGN BATTER/POND/BUND
 - APPROXIMATE FILLING SECTION BOUNDARY
 - CLEAN WATER COLLECTION DRAIN
 - DIRTY WATER COLLECTION DRAIN
 - DRAINAGE PIPE
 - RM — LEACHATE TRANSFER MAIN

DATUM RL. 50.00

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	279.89
CELL 4 TOP OF CAP	85.06	85.06	90.73	95.73	100.45	105.91	109.51	111.74	110.85	107.53	102.98	98.70	94.05	89.43	83.52
CELL 4 DESIGN SURFACE	82.38	75.71	68.74	67.06	69.49	74.22	77.64	79.94	80.30	83.31	91.72	98.70	94.05	89.43	83.52
EXISTING SURFACE LEVEL	82.38	74.90	71.23	66.67	69.49	74.22	78.96	83.69	88.25	83.67	78.85	73.84	68.82	68.30	71.87
LEVEL DIFFERENCE		0.81	-2.49	0.39	0	0	-1.32	-3.75	-7.95	-0.95	12.66	24.87	25.23	21.12	11.65
CUT - / FILL +	-0	0.81	-2.49	0.39	0	0	-1.32	-3.75	-7.95	-0.95	12.66	24.87	25.23	21.12	11.65



CELL 4 LONGITUDINAL SECTION
 SCALE 1000V:1000H



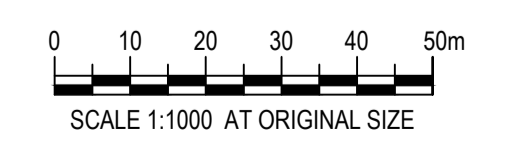
TYPICAL FILLING AGAINST PIGGY-BACK LINER

B SECTION
 SCALE 1:100

NOTE:
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PLAN
 SCALE 1:1000



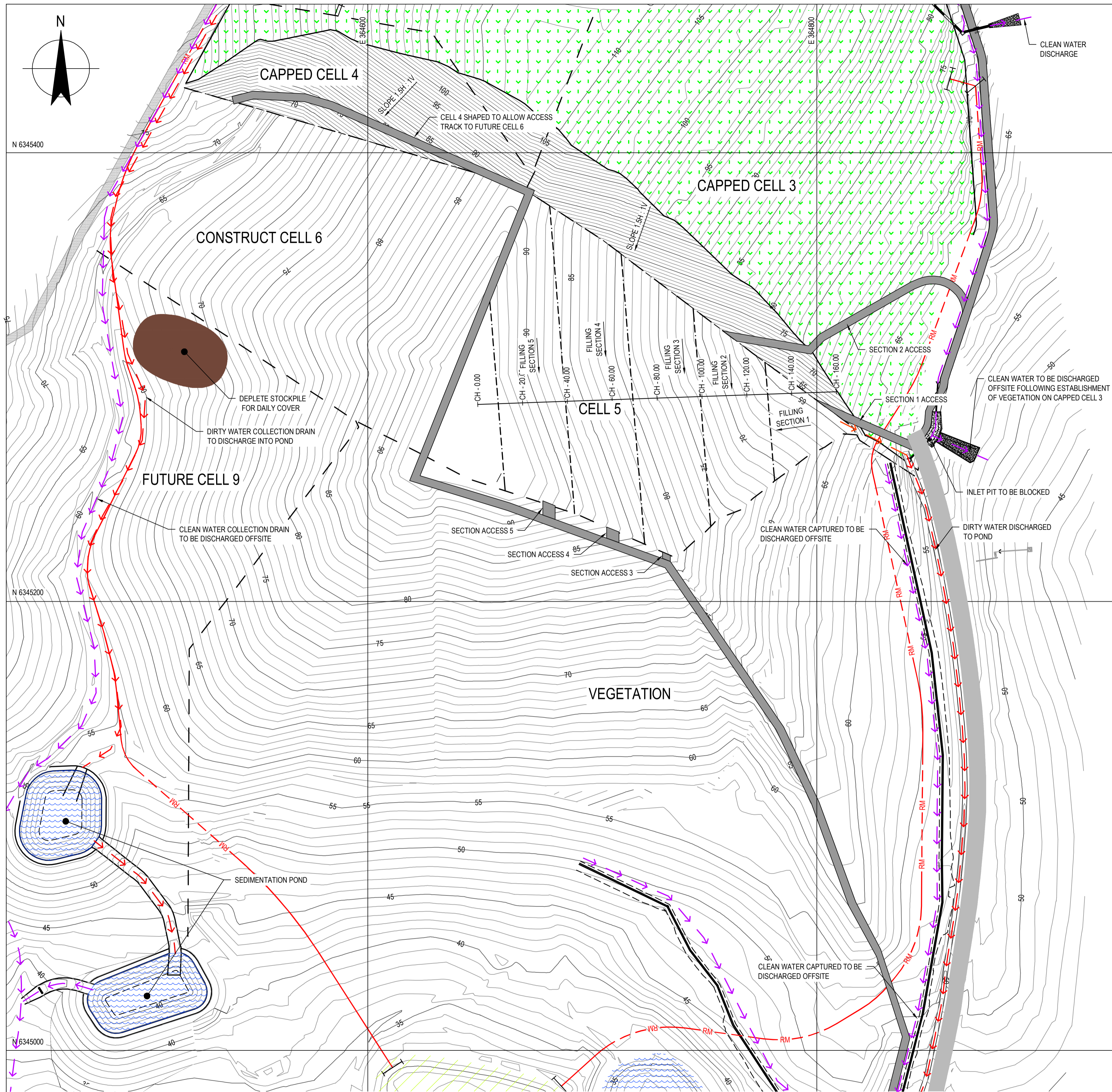
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Approved (Project Director) M. GEBHARD	Date 19.02.16
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Project	AWABA WASTE MANAGEMENT FACILITY EXPANSION
Title	CELL 4 - CONCEPT FILLING PLAN & LONGITUDINAL SECTION
Original Size	A1
Drawing No:	22-16920-C7064
Rev:	D



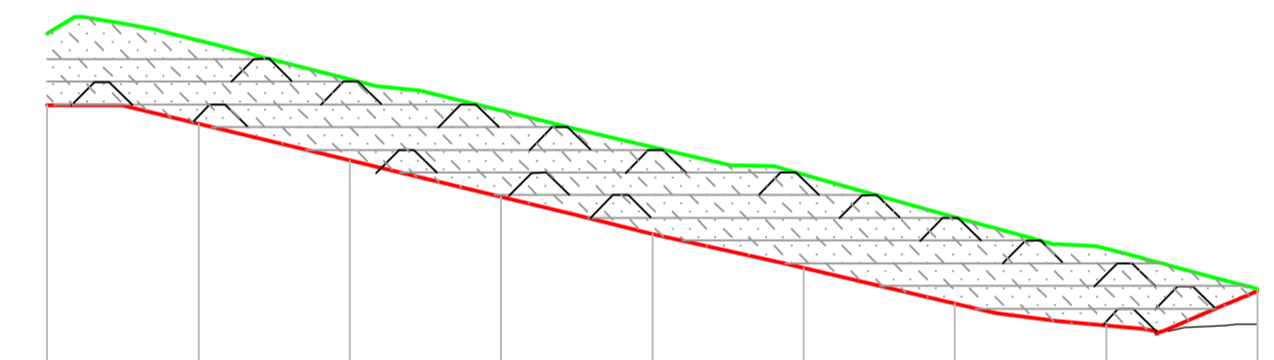
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NOTES:
1. FOR LEGEND AND GENERAL NOTES REFER TO DRAWING 22-16920-C7001.

- LEGEND:**
- APPROXIMATE STAGING BOUNDARIES
 - 60 MAJOR DESIGN CONTOUR
 - MINOR DESIGN CONTOUR
 - TOP OF DESIGN BATTER
 - TOE OF DESIGN BATTER/POND/BUND
 - APPROXIMATE FILLING SECTION BOUNDARY
 - CLEAN WATER COLLECTION DRAIN
 - DIRTY WATER COLLECTION DRAIN
 - DRAINAGE PIPE
 - RM — LEACHATE TRANSFER MAIN

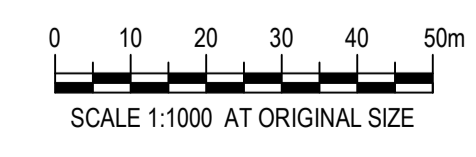


DATUM RL. 48.00

CELL 5 TOP OF CAP	103.50	102.59	97.44	93.31	88.50	84.88	79.26	75.09	69.75
CELL 5 DESIGN SURFACE	94.00	91.56	86.74	81.93	77.01	72.56	67.79	64.91	60.46
EXISTING SURFACE LEVEL	94.00	91.56	86.74	81.93	77.01	72.56	67.79	64.91	60.11
LEVEL DIFFERENCE CUT - / FILL +	0	-0	-0	-0	0	-0	0	-0	4.35
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00

CELL 5 LONGITUDINAL SECTION
SCALE 1000V:1000H

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A	ISSUED TO CLIENT	IMH	AS*	MG*	06.05.14	
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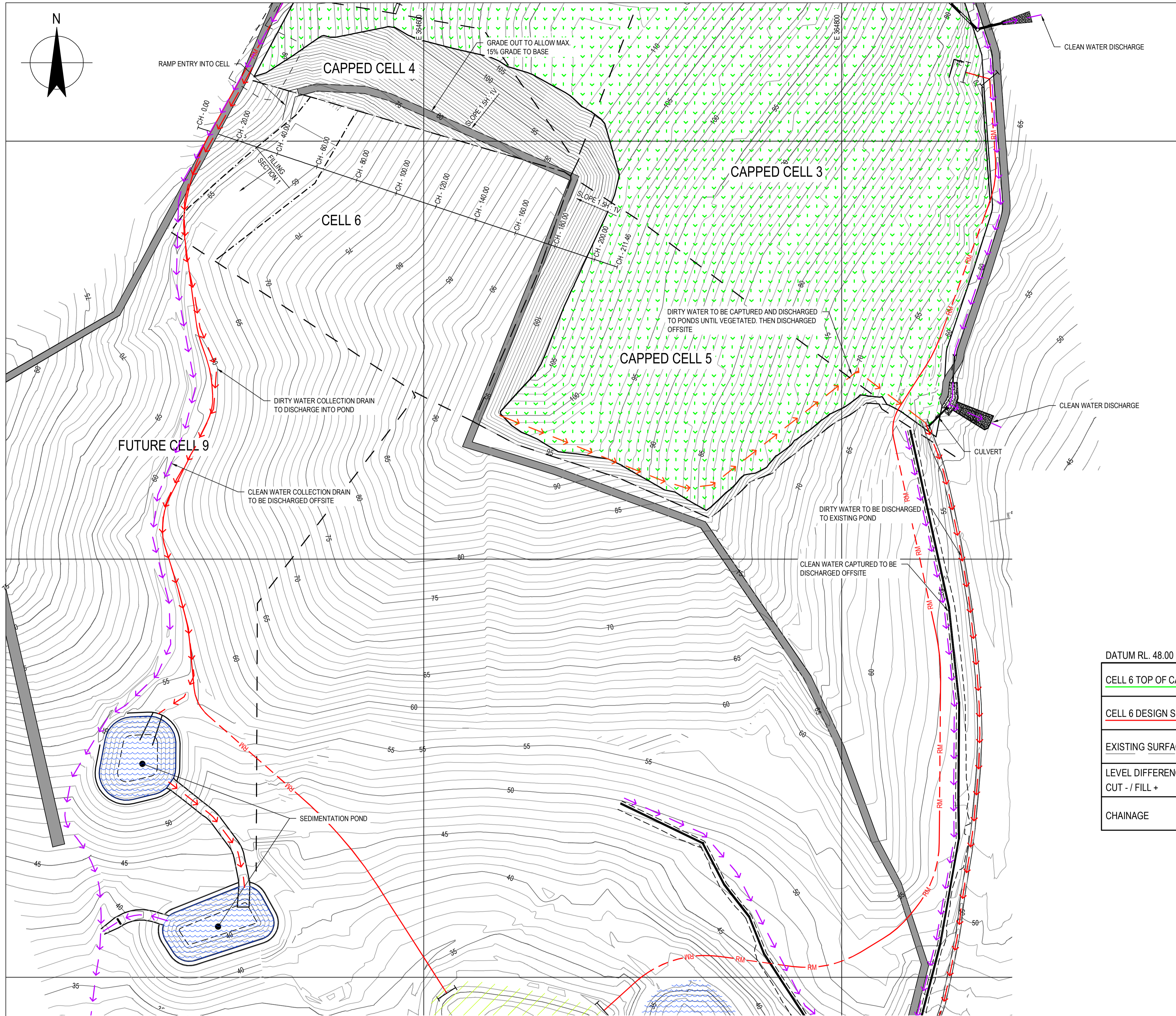
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Approved (Project Director)	M. GEBHARD		
Date	19.02.16		
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FOR TENDER

Client **LAKE MACQUARIE CITY COUNCIL**
Project **AWABA WASTE MANAGEMENT FACILITY EXPANSION**
Title **CELL 5 - CONCEPT FILLING PLAN & LONGITUDINAL SECTION**

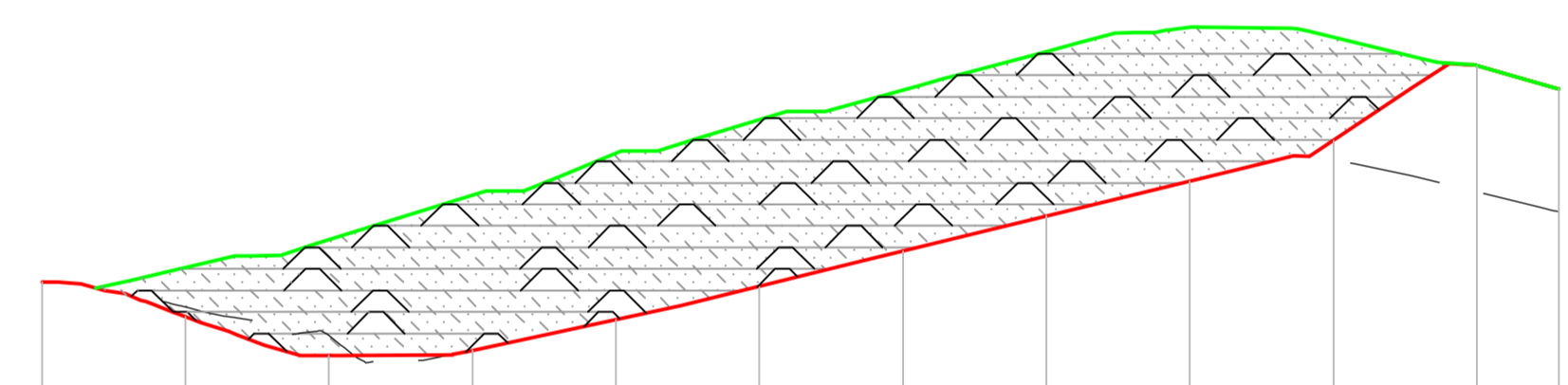
Original Size **A1** Drawing No: **22-16920-C7065** Rev: **D**

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- LEGEND:**
- APPROXIMATE STAGING BOUNDARIES
 - 60 MAJOR DESIGN CONTOUR
 - MINOR DESIGN CONTOUR
 - TOP OF DESIGN BATTER
 - TOE OF DESIGN BATTER/POND/BUND
 - APPROXIMATE FILLING SECTION BOUNDARY
 - CLEAN WATER COLLECTION DRAIN
 - DIRTY WATER COLLECTION DRAIN
 - DRAINAGE PIPE
 - RM --- LEACHATE TRANSFER MAIN



DATUM RL. 48.00												
CELL 6 TOP OF CAP		76.69	80.59	86.80	92.65	97.29	101.47	106.83	110.17	108.80	104.83	101.60
CELL 6 DESIGN SURFACE	74.72	69.87	64.46	65.17	69.48	74.11	79.00	83.88	88.76	94.42	104.83	101.60
EXISTING SURFACE LEVEL	74.72	71.19	67.23	65.17	69.48	74.11	79.00	83.88	88.76	91.87	87.26	84.47
LEVEL DIFFERENCE CUT - / FILL +	0	-1.32	-2.77	0	0	-0	0	0	0	2.56	17.57	17.14
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	211.46

CELL 6 LONGITUDINAL SECTION
 SCALE 1000V:1000H

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B	ISSUED AS FINAL TO CLIENT (NOT FOR CONSTRUCTION)	IMH	AS*	MG*	14.07.14
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 Approved (Project Director) M. GEBHARD
 Date 19.02.16

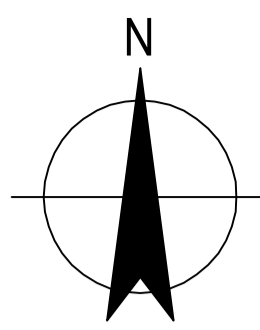
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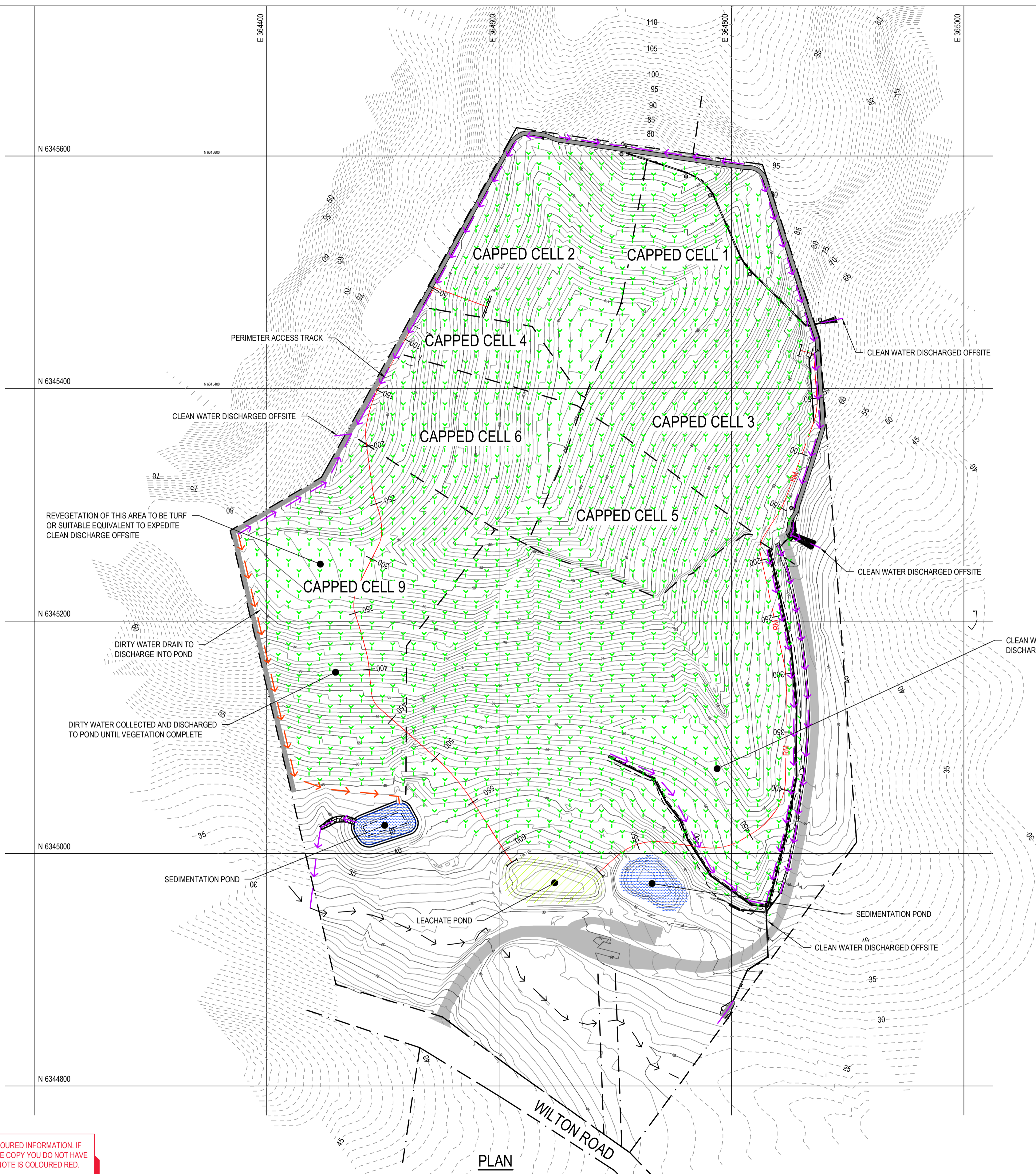
Client **LAKE MACQUARIE CITY COUNCIL**
 Project **AWABA WASTE MANAGEMENT FACILITY EXPANSION**
 Title **CELL 6 - CONCEPT FILLING PLAN & LONGITUDINAL SECTION**

Original Size **A1** Drawing No: **22-16920-C7066** Rev: **D**



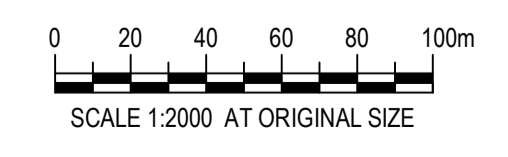
NOTES:
 1. FOR LEGEND AND GENERAL NOTES REFER TO DRAWING 22-16920-C7001.

- LEGEND:**
- APPROXIMATE STAGING BOUNDARIES
 - 60 — MAJOR DESIGN CONTOUR
 - MINOR DESIGN CONTOUR
 - → → CLEAN WATER COLLECTION DRAIN
 - → → DIRTY WATER COLLECTION DRAIN
 - — — DRAINAGE PIPE
 - RM — LEACHATE TRANSFER MAIN
 - → → EXISTING CREEK



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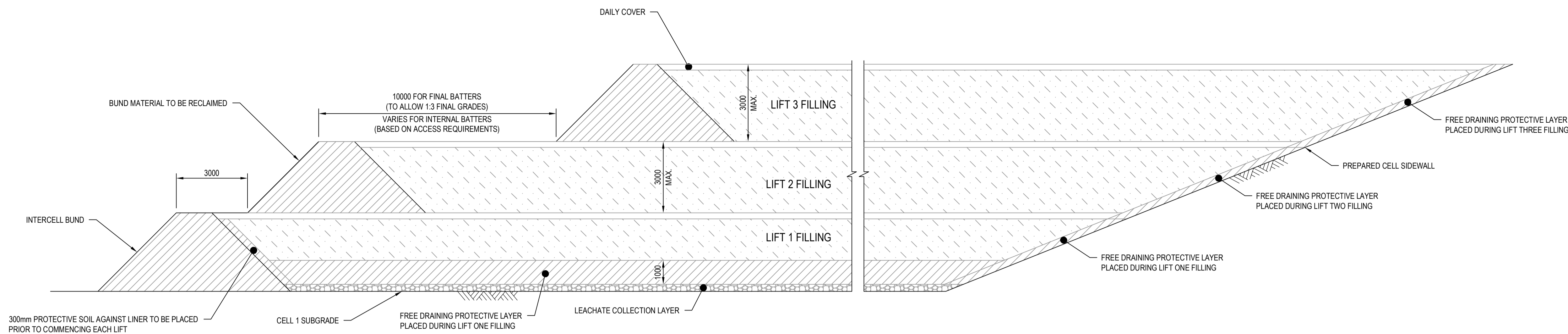
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Approved (Project Director)	M. GEBHARD		
Date	19.02.16		
Scale	AS SHOWN		

Client	LAKE MACQUARIE CITY COUNCIL		
Project	AWABA WASTE MANAGEMENT FACILITY EXPANSION		
Title	FINAL LANDFORM PLAN		
Original Size	A1	Drawing No:	22-16920-C7068
		Rev:	D

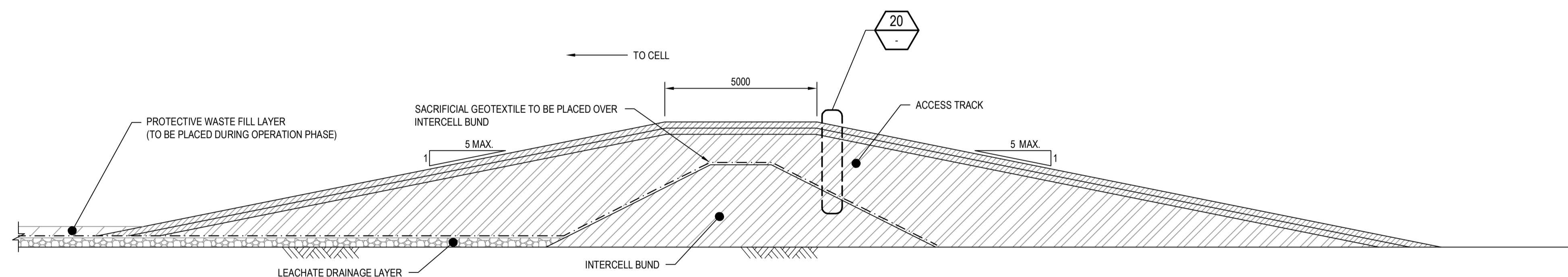
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- NOTES:**
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 - ALL DIMENSIONS SHOWN ARE IN MILLIMETRES.



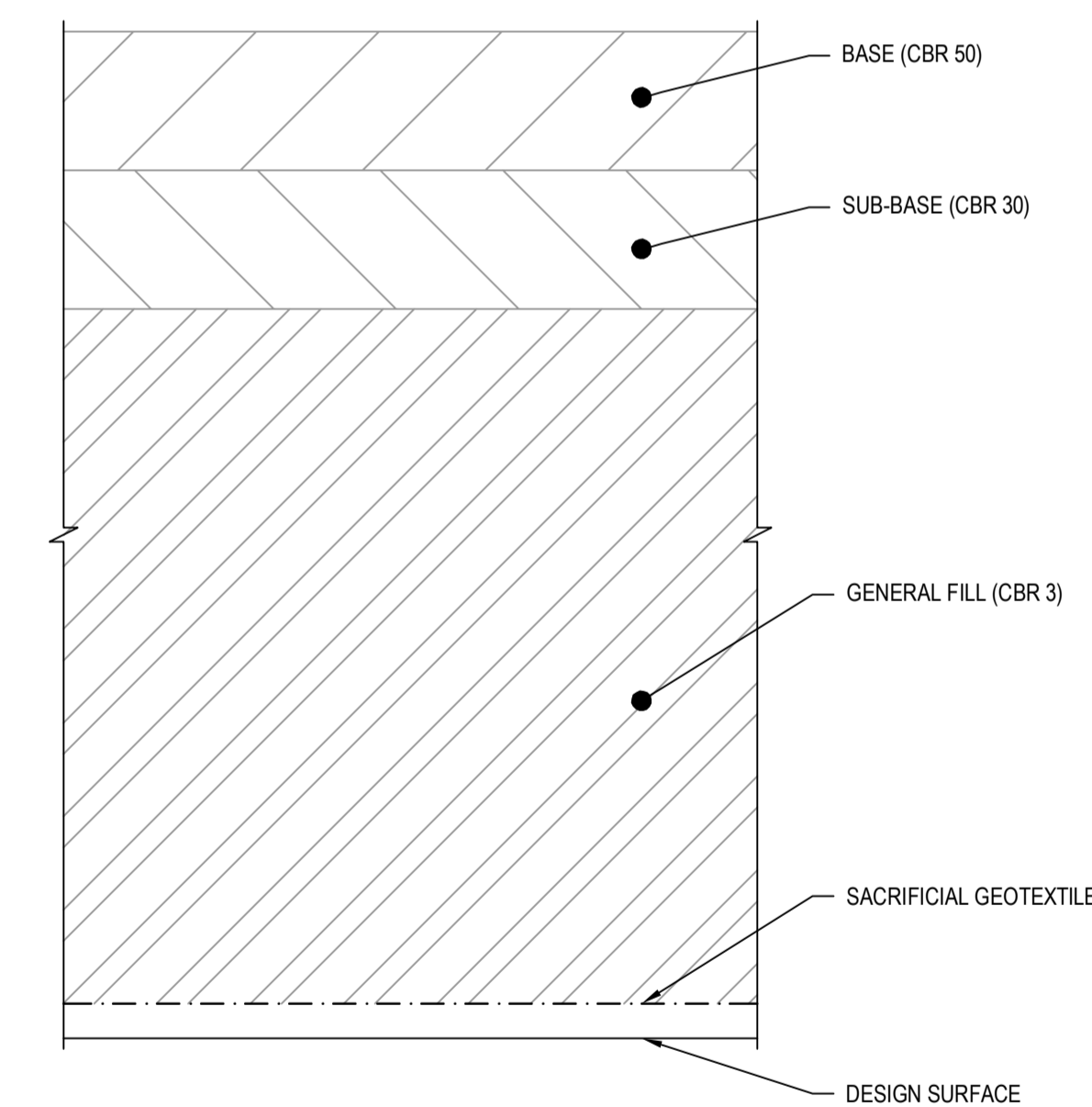
C SECTION
C7061 SCALE 1: 100

TYPICAL FILLING BETWEEN CELLS 1 AND 2



D SECTION
C7061 SCALE 1: 100

TYPICAL ACCESS TRACK



20 DETAIL
SCALE 1: 10

TYPICAL ACCESS TRACK PROFILE

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C	RE-ISSUED TO CLIENT	RJC	AS*	MG*	09.12.15	
B	ISSUED AS FINAL TO CLIENT (NOT FOR CONSTRUCTION)	IMH	AS*	MG*	14.07.14	
A	ISSUED TO CLIENT	IMH	AS*	MG*	06.05.14	
No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date



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Approved (Project Director)	M. GEBHARD		
Date	19.02.16		
Scale	AS SHOWN		

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Client	LAKE MACQUARIE CITY COUNCIL		
Project	AWABA WASTE MANAGEMENT FACILITY EXPANSION		
Title	LANDFILL FILLING - TYPICAL SECTIONS & DETAILS		
Original Size	A1	Drawing No:	22-16920-C7069
Rev:	D		

FOR TENDER

Appendix C – Infrastructure calculations

Drainage sizing

Sedimentation pond sizing

SWMP Commentary, Standard Calculation

Note: These "Standard Calculation" spreadsheets relate only to low erosion hazard lands as identified in figure 4.6 where the designer chooses to not use the RUSLE to size sediment basins. The more "Detailed Calculation" spreadsheets should be used on high erosion hazard lands as identified by figure 4.6 or where the designer chooses to run the RUSLE in calculations.

1. Site Data Sheet

Site name: Awaba WMF

Site location: Awaba

Precinct: 33.015, 151.535

Description of site: Staged landforms

Site area	Site						Remarks
	west 1	east 1	east 2	west 2	Cell 1	Cell 2	
Total catchment area (ha)	6.3	7	3.1	4	2.9	2.7	
Disturbed catchment area (ha)	3	4.5	2.3	4	2.9	2.7	

Soil analysis

Soil landscape							DIPNR mapping (if relevant)
Soil Texture Group	D/F	D/F	D/F	D/F	D/F	D/F	Sections 6.3.3(c), (d) and (e)

Rainfall data

Design rainfall depth (days)	5	5	5	5	5	5	See Sections 6.3.4 (d) and (e)
Design rainfall depth (percentile)	90	90	90	90	90	90	See Sections 6.3.4 (f) and (g)
x-day, y-percentile rainfall event	58.7	58.7	58.7	58.7	58.7	58.7	See Section 6.3.4 (h)
Rainfall intensity: 2-year, 6-hour storm	11.4	11.4	11.4	11.4	11.4	11.4	See IFD chart for the site
Rainfall erosivity (R-factor)	2820	2820	2820	2820	2820	2820	Automatic calculation from above data

Comments:

"west 1" Stage 2 For WEST POND - i.e Cell 2 capped with dirty, cell 6 and partial 8/9 runoff contributing. Count Cell 4 as well. Stage 9 west diversion in place.

"east 1" STAGE 6/7 cell 5 and 7 contribute. Cell 1 and 3 have been diverted offsite. This is above current capacity (3.0ML), therefore, the capping (to current approved heights) and revegetation of Cell 7 is to occur prior to any additional works. This area will then be discharged direct offsite

"east 2" STAGE 3 Cell 1 is capped, vegetated and discharging directly offsite, Cell 3 is capped and contributing to the pond catchment, Cell 5 is under construction, with stormwater to be managed within.

"west 2" STAGE 9 Cell 9B is constructed, removal of pond in 9B, leaving most southern pond only

Cv = Type C soils (Awaba soil landscape), Rainfall depth of 51.3 (Table F2

SWMP Commentary, Standard Calculation

2. Storm Flow Calculations

Peak flow is given by the Rational Formula:

$$Q_y = 0.00278 \times C_{10} \times F_y \times I_{y,tc} \times A$$

- where:
- Q_y is peak flow rate (m^3/sec) of average recurrence interval (ARI) of "Y" years
 - C_{10} is the runoff coefficient (dimensionless) for ARI of 10 years. Rural runoff coefficients are given in Volume 2, figure 5 of Pilgrim (1998), while urban runoff coefficients are given in Volume 1, Book VIII, figure 1.13 of Pilgrim (1998) and construction runoff coefficients are given in Appendix F
 - F_y is a frequency factor for "Y" years. Rural values are given in Volume 1, Book IV, Table 1.1 of Pilgrim (1998) while urban coefficients are given in Volume 1, Book VIII, Table 1.6 of Pilgrim (1998)
 - A is the catchment area in hectares (ha)
 - $I_{y,tc}$ is the average rainfall intensity (mm/hr) for an ARI of "Y" years and a design duration of "tc" (minutes or hours)

Time of concentration (t_c) = $0.76 \times (A/100)^{0.38}$ hrs (Volume 1, Book IV of Pilgrim, 1998)

Note: For urban catchments the time of concentration should be determined by more precise calculations or reduced by a factor of 50 per cent.

Peak flow calculations, 1

Site	A (ha)	tc (mins)	Rainfall intensity, I, mm/hr						C_{10}
			$1_{yr,tc}$	$5_{yr,tc}$	$10_{yr,tc}$	$20_{yr,tc}$	$50_{yr,tc}$	$100_{yr,tc}$	
East D	2.1	11	64.3	106	119	137	160	178	0.86
West D	2.6	11	64.3	106	119	137	160	178	0.86
Cap	2	10	64.3	106	119	137	160	178	0.86
									0.86
									0.86
									0.86

Peak flow calculations, 2

ARI yrs	Frequency factor (F_y)	Peak flows						Comment
		East D	West D	Cap				
		(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	
$1_{yr,tc}$	0.62	0.200	0.248	0.191				Zone B, below 500m
$5_{yr,tc}$	0.88	0.468	0.580	0.446				Zone B, below 500m
$10_{yr,tc}$	1	0.597	0.740	0.569				Zone B, below 500m
$20_{yr,tc}$	1.12	0.770	0.954	0.734				Zone B, below 500m
$50_{yr,tc}$	1.2307447	0.989	1.224	0.942				Zone B, below 500m
$100_{yr,tc}$	1.3502128	1.207	1.494	1.149				Zone B, below 500m

4. Volume of Sediment Basins, Type D and Type F Soils

Basin volume = settling zone volume + sediment storage zone volume

Settling Zone Volume

The settling zone volume for *Type F* and *Type D* soils is calculated to provide capacity to contain all runoff expected from up to the y-percentile rainfall event. The volume of the basin's settling zone (V) can be determined as a function of the basin's surface area and depth to allow for particles to settle and can be determined by the following equation:

$$V = 10 \times C_v \times A \times R_{y\text{-}\%ile, x\text{-}day} \text{ (m}^3\text{)}$$

where:

10 = a unit conversion factor

C_v = the volumetric runoff coefficient defined as that portion of rainfall that runs off as stormwater over the x-day period

R = is the x-day total rainfall depth (mm) that is not exceeded in y percent of rainfall events. (See Sections 6.3.4(d), (e), (f), (g) and (h)).

A = total catchment area (ha)

Sediment Storage Zone Volume

In the standard calculation, the sediment storage zone is 50 percent of the setting zone. However, designers can work to capture the 2-month soil loss as calculated by the RUSLE (Section 6.3.4(i)(ii)), in which case the "Detailed Calculation" spreadsheets should be used.

Total Basin Volume

Site	C_v	R x-day y-%ile	Total catchment area (ha)	Settling zone volume (m ³)	Sediment storage volume (m ³)	Total basin volume (m ³)
west 1	0.63	58.7	6.3	2329.803	1165	3494.7045
east 1	0.63	58.7	7	2588.67	1294	3883.005
east 2	0.63	58.7	3.1	1146.411	573	1719.6165
west 2	0.63	58.7	4	1479.24	740	2218.86
Cell 1	0.63	58.7	2.9	1072.449	536	1608.6735
Cell 2	0.63	58.7	2.7	998.487	499	1497.7305

Appendix D – Maintenance procedures

Weekly and Post Rainfall Environmental Inspection Checklist

Sedimentation Pond Management Procedure

AWABA WASTE MANAGEMENT FACILITY WEEKLY AND POST RAINFALL INSPECTION CHECKLIST

Inspector:	Inspector Signature:
Inspection Date:	Inspection Time:
Also present (name):	Weather:

Item		Checked	Comments
General			
1	Current revision of surface water control plan on-site and available		
2	Operational vehicle activities are confined to the approved areas, including parking and storage		
3	All chemical products, including petroleum, and are stored in a way to prevent them entering the surface water drainage system		
4	Site security fencing, signage and delineation of appropriate access is adequate		
5	Any evidence of vehicles trafficking inappropriate unsealed routes		

Item	Checked	Comments
6		Erosion or deformations to access tracks
7		All operational areas and erosion and sediment controls are accessible by maintained access tracks
8		All run-off from the Site is draining to the sedimentation pond or approved erosion and sediment control structures with no localised ponding
9		All drainage paths are free from blockages / silting / inundation / erosion / undersized and other indicators that may result in overtopping during large storm events
10		Silt fencing, level spreaders and other sediment control devices are correctly installed and functional.
11		Rock check dams are cleared of excess silt and debris and capable of operating as required for the design storm event
12		Silt fencing is cleared of excess silt and debris and capable of operating as required for the design storm event
13		Stockpiles are not impeding surface water flows and are not placed within 2 metres of high flow areas and have required diversion bunding in place

Item		Checked	Comments
14	Record approximate volume of silt removed from on-site devices, the location of removed silt and disposal location		
15	Any further incidences or occurrences of unsuitable surface water management practices that may result in pollution of receiving waters		
16	Inspect entrance road and clean/remove soils and sediments		
17	Record approximate volume of sedimentation pond		
B	Batter Slopes		
1	Observations of any cracks / depressions / bulging or other indicators of surface stability issues		
2	Observations of any scouring / rilling / concentration of flow or other indicators of erosion issues		
C	Active & Intermediate Filling Area		
1	Any occurrences of waste placement outside active filling areas or areas of exposed waste		

Item		Checked	Comments
2	Daily cover stockpile sufficient volume for cover and silt fencing located to prevent runoff entering downstream catchments		
3	Diversion channels and sediment fences appropriately located around active filling area		
4	Inspect density and coverage of grassed areas of the intermediate covered area and re-hydromulch as needed		
D	Monitoring Points		
1	Monitoring points are maintained, accessible and are in working condition		

NOTES:

Awaba Waste Management Facility Sedimentation Pond Management Procedure

WHY SEDIMENTATION POND MANAGEMENT IS REQUIRED?

An important component of water quality control is effective management of sediment ponds at landfill sites.

Under the *Protection of the Environment Operations Act (1997)*, there is a legal responsibility to ensure that runoff leaving a site has an acceptable water quality standard including water being discharged from sediment ponds after storm events.

PROCEDURE

Pond Management

The sediment ponds should be managed to remain no more than 60% full in readiness for the design storm event. The ponds shall be flocculated and emptied within a period of 5 days following the cessation of a rainfall event.

Management of TSS:

To effectively manage TSS in the sediment ponds the following procedure should be undertaken, if required (i.e. if TSS levels are > 50 mg/L):

Apply bulk gypsum evenly across the top of the water at an acceptable rate (i.e. trial and error as different for each pond). Gypsum should be broadcast into the pond using an excavator on ponds and then the water should be circulated using a pump to distribute the gypsum.

The “Blue Book” recommends 32 to 77 kg per 100 cubic metres of volume. However, judging from past experience it is best to apply much more than this initially as this often results in ponds becoming “self flocculating”.

If the above method proves to be ineffective gypsum should be mixed in a perforated drum inside the pond to make a slurry and pumped through a hose to evenly distribute the flocculent. See Figure 1 below.

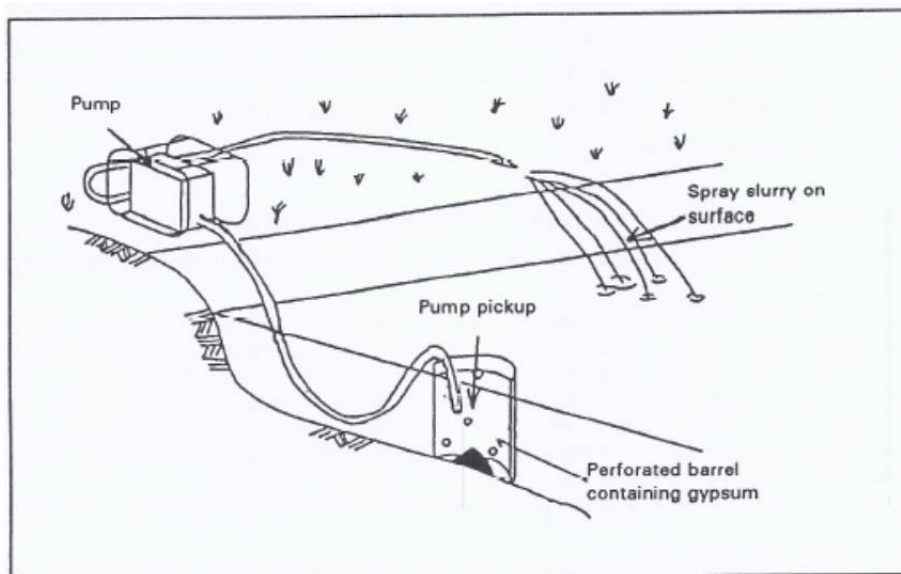


Figure 1: Gypsum application procedure

Source: Dept. of Housing 1998

Other mechanisms to speed up flocculation and assisting ponds to become “self-flocculating” may be applied, such as:

- installing a series of floating, slow release bags containing gypsum in ponds;
- lining inlets and sides of ponds with gypsum;
- installing “floc blocks” at inlets.

Management of pH:

- Test pond water with meter.
- No action if pH reading between 6.5 and 8.5.
- Lime to be added if pH below 6.5.
- Hydrochloric Acid (32% Muriatic) to be added if pH above 8.5.
- Determine volume of water in pond.
- Determine percentage of lime or acid required by taking a 10-litre sample of pond water and adding a known amount of lime or acid (initially 0.004%). If the pH is still not acceptable, vary the amount of lime or acid until within the limits.
- Once the required percentage has been determined, calculate the actual amount of lime or acid to be added by multiplying the volume of water in the pond by the determined percentage.
- Add the required amount of lime or acid to the pond.
- Mix the water in the sediment pond well.
- Treat for pH prior to T.S.S.

Management of grease and oil:

- Examine surface of water for evidence (eg sheen, discolouration).
- No action if no visual contamination.
- Oil absorbent pads to be spread over the surface if contamination is evident (i.e. rainbow sheen) and booms may also be used to collect the oil. Oil contaminated pads and boom to be disposed of in accordance with legislative requirements.

Management of Sediment Build-up within Stilling Pond or Sediment Pond:

Any stilling ponds installed within sediment ponds should also be maintained as described below. This is to ensure the flow of water through the filter walls is maintained. During wet periods, dredging the sediment laden upstream pond will remove the build-up of sediments and increase the capacity. During dry periods this may include:

- Draining the pond and flushing out gabion basket filter banks to remove the build-up of sediments.
- Draining the pond and reworking rock wall filter banks to loosen up sediments to allow removal.

The process includes:

- Examine depth indicator posts for indication of sediment depth.
- No action if capacity sufficient
- If sediment depth above Maximum Sediment Storage mark, excavate sediments as follows:
 - Excavate the sediment onto a cleared pad on the upstream portion of the pond. Any water should drain back into the pond (stilling pond side where available)
 - Allow the excavated material to drain as long as dry weather period permits
 - Place excavated material within active landfill

RECORDS

The water level of each pond should be recorded in the Weekly and Post Rainfall Environmental Inspection Checklist.

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GHD

Level 3 GHD Tower 24 Honeysuckle Drive Newcastle NSW 2300
PO Box 5403 Hunter Region Mail Centre NSW 2310
T: (02) 4979 9999 F: (02) 4979 9988 E: ntlmail@ghd.com

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2	C. Davies J. Dawes	D. Barrett	<i>David Barrett</i>	M Gebhard	<i>M Gebhard</i>	25/02/2016

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Appendix **E**
Surface, Groundwater & Leachate Monitoring
Program


	<p>Procedure</p> <p>Awaba Waste Management Facility - Surface Water, Ground Water and Leachate Monitoring Programme</p>	
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Procedure

1 Introduction

1.1 The site

The Awaba Waste Management Facility (AWMF) is located on Wilton Road Awaba on land owned by Lake Macquarie City Council and identified as Lot 372 DP 723259, 367 Wilton Road Awaba. The landfill site occupies a south-facing gully which is surrounded by predominantly uncleared native vegetation on undulating terrain.

The AWMF was established in 1986 and the site is located between two spurs of north-westerly trending ridgelines, draining in a southerly direction.

The landfill mass overlays an historic drainage line which dissects the existing filled area and creates a natural subsurface catchment for groundwater seepage and any leachate originating from landfill cells that pre-date introduction of requirements to provide landfill cell liners. The approximate location of the historic contour can be seen by overlaying current aerial photography with topographic map data, as depicted in appendix A.

Current surface drainage from the footprint of the site diverts east and west of the landfill area via constructed drainage lines and permanent sediment control dams.

Stormwater from the catchment outside the site is diverted around the facility via clean water diversion channels to overcome potential pollution and erosion/sediment control issues. Natural wet weather flows from the drainage line above the site is piped around the site and returned to natural overland flow at the north eastern boundary via a headwall outlet and rock outlet energy dissipaters.

Leachate control from historic landfill activities pre-dates current best practice measures where impermeable liners are installed to contain and collect leachate for treatment and disposal. Cell lining was first introduced in 2006/7 during expansion of the landfill facility into a disused quarry void. Leachate from this lined cell is piped to the southern leachate dam.

Subsurface movement of leachate from landfill predating this cell construction is intercepted by a subsurface drainage system installed downslope of the landfill mass. This leachate is pumped to the main leachate storage dam.

1.2 Programme Objectives

The Surface Water, Ground Water and Leachate Monitoring Programme (the Programme) is intended to guide the ongoing monitoring of potential environmental impacts of the Awaba Waste Management Facility (AWMF) on surface and ground water quality. The Programme will allow Council to comply with regulatory requirements for monitoring and respond to unforeseen environmental incidents.

1.3 Regulatory Framework

The Programme will guide the operation of the AWMF to ensure compliance with:

- Provisions of the Protection of the Environment Operations (POEO) Act 1997
- Protection of the Environment Operations (General) Regulation 2009.
- Environmental Protection Licence (EPL) No. 5873 – specifically Section 5
- Major Project Approval number 10_0139 issued by the NSW Department of Planning and Infrastructure.
- Hunter Water Corporation Non-Standard Wastewater Service Agreement (WSA) 2014-1036

1.4 Associated Management Plans

The Surface Water, Ground Water and Leachate Monitoring Programme should be read in conjunction with the following management plans and programs which together with this plan form the Soil, Water and Leachate Management Plan:

- Awaba Waste Management Facility - Water Quantity and Quality Assessment, Cardno December 2011
- Awaba Waste Management Facility Erosion and Sediment Control Plan, GHD July 2014
- Awaba Waste Management Facility Surface Water Management Plan, GHD February 2016
- Awaba Waste Management Facility Leachate Management Plan, GHD February 2016
- Surface Water, Groundwater and Leachate Response Plan, September 2018

2 Receiving Waters

2.1 Catchment Overview

The facility is situated near the head of a minor unnamed ephemeral stream which develops into a freshwater stream that ultimately leads to an estuarine inlet on the western most reach of Kilaben Bay in Lake Macquarie.

Dry weather flows are not typically encountered immediately downstream of the AWMF site.

The upper catchment is largely remnant native vegetation however other land use activities within the catchment include:

- An Alternate Waste Treatment (AWT) Facility operated by a contractor is located on an adjacent site to the AWMF. The facility receives organic waste for composting and processing and has a separate leachate management system, which does however utilise the AWMF sewer connection.
- An off-road motorsport venue occupied by the Westlakes Automobile Club Inc.
- Residential development including a 40 site manufactured home estate and semi-rural residential premises.
- Two private primary schools.

3 Monitoring Activities

Monitoring of water and leachate on site will include visual checking, sampling, and analysis of relevant pollutants and indicators. Monitoring may occur for the purpose of regulatory compliance or in response to proactive site investigations.

3.1 Visual Inspection

Visual checks should include:

- Observation of surface flows during/after rainfall events to monitor adequacy of sediment control measures.
- Regular inspection of landfill batters for potential leachate bleeds, with particular focus on areas where site activities are occurring that may increase the likelihood of localised breakout of leachate.
- Checking of relative turbidity/discolouration of sediment and leachate dams.
- Assessing available storage levels in sediment and leachate dams.

3.2 Sampling

Sampling and analysis should be carried out:

- For routine sampling of surface water, ground water, and leachate in accordance with requirements of the EPL.
- For water quality in sedimentation dams prior to planned discharge by pumping.

- Where unforeseen contamination of surface or groundwater is suspected.

3.3 Field Measurements

Field measurements can be useful to support daily operational decision making and quick diagnosis of potential unforeseen incidents.

Care must be taken to ensure that any field methods used for reporting purposes meet the standards set by the EPL or WSA.

It is anticipated that operation of a sequence batch reactor leachate treatment system will require a separate leachate quality monitoring programme to support efficient operation of the system and compliance with HWC requirements.

4 Water Quality Criteria

4.1.1 ANZECC Guidelines

When assessing suitability of drainage leaving the site the water quality parameters should be assessed against Chapter 3 of the (ANZECC) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Specific guidance on water quality parameters relevant to receiving waters can be found in:

- Tables 3.3.2–3.3.3 of the guideline for physical & chemical stressors in south-east Australian waterways – Lowland river.
- Table 3.4.1 of the guideline for toxicants 95% protection level trigger values for toxicants in freshwater.

The classification as a lowland river is the nearest relevant classification for the immediate receiving waters. The choice of 95% protection level for toxicants is based on the receiving waters being classified as slightly to moderately disturbed ecosystems, as set out in section 3.1.3.1 or the Guidelines.

4.1.2 Environmental Protection Licence

In addition to ANZECC criteria, condition L2 of the EPL restricts the discharge of surface water from the site to 50 mg/L of total suspended solids. This concentration limit is only permitted to be exceeded at discharge point of the two final sedimentation dams for the duration of the overflow “whenever a wet weather overflow is occurring due to stormwater events greater than or equal to a 90th percentile 5 day rainfall duration”.

4.1.3 Hunter Water Corporation Waste Service Agreement

The discharge of leachate to HWC sewers is subject to the non-standard WSA which stipulates daily load limits and prohibited pollutants.

5 Sampling and analysis

5.1.1 Equipment and Consumables

The Environmental Officer will be responsible for ensuring that adequate and suitable equipment, sampling containers and other consumables are available at all times to cater for routine monitoring required by regulators in addition to incident investigation and response purposes.

Any field instrumentation used must be maintained in good working order and calibrated to the manufacturer’s specifications.

5.1.2 Sampling and Storage

Water samples must be collected in sample bottles that are a suitable material, have been subject to appropriate pre-treatment and addition of preservatives as required.

Storage time and temperature requirements must be adhered to prior to analysis.

Sampling methodology and sample storage must be consistent with the principles outlined in Standards Association of Australia (1998) AS/NZS 5667.1:1998, and the APHA Standard Methods for the Examination of Water and Waste Water (1998).

5.1.3 Sampling Locations

Condition M2.2 of the EPL outlines the list of analytes and frequency of testing that that must be undertaken for routine groundwater, surface water and leachate storage sites. Sample sites are identified in the EPL as:

- Point 1 to 5 – Groundwater bores
- Point 6 to 9 – Surface Water
- Point 10 – Leachate (southern leachate pond)

The location of corresponding sample sites is depicted in the Amended Ground water and surface water sampling locations - Awaba Waste Management Facility document (Appendix B).

Non-routine or incident response sampling locations will depend on individual circumstances. Principles that should be considered include:

- Inclusion of upstream samples where possible to better quantify potential impacts on receiving waters.
- Collection of sufficient numbers of samples to provide representative indication of water quality.

Due to ephemeral nature of the receiving waterway it will not always be possible to collect environmental samples upstream/downstream from the AWMF site.

5.1.4 Analysis

Sample analysis must be carried out by a NATA accredited laboratory. The EPL requires the use of methods that comply with the NSW EPA Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales. The Approved Methods are also specified up by the Protection of the Environment Operations (General) Regulation 2009, section 60 - Methodology for testing for matter in waters.

Analysis of samples from non-regulated or incident response investigations will require identification of suitable parameters for quantifying pollutants or indicators of the potential impacts being investigated.

EPA Approved Methods is recognised as current best practice and all environmental sampling and analysis should be carried out in accordance with the EPA guideline.

Any onsite physio/chemical measurements must be done with scientific grade instrumentation that has been appropriately maintained and calibrated.

6 Water Quality Parameters for Operational Requirements

In addition to EPL and Trade Waste sampling requirements, there are a number of physical and chemical tests that can be useful for operational checks and decision making.

6.1 Dissolved Oxygen – field measurement.

Dissolved oxygen (DO) in water is relatively unstable and in-situ measurement of DO is essential. Reliable DO measurements can be made using appropriate field instrumentation.

DO levels in water are dependent on temperature. The amount of oxygen contained in water at 100% saturation will increase as temperature decreases. Comparison of DO and temperature will provide a useful indication of potential pollutant load and can be referenced to the DO saturation table included in Appendix C.

Saturation levels will be reduced when pollutants consume oxygen and the two processes likely to be encountered in the context of landfill management are Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD).

Very low DO levels can be used to indicate a high BOD or COD from organic or chemical pollution.

6.2 pH - field measurement

As with dissolved oxygen, pH in environmental samples can be unstable in storage and is best measured in-situ. Reliable pH measurements can be made using appropriate field instrumentation.

Measurement of pH is necessary for efficient use of flocculants in sedimentation ponds.

Extreme variations in pH of surface waters from a neutral range of around 6.5 to 8.5 can also be indicative of significant pollution. Ground water may naturally have lower pH range where it has moved through acid sulphate soils.

6.3 Turbidity

Turbidity can be measured in laboratories however significant settling can occur during storage and re-mixing may not provide representative results. In-situ measurement is preferable.

Turbidity is a measure of suspended materials in water most commonly quantified by how much light is scattered when a beam is past through the sample. Where turbidity is regularly measured at the same time as sample collection, a reliable site specific correlation can be developed between turbidity and laboratory measured total suspended solids (TSS).

Developing a correlation would be useful as a quick field estimation of TSS when assessing sedimentation dam waters against the EPL 50mg/l threshold; however the final decision to discharge should be supported by laboratory analysis unless it can be demonstrated that the Turbidity/TSS correlation is robust and statistically valid.

6.4 Ammonia – field measurement

Field measurement of ammonia is a useful indicator for confirmation of likely presence of leachate contamination in surface waters.

Ammonia can be measured in the field using an Ion Selective Electrode which is similar in operation to a pH electrode.

Non-quantitative detection is also possible using a simple colorimetric kit. These kits utilise a reagent (Nessler's Reagent) to create a colour reaction on contact with ammonia in solution. The test is useful to provide an indication of presence or absence of ammonia.

6.5 Odour

Aside from familiarity with odours created by common pollutants, it is also possible that surface and groundwater may emit an odour where anaerobic (septic) conditions have occurred. This may occur due to introduction of leachate or other organic pollutants which consume dissolved oxygen.

6.6 Colour

Contamination of surface water can by leachate or sediment can often be detected by visual discolouration.

7 Record Keeping and Reporting

Sample details must be recorded on the analysis request and chain of custody form for laboratory analysis.

On receipt of a certificate of analysis from the laboratory the results will be filed in Council's electronic records management system.

In the case of analysis carried out for the purpose of compliance with EPL condition, laboratory results are forwarded to an external consultant for tabulation and preliminary interpretation against relevant guidelines. These results are posted to Council's website when they become available on a quarterly basis.

Reporting of results of routine monitoring activities will comply with the requirements of:

- NSW EPA as set out in the part 6 of the EPL (annually).
- Hunter Water Corporation as required under the Trade Waste Agreement in force at the time.

Immediate reporting is required where an incident occurs which causes or threatens material harm to the environment. This requirement is mandated under Section 5.7 of the POEO Act - Duty to notify pollution incidents. Reporting protocols are outlined in the Surface Water, Groundwater and Leachate Response Plan..

8 Surface Water Monitoring

8.1 Sample Locations

Surface water sample locations required to be monitored under the EPL are shown in appendix B. There are a total of four sites identified as sites 6 through to 9.

- Site 6 - Final sedimentation dam to the west (known as Sediment Pond 3)
- Site 7 - Final sedimentation dam to the east (known as Sediment Pond 2)
- Site 8 – Unnamed ephemeral stream – downstream at site AWMF boundary.
- Site 9 – Unnamed ephemeral stream – upstream at AWMF site boundary.

Condition M2 of the EPL specifies the analytes and testing frequency required for surface water at these sites.

8.2 Surface Water Quality Criteria

The EPL stipulates which analytes must be tested for and what frequency testing should occur for nominated surface water sample points. The EPL restricts the discharge of surface water from the site to 50 mg/L of total suspended solids other than in circumstances described above in Section 4.1.2.

All other results are benchmarked against ANZECC Guidelines for Freshwater 95% protection level trigger values.

9 Groundwater Monitoring

9.1 Sample Locations

Groundwater sample locations required to be monitored under the EPL are shown in appendix B. There are a total of five sites identified as sites 1 through to 5.

- Site 1 – Bore located “upstream” of AWMF just outside north-western boundary
- Site 2 to 4 – Three bores traversing below the southern leachate dam
- Site 5 – Bore located “downstream” of AWMF site in the vicinity of the ephemeral stream.

Condition M2 of the EPL specifies the analytes and testing frequency required for groundwater at these sites.

9.2 Groundwater Quality Criteria

The EPL stipulates which analytes must be tested for and what frequency testing should occur for nominated groundwater sample points.

Results of groundwater analysis are benchmarked against ANZECC Guidelines for Freshwater 95% protection level trigger values

10 Leachate Monitoring

10.1 Sample Locations

Leachate is currently required to be sampled from the southern leachate storage dam identified as Site 10 in appendix B.

Sampling may also occur from the quarry cell leachate outlet pipe for operational purposes, which represents a raw leachate grab sample. The outlet sample point has been identified as site 10A1.

Leachate flow rates are also monitored from the quarry cell outlet via a calibrated v-notch weir, and the output from a pump-well receiving leachate from the intercept drain is monitored via a flow meter.

10.2 Water Quality Criteria

Quality of leachate is required to be monitored under the EPL, although environmental discharges are not permitted. For this reason there are no benchmark levels that must be considered under the EPL.

Historically leachate has been managed via irrigation over the existing landfill batter. As part of the current expansion of the facility a sewer connection has been established to Hunter Water Corporation (HWC) reticulated sewerage system. Discharge to the sewer is governed by the WSA limits imposed by HWC. Disposal of leachate storage is currently limited primarily by the total daily Nitrogen Ammonia loading. Due to the lack of pre-treatment the high ammonia levels mean current leachate generation is significantly outstripping disposal limits. In this regard, leachate is currently being disposed of via tankering to the Central Coast Council Toukley WWTW and the Hunter Water Edgeworth WWTW.

Pre-treatment will be provided via a planned sequence batch reactor wastewater treatment system which will facilitate suitable discharge limits in the future. The current HWC trade waste daily load limits are shown in Table 1.

Table 1

SUBSTANCE	MDM (kg/day)	CONCENTRATION LIMIT (mg/L)
Biochemical Oxygen Demand (BOD)		not to exceed 500 mg/L
Non-Filterable Residue (Suspended Solids)		not to exceed 500 mg/L
pH		not to be less than 6.5 or greater than 10
Chemical Oxygen Demand (COD)		not to exceed 1500 mg/L
Total Kjeldahl Nitrogen (TKN)		Not to exceed 500 mg/L
Nitrogen Ammonia	Not to exceed 7 kg per day	
Sulphate		Not to exceed 2000 mg/L
Zinc		not to exceed 1.5 mg/L
Copper		not to exceed 2 mg/L
Chromium		not to exceed 2 mg/L
Total Petroleum Hydrocarbons(TPH)		less than 30 mg/L
Pesticides		Prohibited
PFAS		Refer to Schedule 4

Ongoing monitoring of leachate quality will be required to satisfy HWC Trade Waste requirements.

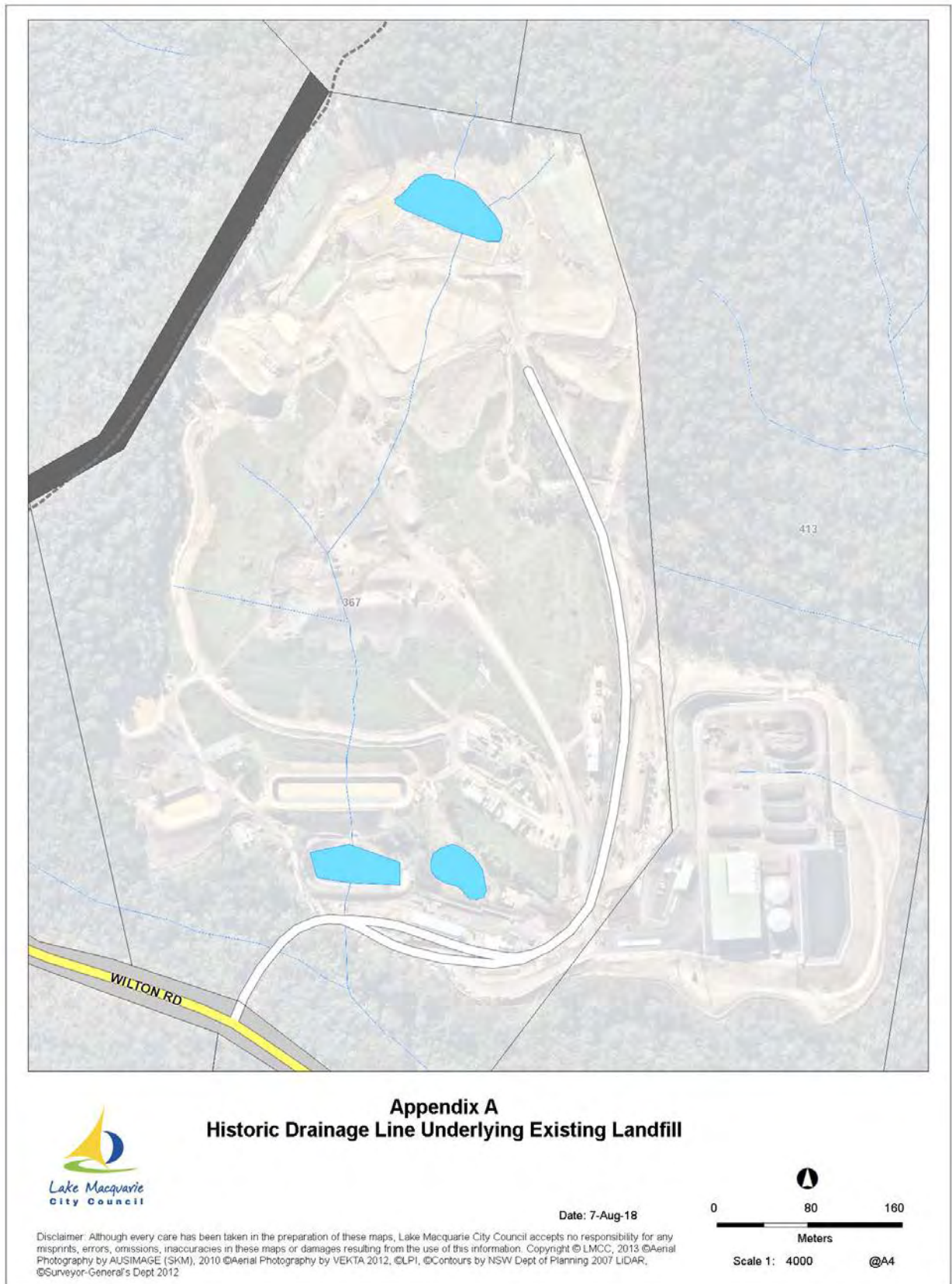
Condition M2 of the EPL specifies the analytes and testing frequency required for leachate (identified as Point 10)

11 Programme Review

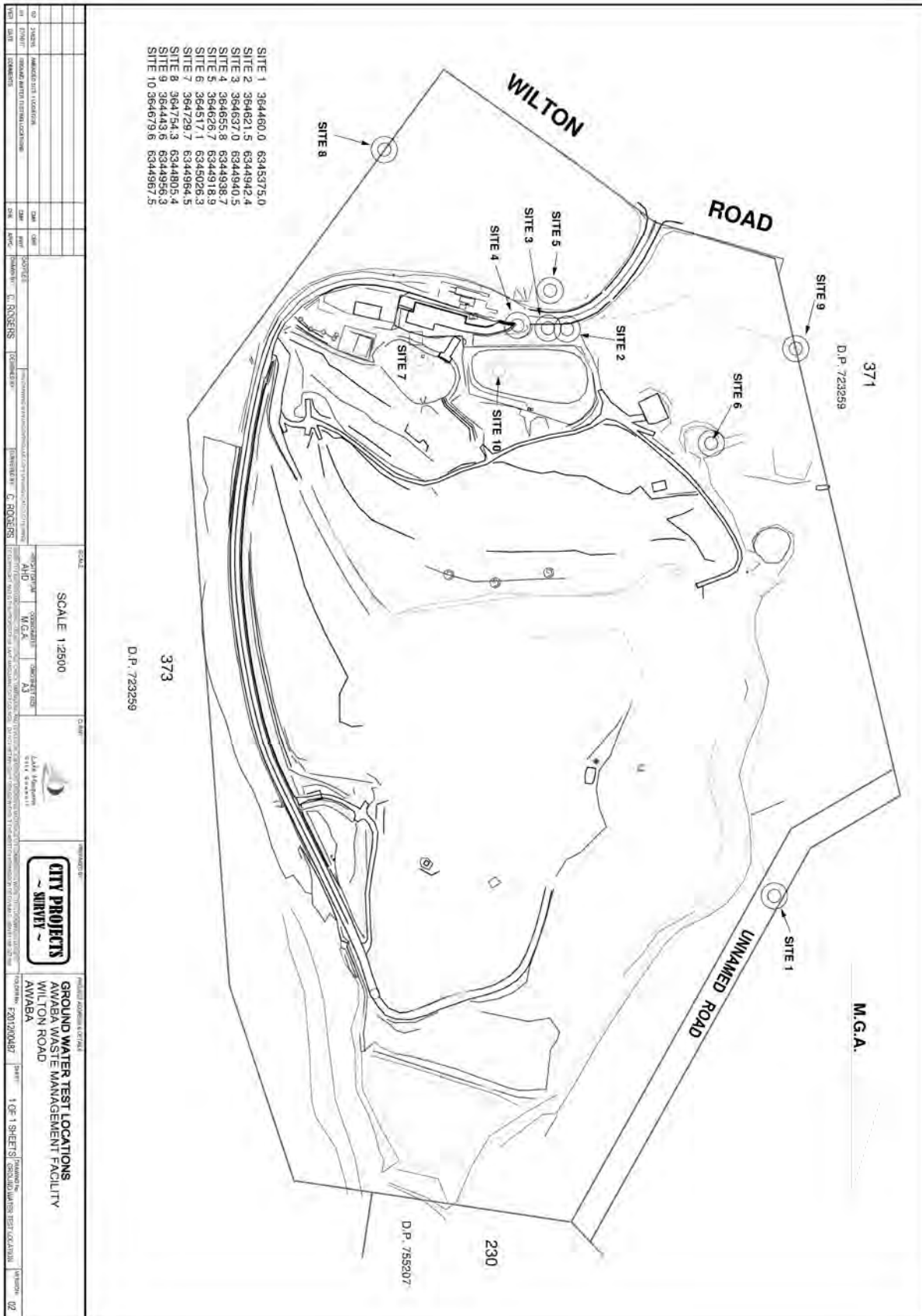
The Monitoring Programme will be subject to review at a minimum in response to the mandatory 3 yearly independent environmental audit of the AWMF, or where operational changes result in additional monitoring requirements that warrant review of the programme.

12 Appendices

12.1 Appendix A – Historic Waterways



12.2 Appendix B – EPL Sample Locations



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12.3 Appendix C – Dissolved Oxygen 100% Saturation Tables

Temperature (degrees C)	DO (mg/L)
0	14.6
1	14.2
2	13.8
3	13.4
4	13.1
5	12.8
6	12.4
7	12.1
8	11.8
9	11.6
10	11.3
11	11.0
12	10.8
13	10.5
14	10.3
15	10.1
16	9.8
17	9.6
18	9.4
19	9.3
20	9.1
21	8.9
22	8.7

Temperature (degrees C)	DO (mg/L)
23	8.6
24	8.4
25	8.2
26	8.1
27	8.0
28	7.8
29	7.7
30	7.5
31	7.4
32	7.3
33	7.2
34	7.0
35	6.9
36	6.8
37	6.7
38	6.6
39	6.5
40	6.4
41	6.3
42	6.2
43	6.1
44	6.0
45	5.9

Controlled Document Information

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Department:	Waste, Environment & Rangers		
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Related Document Information, Standards & References

Related Legislation:	(Legislation Name) Protection of Environment Operations Act 1997 Protection of the Environment Operations (General) Regulation 2009	(Relationship/Context) Regulatory framework Regulatory framework
Related Policies (Council & Internal):	(Policy Name) Awaba Waste Management Facility Surface Water, Groundwater and Leachate Response Plan	(Relationship/Context) WHS Policy
Related Procedures, Guidelines, Forms, WHS Modules/PCD's, Risk Assessments, Work Method Statements:	(Document Name) Working Near, On or Around Water - Process Control Document	(Relationship/Context)
Standards COP's & Other References	(Standard, COP or Other References) Environmental Protection Licence (EPL) No. 5873 Major Project Approval number 10_0139 issued by the NSW Department of Planning and Infrastructure. Environmental Guidelines: Solid Waste Landfills, NSW EPA, 2016 Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales, NSW EPA 2004 Erosion and Sediment Control Plan (GHD, 2014), Leachate Management Plan (GHD 2916) Surface Water Management Plan (GHD 2016) Surface Water, Groundwater and Leachate Response Plan (GHD, 2014)	(Relationship/Context)

Definitions

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Term / Abbreviation	Definition
ANZECC	Australian and New Zealand Environment and Conservation Council
AWMF	Awaba Waste Management Facility
POEO	Protection of the Environment Operations
EPL	Environmental Protection Licence
WSA	Wastewater Service Agreement
AWT	Alternative Waste Treatment
DO	Dissolved Oxygen
COD	Chemical Oxygen Demand
BOD	Biological Oxygen Demand
TSS	Total Suspended Solids
WWTW	Waste Water Treatment Works

Consultation (update for each version created)

Key Departments, Teams, Positions, Meetings:	
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Version History

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Appendix **F**
Surface Water, Groundwater & Leachate
Response Plan


	<p>Procedure</p> <p>Awaba Waste Management Facility - Surface Water, Groundwater and Leachate Response Plan</p>	
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Procedure

Purpose

The purpose of the Surface Water Groundwater and Leachate Response Plan (the Plan) is to define protocols for the investigation, notification and mitigation of any identified exceedances of trigger levels for water quality parameters.

1 Introduction

1.1 Objective

The objective of this Plan is to describe the measures that will be implemented to respond to any surface or groundwater contamination or critical pollution incidents that may result from the operation of the Awaba Waste Management Facility.

1.2 Associated Management Plans

The Surface Water, Groundwater and Leachate Response Plan should be read in conjunction with the following management plans and programs, which together with this plan form the Soil, Water and Leachate Management Plan:

- Awaba Waste Management Facility Erosion and Sediment Control Plan, GHD July 2014
- Awaba Waste Management Facility Surface Water Management Plan, GHD February 2016
- Awaba Waste Management Facility Leachate Management Plan, GHD February 2016
- Awaba Waste Management Facility - Surface Water, Ground Water and Leachate Monitoring Programme, LMCC September 2018

2 Response Protocols and Hierarchy

Where a pollution incident occurs, or an exceedance of trigger values set out in the Surface Water, Groundwater and Leachate Monitoring Programme is identified, the response should be guided by the following framework:

2.1 Control

Where possible immediate action should be taken to prevent any ongoing uncontrolled release of pollutants.

Actions may include:

- isolation via switches or control valves
- repair of damaged equipment or infrastructure
- diversion or interception of pollutants using earth bunds, ditches or subsurface drainage
- treatment and/or disposal of captured contaminated water

2.2 Mitigation

When pollutants leave the site, consideration should be given to any practical measures that may be available to minimise further downstream environmental impact.

Measures available may include:

- temporary soil bunding to slow movement of pollutants downstream
- pumping-out contaminated water to treatment system or tanker
- deployment of booms or sediment control devices in receiving waterways

Consideration should be given to potential impacts of mitigation works to ensure further environmental harm is not caused.

2.3 Reporting and Incident Notification

2.3.1 Environmental Protection Licence Requirements

Reporting obligations are outlined in the Awaba Waste Management Facility - Surface Water, Ground Water and Leachate Monitoring Programme, and the Environmental Protection Licence (EPL) with regard to testing pollutant types and threshold limits.

Reporting is required under Part 6 of the EPL in the form of an Annual Return to the NSW EPA.

In addition to routine reporting, condition R2.4 of the EPL also requires Council to notify the Environment Line on 131 555 whenever leachate is discharged to surface water from the site. In these circumstances, telephone notification must be followed up with a written report to the EPA, which includes the following information:

- a. the volume of the leachate discharged and over what time period the discharge occurred
- b. the date and time of the commencement of the overflow
- c. the weather conditions at the time of the discharge, specifying the amount of rainfall on a daily basis
- d. that had fallen
- e. on the day(s) of the discharge; and
- f. for the one week period prior to the discharge.
- g. the most recent monitoring results of the chemical composition of the leachate
- h. an explanation as to why the discharge occurred
- i. the location(s) of the discharge
- j. a plan of action to prevent a similar discharge in the future; and
- k. was the discharge permitted by this licence.

2.3.2 Pollution Incident Notification

2.3.2.1 What Must be Notified

Where an incident occurs which causes or threatens material harm to the environment, section 5.7 of the Protection of the Environment Operations (POEO) Act imposes a duty to immediately notify pollution incidents. The Act defines harm to the environment as "material harm" if:

- i. it involves actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial, or
- ii. it results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding \$10,000 (or such other amount as is prescribed by the regulations)

Loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment.

Examples where harm may be caused include:

- Oxygen depletion of waterways caused by high BOD/COD in leachate
- Toxic effects on flora and fauna resulting from spillage of toxic liquid chemicals
- Eutrophication of waterways due to high nitrogen & phosphorus in leachate or sediment laden surface water

2.3.2.2 Who Must Notify

Under the POEO Act, the Council has a duty to notify a pollution incident occurring in the course of an activity that causes or threatens material harm to the environment:

If the incident was caused by a contractor on the site, as the occupier of the premises where the incident occurred Council will still be required to report the incident.

The person carrying out the activity may provide notification, however advice should be sought from the Environmental Officer, and consultation should be undertaken with the Waste Group Coordinator - Waste Operations or the Manager of Waste Environment and Rangers where practical.

2.3.2.3 When to Notify

The POEO Act requires that notification must be given immediately, i.e. promptly and without delay, after the person becomes aware of the incident.

2.3.2.4 Who to Notify:

In the event of a reportable incident, Council will notify the following:

- In the first instance, emergency services should be called (000) if the incident presents an immediate threat to human health or property.
- NSW EPA - 131 555
- NSW Health - 4924 6477
- SafeWork NSW - 13 10 50
- Fire and Rescue NSW 1300 729 579 (do not call again if 000 was called)
- Occupiers of potentially impacted neighbouring premises

If an incident occurs, which presents a threat to health and safety of the public the Hazmat Unit of the NSW Fire Brigade should be contacted immediately.

Hazardous Materials Response Unit - Central Coast

8 Craftsman Avenue, Berkeley Vale NSW 2261

Tel: 02 4389 2194

Hazardous Material Response Unit - Hunter

44 Union Street, Cooks Hill NSW 2300

Tel: 02 4927 2535

If Hazmat cannot be contacted on the above numbers, the call should be made to the 000 emergency number and request attendance by the fire brigade.

2.4 Investigation

An internal investigation will be carried out after any trigger level exceedance or notifiable incident.

The investigation should be carried out by the Environmental Officer in conjunction with the Waste Site Supervisor and in consultation with the Waste Group Coordinator.

Council will engage an external consultant where it is identified that internal staff do not possess necessary expertise to undertake a thorough investigation.

2.5 Review

Following completion of the internal investigation, an operational review will be conducted.

The purpose of the review will be to identify the cause of the trigger level exceedance or notifiable incident, and to assess the potential for a re-occurrence.

Consideration will be given to:

- the adequacy of monitoring measures outlined in the Surface Water, Ground Water and Leachate Monitoring Programme
- the efficacy of response protocols outlined in this plan
- preventative actions that can be practically taken to reduce likelihood of further pollution incidents or trigger level exceedances of a similar nature.

The occurrence of a notifiable pollution incident will require the review of any relevant plans or programmes included in the Soil, Water and Leachate Management Plan.

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Officer:	Principal Environmental Officer - Public Health - Andrew Ireland		
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Authorisation:			

Related Document Information, Standards & References

Related Legislation:	(Legislation Name) Protection of Environment Operations Act 1997	(Relationship/Context)
Related Policies (Council & Internal):	(Policy Name) Aw aba Waste Management Facility - Surface Water, Ground Water and Leachate Monitoring Programme	(Relationship/Context)
Related Procedures, Guidelines, Forms, WHS Modules/PCD's, Risk Assessments, Work Method Statements:	(Document Name) Working Near, On or Around Water - Process Control Document	(Relationship/Context)
Standards COP's & Other References	(Standard, COP or Other References) Environmental Protection Licence (EPL) No. 5873 Major Project Approval number 10_0139 issued by the NSW Department of Planning and Infrastructure Erosion and Sediment Control Plan (GHD, 2014), Leachate Management Plan (GHD 2916) Surface Water Management Plan (GHD 2016) Surface Water, Groundwater and Leachate Response Plan (GHD, 2014)	(Relationship/Context)

Definitions

Term / Abbreviation	Definition
AWMF	Aw aba Waste Management Facility
COD	Chemical Oxygen Demand
BOD	Biological Oxygen Demand
POEO	Protection of the Environment Operations
EPL	Environmental Protection Licence
Eutrophication	elevated levels of nutrients in a body of water, which causes excessive growth of aquatic plant life

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Key Departments, Teams, Positions, Meetings:	
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Version History

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Appendix F – Awaba Waste Pollution Incident & Emergency Response Plan

	<p>Emergency Response Plan</p> <p>Awaba Waste Management Facility - Pollution Incident & Emergency Response Management Plan</p>	
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EMERGENCY RESPONSE PLAN FOR:

Site name: Awaba Waste Management Facility

Street: 367 Wilton Road

Suburb: Awaba, NSW 2283

Site Emergency Contact: Steve Merrett – Waste Site Supervisor

Phone: 02 4921 0794

AH Phone: 0408 485 407

1 Evacuation Procedure

1.1 Emergency Contacts for the Awaba Waste Management Facility

The Emergency Warden is to contact the following people as required, if not on site at the time of the incident, so that the mobilisation of emergency site staff and equipment can commence.

Name	Position	Day time contact No.	Mobile No.
Steven Merrett	Waste Site Supervisor Emergency Warden (1 st) First Aid Officer	02 4921 0794	0408 485 407
Arthur Berends	Waste Site Leading Hand Emergency Warden (2 nd)	02 4921 0778	0418 606 672
Bay Hornery	Environmental Officer	02 4921 0683	0436 805 215
Tony Wilcox	Plant Operator	02 4921 0778	0411 523 257
Neil Rae	Waste Site Attendant	02 4921 0778	0418 607 182
Timothy Veitch	Waste Site Attendant	02 4921 0778	0422 738 618
Jason Martin	Waste Site Attendant	02 4921 0778	0406 757 842
Robert Horsey	Waste Site Attendant	02 4921 0778	0413 493 501
Justin Conaghan	Plant Operator	02 4921 0778	0412 823 575
Andrew Vile	Temporary Waste Site Attendant	02 4921 0778	0423 698 450
LMS Energy Nathan McClelland	Landfill Gas Extraction Contractor	Use mobile only	0417 401 500
Remondis	Greenwaste Processing Contractor	Gunther Neumann Andrew Yeomans	0408 167 538 0419 895 402
Paul Collins	Manager Waste Services	02 4921 0545	0436 935 440
David Brake	Group Coordinator Waste Operations	02 4921 0094	0407 404 794
LMCC	Incident Hotline	02 49210650	

1.2 Emergency Department Contacts

The Emergency Warden is to contact the following, as appropriate, if the incident represents an immediate threat to human health or property

NSW Police	000 (112 from mobile)
NSW Fire & Rescue	000 (112 from mobile)
NSW Ambulance	000 (112 from mobile)
NSW Rural Fire Service	1800 679 737
Mine Subsidence Board Lake Macquarie & Newcastle	02 49084300
State Emergency Services (SES)	132500 Mob 0418 800 700

If Emergency Services are to be notified, the Waste Site Supervisor/Emergency Warden will use the following format when notifying.

- 1) Location – Awaba Waste Management Facility
367 Wilton Road
AWABA NSW 2283
- 2) Type of emergency
- 3) Any casualties
- 4) Assistance required
- 5) Hazards
- 6) Telephone contact number - 49 210 778 Mobile - 0408 485 407 (Steve Merrett)
- 0418 606 672 (Arthur Berends)
- 7) Name - Steve Merrett
Arthur Berends

If the incident does not require an initial emergency response agency or once the 000 call is made, then the Emergency Warden will notify the relevant authorities in the following order if the incident represents potential harm to the environment.

Environmental Protection Authority	131 555
Ministry of Health (Local Health Unit)	49246477
Safe Work NSW	131050
Lake Macquarie City Council Incident Hotline	49 210 650
Lake Macquarie City Council Customer Service Centre	49 210 333
Legislation stipulates that NSW Fire and Rescue shall be notified of an emergency incident, even if their services are not required at the time.	02 9469 3111 Or general enquiries number 02 265 2999

1.3 Purpose

This Pollution Incident & Emergency Response Plan sets out the Awaba Waste Management Facility's response to a potential pollution incident and/or emergency situation at the site and;

1. To control or limit any effect that a pollution incident or emergency may have on or off site.
2. To facilitate emergency response and to provide such assistance on site as is appropriate to the situation.
3. To ensure that all vital information is communicated to relevant and external authorities as soon as possible. This may also include all owners and occupiers of premises (including private residences) near the Awaba Waste Management Facility.

The notification to local residents however will only be done after consultation between the Emergency Warden and the Manager Waste Services.

4. To facilitate the reorganisation and recovery operations so that normal operations can be resumed as soon as practicable.
5. To provide relevant emergency training so that a high level of emergency preparedness can be continually maintained.
6. To provide a basis for the revision of pollution and emergency procedures.
7. To comply with the requirements introduced by the Protection of the Environment Legislation Amendment Act 2014 (POELA Act).

1.4 Site Description

2. The Awaba Waste Management Facility is a Licenced (Environment Protection Licence No 5873) General Solid Waste Landfill (putrescible / non-putrescible) under the Protection of the Environment Operations Act.
3. A General Solid Waste Landfill is licenced to accept all inert wastes including stabilised asbestos cement and physically, chemically or biological fixed, treated or processed waste in accordance with any special requirements that may be set by the EPA.
4. The Awaba Waste Management Facility is NOT licenced to accepted hazardous waste.
5. Hazardous waste is described as any waste which, through toxicity, carcinogenicity, mutagenicity, teratogenicity, flammability, explosivity, chemical reactivity, corrosivity, infectiousness or other biologically damaging properties, which may present danger to the life or health of living organisms when released into the environment.
6. The Awaba Waste Management Facility has on site 2 leachate dams containing approximately 11 mega litres of leachate. See Definitions.
7. An aerial photo of the Awaba Waste Management Facility indicating major site features is attached as Appendix A.
8. Appendix A also indicates the emergency evacuation point at the western side of the sewer pump station and at the front gate. The emergency evacuation point is also sign posted in the field.
9. The Emergency Warden may change the location of the designated emergency evacuation point if it is not suitable due to the particular emergency at hand, and to suit site operations and any current construction activity.

In the event of a pollution incident or emergency, the first consideration is the safety of staff, contractors, and general public.

Following this, the next consideration is the minimisation of potential damage to the environment, surrounding community and infrastructure.

1.5 Identifying Emergency Situation

- Emergency situations are often identified through the presence of abnormal occurrences for example smoke, gas leak, uncontrolled fire, finding a suspicious object, threats that may result in damage to property or harm to personnel etc.

1.6 Alerting Warden

- Employees are made familiar with the Emergency Warden at Department Induction and as such are able to contact the warden in person, by telephone, or by two-way radio as appropriate.
- On identifying a potential emergency, advise the Warden and keep other personnel away from immediate area.

1.7 Immediate Warden Response

- The Warden will assess the situation and take immediate action to isolate personnel, customers and contractors from the hazard without risking harm to themselves, and contain the spread of the hazard (if possible).
- To keep people in the surrounding area safe, the Warden will directly, or with assistance of another worker, warn workers, customers and contractors in the immediate area of the danger.
- The Warden will determine any further Emergency Response that may be required.
- Warden advises site staff via two-way and have them standby.
- Where the danger can be controlled initially without a full evacuation the following are examples of immediate response actions that may be taken:
 - Spill – isolate the immediate area with barriers or by closing off impacted sections of the building or grounds then arrange for a clean-up.
 - Civil disorder – Through existing building security measures, ensure staff stay in a safe, secure place while Police are contacted to attend to the instigators.
 - Biological threat – contain the threat by sealing it in a room and turning off the air conditioning to prevent further contamination and seek advice from Police.

Where a full evacuation is required coordinate the evacuation in accordance with section 1.8 (below) of this document.

1.8 Coordinating Evacuation

- Warden advises staff of the nature and location of the emergency via portable 2-way radio.
- Warden contacts the appropriate Emergency Service (Police, Fire Brigade etc) by dialling 0 to obtain dial tone then 000, or dialling 112 on mobile. Once Emergency Services have arrived on site, they will become the Incident Controller.
- Warden checks egress paths to ensure safe passage for evacuation.
- Warden checks all areas to ensure all staff, customers and contractors have been evacuated safely and are accounted for.
- Staff, contractors and customers proceed in a safe manner, directly to the emergency evacuation point.

1.9 Providing First Aid

- The first aid officer collects first aid kit, and takes to the Emergency Evacuation Point. The First Aid officer attends to any casualties as required.
- The general First Aid response procedures are described in Clause 2.6 of the **First Aid – Process Control Document**

1.10 Controlling traffic

Traffic Controllers will as a minimum possess the RTA issued Traffic Control for Non-Construction Worksites ticket.

- The Warden at the Emergency Evacuation Point assigns the role of Site Traffic Controller to a suitably skilled staff member for the Wilton Road entrance.
- Site Traffic Controllers prevent vehicles from entering the Site and ensure unimpeded access for Emergency Services vehicles.

1.11 Communicating with Wardens, Incident Controller and Emergency Control Organisation.

- In most cases, with the exception of Bomb Threats, communication will be through the use of portable 2-way radios.
- If a Bomb Threat is made, no telephone use is permitted and communication will be conducted using 'runners' to physically relay messages.
- On arrival of Emergency Services, the Warden briefs the Incident Controller on the nature and extent of the emergency.

1.12 Accounting for people

- Staff, contractors and Visitors assemble at emergency evacuation point and advise Warden of the names of any persons known to be absent and still on site.
- Warden determines appropriate action for any unaccounted persons and subject to nature of emergency.

1.13 Liaising with Emergency Services

- On arrival of Emergency Services, the Warden briefs the Incident Controller on the nature and extent of the emergency.
- Incident Controller then takes control of the site.

1.14 Assessing that the site safe to reoccupy following the emergency.

- Incident Controller advises Warden when safe for personnel, customers and contractors to return to the workplace.
- Warden advises that it is safe to return to workplace.

2 Emergency Equipment / Resources

Description	Number on site	Locations
Traxcavators	2	Landfilling area
Landfill Compactor	1	Landfilling area
Alternate Daily Cover Vehicle / Water Cart	1	Various
Steel Drum Roller	1	Landfilling area
Gas Monitor	1	Administration Building
Flexi Drive Pumps	3	Various
Diesel Pumps	3	Various
2 Tonne Tipper	1	Various
4 Wheel Drive dual cab utility	1	Various
Portable handheld radios	3	Administration Building
Base Station Radio	1	Administration Building
Fire Extinguishers	20	8 - Administration Building 2 - Weighbridge 5 - Reuse Centre 5 - Transfer Station
Fire Hose Reels	2	Reuse Centre
Wash Down Hose Reels	8	1 - Reuse Centre 7 - Transfer Station (rain water)
Fire Blankets	3	2 - Administration Building 1 - Transfer Station
Eyewash Stations	6	1 - Reuse Centre 1 - Sewer Pump Station 4 - Transfer Station
Avant 750 Loader	1	Various
Hook Lift Trucks	2	Various
Transfer Station Hook Lift Bins	7	Transfer Station
Dirt Hook Lift Bins	2	Various
Subaru Outback Wagon	1	Various

3 Facility / Site Hazards and Emergency Response Procedures

Types of pollution incidents or emergencies that could arise at the Awaba Waste Management Facility include:

- a) Fire
- b) Explosion
- c) Gas leak
- d) Leachate dam failure
- e) Natural disaster events e.g. earthquake
- f) Hazardous waste
- g) Mine subsidence
- h) Bomb threat
- i) Robbery
- j) Odour complaint

The likelihood of some of the above incidents / emergencies occurring is remote due to compliance with the Environment Protection Licence (EPL) conditions imposed by the EPA on the Awaba Waste Management Facility (Environment Protection Licence No. 5873).

In the rare occurrence of an event occurring the following actions will be carried out by the Waste Site Supervisor/Emergency Warden.

All staff on site have been issued with / have available, the appropriate personal protective equipment and will wear such equipment as required and if requested by the Emergency Warden during an emergency.

Refer to Appendix D for the Safety Environmental and Quality Risk Assessment

Refer to Appendix E for the Inventory of Potential Pollutants

3.1 Emergency Procedures - Fire

The Emergency Warden will decide on the appropriate response subject to the location and severity of the fire, including the following.

- The Emergency Warden will decide on the appropriate response subject to the location and severity of the fire, including the following.
- Main gate will have traffic flow monitored by a staff member, so that no new vehicles with waste enter the site. Radio contact to be arranged.
- First Aid Officer to administer first aid as required.
- Emergency Warden to contact the NSW Ambulance for assistance if required.
- Public and contractors on site advised to leave site as quickly as possible via the weighbridge if it is safe to do so.
- Emergency Warden to decide whether or not customers are to weigh out and complete transactions, based upon the location and severity of the fire and the number of customers on site. If decided not to complete transactions, customers will receive free tipping and waste tonnages based on vehicle type adopted for waste reporting purposes.

- Weighbridge operator to advise Emergency Warden that all public and contractors have vacated site.
- Weighbridge closed and made secure.
- If deemed by the Emergency Warden or under their own perception of risk, staff will congregate at the Emergency Evacuation point.
- Emergency Warden to organise on site staff and equipment as required to respond.
- Onsite plant available to respond to a fire is listed in Section 2.0 Emergency Equipment / Resources.
- If safe, waste, which is on fire, will be continually sprayed with water whilst the traxcavator and compactor are used to uncover waste to enable centre of fire to be exposed and extinguished.
- If required the Emergency Warden will contact the Rural Fire Service for assistance in containing / extinguishing the fire. (1800 679 737)
- In the event of major change to the facility the Rural Fire Service and NSW Fire and Rescue shall be invited onsite to familiarise themselves with the location of dams and static water supply; and review access throughout the facility.
- Staff with Breathing Apparatus training shall have the training renewed as per the recommendations of the Breathing Apparatus set manufacturer or supplier.
- The Emergency Warden will discuss with the Manager Waste Services if there is a need to notify any other relevant authorities and local residents of the fire.
- The Emergency Warden will notify the Customer Service Centre to advise that the site may be closed and that customers will have to use an alternative landfill.
- The Emergency Warden will report the incident to Council's Incident Hotline (Ph 4921 0650)
- The Emergency Warden in consultation with the relevant authorities will declare the site safe for normal operations.
- Staff shall be made aware of the Bushfire Evacuation Plan for the site.

3.2 Emergency Procedures - Explosion

The Emergency Warden will decide on the appropriate response subject to the location and severity of the explosion.

The risk of an explosion onsite is considered very low, however if it does occur, the following will be implemented as deemed necessary by the Emergency Warden:

- Main gate closed immediately to public, and staff member stationed at the gate to advise public of situation. Radio contact to be arranged.
- First Aid Officer to administer first aid as required.
- Emergency Warden to contact the NSW Ambulance for assistance if required.
- Public and contractors on site advised to leave the site as quickly as possible via the weighbridge.
- Emergency Warden to decide whether or not customers are to weigh out and complete transactions, based upon the location and severity of the explosion and the number of

customers on site. If decided not to complete transactions, customers will receive free tipping and waste tonnages based on vehicle type adopted for waste reporting purposes.

- Weighbridge operator to advise Emergency Warden that all public have vacated site.
- Weighbridge closed and made secure.
- If deemed by the Emergency Warden, staff will be instructed to congregate at the Emergency Evacuation point.
- The Emergency Warden will notify the Customer Service Centre to advise that the site may be closed and that customers will have to use an alternative landfill
- The Emergency Warden will contact the relevant emergency services if required.
- The Emergency Warden will report the incident to Council's Incident Hotline (Ph 4921 0650)
- The Emergency Warden in consultation with the relevant authorities will declare the site safe for normal operations

3.3 Emergency Procedures - Gas leak

The Emergency Warden will decide on the appropriate response subject to the location and severity of the gas leak: including the following:

- Main gate closed immediately to public, and staff member stationed at the gate to advise public of situation. Radio contact to be arranged.
- First Aid Officer to administer first aid as required.
- Emergency Warden to contact the NSW Ambulance for assistance if required.
- Public and contractors on site advised to leave site as quickly as possible via the weighbridge.
- Emergency Warden to decide whether or not customers are to weigh out and complete transactions, based upon the location and severity of the gas leak and the number of customers on site. If decided not to complete transactions, customers will receive free tipping and waste tonnages based on vehicle type adopted for waste reporting purposes.
- Weighbridge operator to advise Emergency Warden that all public have vacated site.
- Weighbridge closed and made secure.
- If deemed by the Emergency Warden, staff will be instructed to congregate at the Emergency Evacuation point.
- Source of gas leak located if possible.
- If gas leak is determined to be part of the gas extraction system then the Emergency Warden is to contact LMS (Landfill Management Services).
- If gas leak is determined not to be part of the gas extraction system then the Emergency Warden is to arrange for the gas leak to be capped with landfill cover material.
- The Emergency Warden will notify the Customer Service Centre to advise that the site may be closed and that customers will have to use an alternative landfill
- The Emergency Warden will contact the relevant emergency services if required.
- The Emergency Warden will report the incident to Council's Incident Hotline (Ph 4921 0650)

- The Emergency Warden in consultation with relevant authorities will declare the site safe for normal operations

3.4 Emergency Procedures - Leachate dam failure

The Emergency Warden will decide on the appropriate response subject to the location and amount of leachate escape.

An Environmental Inspection checklist is completed by the Waste Site Environmental Officer on a 3-month cycle. A record of the Environmental Inspection is filed on Trim Folder F2012/00487.

The Environmental Inspection identifies any potential environmental hazards that could impact upon the Awaba Waste Management Facility and surrounding environment. This then allows the Waste Sites Supervisor to put in place corrective actions to control the risk of an environmental incident.

Inspections are carried out by the Waste Site Supervisor to ensure that surface water drains are free of sediment build up as well as twice-yearly maintenance of surface water drains to reduce the risk of storm water entering the leachate collection system and dams. All inspections are noted in the Waste Site Supervisor's Daily Diary.

Leachate level of the lower leachate dam is monitored by the Waste Sites Supervisor, when required leachate is pumped to the top temporary leachate storage dam to help prevent an uncontrolled overflow.

The main reason for failure of a leachate dam would be overflow due to exceptionally heavy rainfall.

If a leachate dam wall fails, the following will be undertaken as deemed necessary by the Emergency Warden:

- The Emergency Warden will organise on site plant to build bunds as quickly as possible to stop or reduce the flow of leachate from leaving the site by natural watercourses and / or drainage lines.
- The Emergency Warden will contact the relevant emergency services if required.
- If deemed appropriate, the Emergency Warden will order the closure of the site.
- Main gate closed immediately to public and staff member stationed at the gate to advise public of situation. Radio contact to be arranged.
- Public and contractors on site advised to leave site as quickly as possible via the weighbridge.
- Emergency Warden to decide whether or not customers are to weigh out and complete transactions, based upon the location and severity of the dam failure and the number of customers on site. If decided not to complete transactions, customers will receive free tipping and waste tonnages based on vehicle type adopted for waste reporting purposes.
- Weighbridge operator to advise Emergency Warden that all public have vacated site.
- Weighbridge closed and made secure.
- If deemed by the Emergency Warden, staff will be instructed to congregate at the Emergency Evacuation point.
- The Emergency Warden will notify the Customer Service Centre to advise that the site may be closed and that customers will have to use an alternative landfill
- The Emergency Warden will contact the relevant emergency services if required.
- The Emergency Warden will report the incident to Council's Incident Hotline (Ph 4921 0650)

- The Emergency Warden will in consultation with relevant authorities declare the site safe for normal operations

3.5 Emergency Procedures - Natural disaster event e.g. earthquake

The Emergency Warden will decide on the appropriate response subject to the severity of the earthquake and subsequent damage, including the following.

- Main gate closed immediately to public, and staff member stationed at the gate to advise public of situation. Radio contact to be arranged.
- First Aid Officer to administer first aid as required.
- Emergency Warden to contact the NSW Ambulance for assistance if required.
- Public and contractors on site advised to leave the site as quickly as possible via the weighbridge.
- Emergency Warden to decide whether or not customers are to weigh out and complete transactions, based upon the location and severity of the natural event and the number of customers on site. If decided not to complete transactions, customers will receive free tipping and waste tonnages based on vehicle type adopted for waste reporting purposes.
- Weighbridge operator to advise Emergency Warden that all public have vacated site.
- Weighbridge closed and made secure.
- If deemed by the Emergency Warden, staff will be instructed to congregate at the Emergency Evacuation point.
- The Emergency Warden will notify the Customer Service Centre to advise that the site may be closed and that customers will have to use an alternative landfill
- The Emergency Warden will contact the relevant emergency services if required.
- The Emergency Warden will report the incident to Council's Incident Hotline (Ph 4921 0650)
- The Emergency Warden in consultation with the relevant authorities, declare the site safe for normal operations.

3.6 Emergency Procedures - Hazardous waste

The Emergency Warden will decide on the appropriate response subject to the type and quantity of hazardous waste and may include the following:

- Depending upon the nature of the hazardous waste discovered on site, then the general public and contractors could be required to be removed from the site.
- Main gate closed immediately to public, and staff member stationed at the gate to advise public of situation. Radio contact to be arranged.
- First Aid Officer to administer first aid as required.
- Emergency Warden to contact the NSW Ambulance for assistance if required.
- Public and contractors on site advised to leave the site as quickly as possible via the weighbridge.

- Emergency Warden to decide whether or not customers are to weigh out and complete transactions, based upon the location and severity of the hazardous waste and the number of customers on site. If decided not to complete transactions, customers will receive free tipping and waste tonnages based on vehicle type adopted for waste reporting purposes.
- Weighbridge operator to advise Emergency Warden that all public have vacated site.
- Weighbridge closed and made secure.
- The Emergency Warden will notify the Customer Service Centre to advise that the site may be closed and that customers will have to use an alternative landfill
- The Emergency Warden will contact the relevant emergency services if required.
- If deemed by the Emergency Warden, staff will be instructed to congregate at the Emergency Evacuation point.
- All Awaba Waste Management Facility staff to wear personal protective equipment appropriate to manage the hazardous substance.
- The hazardous substance is to be appropriately identified and disposed of by Council or others.
- The Emergency Warden will report the incident to Council's Incident Hotline (Ph 4921 0650)
- The site will be kept closed until advised by emergency services or the Emergency Warden that it is safe to reopen.

3.7 Emergency Procedures - Mine subsidence

The Emergency Warden will decide on the appropriate response subject to the location and degree of mine subsidence including the following:

- Main gate closed immediately to public, and staff member stationed at the gate to advise public of situation. Radio contact to be arranged.
- First Aid Officer to administer first aid as required.
- Emergency Warden to contact the NSW Ambulance for assistance if required.
- Public and contractors on site advised to leave the site as quickly as possible via the weighbridge.
- Emergency Warden to decide whether or not customers are to weigh out and complete transactions, based upon the location and severity of the mine subsidence and the number of customers on site. If decided not to complete transactions, customers will receive free tipping and waste tonnages based on vehicle type adopted for waste reporting purposes.
- Weighbridge operator to advise Emergency Warden that all public have vacated site.
- Weighbridge closed and made secure.
- The Emergency Warden will notify the Customer Service Centre to advise that the site may be closed and that customers will have to use an alternative landfill
- The Emergency Warden will contact the relevant emergency services if required.
- If deemed by the Emergency Warden, staff will be instructed to congregate at the Emergency Evacuation point.
- If mine subsidence is minor and in an isolated area, The Waste Sites Coordinator will arrange for the area concerned to be barricaded off, staff and contractors notified, and public access to the area restricted.

- The Emergency Warden in consultation with the relevant authorities declare the site safe for normal operations.

3.8 Emergency Procedures - Bomb Threat

- The person receiving the bomb threat phone call is to follow the “Bomb Threat Checklist” as contained in the Emergency Response Guide located within the Gatehouse and attached as Appendix B.
- The Emergency Warden will report the bomb threat to the Police, and in consultation with the Police decide on the appropriate response, subject to the perceived authenticity of the bomb threat.
- If agreed to be necessary the staff, general public and contractors could be required to be removed from the site.
- Main gate closed immediately to public, and staff member stationed at the gate to advise public of situation. Radio contact to be arranged.
- Staff, public and contractors on site advised to leave the site as quickly as possible via the weighbridge.
- Emergency Warden to decide whether or not customers are to weigh out and complete transactions, based upon the location and severity of the bomb threat and the number of customers on site. If decided not to complete transactions, customers will receive free tipping and waste tonnages based on vehicle type adopted for waste reporting purposes.
- Weighbridge operator to advise Emergency Warden that all staff, public and contractors have vacated site.
- Weighbridge closed and made secure.
- The Emergency Warden will notify the Customer Service Centre to advise that the site may be closed and that customers will have to use an alternative landfill
- The Emergency Warden will contact the relevant emergency services if required.
- If deemed by the Emergency Warden, staff will be instructed to congregate at the Emergency Evacuation point.
- The Emergency Warden will comply with directions provided by the Police in responding to the bomb threat.
- The Emergency Warden will report the incident to Council’s Incident Hotline (Ph 4921 0650)
- The site will be kept closed until advised by emergency services or the Emergency Warden that it is safe to reopen.

3.9 Emergency Procedures - Robbery

- The person threatened to be robbed is to cooperate with the robbers. Staff are not to contest the robbers or resist being robbed.
- The Emergency Warden will report the robbery to the Police, and in consultation with the Police decide on the appropriate response, subject to the nature of the robbery.
- If agreed to be necessary the staff, general public and contractors could be required to be removed from the site.

- Main gate closed immediately to public, and staff member stationed at the gate to advise public of situation. Radio contact to be arranged.
- Staff, public and contractors on site advised to leave the site as quickly as possible via the weighbridge.
- Emergency Warden to decide whether or not customers are to weigh out and complete transactions, based upon the nature of the robbery and the number of customers on site. If decided not to complete transactions, customers will receive free tipping and waste tonnages based on vehicle type adopted for waste reporting purposes.
- Weighbridge operator to advise Emergency Warden that all staff, public and contractors have vacated site.
- Weighbridge closed and made secure.
- The Emergency Warden will notify the Customer Service Centre to advise that the site may be closed and that customers will have to use an alternative landfill
- The Emergency Warden will contact the relevant emergency services if required.
- If deemed by the Emergency Warden, staff will be instructed to congregate at the Emergency Evacuation point.
- The Emergency Warden will cooperate and be directed by the Police in responding to the robbery.
- The Emergency Warden will report the incident to Council's Incident Hotline (Ph 4921 0650)
- The site will be kept closed until advised by emergency services or the Emergency Warden that it is safe to reopen.
- All relevant staff are to undergo the Armed Holdup training that is conducted by Lake Macquarie City Council.

3.10 Odour Management Strategy

On occasions odour complaints are received which are perceived to be generated from the waste site operations. Odour complaints are managed in accordance with the following procedure:

- Odour complaint received by Council's Customer Service Centre (CSC).
- CSC officer notify the Awaba Waste Management Environmental Officer by phone ASAP of the odour complaint.
- CSC officer create a Service Request (SR) logging the details of the odour complaint.
- The AWMF Environmental officer visits the customer ASAP and completes an "Awaba Landfill Odour Incident Report" (Appendix C) with the aim of identifying the source of odour. E.g. AWMF or Remondis ORRF operations, or other origin.
- Appropriate actions be implemented subject to the outcome of the Odour Incident Report.
- The Odour Incident Report is filed on Council's records system
- The SR is closed referencing the Odour Incident Report and actions taken.

4 Emergency Drills, Training and Review

The AWMF is open to the public 364 days per year, additionally the emergency warden and staff are continuously engaged in maintaining compliance with day-to-day EPA licensing tasks. Subsequently, it is impractical to undertake evacuation drills without significant community and operational disruption.

In lieu of undertaking practical exercises or drills and to ensure that all staff are aware of their roles whenever a pollution incident / emergency situation occurs, a desk top simulation will be undertaken at least every 12 months.

This Procedure will be provided to, and discussed with the Awaba Waste Management Facility staff at periodic team meetings. Staff roles and responsibilities will be discussed, reviewed, and if necessary, this procedure amended.

The results of the desktop audits and the minutes of these meetings will be recorded and Trimmed in folder F2012/00487.

Each year the folder number will reflect the current year e.g. F2012/00487-06 (2017), F2012/00487-07 (2018).

Specialised training in emergency response that would be appropriate for the staff at the Awaba Waste Management Facility will continually be sourced and if appropriate staff will attend.

This Pollution Incident & Emergency Response Management Plan will be reviewed every 12 months as per EPA requirements or one month following any pollution/emergency incident.

A copy of this plan will be uploaded to the Lake Macquarie City Council's website.

A hard copy of the current version of this plan will be kept onsite in the Administration Building.

A hard copy of the current versions of the LMS Emergency Response Management Plan, and the Remondis Pollution Incident Response Management Plan will also be kept onsite in the Administration Building.

5 Post Emergency / Evacuation Debrief

A Post Emergency / Evacuation Debrief meeting will be initiated by the Emergency Warden as soon as practical following an incident that activates this Pollution Incident and Emergency Response Plan. Debrief meeting outcomes are recorded in accordance with **WHS Module 10 – Records**. Any opportunities for improvement or non-conformances shall be logged as HINC's in accordance with **WHS Module 06 – Risk Management**.

WHS Management System Information

Record Keeping Requirements

Records associated with, and generated in compliance with this document include:-

- Minutes of the Awaba Waste Management Facility team meeting.

All records will be managed in accordance with **WHS Module 10 - Records**.

Training Requirements

Specific training required to carry out the requirements of this document includes:-

- Specialised training as identified that may assist in the implementation of this procedure e.g. Armed holdup training.
- Staff training via desktop simulation training module.

Training requirements will be managed in accordance with **WHS Module 12 – Training**.

Auditing Requirements

Auditing of this process will be managed in accordance with **WHS Module 11 – Auditing**.

Corrective Actions

Corrective actions are to be managed in accordance with **WHS Module 09 – Corrective Actions** whenever it is identified that the requirements of this document and its references are not being met.

Review

This document will be reviewed in accordance with **WHS Module 04 – Document Control** and whenever there is a relevant change to applicable legislation, industry standards, Codes of Practice, the WHS Management System, or the process.

LMS' Emergency Response Plan, and Remondis' Pollution Incident and Response Management Plan will also be reviewed in consultation with nominated representatives of LMS and Remondis for consistency between the plans.

Responsibilities, Authorities & Accountabilities

Responsibility, authority, and accountabilities for all positions within Council are outlined in **WHS Module 01 – WHS Responsibilities** and in the **WHS Responsibilities, Authorities and Accountabilities (RAA) Table** associated with **WHS Module 01**. The RAA table includes responsibility, authority, and accountabilities for employees, managers, supervisors, contractors, visitors, and persons with specialist roles within the organisation.

In addition to **WHS Module 01 – WHS Responsibilities**, the following positions have responsibilities, authorities and accountabilities associated with this document:

Position	Responsibilities, Authorities & Accountabilities
Waste Site Supervisor	Emergency Warden (1st)- Implement procedure.
Waste Site Leading Hand	Emergency Warden (2nd) Implement procedure.
Group Coordinator Waste Operations	Assist and support Emergency Warden.
Manager Waste Services	Assist and support Emergency Warden. Decide on notification of local residents.

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Controlled Document Information

Authorisation Details

Folder No:	F2019/00068	TRIM Record No:	D09901408
Audience:	Departmental - Waste Services		
Department:	Waste Services		
Officer:	Awaba Waste Management Facility - Environmental Officer - Bay Hornery		
Review Timeframe: Max < 4 years	12 Months	Next Scheduled Review Date:	15 March 2022
Authorisation:	Manager Waste Services - Paul Collins - 15 March 2021		

Related Document Information, Standards & References

Related Legislation:	Protection of the Environment Legislation Amendment Act 2014 (POELA Act) WHS Regulation 2017	Procedure developed to comply with POELA Act
Related Policies (Council & Internal):	WHS Policy	Council Policy
Related Procedures, Guidelines, Forms, WHS Modules/PCD's, Risk Assessments, Work Method Statements:	Critical Incident Management - PCD Department Induction Emergency Management – PCD Environmental Guidelines for Solid Waste Landfills First Aid – PCD WHS Module 01 – WHS Responsibilities WHS Module 04 – Document Control WHS Module 06 – Risk Management WHS Module 10 – Records WHS Module 11 – Auditing WHS Module 12 - Training	Reference Document for landfill operations
Standards COP's & Other References	EPL Licence 5873	EPA Environment Protection Licence for the Awaba Waste management Facility

Definitions

Term / Abbreviation	Definition
Pollution Incident	An incident or set of circumstances during or as a consequence of which there is or is likely to be a leak, spill or other escape or deposit of a substance, as a result of which pollution has occurred, is occurring or is likely to occur. It includes an incident or set of circumstances in which a substance has been placed or disposed of on a premises, but does not include an incident or set of circumstances involving only the emission of any noise
Emergency	Is an abnormal and dangerous or potentially dangerous situation, which requires urgent action to control, correct, and return to a safe condition
EPA	Environmental Protection Authority
Leachate	Water that has percolated through or otherwise come into contact with waste materials and has extracted, dissolved or suspended materials from the waste
ADC	Alternate Daily Cover
Emergency Warden	Waste Site Supervisor - Steve Merrett

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	Waste Site leading Hand - Arthur Berends
ORRF PIRMP	Organic Resource Recovery Facility – Pollution Incident Response Management Plan
LMS ERP	Landfill Management Systems – Emergency Response Plan
EPL	NSW Environment Protection Authority – Environment Protection Authority
SES	NSW State Emergency Services

Consultation (update for each version created)

Key Departments, Teams, Positions, Meetings:	David Brake – Group Coordinator Waste Operations Paul Collins –Manager Waste Services Steve Merrett – Waste Site Supervisor Bay Hornery – Awaba Waste Management Facility Environmental Officer Gunther Neumann – Remondis ORRF Nathan McClelland – LMS
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Version History

Version No	Date Changed	Modified By	Details and Comments
1			New document
2	9 Oct 2013	Rick Brindley	Document reviewed. Changes Greenwaste Contractor details
3	29 July 2014	Rick Brindley	Document reviewed as per EPA requirements In emergencies 1,2,3,4,5,6,7,8 &9 “ Emergency Warden to decide whether or not customers are to weigh out and complete transactions, based upon the nature of the emergency and the number of customers on site. If decided not to complete transactions, customers will receive free tipping and waste tonnages based on vehicle type adopted for waste reporting purposes.” Under the heading “ Plant available on site “ only 1 x 2 tonne tipper on site Appendix B included- “Bomb Threat Checklist”
4	June 2015	Rick Brindley	Document reviewed as per EPA requirements. Training now includes online training module.
5	June 2016	Rick Brindley	Document reviewed as per EPA requirements. Contact names and phone numbers checked and changed where required
6	June 2017	Rick Brindley	Document reviewed as per EPA requirements.
7	April 2018	David Brake	Document reviewed as per EPA requirements. Updated to include landfill extension infrastructure Inclusion of Odour Management Strategy Updated Appendix A – Site Map Included Appendix C – Awaba Landfill Odour Incident Report
8	May 2019	Bay Hornery	Document reviewed as per EPA requirements. Document reformatted into Council's new controlled document template Contact names and phone numbers checked and changed where required Included Appendix D – Remondis ORRF PIRMP Included Appendix E – LMS ERP
9	June 2019	Phillip Couch	Document updated for compliance with the NSW Rural Fire Service document Guide for Developing a Bush Fire Emergency Evacuation Plan.
9	July 2019	Bay Hornery	Post Incident Debrief - Review
9	December 2019	Bay Hornery	Document Updated According to NSW EPA Audit Report Action Items Inclusion of Appendix D – Awaba Waste Management Facility Risk Assessment Inclusion of Appendix E – Inventory of Potential Pollutants

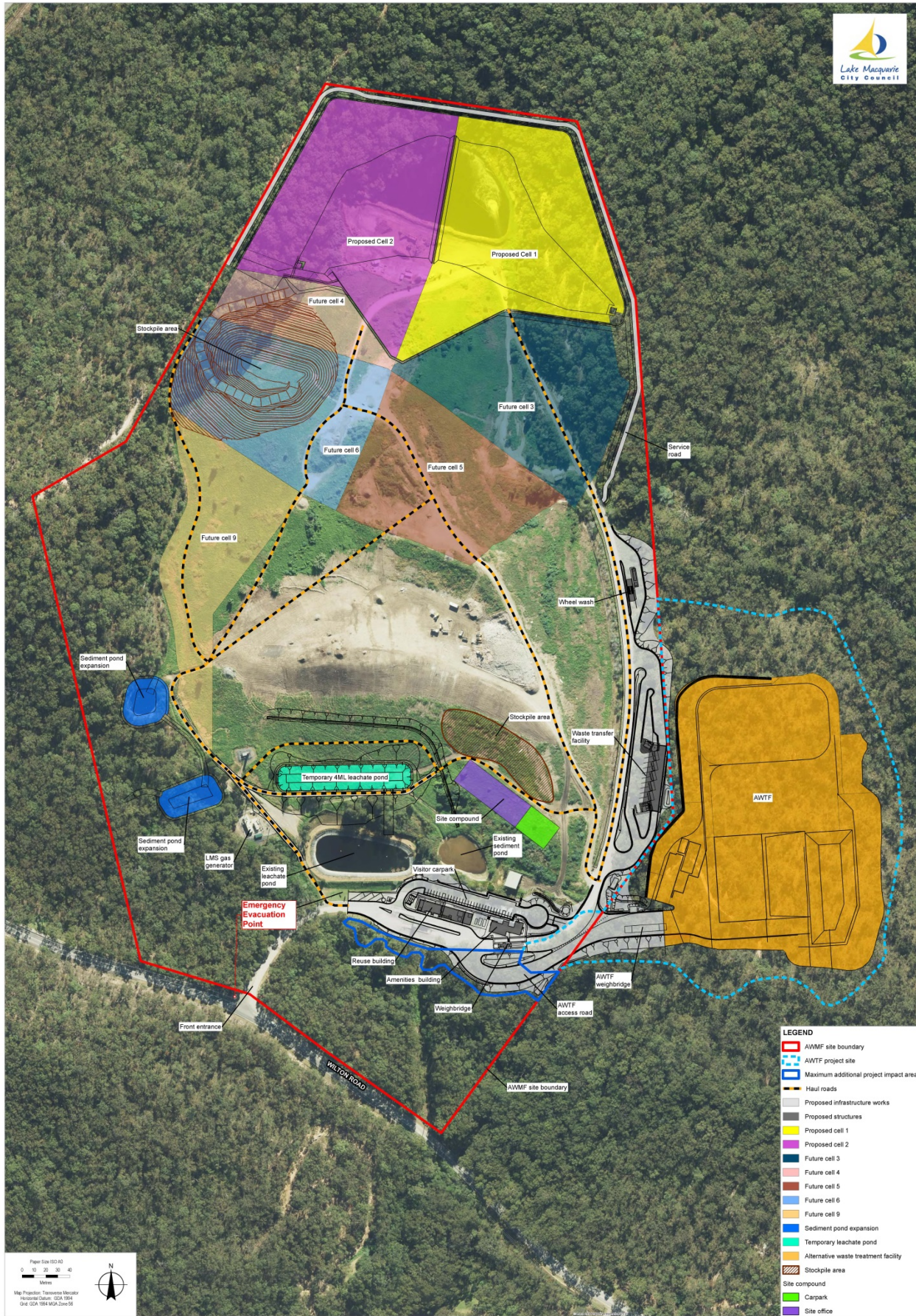
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	March 2020		Inclusion of PIRMP Test Date and Records Table Inclusion of Appendix F - AWMF Leachate and Surface Water Reference Map Inclusion of Appendix G - LMS Landfill Gas Infrastructure Map
9	May 2020	Bay Hornery	Document reviewed as per EPA requirements Updated emergency contact details
10	November 2020	Bay Hornery	Document updated noting date of PIRMP Test

Testing of This PIRMP

PIRMP Version No	Test Date	Method of Test	Tested by
AWMF PIRMP V 9.1	31/07/2019	Post Incident Review/Debrief	B.Hornery, M.Cannon
AWMF PIRMP V 9.4	30/07/2020	Fire Desktop Simulation	All AWMF Site Staff

Appendix A – Site Map



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Appendix B – Bomb Threat Checklist

During the call take note of the following:	
Exact wording of threat:	
General Questions to ask:	
1. What is it?	2. When is the bomb going to explode or When will the substance be released?
3. Where did you put it?	4. What does it look like?
5. When did you put it there?	6. How will the bomb explode or How will the substance be released?
7. Did you put it there?	8. Why did you put it there?
Chemical/Biological Threat Questions:	
1. What kind of substance is in it?	2. How much of the substance is there?
3. How will the substance be released?	4. Is the substance a liquid, powder or gas?
Bomb Threat Questions:	
1. What type of bomb is it?	2. What is in the bomb?
3. What will make the bomb explode?	
Notes:	
Recipient:	
Name:	Telephone Number:
Signature:	

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When the call has finished take note of:

Caller's Voice:

Accent (specify):	Any impediment (specify):
Voice (loud, soft, etc):	Speech (fast, slow, etc):
Diction (clear, muffled):	Manner (calm, emotional, etc):
Did you recognise the caller? If so who do you think it is?	Was the caller familiar with the area?

Threat Language:

Well spoken:	Incoherent:
Irrational:	Taped:
Message read by caller:	Abusive:
Other:	

Background Noises:

Street noises:	House noises:
Aircraft:	Voices:
Music:	Machinery:
Other:	Local Call or STD Call:

Other:

Sex of caller:	Estimated Age:
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Call Taken:

Date:	Time:
Duration of Call:	Number Called:

BOMB/CHEMICAL/BIOLOGICAL THREAT CHECKLIST

After the Call
Page 2

Appendix C - Awaba Landfill Odour Incident Report

Awaba Landfill Odour Incident Report.

1. **Location where odour evident.** Eg 16 Smith St Boolaroo.

2. **Date and time of day odour experienced.**

3. **Duration of odour.** Eg in hours or minutes and constant or intermittent.

4. **Intensity of odour.** Scale 1-10. Where 1 is minimal or slight and 10 is worst.

5. **Description of odour** eg sweet putrid smell (like garbage on hot day).
Rotten egg gas smell. Sewerage or other (describe if possible).

6. **Wind direction** (if available or best guess).

7. **Any other weather conditions** (raining, overcast, approx. temp)

8. **Can odour be smelt now** (Time: am/pm). Date

Completed by (Please print)

Name.....

Address.....

Contact Number.....

Signed.....

Appendix D – Awaba Waste Management Facility Risk Assessment

Operation of Awaba Waste Facility - Risk Assessment

Version 3 - 19 July 2016

Lake Macquarie City Council Risk Assessment Operation of Awaba Waste Management Facility



This document is a **Generic (controlled) activity Risk Assessment**

Work Area / Location	Awaba Waste Management Facility				Find	Locate this document via the Full Controlled Document search on the Backyard	
Assessed By	Steven Merrett Tim Prisk Rick Brindley David Brake	Approved By	Acting Manager Waste Environment & Rangers – Derek Poulton - 19 July 2016	Date Due for Review	19 July 2020	Audience	Departmental - This document applies to staff at the Awaba Waste Facility

WHS Aspects	Possible WHS Impacts	Initial Risk Rating	Control Measures	Timeframe to implement (based on initial risk rating) *	Responsible Position/s	Residual Risk
Entry to site	Unauthorised access by general public	C-3	Authorised access controlled by entry gates opened between 8.00am and 4.00pm for public. Locked at all other times. Security cameras and back to base alarm system installed to gatehouse perimeter Waste Site Supervisor to be contacted by security contractor if unauthorised access detected after hours.	Immediate	Waste Site Supervisor Waste Site Attendant.	L
Gatehouse operation	Non trained staff Overloaded vehicles entering and leaving site. Robbery due to alarms not being set and gates locked	C-3	All gatehouse staff trained in operation of Wasteman weighing system before performing duties Float to be counted/reconciled and confirmed as true and correct at beginning and end of shifts. Any discrepancies with float are reported by Gatehouse staff to Site Supervisor who then reports discrepancy to WER Finance staff as soon as practical Staff to be trained in opening and closing of weighbridge gatehouse building and setting alarm at close.	immediate	Waste Site Supervisor	L

Likelihood	Consequence	Risk Rating	Timeframe *	Consequence if hazard occurs	Likelihood			
					A	B	C	D
A = Almost Certain (Expected to occur)	1 = Catastrophic = Extreme pollution; Death or permanent disability; > \$500,000	E = Extreme	- Immed. - <24hr	1=Catastrophic	E	E	H	M
B = Likely (Will probably occur)	2 = Major = Severe pollution; Long term illness or serious injury; \$50,000 to \$500,000	H = High	- < 7 days	2=Major	E	H	M	L
C = Possible (Might occur at sometime)	3 = Moderate = Significant pollution; Medical attention & off work; \$10,000 to \$50,000	M = Moderate	- < 30 days	3=Moderate	H	M	L	VL
D = Unlikely (Not likely to occur)	4 = Minor = Low level pollution, First aid treatment; \$0.00 to \$10,000	L = Low	- < 6 mths	4=Minor	M	L	VL	VL
		VL = Very Low	- <12 mths					

Generic Activity, Product or Service Risk Assessment Form (Controlled Document) Version 12.

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Operation of Awaba Waste Facility - Risk Assessment

Page 1 of 13

Operation of Awaba Waste Facility - Risk Assessment

Version 3 - 19 July 2016

			Gatehouse staff to check weights and configurations of heavy vehicles leaving and entering site to determine compliance with Heavy Vehicle National Law (NSW). Gatehouse staff to notify any driver of heavy vehicles if an exceedence of its Gross Vehicle Mass (GVM) limits under the Heavy Vehicle National Law (NSW) and Heavy Vehicle (Mass, Dimension and Loading) National Regulation (NSW). Gatekeepers to refer to Overloaded Vehicles at Awaba Waste Management Facility Procedure Trim Folder F2005/01720 regarding correct procedure to be followed with overloaded vehicles			
Access road	Potholes No clear delineation road markings	C-3	Roads maintained and Civilake notified if potholes are present unacceptable trafficable surfaces Road markings applied as per Australian Standards and carried out by authorised Civilake contractor	immediate	Waste Site Supervisor.	L
Lack of adequate Signage	Lack of customer's awareness of disposal fees and responsibility on site. Customers don't obey instructions with regard tipping and unloading. Customers going to wrong tipping area. Customers presenting restricted or hazardous waste	C-3	Signage relating to fees and charges, Class 1 Solid Waste Landfill, hazardous materials etc maintained at entry point. Signage also indicates greenwaste tipping area as well as general tipping areas. WH&S Inspection carried out every 6 months. Environmental checklist carried out every 3 months as well as daily inspections noted in diary	immediate	Waste Site Supervisor	L
Security/Gatehouse	Unauthorised access by public.	C-3	Front gate locked between 4.00pm and 7.30 am each day. Restrict illegal vehicular access at boundaries through use of physical	immediate	Waste Site Supervisor. Security firm	L

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			barriers. Security firm engaged to access site if alarms on weighbridge/gatehouse activated. Cash company collects cash on irregular times so no cash left on premises overnight Door to weighbridge operator and Waste Site Supervisor Office kept locked at all times.			
Weighbridge	Incorrect weights. Overloaded vehicles Weighbridge computer system failure	C-3	Calibration Certificate kept on site. Tag/Test reminder sent to advise when calibration due. Accuweigh advised and calibration carried out. Staff trained in manual system operation of weighbridge to ensure transactions can be carried out. Manual system based on EPA Waste Levy Guidelines National Measurement Institute carry out random calibration certifications.	immediate	Waste Site Supervisor Waste Site Attendants	L
Confined spaces	Gas exposure	C-3	Waste Site Supervisor and Relief Supervisor have annual Confined Space training and identify any possible confined spaces and ensure correct procedures followed as per training given. Examples of possible confined spaces at Awaba Waste Facility include the leachate collection wells, any areas where waste has been exposed through excavation and can also include main leachate collection dam. WPU Section to remind Emergency Warden when certification is up for renewal.	immediate	Waste Site Supervisor Waste Sites & WH&S Coordinator	L

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			Gas monitor on site and calibrated monthly by Waste Sites & WHS Coordinator.			
Sediment dams	Overflow of water to surrounding streams	C-3	Dams monitored by Waste Site Supervisor on daily and 3 monthly inspections to ensure holding capacity is maintained and dams are not at levels to breach overflows. Dam water used for dust suppression and application of daily cover to keep lower water levels Dams can be drained back to main leachate dam if required in an emergency Water sampling carried out 3 monthly by Waste Sites & WH&S Coordinator as per Environmental Guidelines for Solid waste Landfills and EPA Licence 5873	Immediate	Waste Site Supervisor Waste Site Attendants Waste Sites Coordinator	L
Abusive or aggressive customers	Physical or verbal abuse towards staff	C-3	Staff not to engage in confrontational actions with public. Staff to refer person/s to Site Supervisor or advise to contact Customer Service Section. Staff to redirect general public to correct tipping area.	immediate	Gatekeeper. Waste Site Supervisor	L
Reuse Centre	Manual handling	C-3	Staff trained in correct manual handling. Assistance to be obtained if required. See Risk Assessment Awaba Waste Management Facility Community Recycling Centre F2004/10096-02	immediate	Reuse staff. Waste Site Supervisor	L
	Inexperienced staff	C-3	Ensure staff have appropriate skills and experience when being sourced through Resources Section.	immediate	Waste Site Supervisor	L
Reuse Centre	Slip, trips, falls	C-3	Work area identified and kept clean and tidy. Workplace WH&S inspection carried out by Waste Site Supervisor and Waste Sites & WH&S Coordinator every 6 months. Daily checks carried out by Waste Site Supervisor and any hazards noted in	immediate	Reuse staff. Waste Site Supervisor	L

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			daily diary. Council issued high viz clothing to be worn including long shorts or pants, long sleeve shirt and safety footwear. Sun safe hat and sunglasses to be worn when working outside.			
Reuse Centre	Injury from handling sharp metals etc	C-3	Council issued gloves to be worn when handling metals. See Community Recycling Centre risk assessment F2004/10096-02	immediate	Reuse staff. Waste Site Supervisor	L
Reuse Centre	E-Waste	C-3	Container on site and E-waste put into container by customer. Container replaced when full by HRR (Hunter Resource Recovery). See Community Recycling Centre risk assessment F2004/10096-02	immediate	Waste Site Supervisor Sustainability	L
Operating plant	Slip trip falls	C-3	Staff operating plant are to ensure that they use the 3 points of contact whenever entering or exiting plant.	immediate	Waste Site Supervisor Waste Site leading Hand Waste Site Attendants Plant Operators/Relief staff	
	Licences	C-3	All staff appropriately licenced to operate machinery on site	immediate	Plant Operators Waste Site Attendants Waste Site Supervisor	L
Community problem waste drop offs	Customers not putting gas bottles, paints, batteries, polystyrene in correct receptacles	C-3	All staff trained in correct handling and storage of problem household waste See Awaba Waste Community Recycling Centre Risk Assessment. F2004/10096-02	immediate	Reuse staff Waste Site Supervisor	L
Tipping area	Customers not tipping in correct area	C-3	Signs indicating correct tipping areas in place and replaced if necessary.	immediate	Waste Site Supervisor	L

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			Site inspections in place. Witches hats to be used to define road delineation etc. Tip hand on site and directing traffic.			
Tipping area	Customers not going to correct area and not adhering to directions. UV exposure Not covering waste at end of day as per EPA requirements	C-3	Tip hand on site and directing traffic. Tip hand has control of tipping area and all directions given by him are to be obeyed. Designated tipping areas in place and 10-metre separation maintained with Council or heavy plant. Reversing beepers operating on all contractor and Council plant. Contractors to be made aware of Risk Assessment during site induction particularly section dealing with general public tipping area. Tip hand to halt traffic flow if moving plant represents a danger to public and other vehicles. Tiphands to monitor and randomly inspect loads to ensure no hazardous materials are being dumped. LMCC Sun Safe clothing worn by staff. That is high visibility long sleeve shirt. Long shorts or pants. Sun Safe hat, sunglasses and safety footwear. Alternate Daily Cover material sprayed on active tip face at the end of each shift as per EPA licence 5873 Spoil applied to areas that will not be accessed for at least 90 days as per EPA licence 5873 requirements..	immediate	Tip hand Waste Site Supervisor	L
Leachate spraying	Overspray and run off	C-3	No spraying to take place if rain has fallen in previous 24 hours. Sprays to be only used when wind and weather conditions permit. Waste Site		Waste Site Supervisor	

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			Supervisor to decide if spraying is to occur. If overspray, runoff is detected or weather conditions deteriorate sprays to be turned off immediately.	immediate	Waste Site attendants	L
Dust in eyes	Injury to staff or customers	C-3	ADC (Alternate Daily Cover) machine used as water cart on a needs basis. All trafficable areas sprayed continually on a needs basis.	immediate	Waste Site Supervisor.	
	Muddy conditions	C-3	Trafficable areas to be assessed with staff. If required alternate tipping areas organised. Electronic notice board on weighbridge advising customers of muddy conditions. Gatekeepers to advise customers verbally if muddy and slippery conditions exist Waste Site Supervisor to close Waste Facility if conditions warrant after consultation with WER Manager . Summerhill Waste Facility to be notified if site closed. Council's Customer Service Centre also notified Street sweeper used to ensure that dust and dirt is kept to a minimum on site access roads. Waste Site Supervisor and Tip hand to select appropriate area for tipping. If vehicles do become bogged, only the approved towing anchor point is to be used.	immediate	Waste site attendant Waste Site Supervisor	L
	Hazardous substances e.g. asbestos	C-3	Staff trained to identify asbestos. Identified by distinct dimples (like golf balls). Material brittle and sounds similar to broken ceramic tiles when broken. Area cordoned off. Staff to wear respirators if required. Water cart used to wet the substance. Traxcavator to cover with	immediate	Waste Site attendant Waste Site Supervisor	L

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			material immediately. Correct disposal criteria available to public on LMCC web page. If staff in doubt they are to contact Waste Site Supervisor immediately. Waste Site Supervisor also Emergency Warden and Emergency response Plan implemented if required. Staff trained in Emergency Response Plan And records available in Oracle			
	Windblown litter	C-3	Waste to be pushed and compacted as soon as possible to reduce windblown litter. Difficult to control when sudden wind gusts occur. Litter fence used to collect windblown litter and this is moved around site as tipping sites change. Day labour used on a needs basis to collect windblown litter after extreme wind conditions.	Immediate	Waste Site Attendants Waste Site Supervisor	L
	General mowing	C-3	Only staff trained to operate John Deer mower carry out mowing of general grassed areas. See batter slope mowing controls.	Immediate	Waste Site Attendants	L
	Explosive devices	C-3	Emergency Response Plan implemented by Emergency Warden if required. Staff trained in Plan procedures	immediate	Waste Site Attendant Waste Site Supervisor	L
	Batteries, gas bottles	C-3	Sign near weighbridge identifies those items that are not acceptable If found taken to Reuse centre and put in appropriate storage until disposed of. Signage advises customers of prohibited items. See Community Recycling Centre risk assessment F2004/10096-02	immediate	Waste Site Attendant Waste Site Supervisor.	L

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Retrieving scrap metal from tipping area	Manual handling Injury from contact with waste	C-3	Use of mechanical means when available. Wearing of correct PPE (including gloves, long sleeves, steel capped boots) if manually retrieving scrap metal. Staff to be trained in and use correct manual handling techniques. Staff to seek assistance in retrieving scrap metal from tip face if required.	immediate	Waste Site Attendants Waste Site Supervisor.	L
Retrieving scrap metal during unloading of waste from vehicles	Manual handling Injury from contact with waste	C-3 = L	Generally customers to unload their own vehicle. If scrap metal to be retrieved during unloading of waste from a vehicle then: <ul style="list-style-type: none"> Wear correct PPE (including gloves, long sleeves, steel capped boots) Staff to be trained in and use correct manual handling techniques. Staff to seek assistance in retrieving scrap metal during unloading of waste from vehicles if required. 	immediate	Waste Site Attendants Waste Site Supervisor.	D-4 = VL
Applying daily cover	Incorrect mix Windy conditions	C-3 C-3	Posishell has provided training to staff on correct quantities regarding water and mix If wind conditions not favourable for spraying then daily cover to be used e.g. soil. When operating spray truck drivers to ensure access ladder at rear of vehicle is in the upright travel position.	immediate	Waste Site Supervisor	L
Mowing batter slopes	Steep slopes. Vermin	C-3	Approved contractor with specialised mowing unit attachment used due to expertise in this type of terrain and type of vehicle used	immediate	Waste Site Supervisor	L
Greenwaste		C-3	Waste Site Supervisor ensures contractor			

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	Tipping area		is operating area in a safe manner and investigates any complaints from general public. Waste Site Supervisor refers issues raised by public to Contract Administrator (Sustainability Department)	immediate	Waste Site Supervisor. Contract Administrator	L
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Environmental Aspects	Possible Environmental Impacts	Initial Risk Rating	Control Measures	Timeframe to implement (based on initial risk rating) *	Responsible Position/s	Residual Risk
Environmental monitoring	Non compliance to Licence 5873	C-3	Dates selected for monitoring saved in Outlook and reminder given. Dates selected ensure compliance to Annual return requirements	immediate	Waste Sites & OH&S Coordinator	L
	Incorrect bottles	C-3	AECOM deliver bottles 3 days before sampling. Sampling schedule given to AECOM. Appropriate number of sample bottles delivered	immediate	Waste Sites & WH&S Coordinator	L
	Wells not purged	C-3	Wells purged day before sampling as per EPA Environmental Guidelines. Solid Waste Landfills. Results Trimmed in folder F2004/07621-02 and also placed on Council web page as per legislative requirements.	immediate	Waste Sites & OH&S Coordinator	L
	Contaminated samples	C-3	Sampling equipment washed after each sample. Sample bottles stored in appropriate esky's for travel with cold packs as per sampling regime.	immediate	Waste Sites & OH&S Coordinator	L
	Samples to Laboratory	C-3	ALS Laboratory at Warrabrook analyse samples and return results to LMCC	immediate	Waste Sites & OH&S Coordinator	L
Environmental Monitoring Gas	Gas monitor not calibrated	C-3	Gas monitor "bump tested" every month before gas monitoring conducted and full calibration every 6 months. Gas monitor does not need sending for calibration but	immediate	Waste Sites & OH&S Coordinator	L

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			comes with docking station. Life and Rescue International contacted if any problems.			
	Accumulation gas/ Surface gas	C-3	All buildings tested for accumulation gas and all areas with intermediate cover e.g. batter slopes and old landfill areas walked with gas monitor to detect any surface gas migration. All testing done as per Environmental Guidelines Solid Waste Landfill. Completed forms trimmed in F2004/08498 and also placed on Council web page as per legislative requirements	immediate	Waste Sites & OH&S Coordinator	L
Leachate	Security	C-3	Gate to dam kept locked. Floatation vest to be worn when carrying out activities around dam. Signage on dam security fence regards personal protective equipment.	immediate	Waste Site attendant. Waste Site Supervisor	L
	Dam level	C-3	Dam levels monitored daily and spray irrigation carried out when weather condition permit. Contingency plan available in conjunction with Hunter Water Corporation and Thesis Services. See Trim Folder F2005/01720 Awaba Waste Leachate Procedure. Daily checks as well as 3 monthly environmental checklist carried out by Waste Site Supervisor/Waste Sites & OH&S Coordinator to monitor dam levels and sediment drains that could possibly allow surface water into dam.	immediate	Waste Site Attendant. Waste Site Supervisor	L
	Faulty leachate pumps	C-3	Pump maintenance carried out monthly by Newcastle Pumps. Flexi drive pump used to assist leachate well pumps if wet weather dictates.	immediate	Waste Site Supervisor	L
	Surface water entering dam	C-3	All drains inspected on a daily basis as	immediate	Waste Site Supervisor	

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			well as 3 monthly Environmental Inspection Report. Any drains that have excess sediment to be cleaned and sediment removed.		Waste Sites & OH&S Coordinator.	L
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Quality Aspects	Possible Quality Impacts	Initial Risk Rating	Control Measures	Timeframe to implement (based on initial risk rating) *	Responsible Position/s	Residual Risk
	Financial	C-3	Staff trained in Waste-man computer system. Float counted at commencement of each shift. Discrepancies notified to Waste Site Supervisor and WER Finance staff. Monies kept in timer locked safe. Weighbridge calibrated yearly by Accuweigh as well as audited by National Measurement Institute. Internal Auditor carries out random financial audits.	immediate	Waste Site Supervisor	L
Environmental Protection Agency Licence 5873	Failure to comply	C-2	Environmental checklist carried out by Waste Site Supervisor. Water and gas monitoring scheduled as required Site operated to comply with Environmental Guidelines Solid Waste Landfills and EPA Licence 5873. Volumetric Surveys completed as per Licence 5873 every 6 months and returned to EPA as per Licence 5873 Annual Return completed and returned as per Licence 5873.	Immediate	Waste Sites Coordinator Waste Site Supervisor	L

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List all Hazardous Chemicals to be used in this process. Note: All Hazardous Chemicals must be accompanied by a Hazardous Chemical Risk Assessment . Refer to Hazardous Chemical – Process Control Document for guidance.	

The following people were consulted in the development of this risk assessment

Team Members	Team Name and / or Position
Steve Merrett	Waste Site Supervisor
Tim Prisk	Acting Waste Site Supervisor
Arthur Berends, Tony Wilcox, Tim Vietch, Rob Horsey, Neil Rae, Jason Martin, Justin Conaghan	Waste Site Attendants

Dissemination and Acknowledgement (How is this Risk Assessment to be communicated to ALL staff undertaking this task)

Method eg: Site Specific Induction or RA Training &/OR a Toolbox Talk, Team meeting etc	Evidence of dissemination eg: saved to TRIM, &/OR details recorded in Daily Diary or Worker Training Passport.
Team meeting	Team meeting folder

Document References (Acts, Regulation, Codes of Practices, Related Risk Assessments – including Hazardous Chemical, Manual Handling etc)	
Work Place Health & Safety Act 2011	Environmental Guidelines, Solid Waste Landfills. EPA
Environmental Protection Authority Licence 5873	Heavy Vehicle National Law (NSW)
Heavy Vehicle (Mass, Dimension and Loading) National Regulation (NSW)	Overloaded Vehicles at Awaba Waste Management Facility Procedure
Environmental Guidelines for Solid waste Landfills	

<u>Likelihood</u>	<u>Consequence</u>	<u>Risk Rating</u>	<u>Timeframe</u> *	<u>Consequence if hazard occurs</u>	<u>Likelihood</u>			
					A	B	C	D
A = Almost Certain (Expected to occur)	1 = Catastrophic = Extreme pollution; Death or permanent disability; > \$500,000	E = Extreme	- Immed. - <24hr	1=Catastrophic	E	E	H	M
B = Likely (Will probably occur)	2 = Major = Severe pollution; Long term illness or serious injury; \$50,000 to \$500,000	H = High	- < 7 days	2=Major	E	H	M	L
C = Possible (Might occur at sometime)	3 = Moderate = Significant pollution; Medical attention & off work; \$10,000 to \$50,000	M = Moderate	- < 30 days	3=Moderate	H	M	L	VL
D = Unlikely (Not likely to occur)	4 = Minor = Low level pollution, First aid treatment; \$0.00 to \$10,000	L = Low	- < 6 mths	4=Minor	M	L	VL	VL
Generic Activity, Product or Service Risk Assessment Form (Controlled Document) Version 12.		VL = Very Low	- <12 mths					

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Appendix E – Inventory of Potential Pollutants

/ENTERPRISE/MANIFEST/WER- Awaba Waste Facility

HAZARD	MATERIAL NAME	CAS NUMBER	VENDOR	HAZARD CODES	VOLUME / WEIGHT	LANGUAGE	COUNTRY	DGC	PKG	APPROV.
4	Aerogard Personal Insect Repellent Aerosol			H222+H229,H302,H315,H319,H336,H361,H402,H412	0.0 L			2.1	None	Not Approved
2	AIR FRESHENER – MOUNTAIN AIR ALCOHOL BASED		Clean Plus Detergents	H226,H319	0.0 L	English	Australia	3	III	Not Approved
3	Aluminium Sulfate		Chem-Supply	H315,H318,H335,H341	0.0 L	English	Australia	None	None	Not Approved
3	Aluminum Sulphate Octadecahydrate Analar Normapur Analytical Regent		Bio-Strategy Pty Ltd	H315,H318,H335,H341	0.0 L	English	United Kingdom	None	None	Not Approved
3	Aluminium Sulphate (Normal)		Nowra Chemical Manufacturers	H315,H318,H335,H341	0.0 L	English	Australia	None	None	Not Approved
2	Ampol Motor Oil 15W/40 SG/CD			H303,H316,H318,H336,H411	0.0 L			None	None	Not Approved
0	B&B Buff			H316	0.0 L			None	None	Not Approved
4	butane	106-97-8.		H220,H280,H333	0.0 L			2.1	None	Not Approved
1	Caltex Texamatic Fluid (Dexron II)			-	0.0 L			None	None	Not Approved
1	Castrol APX Grease			-	0.0 L			None	None	Not Approved
2	Caterpillar 16386 Cat Extended Life Coolant/AF Bitterant			H302,H304,H316,H319,H402	0.0 L			None	None	Not Approved
2	Caterpillar Cat TDTO-TMS			H303,H304,H316,H319,H336,H373,H401	0.0 L			None	None	Not Approved

HAZARD	MATERIAL NAME	CAS NUMBER	VENDOR	HAZARD CODES	VOLUME / WEIGHT	LANGUAGE	COUNTRY	DGC	PKG	APPROV.
2	Caterpillar Hydraulic Oil 10W		Caterpillar	H304,H315,H336	0.0 L	English	Australia	None	None	Not Approved
0	Caterpillar Trans SAE50			H316,H319,H412	0.0 L			None	None	Not Approved
2	Caterpillar Trans/Drive Train 30		Caterpillar	H304,H318,H336,H411	0.0 L	English	Australia	None	None	Not Approved
2	Cement Australia Grey Cement		Cement Australia (Melcann)	H315,H317,H319,H335,H341,H351	0.0 L	English	Australia	None	None	Not Approved
1	Colgate Palmolive Ajax Spray N Wipe APC - Microemulsions		Colgate-Palmolive	-	0.0 L	English	Australia	None	None	Not Approved
2	diesel	68334-30-5, 68512-90-3, 64742-81-0, 68476-30-2		H227,H303,H304,H313,H315,H320,H333,H336,H351,H411	0.0 L			9	III	Not Approved
3	Diversey Liquid Pyroneg			H290,H314,H318	0.0 L			8	III	Not Approved
1	Dulux 601-Line Dulux Weathershield Exterior Low Sheen			non-hazardous	0.0 L			None	None	Not Approved
3	Ecolab Buddy			H315,H318,H335	0.0 L			None	None	Not Approved
3	Faulding Sea & Ski SPF30+ 250g*****OBSOLETE**			H303,H315,H317,H319,H341,H351,H361,H373,H401,H410	0.0 L			None	None	Not Approved
3	Glade Aero Country Garden			H222+H229,H303,H304,H336	0.0 L			2.1	None	Not Approved
1	Hammersley Nutra Gel			non-hazardous	0.0 L			None	None	Not Approved
1	NUTRA GEL		Hammersley	non-hazardous	0.0 L	English	Australia	None	None	Not Approved

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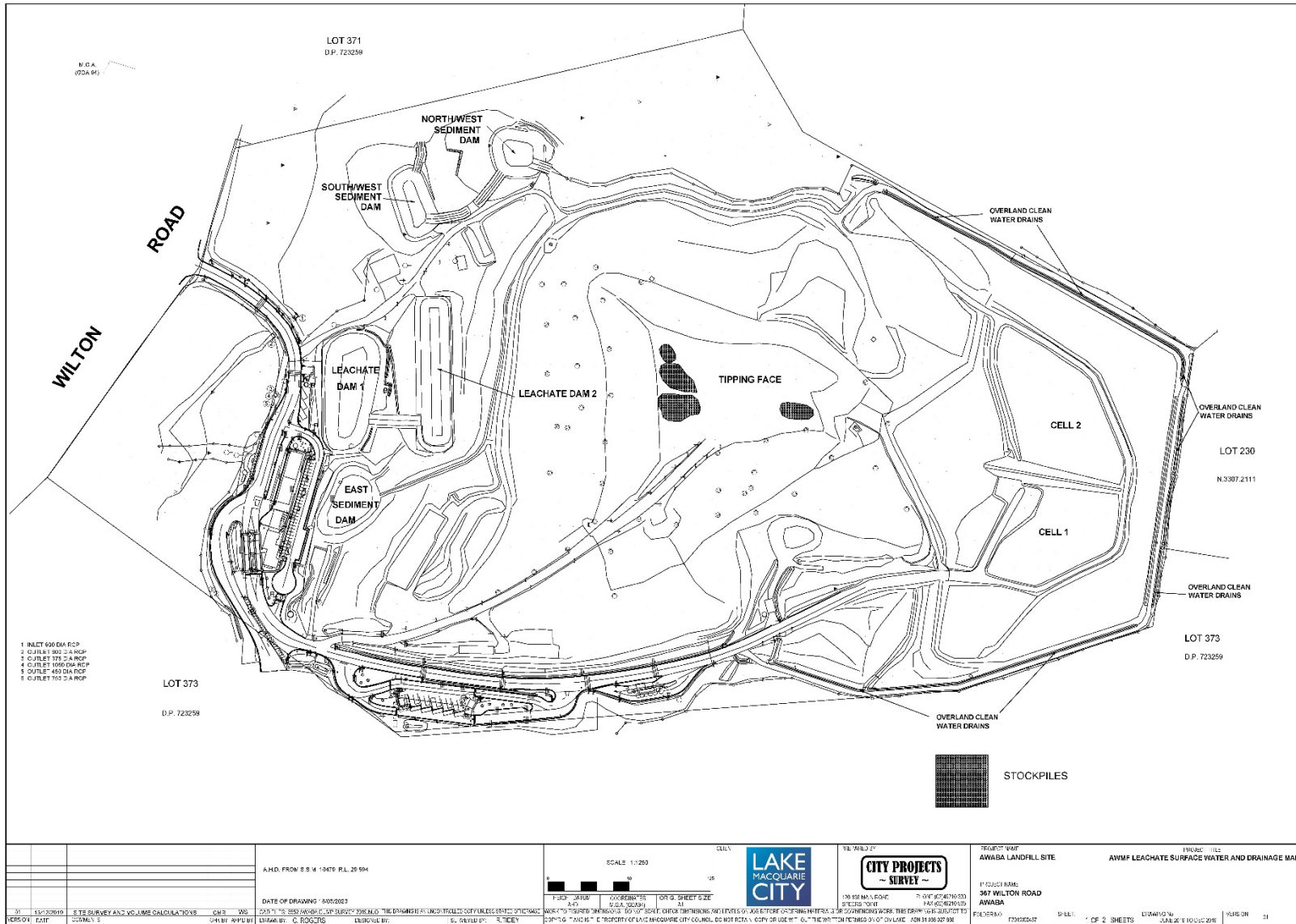
HAZARD	MATERIAL NAME	CAS NUMBER	VENDOR	HAZARD CODES	VOLUME / WEIGHT	LANGUAGE	COUNTRY	DGC	PKG	APPROV.
1	Pennzoil 20W-50 Motor Oil			-	0.0 L			None	None	Not Approved
4	Pine O Cleen Glen 20 Surface Spray Disinfectant Aerosol		Reckitt Benckiser	AUH044, H222,H319,H336	0.0 L	English	Australia	2.1	None	Not Approved
2	Quick Smart Waterless Hand Cleaner			H302,H316,H317, H320	0.0 L			None	None	Not Approved
4	Raid FIK Fastkill			H222+H229,H303, H304,H313,H318, H333,H336,H341, H361,H401,H410	0.0 L			2.1	None	Not Approved
4	Reckitt Benckiser Aerogard Tropical Strength Insect Repellent Aerosol			H222+H229,H315, H319,H336,H402, H412	0.0 L			2.1	None	Not Approved
1	Reckitt Benckiser Harpic Active Blue Flushmatic			-	0.0 L			None	None	Not Approved
3	Reckitt Benckiser Mr Sheen Trigger		Reckitt Benckiser	H340,H350,H412	0.0 L	English	Australia	None	None	Not Approved
1	S.C. Johnson Windex Multi Surface Cleaner, Magic Meadow			H227,H303	0.0 L			None	None	Not Approved
3	Shell Dobatex Gold			H315,H319,H351, H402	0.0 L			None	None	Not Approved
4	Shell Unleaded Petrol			H224,H304,H315, H320,H336,H340, H350,H373	0.0 L			3	II	Not Approved
1	Spray & wipe antibacter		Clean Plus Chemical	AUH018, AUH019, H336,H4	0.0 L	English	Australia	None	None	Not Approved

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HAZARD	MATERIAL NAME	CAS NUMBER	VENDOR	HAZARD CODES	VOLUME / WEIGHT	LANGUAGE	COUNTRY	DGC	PKG	APPROV.
	ial		s	12						
1	STIHL 2 STROKE		Stihl	H227	0.0 L	English	Australia	None	None	Not Approved
1	Stihl 2 Stroke		BP Australia	H227	0.0 L	English	Australia	None	None	Not Approved
3	Sunscreen SPF30+, 4Hr Water Resistant			H316,H317,H341, H350	0.0 L			None	None	Not Approved
1	Surf Liquid		Unilever	H315,H318	0.0 L	English	Australia	None	None	Not Approved
1	Valvoline TEC Multi 15W/40			H303,H320,H336	0.0 L			None	None	Not Approved
0	VINYL POLISH PROTECTANT		Clean Plus Detergents	non-hazardous	0.0 L	English	Australia	None	None	Not Approved
2	WASH & WAX		Hammersley	H315,H319	0.0 L	English	Australia	None	None	Not Approved
1	Windex Blue		SC Johnson	H226,H315,H319	0.0 L	English	Australia	None	None	Not Approved
1	Windex Blue		SC Johnson	H226,H315,H319	0.0 L	English	Australia	None	None	Not Approved

18/12/2019 23:02:18

Appendix F – AWMF Leachate and Surface Water Reference Map



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Appendix G – LMS Landfill Gas Infrastructure Map



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		CO-ORDINATES				CO-ORDINATES					
DESCRIPTION	LOCATION	EASTING	NORTHING	RL	DATE	DESCRIPTION	LOCATION	EASTING	NORTHING	RL	DATE
STATION A	-	364534.033	6345130.536	59.291	Sep-05	50	STATION K	364723.255	6345231.047	75.871	Jan-13
STATION B	-	364559.160	6345208.492	75.252	Sep-05	51	STATION K	364683.850	6345246.014	76.572	Jan-13
STATION C	REMOVED	-	-	-	Sep-05	52	STATION K	364660.008	6345256.657	76.694	Jan-13
STATION D	-	364607.064	6345378.497	77.347	Sep-05	53	REMOVED	-	-	-	Jan-13
STATION E	REMOVED	-	-	-	Sep-05	54	STATION K	-	-	-	Jan-13
STATION F	REMOVED	-	-	-	Sep-05	55	STATION H	364665.258	6345013.527	78.570	Jan-13
STATION G	REMOVED	-	-	-	Sep-05	56	STATION A	364563.413	6345123.905	57.114	Sep-13
STATION H	-	364674.036	6345365.491	83.670	Feb-08	57	STATION A	364595.172	6345128.478	58.543	Sep-13
STATION I	-	364565.243	6345272.873	82.927	Feb-09	58	STATION A	364632.081	6345128.560	57.961	Sep-13
STATION J	-	364718.987	6345278.099	76.391	Jan-13	59	STATION A	364620.094	6345163.339	59.757	Sep-13
STATION K	-	364671.483	6345248.560	76.685	Jan-13	60	STATION A	364587.433	6345155.381	59.877	Sep-13
STATION L	-	364708.732	6345158.681	71.041	Dec-15	61	STATION A	364563.585	6345143.121	60.759	Sep-13
1	REMOVED	-	-	-	Sep-05	62	STATION A	364675.140	6345137.101	58.276	Sep-13
2	REMOVED	-	-	-	Sep-05	63	STATION A	364665.205	6345177.198	59.813	Sep-13
3	REMOVED	-	-	-	Sep-05	64	STATION A	364701.121	6345175.369	60.139	Sep-13
4	REMOVED	-	-	-	Sep-05	65	STATION A	364705.972	6345132.608	58.328	Sep-13
5 old	REMOVED	-	-	-	Sep-05	66	ON MAIN	UNSURVEYED	UNSURVEYED	-	Oct-15
5 recdrill	STATION B	364568.728	6345204.616	71.764	Feb-09	67	ON MAIN	UNSURVEYED	UNSURVEYED	-	Oct-15
6 old	REMOVED	-	-	-	Sep-05	68	ON MAIN	UNSURVEYED	UNSURVEYED	-	Oct-15
6 recdrill	STATION B	364543.510	6345213.697	70.765	Feb-09	69	ON MAIN	UNSURVEYED	UNSURVEYED	-	Oct-15
7	STATION A	364531.623	6345141.002	60.199	Sep-05	70	ON MAIN	UNSURVEYED	UNSURVEYED	-	Oct-15
8	STATION B	364562.977	6345153.259	61.472	Sep-05	71	ON MAIN	UNSURVEYED	UNSURVEYED	-	Oct-15
9	STATION B	364560.861	6345175.198	63.142	Sep-05	72	STATION J	UNSURVEYED	UNSURVEYED	-	Oct-15
10	REMOVED	-	-	-	Sep-05	73	STATION B	364562.509	6345198.304	74.105	Dec-16
11	REMOVED	-	-	-	Sep-05	74	ON MAIN	364576.236	6345169.221	72.578	Dec-16
12 old	REMOVED	-	-	-	Sep-05	75	ON MAIN	364613.661	6345175.307	71.792	Dec-16
12 recdrill	STATION I	364554.469	6345276.313	72.864	Feb-08	76	ON MAIN	364649.799	6345177.389	70.626	Dec-16
13	REMOVED	-	-	-	Sep-05	77	ON MAIN	364745.043	6345163.736	70.629	Dec-16
14 old	REMOVED	-	-	-	Sep-05	78	ON MAIN	364767.968	6345143.346	68.204	Dec-16
14 recdrill	STATION I	364550.038	6345235.752	71.879	Feb-09	79	ON MAIN	364785.135	6345117.504	64.217	Dec-16
15	STATION B	364584.304	6345295.640	77.588	Sep-05	80	ON MAIN	364801.029	6345089.372	61.489	Dec-16
16	STATION I	364583.149	6345297.743	75.626	Sep-05						
17	STATION D	364561.426	6345341.836	75.370	Sep-05						
18 old	REMOVED	-	-	-	Sep-05						
18 recdrill	STATION D	364586.821	6345351.765	75.595	Feb-09						
19	STATION D	364603.368	6345382.370	76.041	Sep-05						
20 old	REMOVED	-	-	-	Sep-05						
20 recdrill	STATION D	364631.916	6345408.037	76.564	Feb-09						
21 old	REMOVED	-	-	-	Sep-05						
21 recdrill	REMOVED	-	-	-	Feb-09						
22 old	REMOVED	-	-	-	Sep-05						
22 recdrill	REMOVED	-	-	-	Feb-09						
23 old	REMOVED	-	-	-	Sep-05						
23 recdrill	REMOVED	-	-	-	Feb-09						
24	REMOVED	-	-	-	Sep-05						
25	STATION B	364604.234	6345149.147	57.533	Sep-05						
26	REMOVED	-	-	-	Sep-05						
27	REMOVED	-	-	-	Sep-05						
28	REMOVED	-	-	-	Sep-05						
29	REMOVED	-	-	-	Sep-05						
30	STATION D	364621.658	6345356.097	76.514	Sep-05						
31 old	REMOVED	-	-	-	Sep-05						
31 recdrill	STATION D	364654.257	6345330.628	83.226	Feb-09						
32	STATION I	364609.808	6345274.661	75.782	Sep-05						
33	REMOVED	-	-	-	Sep-05						
34 old	REMOVED	-	-	-	Sep-05						
34 recdrill	REMOVED	-	-	-	Feb-09						
35 old	REMOVED	-	-	-	Sep-05						
35 recdrill	STATION H	364631.249	6345417.318	77.801	Feb-09						
36 old	REMOVED	-	-	-	Sep-05						
36 recdrill	REMOVED	-	-	-	Feb-09						
36 recdrill	STATION H	364670.630	6345403.449	82.474	Dec-10						
37 old	REMOVED	-	-	-	Sep-05						
37 recdrill	REMOVED	-	-	-	Feb-09						
37 recdrill	STATION H	364694.580	6345382.795	81.704	Dec-10						
38	REMOVED	-	-	-	Sep-05						
39	REMOVED	-	-	-	Sep-05						
40 old	REMOVED	-	-	-	Sep-05						
40 recdrill	STATION H	364672.475	6345369.588	82.848	Feb-09						
41	STATION F	364701.706	6345258.127	63.663	Sep-05						
42	NO WELL	-	-	-	-						
43 old	REMOVED	-	-	-	Feb-09						
43 recdrill	STATION I	364619.805	6345293.298	82.338	Dec-10						
44	STATION I	364598.420	6345281.080	81.458	Feb-09						
45	REMOVED	-	-	-	Feb-09						
45	STATION H	364694.237	6345313.333	78.447	Jan-13						
47 old	REMOVED	-	-	-	Jan-13						
48 old	REMOVED	-	-	-	Jan-13						
49 old	REMOVED	-	-	-	Jan-13						
47 recdrill	STATION K	UNSURVEYED	UNSURVEYED	-	Oct-15						
48 recdrill	STATION J	UNSURVEYED	UNSURVEYED	-	Oct-15						
49 recdrill	STATION J	UNSURVEYED	UNSURVEYED	-	Oct-15						

AS BUILT

AWABA RENEWABLE ENERGY FACILITY

GAS FIELD LAYOUT

SCALE: 1:1000 DRAWING NUMBER: 20019-CA-003 PAGE: 2 OF 2 SIZE: A1 REV: 12

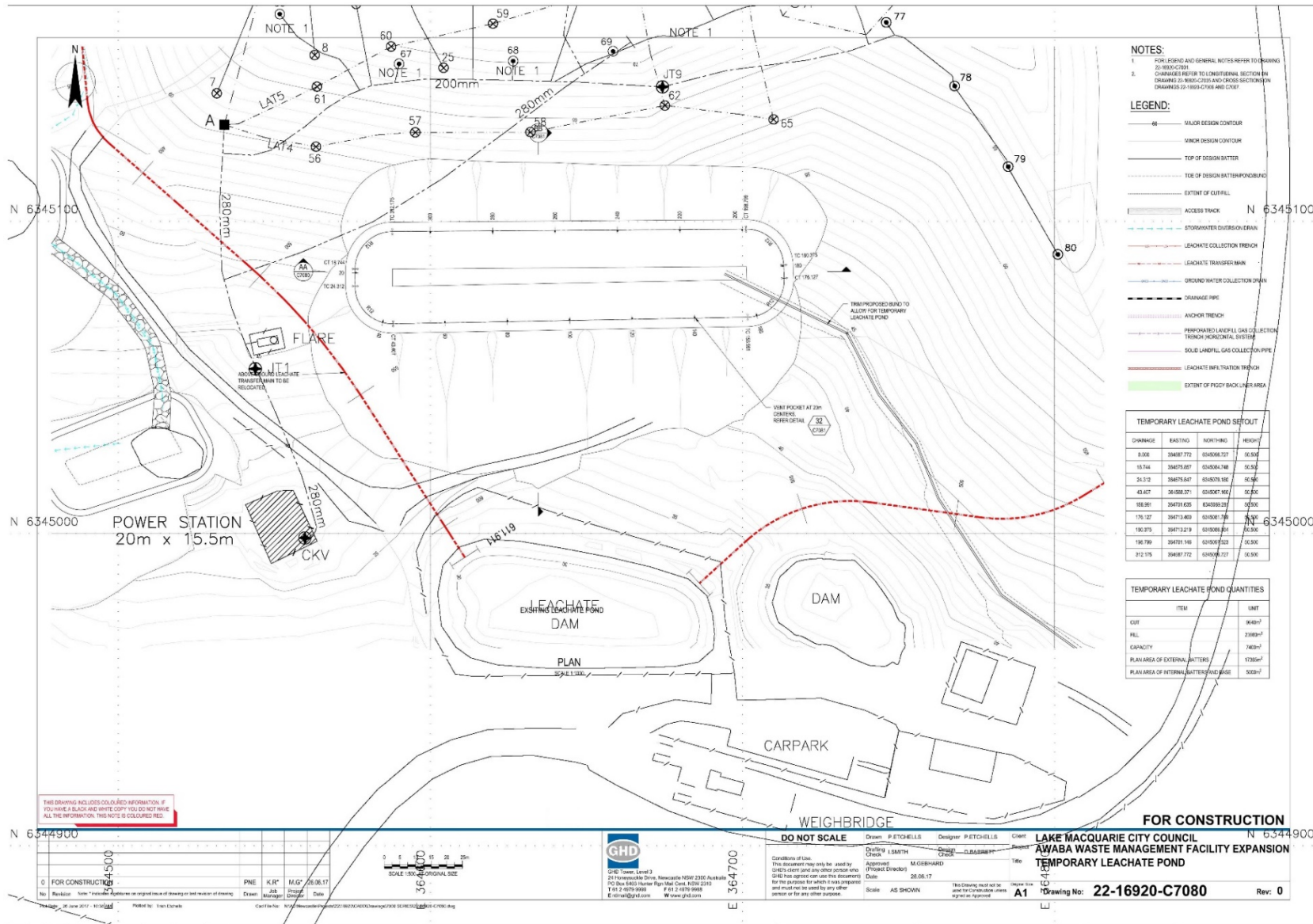
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DATE: 24/07/04 DATE: 24/07/04 DATE: 24/07/04



11	05/08/06	OS	-	-	WELLS 11, 23 & 53 REMOVED. OLD WELL 14 ON B STR RE-ADDED.
10	17/02/08	OS	-	SV	OS WELLS 67-72 ADDED IN APPROX. LOCATIONS.
9	12/10/05	OS	-	SV	WELLS 47, 48 & 49 REDRILLED.
8	08/04/14	OS	CF	CF	- STATION F AND WELLS 22, 34, 39, 45, 47 & 54 REMOVED.
7	11/11/13	ASH	CF	CF	- STATION G AND WELL 38 REMOVED.
12	26/04/17	OS	DD	DD	CF WELLS 73 TO BE ADDED.
No.	DATE	BY	CHKD	APP	DESCRIPTION

Appendix H – AWMF Temporary Leachate Pond Plan



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Appendix G – Community Education Program



Awaba Community Recycling Centre
Communication and Education Plan
2017 – 2019

Lake Macquarie City Council

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Part A Advice for preparing a communication and education plan

Purpose of the CRC communication and education plan

The CRC communication and education plan sets out the activities that you plan to deliver from July 2017 to June 2019 to encourage use of the CRC and explains how and when you will deliver these activities.

All communication and education activities need to contribute to achieving two of the key objectives of the CRC program:

- 75% of NSW householders are aware of the services available for the disposal of household problem waste
- 15% year on year increase in quantity (kg) of household problem waste correctly disposed.

Key messages

The key messages about CRCs can be summarised simply.

- Some household items do not belong in bins – particularly paint, gas cylinders, oil, fluorescent lamps, batteries and smoke detectors. The most appropriate way to dispose of these items is to take them to a CRC.
- There is a CRC in your local area, which is free and easy to use. Include details of the location, opening hours and any other information for people to plan their visit.

Key messages can be customised to particular waste types, types of household or scenarios e.g. moving home or renovating.

Preparing customised messages

When preparing customised messages for your community, consider the following principles.

- Think about the target audience for this communication – Who are they? What would they want to know? How do they source their information? What are the barriers and benefits to their participation?
- Link the message with an opportunity to act (e.g. posters about disposing of old paint placed in the paint section of a hardware store, or brochures in information packs from a real estate agent dealing with people selling a house)
- Give people all the information they need to act – location of the CRC, opening hours, waste types
- Be mindful that different target audiences have differing levels of knowledge and awareness. Some differences may arise from cultural backgrounds, education or experience. Messages should be positive and pitched at the appropriate level.

Principles for behaviour change

There is an extensive field of literature and practice relating to behaviour change and there is no one single theory or approach that will achieve all outcomes. Below are some key considerations about behaviour change to think about when determining your activities.

- Consider the steps people need to take to get to the ultimate behavioural outcome i.e. consider all the smaller behaviours to change the larger behaviour.
- Understand how and why people do what they do (their behaviour) to provide valuable insights when designing education programs.
- Try to understand individual motivations and differences in behaviour rather than assuming a single 'right' or 'best' behaviour.
- Education can be social, collaborative and can support learners to create change.
- Best practice education for sustainability considers: capacity building, futures thinking, partnerships, is on-going and adaptive, identifies complex linkages, involves a diversity of stakeholders and prioritises monitoring and evaluation.

Target audience

Primary target audience

The primary target audience for the CRC program is NSW homeowners aged 35-55 years in CRC locations. There are almost 1.4 million home owners living in NSW (Roy Morgan, 2016) who are 35 – 55 years of age.

Social research results highlight that home owners, within this age demographic, are more likely to have household problem waste. This is reflected in the participation data from the CleanOut program.

- Results from the CleanOut program show that:
 - 18% of participants are aged 18 - 34 years
 - 24% of participants are aged 35 - 44 years
 - 23% of participants are aged 45 – 55 years
 - 19% of participants are aged 56 – 64 years
 - 14% of participants are aged 65 – 74 years
 - 2% of participants are aged 75 years or older.

Secondary target audience

Community needs for the problem waste service are diverse. The service is not just relevant to particular ages, demographics or segments. There are times and situations when people are more likely to have problem wastes, and people in these situations are an important target audience.

The secondary target audience for the CRC program is NSW renovators and home movers living in CRC locations.

EPA social research identified that renovators are more likely to generate a wide range of problem waste types. Roy Morgan (2016) reports that 2.2 million people in NSW have engaged in some form of home improvement/renovation in the last 12 months and a further 1.92 million plan to do so in the next 12 months.

Moving home is a key point in time when householders will need to dispose of old and unwanted goods. In the past 12 months, 363,000 people in NSW bought a house or apartment, and 381,000 people intend to do so in the next 12 months.

Reaching our target audience

The EPA's advertising strategy is driven by an 'occasions, places and time' approach. This aims to focus the communication activities on the people who have household problem waste, at a time when it is relevant. CRC operators are encouraged to take this into consideration when planning activities. Examples include:

- **Occasions** – focusing on communication to people who are moving house, renovating or buying a property. These are common situations when people need to dispose of problem wastes.
- **Places** – focusing on places that are associated with activities that generate household problem waste (such as hardware stores or homemaker centres)
- **Time** – focusing on the weeks following the launch of a CRC, and then other times when waste and recycling may be a focus, such as National Recycling Week.
- **Seasons** – focusing on waste that may arise or be more prevalent from seasonal activities, such as gas bottles from BBQs in summer or smoke detectors and batteries at daylight savings change over.

Resources

The EPA provides a range of resources for communication activities. You can use any of these resources. You can co-brand and adapt these resources, or develop your own resources, but they must be in line with the CRC style guide and EPA approval is required prior to publishing.

Resources	Examples
Signage	CRC entry sign, CRC sign, material icon signs
Print	Brochure, poster, newspaper ads
Digital	Web tiles, videos
Social	Facebook posts
Launch	Invitation, pull up banners
CALD materials	Brochure, poster, newspaper ads,
Evaluation	Surveys

The EPA resources are available at: <http://epa.metrographics.com.au> (Resource Hub). The Resource Hub is password protected. Please email recycling.centres@epa.nsw.gov.au if you require a login or have misplaced your login details.

Communication methods

There are many forms of communication, including advertising, that can be used to promote the CRC.

- Public relations: e.g. media publicity, events such as National Recycling Week, or major CRC milestones.
- Direct marketing activities: e.g. rates notice mailout, or including CRC information in existing targeted communication such as newsletters and email updates.
- Sponsorships/partnerships: e.g. opportunities to work with local hardware stores, real estate agents, and other organisations to promote the CRC service.
- Community engagement and events: e.g. workshops, presentations, stalls at community days or tours of the CRC.
- Social media: Partners can post organically on social accounts (Facebook, Twitter) and also implement paid advertising. Facebook has excellent resources to assist in planning and implementing Facebook advertising.
- Digital marketing: The EPA provides online digital marketing (Google search and Google display) across NSW.

Evaluation

A large amount of effort and time is spent on planning and delivering projects, so it is important for you to know what worked (and why), and what did not work and how to adapt your strategies to ensure you have a successful result. When you monitor and evaluate your project, you can learn from your experiences and adjust your project for the future. Evaluation uses monitoring data to provide a feedback mechanism for continuous improvement of your effort. It should contribute to decision-making at every stage of the project and it should encourage you to reflect on your outcomes so that you can consider future actions.

Many of the communication activities can be monitored by using common measurement metrics e.g. Google Analytics and Facebook Insights. The more challenging piece of evaluation is determining how your activities have impacted on people's intent to use and their use of the CRC. For this evaluation, we need to engage with our target audience and seek feedback from them directly.

Three basic surveys have been developed to help you monitor and evaluate your CRC communication and education activities. These are available on the Resource Hub.

Survey 1: This survey is designed for you to use before the launch of your CRC. The survey results provide a benchmark for community knowledge, attitudes and behaviours. When the survey is done again (i.e. after 1 year of operation), the new results will help you to evaluate your education and communication activities.

Survey 2: The questions in this survey are for people who use your CRC. The survey can help you to understand more about the experience your customer has had at your CRC. Use this survey to get direct feedback on how the community heard about the CRC.

Survey 3: This survey is designed as a follow up to the benchmark questions (Survey 1) for community knowledge, attitudes and behaviours. You can compare the results with survey 1 to help you to evaluate your education and communication activities. A wide range of questions have been included to cover a variety of information needs. You may add, delete or amend questions to tailor the survey to meet your specific needs.

The survey templates are available on the Resource Hub.

Risk management

There are risks that could influence the delivery of the planned communication activities. The main risks are listed below, with options for managing these risks. You are not required to submit a risk management plan to the EPA as part of the communications plan, but you are expected to consider the risks and be prepared to manage them if they arise.

Risks identified	How will the risk be managed?
Delay in launching the CRC	Revise proposed activities and timeline in your plan.
High levels of incorrect materials being delivered to CRC	Develop and distribute targeted educational materials identifying materials that can be taken to the CRC and those which should be taken to CleanOut events.
Unexpectedly low use of the CRC	Survey householders to identify barriers to using the CRC and adapt Communication and Education Plan to address the barriers. Evaluate existing communication channels and refine strategy based on results.
Unexpectedly high use of the CRC	Refine staffing methodology and systems to manage extra demand. Review, refine and update traffic management plan. Review communication and education plan and the timeframe for delivering activities. Notify the EPA.
Traffic problems caused by people accessing the CRC.	If peaks correlate with advertising and promotion of the service, review advertising schedule. Review site layout, including entry and access points and traffic movements around the site. Consider additional signage or changes to site operations. Communicate any changes in educational materials and signage.

EPA reporting requirements

Recipients of the communication and education funding must submit a progress report at the end of the first year (August 2018), and a final evaluation report (August 2019). When preparing your communication and education plan, consider how you will keep records and collect data so that you can report to the EPA.

- Progress report (template to be provided) – detail activities and outcomes for the year, with an opportunity to review and revise the subsequent year’s plan based on these outcomes.
- Final evaluation report (template to be provided) – detail activities and outcomes of the 2017-2019 CRC Communication and Education Plan, identify any challenges faced and what you would do differently in the next plan to maintain use of the CRC and ensure your community continues to manage their household problem waste correctly.

Payment of each year's funding instalment is conditional on demonstration of satisfactory progress and outcomes.

Part B Communication plan

1. Background

Background

The Awaba Community Recycling Centre (CRC) was funded by the EPA's Early Starters grant as part of the Waste Less Recycle More initiative, to provide the community with a free and safe way to dispose of problem waste. It was the first CRC in New South Wales and became fully operational on 10 April 2014. The CRC is open to all 76,000 households of Lake Macquarie City as well as household of other Hunter LGAs, bringing the total accessibility to 240,000 households. Of those in Lake Macquarie, less than 10% are MUDs.

To date the CRC has been well utilised with the number of vehicles and tonnages increasing over the past 3 years. In 2014/15, 96 tonnes of waste was disposed, in 2015/16 that figure rose to 179 tonnes and finally in 2016/17 the total was 254 tonnes. Concurrently visitor numbers increased from 5,739 customers in 2015/2016 to 6,259 in 2016/17.

In September 2015, a total of eight Community Recycling Stations were installed in 6 Lake Macquarie City Council libraries, at Council's administration building and at Councils Works Depot. These stations have fostered greater community awareness of problem waste (light globes, household batteries, mobile phones and accessories, smoke detectors, and more recently CDs and DVDs are collected) across the region. Their utilisation has increased in the past 12 months from 1,740kgs collected in 2015/16 to 2,580kgs in 2016/17. Battery recycling still remains the most popular problem waste recycled with a total of 1,584kgs collected and disposed of through the CRC.

Working collaboratively with Port Stephens Council, NE Waste, Hunter Councils, Hunter Waste Educators Group, and Newcastle City Council to cross promote our CRC and CR Stations has proved successful. We have run bi-annual radio campaigns in November and April of each year in conjunction with Port Stephens Council promoting the two CRC's at Awaba and Salamander Bay. The rebranded NE Waste CRC commercial remains on Lake Mac's website, can be viewed on YouTube and can be played in Council's Customer service centre foyer. Newcastle City Council also promoted Awaba CRC in their annual Waste Services Guide.

Chemical CleanOut events have proved increasingly popular over the last couple of years with volumes of waste and numbers of visitors attending. We now have two events per year with the latest event in September attracting 873 cars and collection 36 tonnes of waste. This compares to only 513 cars and 16 tonnes waste in May 2015.

Since the CRC opening in 2014, we have run continuous education campaigns to promote the CRC. This has involved not only the activities using EPA funds but Council funds as well include bus advertising for an 18 month period, promotion at all Council events, such as the Annual Living Smart Festival and as part of our waste workshops both in schools and at community presentations. Communications have been in the form of online and print advertising, social media posts, shopping centre displays, video produced and uploads on Council's website as well as the production of posters and flyers to be distributed across the City. The installation of the eight Community Recycling Stations in our libraries and Council buildings has further promoted the CRC branding.

2. Target audience

Target audience	Activity	Reason	Reach
Householders	Radio and newspaper advertisements	Local media well utilised	30% of the community
Householders	Social Media alerts	Easy and affordable messaging	25% of the community
Householders	Chemical CleanOut participants	Those already interested in responsible waste disposal	100% of participants
Householders	Online advertising	Different demographic to hard copy newspapers	100% of Local News readers
Householders	Waste Services Guides (annual)	All waste information in easy to read guide	100% of households
Householders	Eco Advocate articles	Free resource appealing to concerned residents	100% of Eco Advocate's 6,000 subscribers
Householders	Council website	Free resource with comprehensive waste information	10% of community
Householders	Shopping Centre displays	Free resource – opportunity for face to face engagement	50% of the community
Householders	Event displays	Free resource – opportunity for face to face engagement	Festival attracts ~ 20,000 people
Householders	Customer service On-hold messaging	Free resource	All customers put on hold
Men's shed participants	Brochure	Free resource appealing direct to targeted waste users	100% Men's shed participants
Landcare participants	Newsletter articles	Free resource appealing to concerned residents	100% Landcare participants

3. Partners

Partners
<p>Since the opening of the CRC, both Lake Mac Council and Port Stephens Council have run joint radio advertising campaigns. We aim to work along other Hunter CRC's as they are rolled out. Further the Hunter Waste Educators Group (HWEG) meet quarterly and there is potential there to cross promote our facilities depending upon funding</p> <p>Collaboration has also taken place between Council and our recycling contractor Solo Resource Recovery whereby CRC flyers are distributed during Solo shopping centre displays and at other local events.</p> <p>Flyers and posters are also distributed through the Mens Sheds Association, Council libraries, schools and Landcare</p>

4. Action plan

There are three phases of communication activities for CRCs:

1. Before the CRC opens – activities in this phase can include preparing communication materials so that they are ready for when your CRC has a launch date.
2. CRC opening and launch – this is the most intense phase for communication activities, including delivering the communication activities prepared in phase 1.
3. Supporting CRC operations and use – activity to inform the community about the CRC and appropriate disposal.

Phase 1. Before the CRC opens (only complete if your CRC has not been officially launched)

Activities	Timing
N/A	

Phase 2. CRC opening and launch (only complete if your CRC has not been officially launched)

Activities	Timing
N/A	

Phase 3. Supporting CRC operations and use

Activities	Year 1 (2017-18)	Year 2 (2018-19)
Radio advertising	Dec 17 and April 18	Nov 18 and April 19
Online advertising	December 2017	November 2018
Newspaper advertising	Dec 17 and April 18	
Shopping centre displays	December 2017	
Social Media posts	Various 2017/18	Various 2018/19
Video of CRC		December 18

5. Evaluation of activities

Activity	Monitoring and Evaluation
List the activities below	How you will measure their effectiveness/success?
Advertising (including radio, online, newspaper)	Increases in number of people using CRC in the promotional period Increase in correct amount of product entering CRC Number of calls coming through to Customer Service Centre from residents enquiring about disposal options Increase in hits on waste pages on Council website Customer surveys at CRC
Facebook advertising	Facebook insights and analytics including: Impressions Clicks Click through rate (%) Cost per click (\$) Engagement (likes, reactions, comments, shares)
Online advertising	Number of click throughs to website
Shopping Centre displays	Customer Surveys Number of customer interactions Amount of information
Video of CRC	Number of online viewings Number of click throughs to website

Outcomes	Monitoring and Evaluation
Increased community awareness of the CRC	Survey data <ul style="list-style-type: none"> • % who are aware of the CRC • % that know how to dispose of household problem waste correctly

Outcomes	Monitoring and Evaluation
Increased use of the CRC	Survey data and CRC data: <ul style="list-style-type: none"> • Increased number of visitors from previous years • Increase in tonnes collected from previous years
Level of inappropriate disposal either through disposal in kerbside bins or illegal dumping	<ul style="list-style-type: none"> • the amount of problem waste in kerbside bins, illegal dumping, and bulky waste collections • data from ongoing recycling audits from recycling contractor • Quantity of by-catch collected at the CRC

6. Communication budget

Please detail the proposed budget for the communication activities in the action plan, and the amount requested from the EPA. Payments will be made each financial year.

Year 1 (2017-18)	Resources from all other sources* (i.e. applicant's contributions in cash and in kind) (a)	Amount rolled over from 2016/17 (b)	Amount requested from the EPA 2017/18 (c)	Amount requested from the EPA 2018/19 (d)	Total budget (a)+(b)+(c)+(d)
1. Project management* for communication activities (please specify – e.g. staff time, writing reports, administration, etc.) * <i>Can only be up to 10% of the budget</i>					
Sustainability Engagement staff 70 hours @\$50	3500	0	0	0	3500
Communications staff 35 hours @ \$50	1750	0	0	0	1750
Design staff 10 hours @\$70	700	0	0	0	700
2. Materials production					
CRC brochures	200	0	0	0	200
Waste Services Guide	5000	0	0	0	5000

Year 1 (2017-18)	Resources from all other sources* (i.e. applicant's contributions in cash and in kind) (a)	Amount rolled over from 2016/17 (b)	Amount requested from the EPA 2017/18 (c)	Amount requested from the EPA 2018/19 (d)	Total budget (a)+(b)+(c)+(d)
3. Communication activities					
Radio adverts	0	0	3000	2900	5900
Online advertising	0	0	2500	2000	4500
Newspaper advertising	1000	0	2400	0	3400
Shopping Centre displays	0	0	2000		2000
Bus wrap	4290	0	0	0	4290
Social media posts	50	28.40	100	100	278.40
Video production	0	0	0	5000	5000
4. Other					
Totals	16,290	28.40	10,000	10,000	36,318.40

Note: Funding supplied by the EPA will support promotional or educational work, including development and publication of materials, related to household problem waste. It cannot be used to fund activities itemised in the Environmental Trust CRC Infrastructure Grant or any existing council programs.

No EPA funds can be allocated towards school based education as children are not a target audience for the CRC program.

WASTE EDUCATION PLAN

The Waste Education Plan has been developed to provide the framework for an extensive educational program targeting all sectors of the community to increase awareness of waste issue as a high priority. It aims to support the objectives and targets set out in the City of Lake Macquarie Waste Strategy 2015-2023.

The main objectives of the Waste Education Plan are to:

- Reduce waste to landfill through increased knowledge and capacity building
- Promote and increase resource recovery
- Reduce the amount of recyclables being placed in the garbage bin
- Reduce contamination in the green waste bin and recycling bin;
- Increase participation rates in the green waste and recycling bins
- Manage problem wastes better

Background

Waste minimisation campaigns and initiatives aim to redirect waste from the Awaba Waste Management Facility (AWMF), to work towards our waste reduction targets and to increase the lifespan of our only landfill. Council's city-wide waste campaign "Sort it Right" focuses on achieving the City's waste diversion target of 75% away from landfill by 2023 relative to a 2007-08 baseline of 616kg per capita. This equates to 154kg per capita to landfill in 2023. This is documented in the City of Lake Macquarie Environmental Action Plan 2014-2023.

In 2010, Council undertook extensive community engagement to raise awareness and seek community input on the future of waste in the City. Then in 2011, after consultation with our community, Council decided to introduce the preferred waste strategy option, which included the following key elements:

- Phased introduction of a 3-bin system for residents to sort their waste. Phase 1 was the introduction of kerbside green waste bin for garden waste, collected fortnightly. Phase 2 involves adding food waste to the green waste bin, collecting the green waste bin weekly and the garbage bin fortnightly.
- Construction of a new organics composting plant to process the City's garden and food waste into high quality mulch and compost.
- Expansion of Awaba Waste Management Facility for the long-term disposal of the City's residual waste

In April 2013, phase 1 of the 3-bin service saw the introduction of the green bin for garden waste, emptied fortnightly. The City experienced a decrease of 149.42kg per capita in 2012/2013 of waste landfilled compared to the 2007/2008 baseline of 615kg per capita. Further, The City of Lake Macquarie Environmental Sustainability Action Plan 2014-2023 has set a target of 75% reduction in per capita waste to landfill by 2023 compared to 2007/2008 baseline levels. In 2014, the introduction of this new service won the Local Government NSW Excellence in Environment award – Organics Recovery.

In early 2013, the NSW Government announced a \$465.7 million initiative to transform waste and recycling in NSW over five years. As part of this package grants to build Community Recycling Centres (CRC) were announced and Council was awarded one of the early starter grants. The CRC was built at Awaba to divert household problem wastes from landfill and a three-year Education Plan and Communication plan developed to promote its use. It was the first CRC in New South Wales and became fully operational on 10 April 2014. Council is currently looking to open a second CRC on the Eastern side of Lake Mac.

To compliment the CRC and to make problem waste disposal more accessible, in September 2015, a total of eight Community Recycling Stations were installed in 6 Lake Macquarie City Council libraries, at Council's administration building and at Councils Works Depot. These stations have fostered greater community awareness of problem waste and they accept light globes, household batteries, mobile phones and accessories, smoke detectors, and CDs and DVDs.

Also, in 2014, Council undertook an eight week community Nappy Trial with 100 users of disposable nappies or incontinence aids. As a result of the findings, Council adopted to continue to provide a fortnightly service for these users but to also provide options for additional garbage services (at cost) if needed.

The City of Lake Macquarie Waste Strategy (2015-2023) was adopted in 2015 after public consultation. The Strategy outlines the steps that Lake Macquarie City Council is taking to meet state waste avoidance and resource recovery targets. It details current and future programs, services and plans for their implementation and promotion.

In spring 2016, 70 households in Rathmines and Fishing Point participated in a 66 day trial of the greener 3-bin service. These households were able to place food into their green bins during the trial, their green bins were emptied weekly and their garbage bins were emptied fortnightly. Trial participants were provided with a starter kit identical to the one which would be delivered to Lake Macquarie community residents before the service change in 2018. Results from the trial showed that the average household produced 3kgs food waste per week and only four per cent of participants reported any difficulty using the food scraps bin and compostable bags, and only twenty percent of garbage bins were full after a fortnight.

As part of the new Food+Garden=Green service a new state of the art Organics Resource Recovery Facility (ORRF), operated by the Remondis Group, was built to process up to 44,000 tonnes of food and garden waste into mulch and compost each year. It was launched on 19 July 2018 in time for the introduction of Lake Mac's greener 3-bin system. It is estimated that it will reduce the amount of waste going to landfill by an estimated 17,000 tonnes a year and offset increasing annual waste disposal costs, making the City's waste services more affordable into the future.

On 30 July 2018 the new Food+Garden=Green service started with all food scraps and garden waste being emptied into the green waste bin, which will be emptied weekly, and the garbage bin emptied fortnightly. Initial results are very promising showing that 97% of residents are sorting their food and green waste correctly.

Currently (October 2018), the AWMF is also undergoing expansion to extend its lifespan of by an estimated 10 years.

The expansion involves:

- construction of two additional landfill cells;
- relocation and upgrade of the weighbridge and gatehouse;
- relocation and upgrade of the Community Recycling Centre;
- a new amenities and administration building;
- a new waste transfer station to improve efficiency and limit vehicle traffic at the tip face;
- a new bypass road to access the new green waste processing facility; and
- a new wheel wash to reduce tracking of dirt from the tip face on to the public road network.

These construction works are due to be completed early 2019.

The Sort it Right campaign focusses on informing, educating and building awareness of the waste services that Council provides, how to use them correctly, and how to reduce contamination. This has been achieved through creating strong partnerships with the community and schools in spreading this message through workshops, Council events and community engagement.

Key Audiences - External

Residents – including homeowners, tenants, landlords, strata managers, multi- unit dwellings, real estate agents,

The primary focus of Council's Waste Strategy is municipal waste. If this group is not adequately informed with knowledge relating to all of Council's waste services and the consequences of any actions they take, then they cannot be expected to make informed decisions.

This is therefore the most important target group

Commercial – small businesses

Commercial operators who pay the commercial waste management charge are entitled to a 240 litre garbage bin. Other waste services are offered at cost. To date uptake of Council recycling services is limited, but the food waste service may be offered to food waste producers in the future.

Tourism – accommodation providers, caravan parks, tourists

Often high waste producers who do not generally view waste as important whilst on holidays. The main focus is to provide those tourism businesses with information on waste and recycling

Schools – primary and secondary

Focus on capacity building with teachers to implement sustainable waste practices at school and provide on-site workshops to primary and secondary schools.

Contractors

Solo Resource Recovery - collection contractor for green waste and recycling

Hunter Resource Recovery

Remondis – ORRF operator

Work with contractor's waste education officer to develop consistent key waste messages particularly in relation to reducing contamination in the recycling and green waste stream.

Key Audiences – Internal

Council – administration building and works depot

Employees and elected members are often residents too making them both internal and external audiences. The large workforce means it will play an important role in conveying sustainability and waste messages to the wider community.

Council practises “Walk the Talk” waste and recycling internally. The main aim for this engagement is to introduce opportunities for recycling and waste minimisation, as well as raising awareness amongst staff of waste issues.

Customer Service Centre

Waste issues remain the main reason why residents will contact Council. Hence it is important the CSC is regularly updated on any changes to the waste services so any calls can be handled directly by them.

Lake Mac libraries

Libraries play an integral role in waste information distribution and event promotion as well as the distribution of compostable bags

Council owned swimming pools

Waste Environment and Rangers (WER)

Waste Education and WER work closely together to produce promotional material, to deal with service requests and

Action plan

Avoid and reduce waste generation and reuse waste

Communications campaign objective	Action	Monitoring method	Target
Reduce the generation of waste by changing behaviours of the community and businesses through community education, engagement and involvement	<ul style="list-style-type: none">• Continue to support Super Street Sales• Continue to support and promote community gardens and home composting• Continue to support food waste avoidance• Continue to provide school waste workshops• Offer waste presentations to community groups• Council is a partner of Responsible Cafes• Promote waste reduction and recycling within Council and its facilities• Participate in the Hunter Waste Educators Group	Survey Weighbridge data	Diversion of waste from landfill is a 75 per cent reduction per capita by 2023 relative to a 2007-08 baseline of 616kgs

Increase recycling and diversion of waste from landfill

Decrease the amount of recyclables in garbage bins	<ul style="list-style-type: none">• Promote upsize of 360 litre recycling bin• Continue to promote “what goes where” educational information• Continue to provide biannual bulk waste collection service for recovery of e-waste, metals, mattresses and green waste	Kerbside audits	Decrease from the current levels of 20 per cent (2013 audit) to 10% by 2023
Increase the overall amount of household recyclable resources collected	<ul style="list-style-type: none">• Promote upsize of 360 litre recycling bin• Continue to promote “what goes where” educational information• Continue to work with Hunter Resource Recovery to promote their recycling education strategy	Weighbridge data	Recover 75 per cent of recycling material presented at the domestic kerb by 2023 relative to a 2007-08 baseline of 18

	<ul style="list-style-type: none"> • Cross regional recycling campaigns • Continue to provide school waste workshops through Council and Hunter Resource Recovery • Continue to provide free recyclables drop off at the Awaba Waste Management Facility • Utilise the Green Waste Education Centre as part of a waste awareness program for schools and the community • Distribute annual waste services guide to all households • Maintain residential recycling directory • Build a Reuse shop at Awaba Waste Management Facility • Continue to recover recyclables at the tip face • Promote and support National Recycling Week 		per cent.
Decrease the percentage of contamination of household recycling bins	<ul style="list-style-type: none"> • Continue to promote “what goes where” educational information • Continue to work with Hunter Resource Recovery to promote their recycling education strategy • Continue to support plastic bag ban and local initiatives to reduce their use • Continue to support initiatives that accept recycling products that are not accepted through Council waste services such as soft plastics through Redcycle, local coffee cup recyclers, and scrap metal merchants 	Hunter Resource Recovery audits and Council audits	Current levels of contamination are approximately 4%. Target to reduce this to 2% by 2023
Increase recycling of problem wastes	<ul style="list-style-type: none"> • Ensure the community has adequate access to facilities that accept 	Weighbridge and waste collector	Since the CRC was introduced in

	<ul style="list-style-type: none"> problem waste • Maintain Community Recycling Centre at Awaba • Work towards establishing a second CRC on the Western side of the lake and associated promotion • Maintain Community Recycling Stations at 6 Lake Mac Libraries, Council's Administration Building and Works Depot • Promote external businesses that recycle these wastes such MobileMuster, Paint Buyback, Hunter Pods (EPS) • Hold two Chemical CleanOuts per year on both the East and West sides of the lake • Establish new contract for supply and collection of public sharps, develop revised collateral to promote the service to the public 	(Toxfree) data	2013 recycling of problem waste has increased annually. Target for this diversion to increase by 10% each year
Reduce waste and increase recycling at Council run events	<ul style="list-style-type: none"> • Work with the Events team and stallholders to reduce waste, promote recycling and food waste collection 	Event audit data	
Provide public place recycling	<ul style="list-style-type: none"> • Continue to provide and service these bins in public places • Increase public recycling infrastructure • Provide adequate signage to ensure proper use of bins 	Weighbridge data	Continue to install new bins near identified hot spots such as beaches and parks
Minimise the amount of litter in the environment	<ul style="list-style-type: none"> • Support and promote the NSW EPA's litter reduction campaign including Return and Earn and Don't be a Tosser • Supporting volunteer efforts for Clean Up Australia Day and the 	Local litter checks	

Council-run Eco Angels program

- Compliance activities undertaken by Council rangers
- Promoting sustainable events on Council land

Communication Methods

There are many forms of communication that are being used to promote the Sort it Right campaign and these include:

- Community engagement and events: e.g. school workshops, community presentations, stalls at community days, shopping centres or major Council events such as the annual Living Smart Festival.
- Social media such as Facebook and Twitter and utilising options to boost posts.
- Digital marketing such as on Council's website or through online advertising in the Newcastle Herald.
- Print advertising in local newspapers and magazines, Council's Your City newsletter, poster displays in local shopping centres.
- Radio advertising in conjunction with Hunter Councils and HRR to promote problem waste recycling and general recycling at Christmas.
- Direct marketing activities: e.g. rates notice mail out, Eco advocate newsletters, email updates, internal Council newsletters, distribution of waste services guide to all Lake Mac households each year.
- Sponsorships/partnerships: e.g. opportunities to work with local sporting clubs, businesses, real estate agents, and other organisations to promote the Council's recycling and food waste service.
- Public relations: e.g. media publicity such as the opening of the ORFF, events such as National Recycling Week, major CRC milestones or media releases outlining results of city-wide kerbside bin audits and the recent food waste collections.
- A purpose-built education centre complete with viewing platform has also been constructed as part of the ORFF and this will be used to run workshops, community open days and meetings

Monitoring and Evaluation

Activity	Monitoring and Evaluation
Advertising (including radio, online, newspaper)	<p>Increases in number of people using services correctly during promotional period</p> <p>Decrease in contamination in recycling and green waste bins</p> <p>For CRC, decrease in by-catch</p> <p>Number of calls coming through to Customer Service Centre from residents enquiring about disposal options</p> <p>Increase in hits on waste pages on Council website</p> <p>Customer surveys of CRC</p>
Facebook advertising	<p>Facebook insights and analytics including:</p> <ul style="list-style-type: none"> Impressions Click through rate (%) Cost per click (\$) Engagement (likes, reactions, comments, shares)
Online advertising	Number of click throughs to website
Community engagement at events and stalls	<p>Customer Surveys</p> <p>Number of customer interactions and dissemination of brochures</p> <p>Amount of information and resources given out at stand</p> <p>Increase in website hits to coincide with displays</p>
Public relations	Requests for interviews for radio, TV and newspaper

Direct marketing	<p>Number of call/enquiries coming through to CRC</p> <p>Uptake in new waste services such as upsized recycling bin, green waste bins for community groups and schools, Super Street Sales registrations</p>
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Outcomes	Monitoring and Evaluation
Increased community awareness of the waste issues in Lake Mac	<p>Survey data (to be uploaded on Council website)</p> <ul style="list-style-type: none"> • % who are aware of the current waste issues • % that know how to dispose of all household waste correctly
Reduced waste to landfill	Weighbridge data – reduction in waste to landfill annually to 75 per cent reduction by 2023
Increased resource recovery through greater use of the recycling and green waste bins, the CRC and Community Recycling Stations	<p>Weighbridge, kerbside audit and Community Recycling Station data:</p> <ul style="list-style-type: none"> • Increased number of bins presented to kerb • Increase in tonnes collected from previous years • Increased number of CRC visitors from previous years • Increased weights collected from CR Stations

Level of inappropriate use of 3-bin system	<p>Kerbside audits</p> <ul style="list-style-type: none"> • The amount of contamination in recycling bins • The amount of contamination in green waste bins • The amount of recyclables in the garbage bin • the amount of problem waste in kerbside bins, illegal dumping, and bulky waste collections • data from 3-bin audits, from recycling contractor and from green waste contractor • Quantity of by-catch collected at the CRC
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Budget

The budget allocated for the 2018/19 financial year is \$181,310 and will be used to fund a general waste awareness campaign.

The budget funds the following components of the campaign:

- Production and distribution of all promotional materials
- Advertising (online, social media, radio and newspaper)
- Sponsorships
- Community events and displays
- Chemical CleanOut (2 events per year)
- Waste Services guide design, production and distribution
- Waste Avoidance Workshops

In addition, as part of the NSW EPA Waste Less Recycle More initiative, \$10,000 is allocated to Council each year to promote the Community Recycling Centre.

Appendix H – Complaints Handling and Investigation Procedure


	<p>Procedure</p> <p>Awaba Waste Management Facility / Organics Resource Recovery Facility - Complaints Management</p>	
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Procedure

Purpose

The purpose of this procedure is to manage complaints received by Council regarding the environmental performance of either the Awaba Waste Management Facility or the Organics Resource Recovery Facility.

The Awaba Waste Management Facility is located at Lot 372 DP 723259, and the Organics Resource Recovery Facility is located at Lot 373 DP 723259. Both facilities share a common access off Wilton Road Awaba with a street address of 367 Wilton Road, Awaba.

Council operates the Awaba Waste Management Facility under the Environment Protection Authority's (EPA) Environment Protect Licence (EPL) number 5873

Remondis operates the Green Waste Processing Facility (under contract to Council) under the EPA's EPL number 20949.

Both Council and Remondis have obligations under their respective EPL's to record, investigate and report pollution incidents and complaints at the time they are identified, and also as part of their Annual Reports. The environmental performance of Licenced premises influences the EPA's Risk Based Licencing assessment, the classification of the site, and also the annual licence fees charged by the EPA.

Generally, the public assume both facilities are operated by Council, and will forward inquiries to Council regarding the operations of both facilities. It is therefore important that initially the inquiry is assessed and assigned to the correct organisation, in a timely manner, to record, investigate, report and respond to such inquires.

This procedure provides a general guideline on how to manage such inquiries.

1 Receipt of Inquiry

Council Customer Service Centre (CSC) or Records department receives the inquiry in the usual manner, including via:

- Phone call
- Letter
- Email
- Person

2 Logging and Assigning Inquiry

Where an inquiry is made via letter or email, the Records department:

- Enter the correspondence into Council's RM8 records management system
- Assign the document to the Awaba Waste Management Facility Environmental Officer
- Create a Service Request (SR) and assign to the Awaba Waste Management Facility Environmental Officer

Where an inquiry is made via phone or in person, the CSC:

- Create a Service Request (SR) and assign to the Awaba Waste Management Facility Environmental Officer

3 Initial Investigation

Upon receipt of the SR the Awaba Waste Management Facility Environmental Officer:

- Responds to the customer to:
 - advise receipt of the inquiry
 - advise when the investigation will commence
 - request any additional information to assist in the investigation
- Investigates the allegation to determine the probable source of the complaint (Awaba Waste Management Facility, Organics Resource Recovery Facility, or other)
- Consults with the appropriate contact at the probable source of the complaint to seek their concurrence and acceptance of responsibility of the SR.
- Updates the SR with actions taken and either accepts responsibility of the SR for further investigations, actions and response, or, reassigns the SR to the Organics Resource Recovery Facility.
- If the Organics Resource Recovery Facility is deemed to be the probable source of the complaint, then the SR will be assigned to the Council Officer responsible for managing the Organics Resource Recovery Facility contract (Senior Waste Officer), who will then forward the complaint on to the Organics Resource Recovery Facility by email, and follow up with Facility management to obtain a timely response.
- If the responsible party is other than the Awaba Waste Management Facility or the Organics Resource Recovery Facility, then the Environmental Officer reassigns ownership of the SR to a Waste Environment and Rangers Environmental Health Officer.

4 Ongoing Investigation

The responsible party (Awaba Waste Management Facility, Organics Resource Recovery Facility, or the WER Environmental Health Officer)

- Accept the SR
- Undertake further investigations as required to
 - determine the cause of the incident,
 - Implement controls to manage the incident
 - Implement controls to reduce the risk of it occurring again
 - Consult with relevant staff
- Update the customer regarding the outcome of the investigation
- Report to the EPA in accordance with the EPL requirements
- Record data for future reference and inclusion in annual EPL reporting requirements
- Close the SR and complete associated RM8 documents.

Controlled Document Information

Authorisation Details

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Related Document Information, Standards & References

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Related Policies (Council & Internal):	Environmental Sustainability Policy	(Relationship/Context)
Related Procedures, Guidelines, Forms, WHS Modules/PCD's, Risk Assessments, Work Method Statements:	(Document Name)	(Relationship/Context)
Standards COP's & Other References	Awaba Waste Management Facility – Environment Protection Licence – 5873 Organics Resource Recovery Facility – Environment Protection Licence - 20949	Defines complaints - receipt, recording, notification and reporting obligations. Defines complaints - receipt, recording, notification and reporting obligations.

Definitions

Term / Abbreviation	Definition
EPA	Environment Protection Authority
EPL	Environment Protection Licence
SR	Service Request
CSC	Customer Service Centre

Consultation (update for each version created)

Key Departments, Teams, Positions, Meetings:	Awaba Waste Management Facility Staff Environmental Health Officers Sustainability Remondis
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Version History

Version No	Date Changed	Modified By	Details and Comments
1	21/05/2018	David Brake	New procedure created

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Appendix I – Biodiversity Management Plan



Biodiversity Management Plan 2015

Awaba Waste Management Facility (AWMF)



Lake Macquarie City Council November 2015

Acknowledgements

This Plan was prepared in consultation with Lake Macquarie City Council staff. Comments from the NSW Office of Environment and Heritage and NSW Department of Planning and Environment are gratefully acknowledged.

Photo credits

Martin Fallding, and Niche Environment and Heritage.

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Appendix A Weed species list

Appendix B Consultation letter from NSW Office of Environment and Heritage

Appendix C Independent land management agency consultation letter

Summary

The Awaba Waste Management Facility (AWMF) was approved subject to conditions requiring implementation of measures to mitigate impacts on native flora and fauna. The site forms part of a large area of natural bushland with biodiversity values.

This Biodiversity Management Plan outlines measures to be applied during project construction and ongoing management of natural areas retained on the site for conservation.

This plan consolidates and integrates a number of biodiversity plans and protocols required by the AWMF consent. The Plan provisions for biodiversity will be implemented as part of the project planning and construction process.

Key issues addressed in the Plan are vegetation clearing and weed management practice.

1 Introduction

This Biodiversity Management Plan has been prepared to guide construction of the Awaba Waste Management Facility (AWMF) and associated works, and provides a framework for ongoing management of retained natural areas on the site.

The Plan applies to all of Lot 372 DP 723259, off Wilton Road, Awaba and additional land as shown on Map 1. It relates to the extension of the existing landfill facility which currently occupies an area of about 20 ha. The AWMF extension will result in clearing of 8.55 ha of native vegetation.

In addition, a sewer pipeline approximately 3.4 km long will be constructed from the AWMF to the Rathmines sewer pump station (SPS). The pipeline will be placed beneath the existing road formation within Lot 372 and the access road to Rathmines SPS. The remainder of the pipeline would be placed within a 3 m wide easement immediately adjacent to Wilton, Wangi and Dorrington Roads, Awaba. The pipeline will remove up to approximately one hectare of mostly modified native vegetation within road reserves and up to 10 trees will require removal, trimming or sustain root damage as a result of trenching works. While a separate construction and environmental management plan will be prepared for this project, the provisions of this Plan may be adopted by reference.

2 Background information

2.1 Approval context & conditions

The Awaba Waste Management Facility project approval (consolidated) as modified by the NSW Land and Environment Court on 23 October 2013 requires the preparation of a number of biodiversity management plans. This Plan consolidates and integrates the required plans and fulfils the development consent requirement. The Plan should be read in conjunction with a number other plans and documents are outlined in Section 2.4.

The AWMF project approval requires implementation of measures relating to threatened biodiversity as outlined in the consent conditions.

Table 1 Consent conditions addressed in the Plan

Consent requirement	Plan reference
Pre-clearance surveys (Condition 53)	Section 3 and 6.1
Translocation Plan for the Project (Condition 54)	Section 5.2
Vegetation and Fauna Management Plan (Condition 55)	Section 5.1 and 6.1
Vegetation Clearing Protocol (Condition 56)	Section 5.1 and 6.1

Comprehensive flora and fauna assessments were undertaken prior to the approval, and reviewed both the area required for clearing for the AWMF (Forest Fauna Surveys Pty Ltd et al. 2012) and the associated pipeline (Niche Environment and Heritage 2012). Measures were recommended to avoid and mitigate biodiversity impacts of the pipeline works are to (1) adjust the pipeline alignment to avoid mature trees, (2) implement a Construction Environmental Management Plan, and (3) reduce soil and vegetation disturbance at creek crossings.

Actions recommended in project approval documents to reduce potential impacts have been included in the Plan. It is expected that the only additional field ecological survey work required will be to document and mark habitat trees to be cleared.

The provision of compensatory habitat was reviewed in the preparation and assessment of the proposal and is subject to separate approval requirements. This Plan contains no provisions for providing or managing compensatory habitat.

The Plan has been prepared by Lake Macquarie City Council staff with appropriate qualifications and extensive experience in threatened species planning and management.

2.2 Plan objectives & structure

The Plan applies to (1) land where native vegetation is proposed to be cleared, (2) measures to be undertaken during the project construction stage, and (3) ongoing bushland management requirements. Objectives of the Plan are to:

- Inform and guide on ground works related to the AWMF project.
- Ensure that conditions of consent for the project are complied with.
- Identify implementation and monitoring requirements.

The Plan is required prior to commencement of construction and will be used in the project tender process.

This Biodiversity Management Plan identifies specific plans and protocols required to manage flora and fauna impacts, in accordance with the project's conditions of approval. It is structured to incorporate a vegetation and fauna management plan (Section 5.1), a translocation plan (Section 5.2) and a set of protocols (Section 6) detailing required management actions during the construction stage:

1. General vegetation clearing protocol
2. General weed control protocol
3. Construction vegetation management and rehabilitation protocol

The protocols are structured to enable them to be incorporated in construction management plans for works associated with the proposal, including the Construction and Environmental Management Plan (CEMP) for the sewer pipeline.

The vegetation and fauna management plan and translocation plan will apply for the operational life of the project, whereas the protocols relate to the project construction stage only. Following the completion of the post construction actions required for the project, parts of the Plan will therefore cease to have effect.

2.3 Consultation

Comprehensive consultation in relation to the project occurred in the preparation of the development application and development assessment stages.

Further consultation occurred with the NSW Office of Environment and Heritage and Department of Planning and Environment in the preparation of this Plan. The NSW Office of Environment and Heritage consultation letter is in Appendix B.

Consent conditions 54 and 55 require the translocation plan (Section 5.2) and vegetation and fauna management plan (Section 5.1) to be reviewed by an independent agency that oversees land management outcomes in the region. For this reason, Hunter Local Land Services has been consulted in the preparation of this Plan, and its comments are in Appendix C.

Ongoing consultation with stakeholders may also be undertaken in relation to specific matters that may arise during the construction of the project.

2.4 Relationship with other plans

Sections 5 and 6 of the Plan may be incorporated in a Construction and Environmental Management Plan (CEMP), or the conditions of this Plan may be adopted by reference in the CEMP.

Management of natural areas retained for conservation is to be consistent with the *Awaba Biodiversity Conservation Area – Plan of Management 2015* (Lake Macquarie City Council 2015), which applies to land providing a biodiversity offset for the development impacts of the AWMF and other projects, and is located directly to the south of Wilton Road. The management measures in that Plan may be applied for ongoing management of retained natural bushland areas on the land to which this Plan applies.

3 Biodiversity values & issues

Comprehensive biodiversity surveys were undertaken as part of the project design and assessment process (Forest Fauna Surveys et al. 2012 and Niche Environment and Heritage 2012). Impacts on threatened species and endangered ecological communities were assessed, and approval was conditional on implementing measures to minimise and mitigate impacts.

Four threatened plant species were recorded within the site area as identified in Table 2. While clearing of some *Tetratheca juncea* and its habitat is proposed (Figure 1), the other threatened plant species are expected to be unaffected. Management practices are proposed during construction and for the long term to ensure these species remain on the site.

Table 2 Management measures for threatened plant species on the site

Scientific name	Common name	Characteristics & management measures
<i>Tetratheca juncea</i>	Black-eyed Susan	Widely spread across the area to be cleared, and occurs in bushland to be retained. Areas of habitat are to be retained and not disturbed.
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>		Not identified in areas proposed for clearing, although it is known in bushland area to be retained.
<i>Acacia bynoeana</i>		Limited occurrence on the site. Plants are not proposed to be disturbed.
<i>Angophora inopina</i>		Limited occurrence in part of the site where native vegetation will be retained. Potential impacts from activities carried out along Wilton Road.

Native vegetation cover on the site and surrounding land is shown on Map 2 and is generally in good condition. The site is subject to weed impacts and also affected by other issues. The Plan identifies priority issues and protocols for operational works affecting flora and fauna.

Biodiversity surveys undertaken include identification of all hollow-bearing habitat trees affected by clearing required for the proposal (Map 3). Further pre-clearance survey is only required to confirm the previous field surveys as provided by the vegetation clearing protocol (Section 5.1). Native vegetation communities on the land are shown on Map 4.

Habitat suitable for a range of threatened fauna species occurs on the land and there is potential for them to occur. Impacts on these species were not assessed as being significant. Measures are proposed in the Plan to ensure that impacts are minimised, specifically by applying appropriate clearing management practices especially for clearing hollow bearing trees.



Figure 1 - The threatened plant species *Tetratheca juncea* is widespread on the land



Figure 2 – View east along Wilton Road with non-native plants along roadsides

4 Responsibilities for biodiversity management

This Plan is required to fulfil the terms of consent conditions 53, 54, 55 and 56 for the Awaba Waste Management Facility (AWMF) and guides implementation of the consent provisions.

This Plan may be included in the construction and environmental management plan (CEMP) for the project, either in full or by reference. Responsibilities for implementing the Plan are outlined in Table 3.

Subcontractors are required to apply relevant provisions of this Plan specific to their detailed activities. Lake Macquarie City Council will be responsible for determining whether subcontractor documents and practices are consistent with this Plan.

Project personnel will undergo training in flora and fauna protection and management measures required by the Plan. It is expected that this will be part of general project induction prior to commencing work. Topics that must be covered in awareness training are:

- Location of native vegetation areas retained for conservation
- Identifying and protecting habitat trees
- Soft-fell clearing procedures
- Basic fauna rescue procedures
- Weed identification and control

Table 3 Project roles & responsibilities

Role	Key responsibilities
Project Manager (Council)	<p>Approve this Plan and any subsequent revisions.</p> <p>Comply with consent conditions and complete monitoring and reporting required as a consequence of this Plan.</p> <p>Ensure appropriate resources are available for the implementation of flora and fauna management actions and protocols in the Plan.</p>
Construction/ Environment Manager (Contractor)	<p>Provide sufficient resources to enable the plans and protocols to be implemented.</p> <p>Ensure personnel are provided with inductions relating to the matters included in this Plan.</p> <p>Ensure necessary pre-clearance surveys are conducted and a project ecologist is engaged.</p> <p>Assist project engineers in implementing appropriate corrective or preventative actions that may be required.</p> <p>Ensure that appropriate flora and fauna management measures are implemented and maintained.</p>
Site Coordinator (Contractor)	<p>Ensure personnel are provided with inductions relating to the matters included in this Plan.</p> <p>Ensure pre-clearance surveys are conducted to identify and mark habitat trees.</p> <p>Report non-compliances or hazards associated with this Plan to the Construction/Environment Manager.</p> <p>Inform the Construction/ Environment Manager of any flora and fauna management issues as they arise.</p> <p>Ensure that flora and flora management requirements are implemented as required.</p> <p>Provide assistance and advice to the project engineers and other relevant personnel on flora and fauna related matters as required.</p>
Project ecologist (Engaged by contractor in consultation with Council)	<p>Provide advice on hollow bearing tree clearing and fauna displacement.</p> <p>Undertake pre-clearing habitat tree survey in and immediately adjacent to the area to be cleared, and other flora and fauna assessment as required.</p> <p>Observe clearing activities and direct clearing works including additional ecologists to oversee works involving multiple work fronts if necessary.</p> <p>Animal handling, identification and recording.</p>
Environmental review group (or similar)	<p>Oversee implementation of plan as required.</p>

5 Biodiversity management & translocation plans (ongoing)

This section of the Plan outlines plans that will apply over the life of the AWMF project, and comprises the plans for vegetation and fauna management and threatened species translocation. The provisions of the translocation plan will primarily apply during the construction period, but may extend over the life of the project.

5.1 Vegetation and fauna management plan

The AWMF site will retain some areas of native vegetation and habitat for native species. Native vegetation on surrounding land will also be retained. This Plan includes measures to be implemented for vegetation and fauna management for the full duration of the establishment and operation of the AWMF and associated works.

Measures to be applied are shown in Table 4 and aim to limit ongoing impacts on native species, specifically listed threatened species. This should be read in conjunction with the protocols that are to be implemented during the project construction stages to mitigate impacts.

Table 4 General vegetation and fauna management measures

Number	Management and mitigation measure	Timing	Responsibility
1	Personnel shall have a site induction to include information on flora and fauna management measures, retained conservation areas and restrictions on access.	All stages	Project Manager
2	The native vegetation clearing footprint for the development is to be minimised throughout the construction and operational stages.	All stages	Project Manager
3	A 30 metre vegetated buffer around the water course is to be retained as described in the project environmental assessment (EA) documentation.	All stages	Project Manager
4	Construction and maintenance activities shall be restricted to the approved development footprint as designated. Native vegetation areas retained for conservation must not be entered.	All stages	Project Manager
5	An appropriate buffer distance must be provided between any construction activity and native vegetation in retained conservation areas or on adjoining land.	All stages	Project Manager
6	Clearing or activities that could potentially affect breeding of native animals are to be avoided during the spring and early summer months (September to January).	All stages	Project Manager
7	Appropriate fencing or delineation is to be constructed and maintained to prevent access in retained conservation areas.	All stages	Construction/ Environment Manager
8	Rubbish and waste material is to be removed from retained natural areas.	All stages	Site coordinator

Number	Management and mitigation measure	Timing	Responsibility
9	Adequate sediment / erosion control measures are implemented to avoid runoff from construction activities (including nutrients, weed seeds, contaminants and pollutants) entering adjoining native vegetation.	All stages	Construction/ Environment Manager
10	Fencing shall be designed and constructed to not harm wildlife. Wildlife friendly design, materials to include non-barbed wire, appropriate wire spacing and height, visibility and permeability.	All stages	Construction/ Environment Manager
11	Vehicles and machinery shall remain on designated vehicle tracks and in designated work areas to prevent damage to vegetation and injury to fauna from impact. Vehicles shall obey speed limits to minimise fauna fatalities.	All stages	Site coordinator
12	Long term management actions to maintain and improve habitat resources on the site will be considered and implemented where practical, including: <ul style="list-style-type: none"> • placement of nesting boxes in suitable habitat for birds and arboreal mammals; • relocation of habitat features salvaged from felled trees (e.g. hollow branches or logs) 	All stages	Project Manager
13	Weed management strategies will be implemented on the land to prevent spread of weeds into native vegetation.	All stages	Project Manager
14	In the event that a threatened species or endangered ecological community is identified on the land, which was not identified in the environmental assessment (eg a new listing of a species, population or community), a suitably qualified ecologist will be engaged to assess the impacts. Appropriate measures will be implemented to ensure that ongoing work will not significantly impact on the species while appropriate ameliorative and management measures are investigated.	All stages	Project Manager
RESOURCES & INFORMATION			
	<i>Awaba Biodiversity Conservation Area Plan of Management 2015</i> (LMCC 2015) applies to land adjacent to the site. Management of the land should be consistent with this Plan and should be used for reference.		

5.2 Threatened species translocation plan

Background

Translocation is the deliberate movement of organisms from one site to release at another site, and is a last resort. Translocation is generally not an acceptable option, has been demonstrated to have limited success, and is associated with significant risks.

Although clearing of native vegetation at the AWMF will result in dislocation of native fauna and flora, there is no proposal or commitment to translocating the species affected. For translocation to be undertaken, species to be moved and recipient sites must be identified. The only species where translocation could reasonably be considered from the AWMF project is the threatened plant *Tetratheca juncea* where 2,302 identified plant clumps are proposed to be cleared from the site. While native fauna species will be affected by clearing, these will not be translocated, but relocated to adjoining bushland in accordance with the vegetation clearing protocol.

Required actions

There is no proposal to translocate any species from the site. In the event that an opportunity arises for a suitable recipient site, translocation will only be considered for *Tetratheca juncea*.

Any translocation must be in accordance with relevant guidelines and the Lake Macquarie *Tetratheca Juncea* Planning and Management Guidelines (LMCC 2014). Legislative requirements may also apply. Translocation will only be considered within 10 km of the site, and in the North-west and/or Westlakes Planning Sectors identified in LMCC (2014). Movement of soil material must take care to avoid contamination and spread of weeds and pathogens. Any translocation will be subject to a monitoring requirement for at least 2 years.

Additional information and references

IUCN/SSC (2013) *Guidelines for Reintroductions and Other Conservation Translocations. Version 1.0*. Gland, Switzerland: IUCN Species Survival Commission.

Lake Macquarie City Council (2014) Lake Macquarie *Tetratheca juncea* Planning and Management Guidelines.

NSW National Parks and Wildlife Service (2001) *Policy for the Translocation of Threatened Fauna in NSW*, Threatened Species Management Policy and Procedure Statement No 9.

Vallee L, Hogbin T, Monks L, Makinson B, Matthes M & Rossetto M, 2004, *Guidelines for the Translocation of Threatened Plants in Australia – Second Edition*, Australian Network for Plant Conservation.



Figure 3 – Hollow bearing trees provide important fauna habitat

6 Biodiversity management protocols (construction stage)

Project mitigation and management measures are outlined in the protocols in this section to ensure compliance with approval conditions. These protocols apply only to the construction stage of the development and include management and mitigation measures requiring implementation.

These protocols can be referred to in tender and contract documents. Note that while the protocols relate to separate aspects of the project, they are to be considered in conjunction with one another.

6.1 General vegetation clearing protocol

The general vegetation clearing measures to be applied during construction works are outlined in Table 5. These measures are grouped according to relevant construction stage, including those to be applied prior to clearing, during clearing, and following the completion of works.

Table 5 General vegetation clearing protocol

Number	Management and mitigation measure	Timing	Responsibility
DELINEATION OF AREA TO BE CLEARED – The area for clearing is to be identified and checked prior to pre-clearing actions being undertaken.			
1	The boundary between the area to be cleared and adjoining vegetation will be clearly marked or fenced.	Pre-construction (min 2 weeks before clearing)	Construction/environment Manager

Number	Management and mitigation measure	Timing	Responsibility
2	Marked boundaries will be cross-referenced to the approved impact area. Use a surveyor to identify boundaries if required.	Pre-construction (min 2 weeks before clearing)	Construction/ environment Manager
3	Relevant staff are to walk clearing limits to ensure they are adequately described and marked and agreed prior to clearing. Clearing is only to occur within the agreed delineated area.	Pre-construction	Construction/ environment Manager
PRE-CLEARING ACTIONS – Actions are required to identify and/or confirm flora and fauna habitat elements, especially habitat trees. Retained native vegetation and conservation areas are to be delineated.			
4	A suitably qualified project ecologist is to be engaged to undertake the requirements of the protocol.	Pre-construction	Construction/ environment Manager
5	Tree clearing is to be scheduled where possible to avoid disturbance to fauna during hibernation and breeding periods. Preferred period is March to May.	Pre-construction	Construction/ environment Manager
6	A pre-clearance inspection of all habitat trees in and near the clearing area will be undertaken within two weeks prior to the commencement of vegetation clearing. Habitat trees are marked on Map 3 and are primarily old trees with hollows. Characteristics for identification include: <ul style="list-style-type: none"> • Dead trees • Snapped off branches • Trunk spouts, damage or disease • Damage to trunk such as disease 	Pre-construction (2 weeks before clearing)	Site co-ordinator
7	Habitat trees outside the clearing area but in close proximity to construction activities will be clearly marked and protected. Refer to Map 3.	Pre-construction (2 weeks before clearing)	Site co-ordinator
8	Ensure project ecologist will be available on site during clearing works.	Pre-construction (2 weeks before clearing)	Site co-ordinator
9	Within the clearing area all habitat trees are to be clearly marked.	Pre-construction	Project ecologist
10	Mark and fence exclusion areas to protect native vegetation and habitat elements to be retained.	Pre-construction	Site co-ordinator
11	The earlier survey documenting habitat trees of the area (Forest Fauna Surveys et al. 2012) will be reviewed and correlated with the trees identified. Any inconsistencies will be investigated and reported to the project manager.	Pre-construction	Project ecologist

Number	Management and mitigation measure	Timing	Responsibility
12	Seed or other plant material from native species on the site may be collected from areas to be cleared to provide locally endemic species for revegetation or other uses.	Pre-construction	Site co-ordinator
13	Locate nearby habitat suitable for release of fauna that may be encountered during clearing and habitat removal.	Pre-construction	Project ecologist
14	Where possible, seed collected from the area will be stored or propagated for subsequent rehabilitation activities in accordance with Florabank guidelines. The following measures apply when undertaking seed collection activities: <ul style="list-style-type: none"> • Seed collection should be undertaken at various times throughout the year as plant species set seed at different seasons. • Take seed from several different plants of the same species to ensure genetic diversity is maintained. • Seed should be collected from a variety of different habitats such that these communities can be re-created in rehabilitation areas. • All seed should be labelled showing the species name, the date and exact collection location. • Seed should be stored in the most appropriate manner for each species to maintain seed viability until it is to be utilised. 	Pre-construction	Site co-ordinator
15	Review potential presence of disease causing agents present on the site such as bacteria or fungi where spread should be prevented.	Pre-construction	Project ecologist
<p>CLEARING HOLLOW-BEARING TREES – This protocol specifically relates to hollow-bearing habitat trees. A total of 40 habitat trees were identified within the clearing area on Lot 372. Habitat trees with hollows provide essential habitat for some native fauna species and are an important resource for many other species. Measures to reduce the impacts of clearing these trees are to be implemented to minimise harm to fauna and to potentially allow their removal and reuse.</p>			
16	Hollow-bearing trees removed are to be salvaged to be able for use in rehabilitation works around the site, and where a hollow bearing tree is to be felled, a controlled felling technique will be used as described below.	During clearing	Site co-ordinator
17	Identified and marked hollow-bearing trees are assumed to provide habitat for fauna, and when clearing: <ul style="list-style-type: none"> • Investigate trees on the day that they are to be felled, to detect any individual animals present at the time. • Where arboreal species are detected in a tree, that tree and a 5 metre buffer around it are to be left uncleared, and the animal left to vacate the tree of its own accord, generally overnight. 	During clearing	Site co-ordinator & Project ecologist

	<ul style="list-style-type: none"> • Clear surrounding native vegetation first and allow hollow-bearing trees to remain standing overnight. After at least 24 – 48 hours, hollow-bearing trees can be removed in accordance with the steps below. • When removing hollow-bearing trees, a spotter should be present at each tree to be removed to look for signs of animal movement in the tree to be cleared. The spotter should be able to communicate directly with plant operators. • Prior to clearing hollow-bearing trees, use an excavator or loader to hit or sharply nudge the trunk as high up the tree as possible several times. Wait at least 30 seconds. Repeat this process several times. • Watch and wait for fauna to vacate the tree for up to 5 minutes. • Trees shall be soft-felled to minimise impacts upon any fauna inside and felled habitat trees shall be left for two days to allow fauna inside to escape unless the absence of fauna can be confirmed at an earlier time. • Carefully fell hollow-bearing trees and check tree-hollows to locate any wildlife. • All trees are to be felled into the clearing area or construction zone. • Select the preferred direction of fall, and note potential escape routes for fauna that may emerge. • Felled trees are to be examined immediately for the presence of fauna by the project ecologist, who will examine potential shelter sites (hollows, nests, termitaria, epiphytes, decorticating bark, crevices, etc). • Once the hollow-bearing limbs or hollow-bearing tree are on the ground, the spotter must check each hollow for signs of wildlife before the next limb/tree is removed. • If taking the tree down in stages, remove non hollow-bearing limbs first. Then remove hollow-bearing limbs. • Records of any animals removed or injured must be retained. • Collect any wildlife located during clearing activities after all the above mitigation measures have been undertaken, and immediately release into adjacent bushland. In the event that an animal is found injured, the local Wildlife Information Rescue and Education Services (WIRES) organisation will be contacted immediately for assistance on phone number 1300 094 737. 		
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Number	Management and mitigation measure	Timing	Responsibility
18	<p>Appropriate, species specific temporary housing for displaced fauna is to be provided. For example:</p> <ul style="list-style-type: none"> • An appropriate large safe container will be used to capture mammals, which are then transferred into a thick sack. • Gliders, possums, snakes and frogs will be similarly held individually in a calico bag until release in adjacent habitat. • Nesting birds and eggs will be placed in a covered cardboard box equipped with soft cloth. • Rescued fauna will be protected from exposure to heat and removed from the area undergoing clearing to minimise exposure to noise. • Any fauna that cannot be released immediately or by the evening of the day clearing occurred will be passed onto a wildlife rescue organisation/carer. 	During clearing	Site co-ordinator
19	Hollow-bearing habitat trees will be inspected after felling to determine their suitability for reuse and relocation.	During clearing	Project ecologist
<p>VEGETATION CLEARING – The protocols apply to clearing of native vegetation other than habitat trees. Impacts must be avoided in important biodiversity areas and retained conservation areas.</p>			
20	Where possible, vegetation clearance will be scheduled to incorporate seasonal habitat requirements of bats and other mammals by avoiding hibernation and breeding periods. Generally, clearing of habitat should be avoided between September and February.	Pre-construction	Project manager
21	<p>Ensure that the project ecologist is present during all clearing activities to do the following:</p> <ol style="list-style-type: none"> 1. rescue and ensure treatment of injured fauna, and 2. observe and assist fauna dispersal to adjoining areas, and 3. identify and record animals encountered within the clearing area. <p>Multiple ecologists will be required to oversee each area of clearing if more than one machine is undertaking clearing on site or if more than one area is being cleared at any one time.</p>	During clearing	Site co-ordinator
22	Vegetation clearing will occur in a two-stage process whereby non-habitat trees are removed first, then habitat trees removed after a 24-48 hour period to allow an opportunity for any fauna to move from the habitat trees.	During clearing	Site co-ordinator
23	Felled hollow trees will be thoroughly inspected by the Project Ecologist to ensure any remaining fauna are relocated away from the site.	During clearing	Project ecologist

Number	Management and mitigation measure	Timing	Responsibility
24	Animals found prior to or during clearing activities will be released to surrounding suitable habitat.	During clearing	Project ecologist
25	In the event of the detection of listed threatened bird species within the area to be cleared, all clearing work will cease and further investigations will take place to determine if nesting is occurring. If nesting is recorded, a buffer of 200m around the nest site will be established. Clearing may occur outside this exclusion zone until any young have left the nest.	During clearing	Site co-ordinator
26	In the case of arboreal or flying mammals, attempts may be made to relocate the identified den or roost to an alternative location on the site. After capture, the animal(s) will be held by a trained wildlife carer for a period of no longer than two weeks until the roost or den can be relocated, either as an entire tree or part, in a suitable location having regard to vegetation, aspect and height above ground. Artificial roosts or den sites will be placed around the relocated roost or den. If relocation of the roost or den is not possible, at least five suitable artificial boxes will be provided within the most suitable habitat. Work may recommence once the animal(s) have been captured and removed from the area.	During clearing	Project ecologist
27	Felled trees will be placed between cleared and remnant bushland where possible to provide runways of ground cover for dispersal of animals. Tree trunks will be placed along the bunds adjacent to cleared areas to facilitate terrestrial species movement and to provide refuge and foraging opportunities. Woody debris from smaller trees will be placed along any bunds or in small piles or strips within the vegetation adjacent to the clearing area. Excess material may be mulched and used on site.	During clearing	Project ecologist
28	Where practicable, tree hollows in large branches will be removed during tree clearing operations and relocated to a suitable alternative site as determined by the project ecologist. Micro habitats, including dead trees, stags, stumps and hollow branches will be salvaged and relocated to areas lacking tree hollow habitat and/or to revegetation areas.	During clearing	Project ecologist
29	Within riparian areas (areas adjacent to waterways) vegetation is to be cut at the stump and the roots left in place to ensure minimum bank disturbance (where construction activities allow).	During clearing	Site co-ordinator
30	Where the removal of trees is required, fell trees into the most disturbed area possible, to avoid damaging adjacent vegetation and do not push felled vegetation into areas to be retained.	During clearing	Site co-ordinator
31	All native trees other than those determined to remain on the site for fauna habitat will be mulched after clearing for re-use as erosion and sediment controls or in landscaping works.	During clearing	Site co-ordinator

Number	Management and mitigation measure	Timing	Responsibility
32	Appropriate measures are to apply to ensure that machinery does not bring materials (soils etc.) onto the site that may infect vegetation with <i>Phytophthora cinnamomi</i> or other soil fungi or pathogens, as described in Appendix 1 of the Awaba Alternate Waste Treatment Facility Plant Pathogen Management Plan (LMCC 2015).	During clearing	Site co-ordinator
FAUNA PROTECTION & HANDLING – Protocols apply where fauna are found during clearing operations.			
33	Any uninjured animals must be encouraged to leave the site. Direct contact with any fauna species should be avoided wherever possible.	During clearing	Project ecologist
34	Where animals are injured, WIRES or similarly qualified and licensed personnel should be contacted to collect and treat any injured individuals.	During clearing	Project ecologist
35	<p>If fauna are encountered at any stage of the project, and the fauna species is identified as a threatened species that has not previously been recognised as occurring or likely to occur on the site, then:</p> <ul style="list-style-type: none"> • Immediately cease work if it is likely to affect the that species. • Undertake an assessment to verify any potential impacts on the new species, and develop new mitigation measures if necessary. • Discuss with the NSW Office of Environment and Heritage (OEH). • Do not recommence work that is likely to affect the species until the project manager has reviewed the assessment and discussions and determined that re-commencing work is appropriate. 	During clearing	Site co-ordinator/ Project ecologist
USE OF CLEARED VEGETATION & SOIL – Spoil from clearing is a potential resource and may be valuable for rehabilitation and soil stabilisation			
36	<p>In the disposal of vegetative slash and felled timber, the following measures should apply:</p> <ul style="list-style-type: none"> • Habitat features such as surface rock and large logs should be redistributed to adjacent areas following the works. • Mulch rather than burn cleared native vegetation. If non-weedy, this can be used in rehabilitation works. • Weedy vegetation should not be reused. It should be treated onsite and suitably disposed of. 	After clearing	Site co-ordinator/ Project ecologist
37	Review opportunities for re-instating some of the felled habitat trees on or adjacent to the site.	After clearing	Co-ordinator/ Ecologist
38	Topsoil is not to be reused in weedy areas identified by the project ecologist.	After clearing	Co-ordinator/ Ecologist

Number	Management and mitigation measure	Timing	Responsibility
MONITORING – The construction and environmental management plan (CEMP) may apply benchmarks and indicators to ensure that clearing objectives are met.			
39	Indicators to be monitored include: <ul style="list-style-type: none"> • Number and species of fauna individuals observed. • Number of times WIRES has been contacted where required. • Compliance with habitat tree clearing procedures. • Regular tool box talks identifying the above issues. 	All stages	Site co-ordinator
40	Prepare and complete a checklist daily during vegetation clearing.	All Stages	Site co-ordinator
RESOURCES & INFORMATION			
	<i>AS4970 2009 Australian Standard: Protection of trees on development sites</i> should be used as a guideline; this document provides a protocol for determining tree protection zones.		
	The number for WIRES should be retained onsite for injured animals – 1300 094 737 www.wires.org.au		
	NSW Roads and Traffic Authority, 2011, <i>Biodiversity Guidelines</i> includes additional information, photos and examples of measures to be applied.		
	Lake Macquarie City Council, 2015, <i>Awaba Alternate Waste Treatment Facility Plant Pathogen Management Plan</i> includes a protocol for prevention of plant pathogens during construction (Appendix 1).		

6.2 General weed control protocol

For management purposes a weed is regarded as any non-locally indigenous plant. Measures are to be implemented to control and manage existing and future processes leading to weed invasion and sources of weeds which are invasive of natural areas.

Weed invasion occurs in natural areas mainly as a result of the following factors:

- physical disturbance due to construction activity, clearing, or mowing
- increased soil moisture due to runoff
- increased nutrients from runoff or waste dumping
- increased light levels due to clearing or dieback
- increase in weed propagules and seed dispersal agents.

Measures are to be taken during construction work to prevent the occurrence of factors leading to weed invasion as outlined in Table 6. Typically, weeds move into

bushland from adjoining urban or other modified areas. The main entry locations are stormwater drains, roads and tracks. Weeds tend to spread most rapidly downslope along watercourses, roads and tracks, and then move slowly into adjacent bushland.

Table 6 General weed control protocol

Number	Management and mitigation measure	Timing	Responsibility
WEED SPECIES & DISTRIBUTION – It is important to be aware of the distribution of weeds and their potential to be spread during construction work and rehabilitation. The work areas contain a number of Class 4 noxious weeds which must be controlled.			
1	Weed species identified on the land are identified in Appendix 1, and include noxious species for which specific legislative requirements apply.	Pre-construction	Site co-ordinator
2	Priority weeds are identified in Table 6 and control requires attention to the biological characteristics of individual species as summarised in the table.	Pre-construction	Site co-ordinator
WEED MANAGEMENT STRATEGY – A strategy will assist reducing weed management costs.			
3	Noxious weeds (plants posing a threat to agriculture, the environment or the community) are formally declared under the <i>Noxious Weeds Act 1993</i> . Some categories of noxious weeds are legally required to be removed as soon as possible.	All stages	Site co-ordinator
4	The preferred method of weed control is manual removal, or control by slashing. Weed spraying with chemicals is a last resort option.	All stages	Site co-ordinator
5	Where there are existing infestations, the management priority is to ensure that there is no spread of the area of infestation.	All stages	Site co-ordinator
6	Program works from least to most weed infested areas and consider using a variety of weed control methods.	All stages	Site co-ordinator
7	With dense weed infestations the aim is to contain the core of the infestation and eradicate outlying populations before they became well established.	All stages	Site co-ordinator
WEED CONTROL MEASURES – Practices should be applied to prevent weed dispersal.			
8	It is important to undertake manual removal of weeds at the correct time. This means removal before flowering and seeding, or when plant is at maximum visibility. During moist soil conditions, mechanical removal is most effective, since maximum root removal can be achieved.	All stages	Site co-ordinator
9	Mow/slash areas infested with weeds along road verges before they seed. This may reduce the propagation of new plants.	All stages	Site co-ordinator
10	Clean machinery, vehicles and footwear before moving to a new location.	Construction	Site co-ordinator

Number	Management and mitigation measure	Timing	Responsibility
11	Securely cover loads of weed contaminated material to prevent weed spread and dispose of properly.	Construction	Site co-ordinator
12	Do not stockpile weed contaminated soil, and dispose of immediately.	Construction	Site co-ordinator
13	Separate weeds from native vegetation where native vegetation is used for mulch for rehabilitation or erosion control purposes. Do not use weeds for mulch.	Construction	Site co-ordinator
14	Weed control is to be carried out in a manner that minimises negative environmental impacts. Different techniques are required in varying situations, especially along watercourses, which are very sensitive to pollution impacts.	Construction	Site co-ordinator
15	Other management issues and practices directly relate to the potential for introduction and spread of weeds, and their management. Weeds are most likely to be introduced by motor vehicles, rubbish dumping, earthworks and by wind and bird spread. More intense weed survey and control must be undertaken in the 12 months following any bush fire.	Post construction	Site co-ordinator
WEED MONITORING – Actions are required to review the effectiveness of weed management practice.			
16	Six monthly weed inspections are to be undertaken and reported annually.	All stages	Project manager
17	Weed management in natural areas requires ongoing regular weed monitoring and periodically walking over the land at times when plants are most likely to be evident (eg during flowering or rapid growth stages), and at least annually. Walking routes should be along all existing tracks where weeds are most likely to establish, along watercourses, and also randomly in areas not commonly frequented, particularly for those species spread by birds.	All stages	Project manager
18	Monitoring is to be undertaken to identify and respond to the occurrence of new plant species posing a potential threat to natural areas.	All stages	Project manager
RESOURCES & INFORMATION			
	Natural Heritage Trust (2004) <i>Introductory Weed Control Manual</i> .		
	Department of Primary Industries (2007) <i>Noxious and Environmental Weed Control Handbook</i> .		
	Weed species list (Appendix 1).		

The weeds identified in Table 7 require active management, including removal where noted. Appropriate on-ground staff should be able to identify these species.

Table 7 Priority weeds requiring control on or near the land

Common name	Scientific name	Key characteristics	Management strategy	Site location & management actions
Moth Vine*	<i>Araujia sericifera</i> (syn. <i>A. hortorum</i>)	A woody perennial vine with shallow root system that can climb up to 7 metres and smothers native vegetation, often in moist areas.	Manually remove	Uncommon
Spear Thistle*	<i>Cirsium vulgare</i>	Annual or biennial erect herb.	Prevent seeding	Scattered occurrence - monitor
Fireweed*	<i>Senecio madagascariensis</i>	Daisy like annual or biennial herb up to 70 cm high.	Prevent seeding	Scattered occurrence - monitor
Castor Oil Plant*	<i>Ricinus communis</i>	Perennial shrub up to 6 m high.	Prevent seeding	Uncommon - monitor
Bitou bush*	<i>Chrysanthemoides monilifera</i> subspecies <i>rotundata</i> & <i>monilifera</i>	Class 4 Noxious Weed and a Weed of National Significance	Must be managed in a manner that reduces its numbers spread and continuously inhibits its reproduction	Scattered across site in natural bushland. Regular inspection and manual removal.
Blackberry *	<i>Rubus fruticosus</i>	Class 4 noxious weed. Perennial with canes capable of forming new plants where tips contact ground. Spread by birds and animals.	Growth must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction	Only one plant identified on the land along internal track near creek. Seek to manage and prevent spread of infestations by manual removal and/or chemical treatment with a metsulfuron – methyl product.
Buffalo grass	<i>Stenotaphrum secundatum</i>	Creeping grass usually 10-30 cm tall. Widespread lawn grass	Foliar spray	Along Wilton Road. Spray

Common name	Scientific name	Key characteristics	Management strategy	Site location & management actions
Cassia*	<i>Senna pendula</i>	Perennial sprawling multi-stemmed shrub or tree up to 5m tall. The large seed pods are eaten by birds and other animals. Establishes in a wide range of native plant communities	Dispose of large seed pods. Plants easily dug out, removing all roots. Herbicide treatment using the cut and paint technique	Along Wilton Road. Manually remove
Thatch grass	<i>Hyparrhenia rufa</i> subsp. <i>rufa</i>	A long lived invasive drought, fire and herbicide tolerant tussock grass. Dispersed by wind and vehicles. Flowers and sets seed from spring to autumn	Foliar spray, with 2 – 3 applications for control. Potential for spread by slashing and vehicles	Along Wilton Road. Spray and monitor spread
Crofton weed*	<i>Ageratina adenophora</i>	Class 4 Noxious Weed. Flowers in mid Spring (mid October), seed spreads by wind, preferentially grows along watercourses, wet areas and in disturbed areas	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction. Control by annual physical removal and/or chemical treatment with a metsulfuron – methyl product. Remove when flowering (usually August/September) and before seeding.	On disturbed land. Inspect and pull out by hand (preferably when soil is moist)
Lantana*	<i>Lantana specios</i>	Weed of National Significance	Monitor. Manual removal	Monitor
Rhodes Grass	<i>Chloris gayana</i>	Drought tolerant perennial or annual grass, generally in disturbed areas	Manual removal when other grasses are being treated with chemicals.	Along Wilton Road

Common name	Scientific name	Key characteristics	Management strategy	Site location & management actions
Whiskey grass	<i>Andropogon virginicus</i>	Perennial tufted grass 0.5 – 1 m in height. Reproduces mainly by seed, and commonly dispersed by vehicles or slashing. Can invade open woodlands and forests	Foliar spray, or physical removal before seeding in summer/autumn.	Primarily along tracks. Spray

Note - weeds identified with * are listed as noxious under the *Noxious Weeds Act 1993*.

6.3 Construction vegetation management and rehabilitation protocol

Although the provisions relate to AWMF site clearing works, they are also relevant to pipeline construction clearing and any other construction works affecting native vegetation on or near the site.

This protocol is in Table 8 and applies to all areas disturbed by works (including trenches, road verges, and hard stand areas) associated with construction works. Implementation of the measures in the protocol will limit flora and fauna impacts and ensure site restoration and rehabilitation following construction.

The objective is to minimise surface disturbance, rapidly re-establish stable surfaces resistant to erosion and weed ingress and to ultimately return disturbed areas to their undisturbed state with similar plant species composition and vegetation structure.

Procedures will be implemented for trench and pit excavation work to reduce the risk to fauna that may become trapped in trenches, minimise injury to fauna that become, trapped and to ensure that trenches and pits are adequately rehabilitated.

Weed management is required before, during and after construction, recognising that different weed species occur along different areas. Requirements are outlined in the weed management protocol which is to be implemented in conjunction with this protocol. Weed occurrences in key management areas are identified in Niche (2012) for the following areas, namely Rathmines SPS access track, Dorrington Road, Wangi Road, and Wilton Road.

Table 8 Construction vegetation management and rehabilitation protocol

Number	Management and mitigation measure	Timing	Responsibility
<p>PRE CLEARING SURVEY – A survey of native vegetation and habitat along the sewer pipeline route was undertaken in 2012. This has shown that about 1 ha of mostly modified native vegetation in road reserves and up to 10 trees may require removal, trimming or may sustain root damage due to trenching works. This survey also identified weeds and introduced plants and important biodiversity areas close to the pipeline.</p>			
1	Prior to clearing, the pipeline route is to be clearly marked, together with the 3 m wide construction easement.	Construction	Site co-ordinator
2	Trees requiring removal are to be identified, and those requiring trimming or within 5 metres of the trench are to be separately marked.	Construction	Site co-ordinator
3	Areas close to the construction easement and not disturbed by trenching which are important biodiversity areas (eg habitat trees or threatened plants identified by the project ecologist) are to be marked and fenced to prevent disturbance. Refer to Niche (2012) Appendix 8.	Construction	Site co-ordinator
4	Areas of the construction easement where noxious weeds are present are to be identified by the project ecologist, and these weeds are to be removed or treated prior to construction.	Construction	Site co-ordinator
<p>TRENCH EXCAVATION MANAGEMENT – In some areas (eg watercourses), trenching is not appropriate and under boring is expected to be required. Open trenches can potentially trap native fauna and measures must be taken to minimise potential impacts. Animals that may become trapped in trenches or pits are most likely to include small mammals, frogs and reptiles. It is preferred that trenches be left open for the minimum time possible before rehabilitation, adequately fenced, and not allowed to fill with water.</p>			
5	Slash pipeline route prior to excavation to prevent spread of seed by machinery.	Construction	Site co-ordinator
6	During construction works trenches and pits are to be left open for the least amount of time practical.	Construction	Site co-ordinator
7	Trim nearby vegetation where possible rather than removing it.	Construction	Site co-ordinator
8	Trenches or pits left open overnight will be fenced or sealed where possible to prevent fauna becoming trapped.	Construction	Site co-ordinator
9	Open trenches or pits left overnight will be inspected at first light and any trapped fauna removed and relocated in areas of adjacent habitat outside the work area.	Construction	Site co-ordinator
10	Providing a timber stick or ramp may allow trapped fauna to exit the trench without being handled.	Construction	Site co-ordinator
11	Fauna should be handled only if required, by an ecologist if possible. Handle trapped animals safely, minimising stress and injury. Frogs will only be handled using gloves.	Construction	Site co-ordinator

Number	Management and mitigation measure	Timing	Responsibility
12	WIRES should be phoned immediately to treat injured fauna and this should be noted as an incident.	Construction	Site co-ordinator
ACCESS CONTROL – Restriction on vehicle and machinery access is important as direct impacts on flora and fauna can include road kills along service roads, felling of habitat trees and crushing of fallen logs during clearing. Indirect impacts from vehicles and machinery include fuel spills, dispersal of weeds, erosion, noise, dust and light.			
13	Access will be managed to limit vehicles and construction machinery to prevent disturbance to native vegetation outside the construction area, and to reduce impacts such as weed invasion, disturbance to vegetation, damage to rehabilitation areas, and fauna injury from vehicle collision.	Construction	Site co-ordinator
14	Measures will be undertaken to identify access entrances into native vegetation and to implement appropriate methods of controlling access into these entrances including signs, gates, or rehabilitation of access tracks.	Construction	Site co-ordinator
15	Limit access to sensitive creeks or drainage areas of riverbanks and riparian vegetation during construction of the sewer pipelines to prevent inadvertent or unauthorised disturbance of adjacent vegetation.	Construction	Site co-ordinator
WEED CONTROL – Construction activities impact significantly on the spread of weeds, and weed management measures are to be undertaken in conjunction with site works. See Weed Control Protocol in Table 5.			
16	Weed control methods should be specific to the species and consistent with the general weed control protocol and local weed management plans.	Construction	Site co-ordinator
17	Identify weed species present and areas requiring control prior to construction.	Construction	Site co-ordinator
18	Treat existing weed infestations in accordance with the appropriate management methods. Weeds may require control or slashing prior to construction to prevent weed seed spread.	Construction	Site co-ordinator
19	Weed control activities should be undertaken by a contractor with experience in weed control, with control measures appropriate to the species and season and in accordance with local management plans.	Construction	Site co-ordinator
20	Minimise the area of disturbance by implementing the Vegetation Clearing Protocol.	Construction	Site co-ordinator
21	Prevent introducing and spreading weeds by utilising materials (eg fill and hay bales) that are weed and nutrient free.	Construction	Site co-ordinator
22	Vehicle and machinery movement and temporary storage of equipment/materials is to be confined to disturbed areas and existing tracks where possible.	Construction	Site co-ordinator

Number	Management and mitigation measure	Timing	Responsibility
23	Vehicles and machinery are to be cleaned (tyres brushed or washed down) prior to accessing and leaving areas where weeds have been identified.	Construction	Site co-ordinator
24	Following the completion of works, rehabilitate all disturbed areas according to the Rehabilitation Protocol.	Post-construction	Site co-ordinator
25	Weed monitoring and management is to occur in rehabilitation areas for 2 years following completion of construction.	Post-construction	Site co-ordinator
CLEARING – The general vegetation clearing protocol is to apply during and following construction works.			
26	Adequate tree protection zones shall be provided where adjacent trees may be impacted by construction works. The tree dripline (area directly under the branches) can be used to guide the adequacy of a protection zone.	All stages	Site co-ordinator
EXCAVATION, FILLING, EROSION AND SEDIMENT CONTROL – Soil disturbance may contribute to soil erosion and sedimentation with resulting environmental impacts.			
27	Works should anticipate erosion and sediment control issues and implement appropriate control measures.	All stages	Site co-ordinator
28	Construction works should aim to achieve immediate stabilisation of the surface to minimise erosion and subsequent sedimentation impacts downstream.	All stages	Site co-ordinator
29	Where there are construction works in the vicinity of streams or gullies, riparian vegetation is to be retained where possible.	All stages	Site co-ordinator
30	Non-weedy topsoils from excavation will be stored separately and respread prior to rehabilitation.	All stages	Site co-ordinator
31	Trenches will be filled such that topsoil is placed above subsoil in the trench.	All stages	Site co-ordinator
RUBBISH & WASTE – Measures are to be taken to control rubbish and waste			
32	A “carry-in, carry-out” policy will apply regarding rubbish and waste materials generated on site to avoid waste materials (including cigarette butts) entering adjacent vegetation and waterways or attracting vermin to site.	All stages	Site co-ordinator
33	Rubbish and waste currently on the site and directly adjacent to work areas is to be removed and disposed of appropriately.	All stages	Site co-ordinator
REHABILITATION - Disturbed areas will be rehabilitated progressively throughout the construction phase. Effective restoration requires using strategies appropriate to the location and condition with input from suitably qualified personnel.			
34	Rehabilitation is to be undertaken as soon as possible as works progress.	Post-construction	Site co-ordinator

Number	Management and mitigation measure	Timing	Responsibility
35	Restoration techniques can range from simply replacement of topsoil, allowing the natural seed bank to germinate, through to importation of topsoil and planting of tube stock. Maintenance (watering and follow up seeding or planting) will depend on the method used and seasonal and other environmental conditions at the time of the works.	Post-construction	Site co-ordinator
36	The goal of rehabilitation is to establish a functional and sustainable vegetation community with structure and floristics comparable to that of surrounding, naturally occurring vegetation.	Post-construction	Site co-ordinator
37	Use native vegetation grown from locally endemic seed for revegetation where possible.	Post-construction	Site co-ordinator
38	Disturbed areas are to be stabilised to prevent weed ingress or soil erosion.	Post-construction	Site co-ordinator
39	In areas with limited topsoil, hydromulch or imported non-weedy topsoil may be used.	Post-construction	Site co-ordinator
40	If rainfall is insufficient to establish the growth of vegetation, reseeded areas should be watered weekly until plants are established and self sufficient (based on weekly monitoring).	Post-construction	Site co-ordinator
41	Success of rehabilitation works is to be monitored on a monthly basis post construction works to ensure stable surfaces (70% vegetation cover) are achieved.	Post-construction	Site co-ordinator
42	Monitoring of rehabilitated areas is to be undertaken for at least 2 years following the completion of construction, and will determine following up actions that may be required such as weed control, reseeded and fencing.	Post-construction	Site co-ordinator
MONITORING – The construction and environmental management plan (CEMP) may apply benchmarks and indicators to ensure objectives are met.			
43	Revegetation monitoring is to be undertaken. Indicators to be monitored (normally 3 monthly for at least 2 years) include: <ul style="list-style-type: none"> • Percentage groundcover – A minimum 70% vegetation cover is required. Bare ground is susceptible to soil erosion and weed invasion. • Presence of weed species and proportion of native/non-native species. • Presence of active soil erosion • Soil stabilisation measures are required where present. 	Post-construction	Site co-ordinator

Number	Management and mitigation measure	Timing	Responsibility
44	Monitoring within revegetated areas will specifically focus on: <ul style="list-style-type: none"> • Germination rates where direct seeding has been used • Survival rates of tube stock • Health of plants (comparing within species and between species); and • Need for maintenance activities including watering, weed control, repair of damaged plant bags, or removing plant bags from trees that have grown too large. 	Post-construction	Site co-ordinator
45	Flora and fauna indicators to be monitored are: <ul style="list-style-type: none"> • Number of fauna individuals injured • Number and species of fauna trapped and removed at first light • Number of times WIRES has been contacted where required • Regular tool box talks discussing the above issues 	Post-construction	Site co-ordinator
RESOURCES & INFORMATION			
	NSW Roads and Traffic Authority, 2011, <i>Biodiversity Guidelines</i> includes additional information, photos and examples of measures to be applied.		
	The number for WIRES should be retained onsite for injured animals – 1300 094 737 www.wires.org.au		
	Niche Environment and Heritage (2012) <i>Flora & Fauna Assessment – Proposed pipeline from Awaba Waste Disposal Facility to Rathmines SPS</i> , report to Lake Macquarie City Council includes a map of pipeline route and the location of important biodiversity areas and species lists which are reproduced in this document.		

7 Implementation & monitoring

During the project construction phase, implementation of the plans may form part of the construction and environmental management plan (CEMP) which will apply relevant protocols. Regular inspections of the construction site will be undertaken to identify actual or potential flora and fauna management issues of concern.

The proposed inspection schedule and audit requirements, including responsible personnel, reporting requirements and frequency will be detailed in the CEMP.

Weed monitoring and management is to be undertaken at 6 monthly intervals for a minimum 2 years following the completion of construction, and until a stable natural ecosystem can be maintained, consistent with pre-construction conditions.

References

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Murphy C L, 1993, *Soil Landscapes of the Gosford-Lake Macquarie 1:100,000 Sheet*, Department of Conservation and Land Management.

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Niche Environment and Heritage, 2012, *Flora & Fauna Assessment – Proposed pipeline from Awaba Waste Disposal Facility to Rathmines SPS*, report prepared for Lake Macquarie City Council.

Map 1 **Location map**

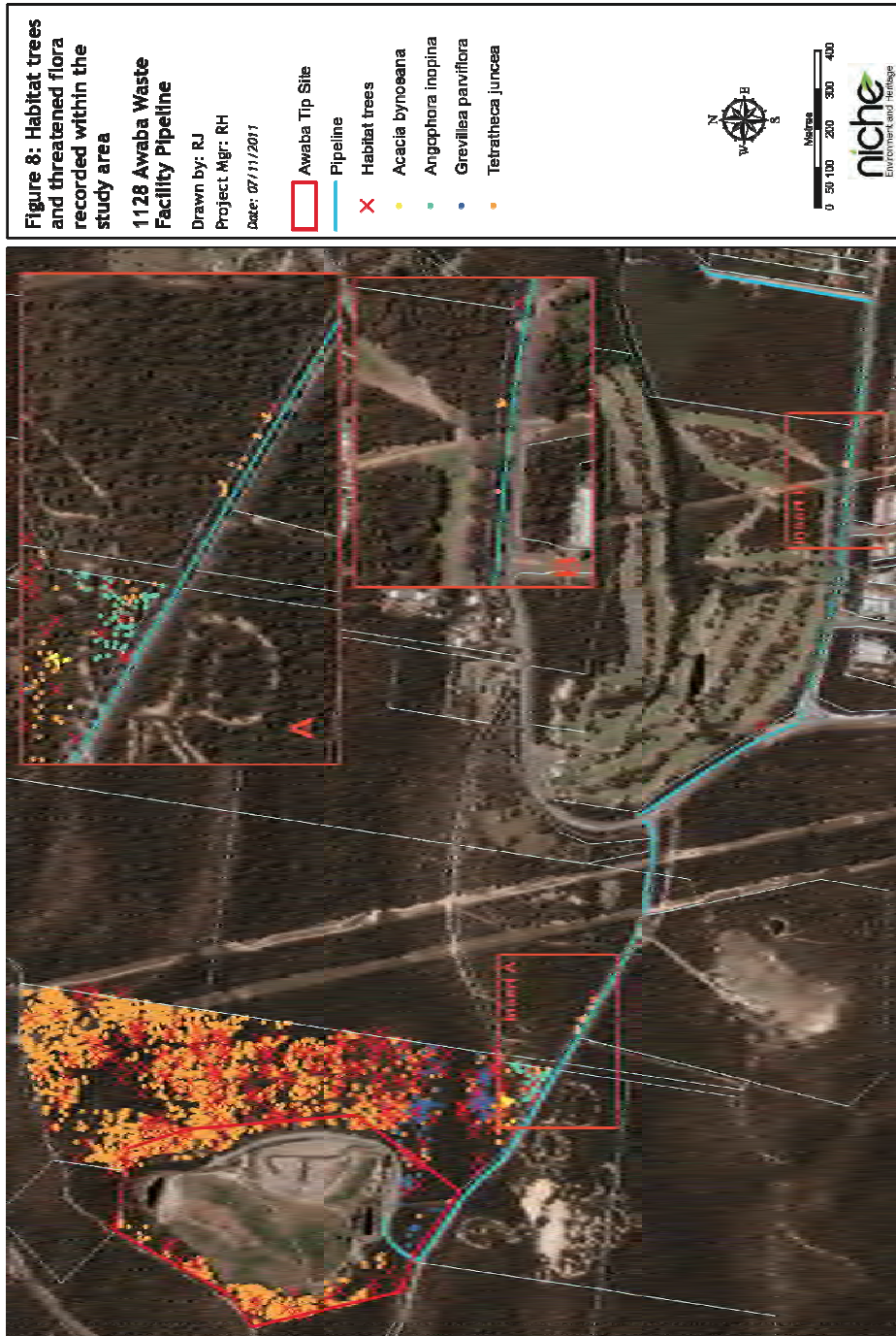


Note: Awaba Waste Management Facility is marked purple, sewer pipeline in red.

Map 2

Flora and Fauna Records and threatened species

(Figure 8 from Niche Environment and Heritage 2012)



Map 3

Habitat trees

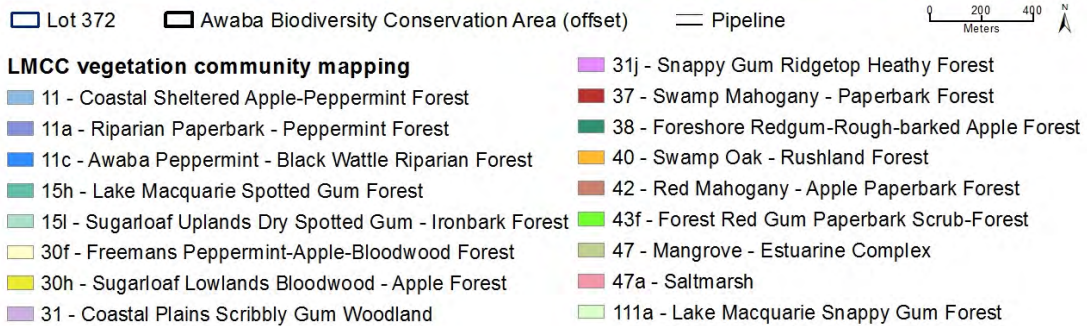
(from Forest Fauna Surveys et al. 2012)



Study Area - Lot 372 Awaba Landfill
Vegetation / Habitat Disturbance Area

Map produced by Forest Fauna Surveys Pty Ltd
Base Aerial Photograph copyright LMCC
Aerial Photo Date: 2007

Map 4 Native Vegetation Communities



Appendix A Weed species list

Weeds currently occurring on the AWMF & sewer pipeline route (from Niche 2012)

Family & Scientific Name	Common Name	Status	Control priority	Comments 1,2,3,4
Apiaceae				
* <i>Cyclospermum leptophyllum</i>	Slender Celery		Moderate	mc mc u
Apocynaceae				
* <i>Araujia sericifera</i> (syn. <i>A. hortorum</i>)	Moth Vine	Noxious Weed	High	u
Asteraceae				
* <i>Ageratina adenophora</i>	Crofton Weed	Noxious Weed	High	mc u
* <i>Bidens pilosa</i>	Cobblers Pegs		Low	mc mc
* <i>Chrysanthemoides monilifera</i> subsp. <i>rotundata</i>	Bitou Bush	Noxious Weed	High	u u
* <i>Cirsium vulgare</i>	Spear Thistle	Noxious Weed	High	u mc
* <i>Conyza bonariensis</i>	Flaxleaf Fleabane		Low	mc u c u
* <i>Erigeron karvinskianus</i>	Seaside Daisy		Low	u
* <i>Foeniculum vulgare</i>	Fennel		Low	u u
* <i>Gamochaeta ? americana</i>	Cudweed		Low	u u u
* <i>Hypochoeris radicata</i>	Flatweed		Low	mc u mc
* <i>Senecio madagascariensis</i>	Fireweed	Noxious Weed	High	mc mc u
* <i>Sonchus oleraceus</i>	Common Sowthistle		Low	u u u u
* <i>Taraxacum officinale</i>	Dandelion		Low	c u
Caryophyllaceae				
* <i>Cerastium glomeratum</i>	Mouse-ear Chickweed		Low	u mc
* <i>Petrorrhagia nanteuillii</i>			Low	u u

<i>Proliferous Pink</i>				
Cyperaceae				
* <i>Cyperus eragrostis</i>	Umbrella Sedge		Low	u u u
Euphorbiaceae				
* <i>Ricinus communis</i>	Castor Oil Plant	Noxious Weed	High	u
Ericaceae				
* <i>Senna pendula</i>		Noxious Weed	High (Noxious Weed)	u mc
Fabaceae				
* <i>Melilotus indicus</i>	Hexham Scent		Low	u
* <i>Tephrosia ? grandiflora</i>	Narrow-leaved Clover		Low	mc mc u
* <i>Trifolium angustifolium</i>			Low	u
* <i>Trifolium campestre</i>	Hop Clover		Low	u mc mc mc
* <i>Trifolium pratense</i>	Red Clover		Low	u mc
* <i>Trifolium repens</i>	White Clover		Low	mc mc c mc
* <i>Trifolium sp.</i>	a clover		Low	u
* <i>Trifolium subterraneum</i>	Subterranean Clover		Low	mc mc mc
Faboideae				
* <i>Vicia sativa subsp. nigra</i>	Vetch		Low	mc u mc u
Gentianaceae				
* <i>Centaurium erythraea</i>	Common Centaury		Low	
* <i>Centaurium tenuiflorum</i>			Low	u
Iridaceae				
* <i>Iris sp.</i>			Low	u
* <i>Sisyrinchium iridifolium</i>	Blue Pigroot		Low	u
Liliaceae				
* <i>Lilium formosanum</i>	Formosan Lily		Moderate	u mc u

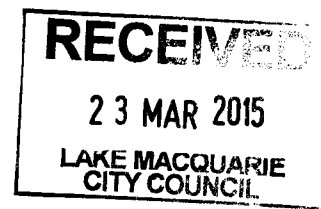
Malvaceae				
* <i>Sida rhombifolia</i>	Paddy's Lucerne		Low	mc
Plantaginaceae				
* <i>Plantago ? myosuroides</i>			Low	u u
* <i>Plantago lanceolata</i>	Lamb's Tongues		Low	mc c c mc
Poaceae				
* <i>Agrostis sp.</i>	Bent Grass		Low	u
* <i>Aira sp.</i>	Hairgrass		Low	u u
* <i>Andropogon virginicus</i>	Whiskey Grass		Moderate	mc mc u mc
* <i>Anthoxanthum odoratum</i>	Sweet Vernal Grass		Low	mc u
* <i>Avena barbata</i>	Bearded Oats		Low	u
* <i>Briza maxima</i>	Quaking Grass		Low	mc mc mc mc
* <i>Briza minor</i>	Shivery Grass		Low	mc mc mc
* <i>Briza subaristata</i>			Low	mc mc mc mc
* <i>Bromus catharticus</i>	Prairie Grass		Low	mc mc mc
* <i>Bromus sp.</i>	a broome		Low	u
* <i>Chloris gayana</i>	Rhodes Grass		Moderate	mc c
* <i>Dactylis glomerata</i>	Cocksfoot		Low	mc
* <i>Ehrharta erecta</i>	Panic Veldtgrass		Low	
* <i>Eragrostis sp.</i>			Low	u u mc u
* <i>Holcus lanatus</i>	Yorkshire Fog		Low	u u
* <i>Hyparrhenia rufa supsp. altissima</i>	Thatch grass		Medium	u
* <i>Lolium perenne</i>	Perennial Ryegrass		Low	mc c
* <i>Panicum capillare</i>	Witchgrass		Low	mc u
* <i>Paspalum dilatatum Paspalum</i>			Low	c
* <i>Pennisetum clandestinum</i>	Kikuyu		Low	mc
* <i>Poa annua</i>	Winter Grass		Low	u u

* <i>Setaria sp.</i>			Low	u mc
* <i>Sporobolus ? africanus</i>	Parramatta Grass		Moderate	u
* <i>Stenotaphrum secundatum</i>	Buffalo Grass		Low	c
* <i>Vulpia myuros</i>	Rat's Tail Fesque		Low	u
Polygalaceae				
* <i>Polygala virgata</i>	Broom Milkwort		Low	u
Primulaceae				
* <i>Anagallis arvensis</i>	Scarlet/Blue Pimpernel		Low	mc mc u mc
Rosaceae				
* <i>Rubus fruticosus</i>	Blackberry complex	Noxious Weed	High	u mc u
Rubiaceae				
* <i>Richardia ? humistrata</i>			Low	u mc mc
Solanaceae				
* <i>Solanum mauritianum</i>	Wild Tobacco Bush		Low	u
* <i>Solanum nigrum</i>	Black-berry Nightshade		Low	u
Verbenaceae				
* <i>Lantana camara</i>	Lantana	Noxious Weed	High	u mc u u
* <i>Verbena bonariensis</i>	Purpletop		Low	c mc u mc

Relative abundance Key; U = uncommon, Mc = moderately common, C = common

Status Key; V = vulnerable on either the TSC Act or EPBC Act, * = exotic species; Location Key; 1 = Rathmines SPS access track, 2 = Dorrington Road, 3 = Wangi Road, 4 = Wilton Road

Appendix B Consultation letter from NSW Office of Environment and Heritage



Your reference: PM13/0203/14
Our reference: DOC15/74283-02
Contact: Robert Gibson, 4908 6851

Mr Brian Bell
General Manager
Lake Macquarie City Council
Box 1906
HUNTER REGION MAIL CENTRE NSW 2310

Attention: Martin Fallding

Dear Mr Bell

RE: AWABA WASTE MANAGEMENT FACILITY – BIODIVERSITY MANAGEMENT CONSULTATION

I refer to your letter dated 2 March 2015 seeking comment on the draft Biodiversity Management Plan prepared for the Awaba Waste Management Facility. The Office of the Environment and Heritage (OEH) notes that conditions 54 and 55 of the consent specify that the translocation and fauna management plan components of the Biodiversity Management Plan must be prepared in consultation with OEH. Further, OEH acknowledges that this Biodiversity Management Plan has been prepared to meet conditions for related projects at the Awaba Waste Management site.

OEH has reviewed the draft Biodiversity Management Plan, dated 23 February 2015, for this project. Please note that OEH encourages the development of such plans to ensure that proponents have determined how they will meet their statutory obligations and designated environmental objectives. However, OEH does not normally approve or endorse these documents as our role is to set environmental objectives for environmental/conservation management, not to be directly involved in the development of strategies to achieve those objectives. In this instance, however, the following recommendations and comments are provided for your consideration:

- In relation to the Section 5.1 *Vegetation and fauna management plan* - OEH recommends that row numbered 13 in Table 3 *General vegetation and fauna management* is reworded to also include the possibility that additional threatened species may occur on the Awaba offset land. This may happen for example, by new listings of threatened entities in *Schedules of the Threatened Species Conservation Act 1995*. Additional species, populations or communities identified on the offset site may result in the need for further assessment and possibly some additional management actions for the offset site.
- In relation to Section 5.2 *Threatened species translocation plan* - OEH recommends that the *Guidelines for the Translocation of threatened Plants in Australia: Second Edition* (Vallee *et al.*, 2004 (and future editions, when available)) is also cited in this section. This is recommended as this book includes examples, checklists and detailed advice on monitoring that would complement the other literature cited in the draft management plan, which would be useful in the event that translocation of threatened plants occurs onto the offset land.
- In relation to Section 6.2 *General weed control protocol* - OEH recommends that *Chrysanthemoides monilifera* subsp. *monilifera* is added to Table 6 *Priority weeds requiring control on or near the land*,

for there are records of this species from the local region (<http://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswfl&lvl=in&name=Chrysanthemoides~monilifera~subsp.+monilifera>). In addition, OEH recommends that this list of weeds requiring control is reviewed periodically and updated to include any additional species that will require monitoring for, or management on the offset site.

- OEH recommends that the final version of the Biodiversity Management Plan for this project is a searchable 'pdf' file (rather than a scanned file without a ready search function).

If you have any enquiries concerning this advice, please contact Robert Gibson, Regional Conservation Planning Officer, on 4908 6851.

Yours sincerely



19 MAR 2015

RICHARD BATH
Senior Team Leader Planning, Hunter Central Coast Region
Regional Operations

Reference:

Vallee L, Hogbin T, Monks L, Makinson B, Matthews M and Rossetto M. (2004) *Guidelines for the Translocation of threatened Plants in Australia: Second Edition*. Australian Network for Plant Conservation. Canberra.

Appendix C Independent land management agency consultation letter



Local Land
Services
Hunter

Martin Fallding
Environmental Planner
Lake Macquarie City Council
Box 1906 HRMC NSW 2310

30 March 2015

To Martin,

Review of Biodiversity Management Plan for Awaba Waste Management Facility

I refer to your letter of 5 March 2015 requesting review of relevant provisions of the draft Biodiversity Management Plan for the Awaba Waste Management Facility as required by conditions 54 and 55 of the development consent for the project.

Hunter Local Land Services has reviewed the document. The Plan provisions are generally consistent with the Hunter-Central Rivers Catchment Action Plan 2013 – 2023 and regional approaches to biodiversity management as long as adaptive management is applied during the implementation of the plan.

Thank you for the opportunity to comment on the Plan.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Nicolai Cooper'.

for Nicolai Cooper

Calaghan Cotter
Manager Land Services

Appendix J – Biodiversity Conservation Area Plan of Management



Awaba Biodiversity Conservation Area - Plan of Management 2015



Lake Macquarie City Council February 2015

Acknowledgements

This Plan was prepared in consultation with a range of Lake Macquarie City Council staff and other organisations with an interest in the management of the land. Comments from the NSW Office of Environment and Heritage are gratefully acknowledged.

Photo credits

Lake Macquarie City Council, Martin Fallding and Niche Environment and Heritage.

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Summary

The Awaba Biodiversity Conservation Area has been established by Lake Macquarie City Council for the purposes of protecting its natural ecosystems and biodiversity values. It provides an offset to compensate for the loss of biodiversity resulting from Council development elsewhere in the City.

The land has an area of 121 ha, is located south of Wilton Road at Awaba, and forms part of a large area of natural bushland. It has significant biodiversity values.

This Plan of Management outlines Lake Macquarie City Council's objectives and actions in managing the land. The Plan has been prepared in consultation with stakeholders with an interest in its future management.

Key issues addressed in the Plan are weeds, maintaining biodiversity and threatened species, access and tracks, bush fire management, feral animals, and monitoring and reporting.

1 About the Plan

This Plan has been prepared to guide future management of the Awaba Biodiversity Conservation Area, a bushland site owned by Lake Macquarie City Council. The plan is referred to as the Awaba Biodiversity Conservation Area Plan of Management.

The Plan applies to all of Lot 463 DP 1138964, 304 Wilton Road, Awaba as shown on Map 1, an area of 121.19 ha. The land was purchased by the Council for the purpose of protecting the biodiversity values of the site in perpetuity and to use the site as a biodiversity offset for expansion of the Awaba Waste Management Facility (AWMF). Other Council development projects will potentially use biodiversity offsets resulting from the protection of the land.

The Awaba Waste Management Facility project approval (consolidated) as modified by the NSW Land and Environment Court on 23 October 2013 requires the making of a Biodiversity Offset Management Plan (BOMP). This Plan fulfils that consent requirement.

This Awaba Biodiversity Conservation Area Plan of Management outlines how the land will be managed to protect and maintain its biodiversity offset values. Key roles of the Plan are:

- To record the biodiversity offset strategy required as a development consent condition, and to document biodiversity values on the land.
- To provide a framework for ongoing management of the land, by outlining key issues, objectives, management areas, actions and a budget.
- To identify requirements for monitoring and evaluation.
- To identify a process of stakeholder consultation in managing the land and revising the Plan as required.

Lake Macquarie City Council is the manager of the land. The land is categorised as Operational Land for the purposes of the *Local Government Act 1993*, meaning that Lake Macquarie City Council as landowner is managing the area for operational purposes to support the AWMF rather than a community purpose such as parkland. There is no legislative requirement for the preparation of a plan of management for the land.

The land forms part of a larger contiguous area of native vegetation recognised as having high biodiversity values. Current planning controls applying to the land and surrounding areas recognise and aim to protect these natural values.

The Plan recognises prior Aboriginal use and ownership of the land and acknowledges its traditional owners. The land has cultural importance for a number of Aboriginal people and groups, and a desire for access rights has been expressed. Part of the land contains track constructed and maintained by the Westlakes Automobile Club Inc, a non-profit community association. Centennial Newstan has existing rights affecting the land under current mining leases and development consent. The Plan recognises these uses and outlines continuing responsibilities where they are to continue.

This Plan was approved by the NSW Department of Planning and Environment on 22 January 2015 and commenced on 1 February 2015. The provisions of the Plan are to be reported on annually, and the Plan is to be reviewed and updated at not less than 5 yearly intervals after its commencement.

2 About the land

The land is south of Wilton Road at Awaba, and has an undulating topography rising from about 20 metres to 100 metres above sea level. It comprises two main gullies running from west to east and three east–west oriented ridgelines with sandy loam soils. The southern gully on the land forms the headwaters of Kilaben Creek.

The land contains native vegetation over virtually its whole area with the exception of some tracks. Although there is evidence of some light logging in the past, the native vegetation remains in very good condition and there are virtually no weeds evident, except in localised areas of disturbance along tracks. Access tracks were constructed on the land around the late 1950's, some of which were used to service a former power line crossing the site from south-east to north-west, which has now been removed.



Figure 1 - View north across the land

A biodiversity assessment of the land was undertaken to document its biodiversity values and credits that could be generated using the Biobanking Assessment Methodology (Niche Environment and Heritage 2013, DECCW 2009). Vegetation mapping for the site was reviewed and updated by Eastcoast Flora Survey (2014) to maintain consistency with the Lake Macquarie City Council vegetation mapping program, and identifies five vegetation communities as shown on Map 2. A total of 151 native plant species were recorded (Niche Environment and Heritage 2013), including the threatened species *Tetratheca juncea* and *Acacia bynoeana* (one specimen only). Thirty six fauna species have been recorded on the site, including two threatened fauna species, being the Powerful Owl and Glossy Black Cockatoo. Species lists are provided in Appendix A.

Flora and fauna surveys of the site have concentrated on creation of ecosystem credits and on threatened species for which species credits can be created under the Biobanking Assessment Methodology. As a result, the species recorded do not represent a comprehensive list of all native species present on the site. In particular, ground orchids could be expected to occur, and the number of fauna species using the site is expected to be much greater than the number currently identified.



Figure 2 - Forest and woodland vegetation communities occur on the land

The land comprises the Awaba and Doyalson soil landscapes (Murphy 1993). The Awaba soil landscape is characterised by low rolling hills on predominantly coarse-grained sediments of the Narrabeen Group and Newcastle Coal measures. It contains some localised steep slopes and narrow, incised drainage lines. Soils are shallow, erodible and of low fertility. The Doyalson soil landscape forms the southern portion of the land and comprises gently undulating rises on Munmorah Conglomerate, with broad crests and ridges with long, gently inclined slopes. Soils in this landscape are moderately deep, infertile and are subject to erosion and localised seasonal waterlogging. The soil characteristics have implications for management of trails on the land.



Figure 3 - A number of plants in the family Proteaceae occur on the land, including *Lambertia formosa*

An Aboriginal Heritage Information Management System (AHIMS) search for identified Aboriginal sites shows that one site has been identified on the land (Site ID 45-7-0319) which comprises a carved or scarred tree. It is expected that the land contains other Aboriginal cultural heritage values. Sensitive Aboriginal landscapes on the land include ridges and watercourses.

3 Plan status

This Plan is required to fulfil the terms of a condition of consent for the Awaba Waste Management Facility (AWMF), which requires biodiversity offsets to compensate for the loss of biodiversity values arising from the development. This was a major project (MP 10_0139) under the now defunct Part 3A of the *Environmental Planning and Assessment Act 1979*. Consent for the AWMF was Issued on 8 May 2013 by NSW Planning and Infrastructure and Condition 51, Schedule 4 of the consent states that “*Prior to construction, the Proponent shall prepare a Biodiversity Offset Management Plan for Lot 463 DP 1138964 in consultation with OEH and to the satisfaction of the Director-General*”. The biodiversity offset strategy to be implemented through this Plan is outlined in Section 4. Condition 51A of the approval for the AWMF requires a restriction as to user on the land to implement the Biodiversity Offset Strategy.

In addition, this Plan will guide Lake Macquarie City Council as landowner and management authority in how to manage the land. The Plan outlines principles to guide management actions and identifies required management actions and a budget for implementing these actions.

The land is affected by a number of interests and restrictions as identified below:

- Lot 463 DP 1138964 is within and surrounded by various mining authorities held by Centennial Newstan Pty Ltd. Exploration Licence No 5138 (EL5138) and Mining Lease No 1452 (ML1452) overlap the land. These titles are granted under the *Mining Act 1992*. EL5138 includes the surface and land below to a depth of 15.24m and gives the holder various rights to explore for coal. ML1452 was granted on 6 July 1999 for a period of 21 years and operates until 2020 (unless extended by renewal). The lease excludes the surface of the land to a depth of 15.24m. ML1452 permits underground mining and was granted following development consent for the Newstan Life Extension Project, but it is unclear as to whether development consent for mining exists under the land. Under the *Mining Act 1992*, the holder of a sub-surface mining lease can make application to carry out various surface activities related to mining but is required to reach agreement with the landowner, prior to commencing surface works. The mining lease holder has advised Council that in the event of future underground mining, up to approximately 6 ha of surface disturbance to the land may be required.
- The land was purchased from the NSW Aboriginal Land Council. There are no site specific Aboriginal interests in, or claims on the land, although Lake Macquarie City Council recognises that the land is Aboriginal traditional land and is of Aboriginal cultural value. A number of Aboriginal groups have been consulted with in the preparation of the Plan.
- Under the terms of the AWMF development approval (condition 51A), Lake Macquarie City Council is required to register a restriction on user burdening the land (Lot 463 DP 1138964) in favour of the Minister for Planning and Infrastructure to implement the Biodiversity Offset Strategy in condition 50 of the approval.

- Part of the land contains a constructed track used for motor racing and maintained by the Westlakes Automobile Club Inc. Preliminary discussions have taken place between representatives of Lake Macquarie City Council and the club to determine a process to determine the future of this track, as discussed elsewhere in the Plan.
- Under the terms of the AWMF development approval (condition 51A), Lake Macquarie City Council is required to register a restriction on user burdening the land (Lot 463 DP 1138964) in favour of the Minister for Planning and Infrastructure to implement the Biodiversity Offset Strategy in condition 50 of the approval. It is a requirement that the restriction on user instrument not restrict or constrain the holder of an authority granted or renewed under the *Mining Act 1992* or any Act consolidating or replacing that Act from carrying out on the subject land prospecting, mining operations, mining purposes and related improvements and activities authorised by or under any such authority.
- Native Title Claims under the *Native Title Act 1993* affecting large areas have the potential to affect the land in the future but have not been determined. Lake Macquarie City Council is aware that the Wonnarua People are party to an Indigenous Land Use Agreement in respect of coal mining leases adjacent to the land.

Under the terms of the *Local Government Act 1993*, the land is classified as Operational. No plan of management for the land is required under this legislation. However, management will generally be consistent with that applied to Community land categorised as Natural Area under that Act. There are no easements, rights of carriageway, or other title restrictions currently affecting the land.

This Plan does not over-rule existing legislation that also applies to the management of Council owned land. Other legislation and policies to be considered in management of the land include, but are not limited to:

- *Local Government Act 1993*
- *Environmental Planning & Assessment Act 1979*, & instruments made under that Act
- *Threatened Species Conservation Act 1995*
- *Native Vegetation Act 2003*
- *Water Management Act 2000*
- *Clean Waters Act 1970*
- *Rural Fires Act 1997*
- *Noxious Weeds Act 1993*
- *Pesticides Act 1999*
- Lake Macquarie Bush Fire Risk Management Plan
- Lake Macquarie Biodiversity Offsetting Practice Guideline
- Lake Macquarie Vertebrate Pest Policy

Note that no provisions in a recovery plan or threat abatement plan prepared under the *Threatened Species Conservation Act 1995* or *Fisheries Management Act 1994* that apply to the land.

This Plan authorises the granting of future leases and licences or delegation of management of the land for purposes consistent with the objectives of this Plan. This Plan also allows Council to enter into a conservation agreement, including a Biobanking agreement under the *Threatened Species Conservation Act 1995* with the Minister administering the *National Parks and Wildlife Act 1974* and *Threatened Species Conservation Act 1995* to provide for the maintenance of its biodiversity values in perpetuity.

4 Biodiversity strategy

A Biodiversity Offset Strategy was prepared as part of the AWMF project documentation and is summarised in approval condition 50 (Table 3). The strategy provides that the whole of the land will be conserved for its biodiversity values in perpetuity, pursuant to the terms of a restrictive covenant referred to in the AWMF Development Approval (condition 51A), specifically to compensate for the loss of biodiversity values on a number of Lake Macquarie City Council development sites. The strategy is based on the application of the NSW Biobanking Assessment Methodology (Version 2.0) to the land by Niche Environment and Heritage (2013). As no Biobank site is to be established, no formal Biobanking credits have been created, and therefore the offsetting measurement is referred to as an “equivalent credit”.



Figure 4 - The key management objective for the land is to protect its biodiversity values

Based on the determination by Niche Environment and Heritage (2013) and as outlined in the Biodiversity Offset Strategy and approved in the development consent, the “equivalent credits” available for offsetting on Lot 463 DP 1138964 and the “equivalent credits” used to offset the approved AWMF project are shown in the following table. The calculations are based on the determination by Niche (2013) and accepted by the approval authority.

Table 1 Biodiversity offsetting “equivalent credits” for Lot 463 DP 1138964

“Equivalent credit” type	“Equivalent credits” available	“Equivalent credits” used to offset AWMF	“Equivalent credits” available for other offsets
Ecosystem credits	869	392	477
Species credits – <i>Tetratheca juncea</i>	49,938	33,853	16,085
Species credits – <i>Acacia bynoeana</i>	6	0	6

Note: Since Biobanking credits are not being created, and therefore cannot be retired under the Biobanking Scheme as provided for in the *Threatened Species Conservation Act 1995*, Lake Macquarie City Council undertakes to record and account for the ‘equivalent credits’ on the land to ensure that they are not used more than once to offset development on other sites.

The calculation and use of the land for biodiversity offsetting has taken into account the Office of Environment and Heritage principles for the use of biodiversity offsets in NSW. In particular, the use and management of the land complies with these principles, particularly since the site will protect biodiversity values in the long term, the offsets are quantifiable, achieve like for like or better outcomes, and supplementary, and enforceable through development consent processes.

Development consent for the AWMF requires biodiversity offsets to be provided on Lot 463 DP 1138964 by maintaining on that land:

- 33,853 *Tetratheca juncea* species “equivalent credits”
- 392 ecosystem “equivalent credits”

A biodiversity offsets balance register for the site is maintained, and Appendix F shows this balance at the time of the preparation of the plan. Lake Macquarie City Council undertakes to record and account for offsets on the land to ensure they are not used more than once to offset development on other sites. Offsets are provided on the land for three development projects, and a map showing the allocated offset areas for each project is in Appendix G.

Under the terms of condition 51 of the project approval, the Plan must be prepared prior to construction of the AWMF “*in consultation with the Office of Environment and Heritage and to the satisfaction of the Director-General of the Department of Planning and Infrastructure*”.

This Plan has been prepared in consultation with the Office of Environment and Heritage as required by the consent condition. A letter outlining the consultation process and conclusions is included in Appendix C.

5 Plan objectives

This Plan aims to protect the biodiversity values on the land as a biodiversity offset with the following land management objectives:

1. To maintain and improve the biodiversity values of the land, and support the conservation of adjoining bushland.
2. To periodically monitor biodiversity, and review the effectiveness of management actions.
3. To provide access for approved uses on the land (eg Aboriginal traditional use or scientific research) compatible with the protection of its biodiversity values.
4. To minimise long-term management costs.
5. To ensure that the interests of neighbouring property owners and users are taken into account in managing the land.

Lake Macquarie City Council will consider making the site a Biobanking site under the *Threatened Species Conservation Act 1995* if this becomes feasible in the future.

6 Management issues & guidelines

This part identifies priority issues and guidelines for the management of the land in general order of priority as follows:

- Weed management
- Maintaining biodiversity and threatened species
- Access and track management
- Bush fire management
- Feral animal management
- Governance, monitoring and reporting
- Other issues

The following sections of the Plan provide background information for each issue, together with management principles, management actions and budget, relationships to other management issues, actions not allowed, and monitoring and record keeping requirements. In some cases active management is required, whereas the management of some issues requires passive management (ie not taking actions).



Figure 5 - Large trees with hollows provide important fauna habitat

6.1 Weed management

Background information

For the purpose of native vegetation management, a weed is regarded as any non-locally indigenous plant.

Overall, the bushland on the site is in excellent condition and has relatively few weeds. Weeds that do occur on the land are identified in Appendix A and are mainly distributed along the roadside on the northern part of the land, and along the internal tracks.

Weed invasion probably represents the most significant long term threat to the biodiversity values of the land, and will require ongoing monitoring and management actions. There is a risk of new weed invasions, which is difficult to anticipate, and for which allowance should be made.

An important component of initial weed surveys and control measures will be the preparation of a distribution map for each weed species. This will form the basis for planning the annual weed management program.

Measures are to be implemented to control and manage existing and future processes leading to weed invasion and sources of weeds which are invasive of natural areas. An important element of weed control is an understanding the causes of weed invasion and taking measures to minimise these causes.

Weed invasion occurs in natural areas mainly as a result of the following factors:

- physical disturbance due to construction activity, clearing, or mowing
- increased soil moisture due to runoff
- increased nutrients from runoff or waste dumping
- increased light levels due to clearing or dieback
- increase in weed propagules and seed dispersal agents.

Measures are to be taken to prevent the occurrence of factors leading to weed invasion. Typically, weeds move into bushland from adjoining urban or other modified areas. The main entry locations are stormwater drains, roads and tracks. Weeds tend to spread most rapidly downslope along watercourses, roads and tracks, and then move slowly into adjacent bushland.

The weeds identified in Table 2 have been identified on the land and require management, and if possible removal. Weeds identified in Table 3 are potential weeds.

Table 2 Weeds currently occurring on the land

Common name	Scientific name	Key characteristics	Management strategy	Site location & management actions
Asparagus sp.	<i>Asparagus aethiopicus?</i>	Class 4 Noxious Weed. Perennial climber or scrambling plant commonly spread by dumped garden waste containing seeds and rhizomes and by birds that eat the colourful berries and deposit seeds in their droppings. Seeds germinate readily and start new infestations	Hand remove small populations or isolated plants. Carefully remove all fragments of the tuberous root system and all berries. Carefully treat larger infestations with herbicide or by weeding. If flowering, cut foliage back to main stem to prevent fruiting. If already fruiting, harvest material and destroy by burning or deep burial	Along Wilton Road. Hand removal
Bitou bush*	<i>Chrysanthemoides monilifera rotundata</i>	Class 4 Noxious Weed and a Weed of National Significance	Must be managed in a manner that reduces its numbers spread and continuously inhibits its reproduction	Scattered across site in natural bushland. Regular inspection and manual removal.

Common name	Scientific name	Key characteristics	Management strategy	Site location & management actions
Blackberry *	<i>Rubus fruticosus</i>	Class 4 noxious weed. Perennial with canes capable of forming new plants where tips contact ground. Spread by birds and animals. Only one plant identified on the land.	Growth must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction	Only one plant identified on the land along internal track near creek. Seek to manage and prevent spread of infestations by manual removal and/or chemical treatment with a metsulfuron – methyl product.
Buffalo grass	<i>Stenotaphrum secundatum</i>	Creeping grass usually 10-30 cm tall. Widespread lawn grass	Foliar spray	Along Wilton Road. Spray
Carpet grass	<i>Axonopus fissifolius</i>	Summer growing perennial grass.	Foliar spray	Internal track near gully crossing. Spray
Cassia	<i>Senna pendula</i>	Perennial sprawling multi-stemmed shrub or tree up to 5m tall. The large seed pods are eaten by birds and other animals. Establishes in a wide range of native plant communities	Dispose of large seed pods. Plants easily dug out, removing all roots. Herbicide treatment using the cut and paint technique	Along Wilton Road. Manually remove
Thatch grass	<i>Hyparrhenia rufa</i> subsp. <i>rufa</i>	A long lived invasive drought, fire and herbicide tolerant tussock grass. Dispersed by wind and vehicles. Flowers and sets seed from spring to autumn	Foliar spray, with 2 – 3 applications for control. Potential for spread by slashing and vehicles	Along Wilton Road. Spray and monitor spread

Common name	Scientific name	Key characteristics	Management strategy	Site location & management actions
Crofton weed*	<i>Ageratina adenophora</i>	Class 4 Noxious Weed. Flowers in mid Spring (mid October), seed spreads by wind, preferentially grows along watercourses, wet areas and in disturbed areas	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction. Control by annual physical removal and/or chemical treatment with a metsulfuron – methyl product. Remove when flowering (usually August/September) and before seeding. Map the distribution, regular inspection, liaise with neighbours to prevent spread	On disturbed land near edge of WAC track. Inspect and pull out by hand (preferably when soil is moist)
Whiskey grass	<i>Andropogon virginicus</i>	Perennial tufted grass 0.5 – 1m in height. Reproduces mainly by seed, and commonly dispersed by vehicles or slashing. Can invade open woodlands and forests	Foliar spray, or physical removal before seeding in summer/autumn.	Primarily along tracks

Common name	Scientific name	Key characteristics	Management strategy	Site location & management actions
Phoenix Palm	<i>Phoenix canariensis</i>	Seeds spread by birds and water	Dig out, seedlings and small plants (all year round), and dispose of material appropriately off site. Drill and inject large plants (all year round): drill holes at least 2.5 cm deep every 10 cm around trunk, near the ground, and inject each with 10 ml glyphosate (undiluted). Cut and paint stumps (all year round): glyphosate (250ml/L). Leaves can be mulched, but dispose of trunk appropriately. Alternatively, overall spray (spring-summer): spray new growth with glyphosate (20ml/L) + penetrant. Monitor periodically	Along Wilton Road. Mechanical removal is preferred
London Pride	<i>saxifraga umbrosa</i>	Horticultural plant	Little known	Along Wilton Road. Manual removal
Rhodes Grass	<i>Chloris gayana</i>	Drought tolerant perennial or annual grass, generally in disturbed areas	Manual removal when other grasses are being treated with chemicals.	Along Wilton Road

Note - weeds identified with * are listed as noxious under the *Noxious Weeds Act 1993*.

Table 3 Potential weeds (capable of spreading to the land)

Common name	Scientific name	Key characteristics	Management strategy	Management actions
Camphor laurel	<i>Cinnamomum camphora</i>	Large tree capable of invading bushland. Seeds spread by birds	Manual removal of seedlings if found	Monitor
Lantana*	<i>Lantana species</i>	Weed of National Significance	Monitor. Manual removal	Monitor
African Love Grass	<i>Eragrostis curvula</i>	Perennial grass found along roadsides, spread by vehicles	Monitor tracks and road sides, and spray if present.	Monitor

Note: This is an indicative list only, and other weeds have potential to colonise the land. Note that the adjacent Awaba Waste Management Facility (AWMF) could be an important source of weed dispersal onto the land to which the Plan applies, and continuous improvement of management at this Facility should remain on objective.



Figure 6 - Weeds including Bitou Bush occur on the land, mainly in disturbed areas

Key principles

Controlling weeds requires attention to the biological characteristics of individual species, as summarised in Table 2 and 3. Priority for weed management will be given to reduction in the occurrence of existing species, and monitoring and elimination of the identified potential species.

An important part of weed management is regular monitoring of weeds in natural areas on an ongoing basis. This is to be done by periodically walking over the land at times when plants are most likely to be evident (eg during flowering or rapid growth

stages), and at least annually. Walking routes should be along all existing tracks (weeds are most likely to grow here), along watercourses, and also randomly in areas not commonly frequented, particularly for those species spread by birds.

Monitoring is to be undertaken to identify and respond to the occurrence of new plant species posing a potential threat to natural areas.

Weed control is to be carried out in a manner that minimises negative environmental impacts. Different techniques are required in varying situations, especially along watercourses, which are very sensitive to pollution impacts.

Where there are existing infestations, the management priority is to ensure that there is no spread of the area of infestation, and the preferred method is to work from the least infested areas first, to the most infested areas last.

Noxious weeds (plants posing a threat to agriculture, the environment or the community) are formally declared under the *Noxious Weeds Act 1993*. Some categories of noxious weeds are legally required to be removed as soon as possible.

The preferred method of weed control is manual removal, or control by slashing. Weed spraying with chemicals is a last resort option.

Vehicles have potential to spread introduced weed species (eg earthmoving machinery) and shall be washed before entering the site, and any areas of operation will be monitored annually for two subsequent years during Spring.

A key area for weed control is along internal tracks and land directly adjacent and downslope from the Westlakes Automobile Club track, and in the vicinity of any associated earthworks.

Management requirements

Correct weed identification is essential.

It is important to undertake manual removal of weeds at the correct time (Tables 2 and 3). This means removal before flowering and seeding, or when a weed plant is at maximum visibility. During moist soil conditions, mechanical removal is most effective, since maximum root removal can be achieved.

Relationship to other management issues

Other management issues directly relate to the potential for introduction and spread of weeds, and their management. Weeds are most likely to be introduced by motor vehicles, rubbish dumping, earthworks and by wind and bird spread. More intense weed survey and control must be undertaken in the 12 months following any bush fire.

Management actions & budget

Allow 1 – 2 weeks per year for monitoring and physical removal of weeds by a qualified team at a suitable time during at least 2 seasons.

Things not to do

Do not allow existing weeds to seed and spread further, especially Crofton Weed and Blackberry.

Measuring performance & keeping records

Undertake a comprehensive weed survey in the first year of management.

Regular weed monitoring (see survey and monitoring program in Section 6.2).

Prepare and maintain a map of the distribution of each weed species on the land (both current and historic distribution), updated annually.

6.2 Maintaining biodiversity and threatened species

Background information

Biodiversity refers to the variety of native flora and flora species and other organisms that occur on the land. A key objective of management is to retain the biodiversity and natural vegetation communities occurring on the land, especially listed threatened species.

The main purpose of owning and managing the land is to maintain and enhance its biodiversity values, especially the threatened species occurring on the land. Part of this Plan is documentation of the biodiversity values of the land and identifying which of these values have been used as development offsets and which of these values may potentially be available for future offsets. The second key component of the Plan is the outline of the management actions that are needed to maintain and enhance biodiversity values on the land.



Figure 7 - Vegetation communities on the land have high biodiversity value

Biodiversity values on the site have been assessed by Niche Environment and Heritage (2013) using the Biobanking Assessment Methodology applying in 2013 (Version 2.0). Key threatened species occurring on the site are the plants *Tetratheca juncea* and *Grevillea parviflora* subsp. *parviflora*, although knowledge of the latter on the site is uncertain. While threatened fauna species probably do utilise the site as permanent residents or intermittently, these have not been documented. Although the Biobanking Assessment Methodology has been used to quantify offsetting values, no credits have been created or traded and therefore these values are indicative only. While they have no legal status apart from a development consent

requirement, they nevertheless provide the basis for negotiated offset arrangements and are formally recognised in the Plan.

The matters most likely to affect biodiversity values and threatened species arise directly or indirectly from human impacts and disturbance, and include weed invasion, impacts from use of access tracks and bush fires. These matters are identified as separate management issues.



Figure 8 - The threatened plant species *Tetratheca juncea* occurs extensively on the land

Key principles

A list of species present on the land will be maintained and periodically updated (Appendix A).

Before any activity with the potential to disturb the land surface or vegetation is carried out on the land, a flora survey must be undertaken to establish an inventory of the species present, and any specific management requirements for particular plants.

Where land disturbance occurs, measures are to be taken to ensure minimal disturbance. Earthmoving machinery is to be washed down prior to entering onto the land to prevent the introduction of non-indigenous plant material.

On sites to be rehabilitated, natural regeneration is the preferred method. Any planting of vegetation in rehabilitation areas will only use local genetic material from the land.

Dead trees and fallen timber are to be retained on the land except where these have the potential to fall on Wilton Road and/or cause a traffic hazard.

Different plant species have varying fire sensitivity and may require varying fire frequencies and intensities for survival. This is to be considered in undertaking any management activities involving the use of fire (see also section 6.4 and Appendix B). Characteristics of the following species or groups occurring on the land are outlined in the Table 4. This table provides examples only and is not comprehensive.

Table 4 Examples of plant fire responses and characteristics

Scientific name	Common name	Fire response & characteristics
<i>Tetratheca juncea</i>	Black-eyed Susan	Resprouts and grows from seed. Fire frequency should not be shorter than the time taken for plants to develop to reproductive maturity, and go through one or more reproductive cycles to replenish the seed bank. Maintaining habitat requires periodic fire with a probable desirable interval of between 7 and 30 years (Lake Macquarie City Council 2014).
<i>Callicoma serratifolia</i>	Black Wattle	Resprouter. Primary juvenile period 3-5 years.
<i>Imperata cylindrica</i>	Blady grass	Resprouter.
<i>Pteridium esculentum</i>	Bracken fern	Resprouter. Indefinite longevity.
	Ground orchids	Killed. Fires should avoid flowering/ fruiting periods.

Deliberate introduction of new fauna species, or relocation of species from off the site, must not be undertaken.

Measures are to be taken to avoid fragmentation of vegetation in natural areas by roads, tracks, services, etc. Natural areas should be retained in contiguous areas as large as possible, with the minimum length of perimeters.

Native fauna populations and habitats are to be protected, maintained and enhanced. Impacts on wildlife and habitat are to be taken into consideration whenever any management activity is proposed (such as bushland regeneration, weed control, bushfire hazard reduction, etc). It is noted that a comprehensive fauna survey of the land has not been undertaken, as the Biobanking assessment undertaken for the land did not include fauna surveys for all species or groups.

The land is occupied and utilised by listed threatened native flora and fauna species. Any activities undertaken on the land shall be carried out in a manner that ensures that these species are not adversely affected by the activity. Management measures are described in Table 5.

Table 5 Management measures for threatened species known from the site

Scientific name	Common name	Characteristics & management measures
<i>Tetratheca juncea</i>	Black-eyed Susan	Widely spread across the site, mainly on ridges. Retain native vegetation, and suitable bush fire regime.
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>		Identification of this species requires further investigation. Management requires retention of native vegetation. No comprehensive survey has been undertaken although it is known to be dispersed across the site.
<i>Acacia bynoeana</i>		Only one plant of this species has been identified on the site. Further survey is warranted. Distribution may be affected by bush fire regime.
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	Retain dead trees and native vegetation structure. Species primarily uses the land for foraging, especially <i>Allocasuarina</i> species.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle	Nomadic species observed on the site. Retain native vegetation structure.
<i>Ninox strenua</i>	Powerful Owl	Retain dead trees and native vegetation structure. Species primarily uses the land for foraging. Possible roosting or nesting trees in moist gullies, but none have been identified.

Note that other threatened species are likely to occur on the land including the Squirrel Glider, and a number of bird species.

Management requirements

Important skills required to manage biodiversity on the land are as follows:

- Fauna identification and monitoring
- Plant identification and monitoring

Flora and fauna surveys are to be consistent with relevant Lake Macquarie City Council survey guidelines and methodology.

Relationship to other management issues

Biodiversity is significantly affected by weed and bush fire management. The biodiversity issues related to weed and bush fire management are identified in Sections 6.1 and 6.4.

Management actions & budget

- Implement the proposed biodiversity monitoring program
- Provide annual budget allocation for monitoring

Things not to do

Do not introduce new species.

Measuring performance & keeping records

- Record observations of species
- Photo identification points (periodic photographs)
- Flora and fauna survey and monitoring program as outlined in Table 6, with location of sites shown on Map 3.

Table 6 Flora and fauna survey program

Species/Group	Month			Techniques	Comments
	Sept	Jan-Feb	Apr		
Native vegetation (essential)	X	X		Annual quadrat floristic surveys at identified monitoring plots (see Map 3). 5 yearly photo monitoring at each site, or after bushfires.	Systematic plot surveys can be done at any time, and about 6 months after fire. Photos to record structure and condition. Minimum of 50% of plots to be surveyed annually. Record weeds.
Weeds (essential)	X	X	X	Walk all tracks 6 monthly plus random meander	Record location and species for addition to GIS database
Small and arboreal mammals (essential)		X	X	Trapping (Elliott traps) 50 x 5 nights	Survey of small and arboreal mammals at 5 yearly intervals
Large mammals (essential)	X	X	X	Day/night transects	Use volunteers. Used opportunistically to indicate presence of feral animals. Undertaken at minimum 5 yearly interval
Amphibians (optional)		X		Frog calls and spotlighting, normally during wet conditions	Use volunteers.
Invertebrates (optional)	X	X	X	Various methods, including pitfall traps	Use volunteers. Low priority.
Birds (essential)	X	X	X	Observation	Update bird list and records continually. Record during vegetation surveys.

Note: Results of monitoring to be included in annual reporting documentation. The Council may use the community ecosystem monitoring program to undertake some of this monitoring work.



Figure 9 - Creek lines with listed endangered ecological communities occur on the land

6.3 Access and track management

Background information

Existing access tracks occur within the site, and form part of a larger track network extending to surrounding properties. There is no direct vehicular access to the land from Wilton Road. Tracks from the north and west are accessed through Crown land within mining authorities held by Centennial Newstan Pty Limited, and the track on the south of the land partly is located on Crown land within mining authorities held by Centennial Newstan Pty Limited and can be accessed from Wilton Road through land currently owned by the NSW Aboriginal Land Council.

The internal access tracks include steep and eroded sections and require works if they are to be retained for long term access purposes. Some of the tracks have been constructed on the land to service a former power line traversing the land, which has since been removed, and others may have been constructed for bush fire control in 1994. The tracks are used intermittently as part of an informal motorcycle and 4WD track network. This has impacted upon biodiversity values and the disturbance is likely to result in weed invasion and other impacts. It is proposed that a review of the track network be carried out in conjunction with adjoining landowners.

Access tracks are necessary for management of the land and bush fire management and represent a significant investment. Determining an access strategy for the land is a high priority in the early years of management. While internal tracks potentially have some value for bush fire management purposes, these tracks are not suitable for vehicles. Some tracks will be able to be closed and rehabilitated, while remaining tracks will need regular maintenance and stabilisation.

No fences exist on the land, and it is not feasible or desirable to fence the property boundaries. Access to the land from Wilton Road is restricted by steep slopes and

the road embankment and effectively prevents access along its full frontage to the land.

The Plan recognises vehicular access through the land may have a range of impacts such as introduction of weeds species, causing soil erosion or adversely affecting water quality. Any adverse impacts are most likely during wet weather, especially during winter months.

Public access to the land should not be encouraged, although walking is unlikely to cause any significant impacts on the site. It is proposed that access will not be prevented, however prior permission will be required.

Key principles

The use of the land by the public will not be encouraged or promoted as the priority use of the land is for biodiversity conservation and visitor use has the potential to adversely affect its biodiversity values. Since all tracks accessing the land from Wilton Road traverse private property not in Council's ownership, access limits along these tracks requires the co-operation of these landowners.

Subject to the limitations on activities permitted on the land as outlined in Section 10, the Council may allow public access to the land (eg by Aboriginal groups) by walking subject to adequate prior notification and consent.

Avoiding damage to tracks is best achieved by avoiding (or minimising) their use during wet weather, and by heavy vehicles such as 4WDs.

The Plan does not authorise the construction of new tracks or roads, or the substantial realignment of existing tracks.

Where a track is determined to be essential for access, periodic maintenance is to be undertaken to ensure that existing roads are regularly maintained in a safe condition. Maintenance is to have regard to relevant bush fire standards, potential safety and environmental risks.

Mountain bike riding is permitted on tracks where it will cause no damage to natural vegetation, or contribute to soil erosion or track damage.

Recreational 4WD and trail bikes are not permitted on the land, but their unauthorised use is likely to be difficult to control for the foreseeable future.

Measures (eg signage) are to be taken to cease or prevent any unauthorised access across the land consistent with that on the adjoining lands. Directional or safety signs will not be erected on the land.

Management requirements

Access tracks required for vehicular use for management are shown on Map A1 (Appendix B). Other management requirements are to:

- Negotiate with neighbouring landowners in relation to access issues and encroachments
- Undertake maintenance work only on trails that are designated as fire trails, and recognised by the Rural Fire Service
- Periodically review road safety and hazards such as trees, and the condition of tracks

Relationship to other management issues

This issue relates to bush fire management, illegal rubbish dumping, and to the ability to carry out biodiversity monitoring.

Management actions & budget

- Formalise a review of tracks within 2 years of the commencement of the Plan
- Review opportunities for the construction of gates or other access control measures

Things not to do

Vehicles are not to be used on any tracks not designated on Map A1, and not on any tracks during rain or wet conditions.

6.4 Bush fire management

Background information

The land forms part of a much larger area of bushland. A strategy for managing bush fires on the land has been prepared, having regard to the Lake Macquarie Bush Fire Management Plan, the management intentions of adjoining landowners and Rural Fire Service requirements. The bush fire management strategy is in Appendix B.

Since there will be no built assets on the land apart from potential access controls (eg gates or signs), the main bush fire management issue is to avoid potential escape of fire from the land (and consequential impacts on life and property), as well as ensuring that the bushfire management regime (ie frequency, intensity and seasonality of fire) is suitable for maintaining biodiversity and habitat structure on the land (see Section 6.2).

While there are currently a number of access tracks through the land, some of which are identified on Rural Fire Service mapping, these are not designated fire trails, and with the exception of the track along the southern boundary are in steep terrain and unsuitable for this purpose.

Advice from the local Rural Fire Brigade captain indicates that the last fire on the land was in 1994, when a number of tracks were bulldozed through bushland on, or in the vicinity of the land to make control lines.

Bush fire risks and management measures are summarised in Table 7.

Table 7 Bush fire assessment and management measures on the land

Type of risk	Potential loss	Potential risk	Risk management measures
Damage to buildings	Nil	Low	N/A
Damage to fences, gates and signs	Nil	Low	Currently no improvements or measures in place. New construction should be fire resistant
Loss of native species	Low	Low	Maintain desired fire regime
Loss of human life	Moderate	Low	Inform users of risks, and advise of procedures in the event of fire. Prevent access during extreme or catastrophic fire weather conditions
Damage to services (electricity, phone lines, etc)	Nil	Low	Not applicable
Escape of fires to neighbouring properties	Low for immediately adjoining properties	Low	Designated fire trails are proposed between property and adjoining properties to east, south and west. Asset protection measures for the adjoining Westlakes Automobile Club Inc. occupied land are able to be provided on that land.

Key principles

The bush fire strategy outlined in Appendix B is to be followed. This strategy is to be periodically reviewed.

In conjunction with adjoining landowners, negotiate a maintained designated fire trail around the land using existing tracks suitable for this purpose.

Weed monitoring and control needs to be undertaken after bush fires and any hazard reduction burning.

Periodic ecological burning as a conservation measure may be considered in the future.

Management requirements

- Implement bush fire strategy
- Maintain any designated bush fire trails as negotiated with neighbouring landowners
- Consult with the Rural Fire Service in relation to Plan reviews

Relationship to other management issues

Bush fire management is a key issue affecting all other management issues for the land. It is closely related to access and tracks.

Management actions & budget

- Discuss bush fire management arrangements with the Rural Fire Service
- Periodically review bush fire management strategy, particularly following local fire events.
- Liaise with neighbouring land owners and occupiers

Things not to do

Ensure that there is no potential for accidental ignition of fires during high fire danger periods.

Measuring performance & keeping records

A map record is to be kept showing the areas of the land burnt by any fires.

A photographic record is to be made immediately after fires, utilising existing vegetation monitoring points.

6.5 Feral animal management

Background information

Introduced fauna and feral animals have potential to adversely affect native species. Some species have potential to occur on the land.

There has been no investigation of feral animals occurring on the land. However, given that virtually all of the land contains native vegetation in a relatively undisturbed state, it is expected that feral animal populations are low and unlikely that control actions are required.

Key principles

Opportunistic monitoring will be undertaken to observe whether feral species are present, and periodic feral animal monitoring is desirable to determine the presence of species and to estimate the population of these species where present.

Domestic animals (dogs and cats) are incompatible with the protection and management of native fauna and habitat. These species are not allowed on the site.

It will be important to ensure ongoing monitoring to review the presence of feral animals over time.

Management requirements

Non-native animals will not be allowed on the site, including companion animals.

Biodiversity monitoring will be undertaken to identify the presence of feral animals.

Relationship to other management issues

The presence of feral animals will adversely affect the biodiversity values of the land.

Management actions & budget

No actions are proposed, although a contingency is proposed to allow necessary control measures to occur.

Things not to do

Introduction of feral animals is not to occur.

Measuring performance & keeping records

Feral animals will be recorded as part of the biodiversity monitoring program.

6.6 Governance, monitoring and reporting

Background information

This land will remain as a permanent offset site where biodiversity values are required to be retained. A covenant is to be imposed on the land requiring measures to protect and maintain its natural values.

The Plan forms part of a range of governance measures to ensure that the land is effectively managed, that management funding will be adequate in perpetuity and can be accounted for, and that environmental monitoring is undertaken and used to inform adaptive land management.

Lake Macquarie City Council has in place a Biodiversity Offset Practice Guideline for administration and financial management to ensure that biodiversity offset values are managed appropriately.

Key principles

The land is to remain classified as Operational Land under the Local Government Act 1993 at least until such time as it is determined that no further biodiversity offsets are required for Council developments.

Lake Macquarie City Council will be responsible for managing the land, with annual funding allocated through an integrated planning and reporting framework (LG Act).

Biodiversity data collection and management is to be undertaken in a way that it can be analysed by appropriate statistical techniques so that ecological changes and trends can be detected as early as possible to support adaptive management practice.

Management requirements

Financial arrangements for in perpetuity funding are to be made.

Relationship to other management issues

Monitoring is a key element of the Plan to enable improved adaptive management.

Management actions & budget

Establish governance and management framework

Measuring performance & keeping records

The monitoring and reporting outlined in Table 8 will be undertaken.

Table 8 Monitoring and reporting program

Matter to be monitored and reported	Frequency & method	Comments
Biodiversity	Varying frequency as outlined in Section 6.2	See Table 6
Weeds	Regular and after bush fires	Map and report on weed distribution records at least annually
Bush fire	After fire events	Map the area of the land burnt by fire. Photographs at vegetation monitoring points immediately after fires and at 6 monthly intervals for 2 years post fire. Refer to Section 6.4.
Financial expenditure	Annual	Financial accounts for the land are to be maintained and reported annually

6.7 Other issues

Other issues for future management of the land are:

- Unauthorised rubbish dumping
- Westlakes Automobile Club track
- Neighbour relations
- Potential future underground coal mining
- Aboriginal cultural heritage
- Other risks

Background information

Other management issues that will arise include dumping of rubbish, the use of track constructed on the land by the Westlakes Automobile Club Inc. (WAC), and management of Aboriginal heritage values on the site. The surface impacts of potential future underground coal mining also could impact on the site. This will be dealt with pursuant to the existing rights under current mining leases and development consent, pursuant to the terms of a Restrictive Covenant referred to in the AWMF Development Approval (condition 51A) and as part of the consideration of any future development applications and other necessary approvals for this purpose.

It is also possible that other unanticipated issues may arise in the future, which might include the introduction of pathogens or organisms that affect biodiversity values such as Phytophthora or Myrtle Rust. Contingencies and arrangements will need to be put in place to accommodate these if they eventuate and impact on the management objectives for the land.

Rubbish dumping is expected to be an ongoing issue along the Wilton Road frontage. Limited access to the remainder of the site means that this has not been a problem elsewhere on the site to date.

In conjunction with a Crown Land permissive occupancy on the adjoining land, WAC has constructed and maintains a section of its unsealed track on Council land. A number of options for the future of this track exist which require further negotiation between WAC and the Council and might include the following:

1. Immediate closure and rehabilitation of the track. Costs and timing of closure and rehabilitation methods to be negotiated between Council and WAC.
2. Formalise an interim short term (eg 3 year) lease arrangement between Council and WAC, during which time the longer term future of this track is determined. Such an arrangement would require that WAC indemnify Council for any risks that may be associated with its use of the track, undertake regular weed management associated with the track, and carry out environmental improvements (eg rubbish removal) associated with the track and its operation.
3. Enter into a long term (eg 20 year) commercial lease between WAC and Council, with WAC to pay Council's full costs of the lease, including survey costs and an annual commercial lease payment.

It is appropriate for the WAC track section of the land to be recognised as a separate management area in the Plan to facilitate resolving the presence of part of the track on Council land, and associated ongoing weed issues.

Key principles

Rubbish will be removed from the land as soon as practicable after Council is aware of it.

Actions to manage rubbish on the land will be consistent with the Council's illegal dumping strategy, and may include a range of measures including signage.

Until the future of the track constructed on Council land by the WAC is resolved, measures shall be taken to ensure that this does not have direct or indirect impacts on the biodiversity values of the land.

A long term lease of the WAC track should be at no cost to the Council.

While existing rights under the current mining leases and development consent are recognised, the Council shall oppose any surface or underground mining of the land where this has potential to adversely affect the biodiversity values for which the site is protected and managed. In the event that any damage is caused, suitable biodiversity offset arrangements and financial compensation will be sought for any losses arising or reasonably anticipated.

Management requirements

- Undertake regular rubbish removal along the Wilton Road frontage of the land
- Consult with Aboriginal interest groups about cultural heritage issues and access arrangements for the land
- Initiate negotiations with WAC to make formal arrangements for access to that section of the track on Council land and its ongoing management

Relationship to other management issues

These additional identified issues are not expected to affect the biodiversity values of the land.

Management actions & budget

Negotiate with WAC in relation to legal and management actions relating to the future use and operation of its track.

Maintain contact with neighbouring landowners and occupiers as required, including the WAC, Centennial Coal and Aboriginal organisations.

Things not to do

Do not allow dumped rubbish to accumulate on the land.

Measuring performance & keeping records

Report annually on rubbish dumping and removal, and management actions associated with the WAC track.

7 Management areas

This Part describes the way in which specific management areas are to be managed. It must be read in conjunction with the general principles and guidelines outlined in earlier sections.

Two management areas are identified for management of the land. Each area has differing management objectives and priorities. These are:

1. Natural Area - comprising undisturbed bushland native vegetation.
2. WAC occupied area – comprising that part of the WAC track constructed on Council land, any disturbed area in the vicinity, and a 20 metre bushland buffer.

Map 4 identifies the geographic extent of the management areas, and the objectives and priorities for each unit are shown in Table 9. Soil and native vegetation characteristics are common to both management areas, the only difference being in relation to the use of the land and the extent of physical disturbance.

Table 9 Area management objectives and priorities

Management area	Area (approx)	Area management objectives	Management priorities
Natural Area	121.25 ha	Protect biodiversity values, consistent with the Plan objectives and principles	Prevent physical disturbance to the land, monitor biodiversity, monitor and remove weeds.
Westlakes Automobile Club occupied area	1.77 ha	Maintain current biodiversity values, implement any agreement in relation to future use of the track made under Section 6.7.	Control weeds and prevent establishment and spread of weeds. Remove rubbish.

8 Budget, management actions and program

An annual works program will be implemented, consistent with an annual funding allocation of \$37,500 to \$70,000 depending on management responsibilities applicable in a given year, indexed each year in accordance with CPI.

The funding allocation is based on an estimate of the measures required to maintain the biodiversity values on the land, plus a contingency to cover unexpected events. This has been calculated in a separate spreadsheet.

9 Monitoring, reporting and review program

The Plan is to be reviewed within five years of the commencement of the Plan. However, the Plan remains in force despite any failure to undertake or complete such a review.

A review of the Plan is to commence at least one year prior to the date on which it ceases to remain in force. The purpose of the review is to determine whether the objectives of the Plan remain valid, and whether the Plan remains appropriate for securing those objectives. In undertaking the review, the Council is to consider the results of annual reporting and relevant background information and will consult with stakeholders with an interest in the management of the land.

This Plan specifies a management reporting and review framework with indicators and performance targets for the land, as indicated in Table 10.

Table 10 Management reporting and review framework

Issue	Objectives & Performance Targets	Means of Achievement	Manner of Assessment
Biodiversity conservation	To maintain and improve the biodiversity values of the land.	Compliance with Plan principles and actions.	Annual report.
	To periodically monitor biodiversity, and review the effectiveness of management actions.	Compliance with Plan monitoring requirements.	Annual report.
Bushland management	To limit access to facilitate approved uses on the land compatible with the protection of its biodiversity values.	Compliance with Plan principles and actions.	Annual report.

Issue	Objectives & Performance Targets	Means of Achievement	Manner of Assessment
Governance	To minimise long term management costs.	Annual financial report.	Annual report.
	To ensure that the interests of neighbouring property owners and users are taken into account.	Periodic consultation with neighbouring landowners and interest groups.	Consultation undertaken.

10 Permitted activities and responsibilities

This Plan identifies activities that are permitted without approval, activities that may be permitted with approval, and activities that are prohibited on this land. These are as outlined below. Note that a restrictive covenant is proposed to apply to the land as referred to in the AWMF development approval (Condition 51). Activities carried out must be consistent with a covenant, where it applies to the land.

Activities that do not require approval:

- Activities arranged under the auspice of bodies appointed by Council to manage the land or engaged by Council to carry out works consistent with a Plan and a restrictive covenant where it applies.
- Bush fire hazard reduction works by an authorised body, or by Council carried out in accordance with a bush fire risk management plan

Activities requiring Council's approval:

- Bush walking, research/study/education, sight-seeing
- Picnics, camping or events by an approved community group (eg scouts, guides, Aboriginal groups)
- Native seed collection.

Prohibited activities:

- Any activity that may be considered by an authorised Council officer to be dangerous to other users, or that would compromise the core objectives for the land category
- Any activity undertaken contrary to a notice on the land
- Asset Protection Zone creation for any proposed development on adjoining land
- Fires, unless specifically approved by Council

- Placing fill or rubbish on the land, unless specifically approved by Council
- Removing bush rocks or endemic plant or animal species from the land
- Trail, trike or quad bike, or unregistered vehicle use on the land
- Any other activity considered by an authorised Council officer to be contrary to the Plan objectives

Leases and licences are not authorised under this Plan, except for necessary arrangements within the Westlakes Automobile Club track area in accordance with any agreement between Lake Macquarie City Council and the WAC.

References

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Murphy C L, 1993, Soil Landscapes of the Gosford-Lake Macquarie 1:100,000 Sheet, Department of Conservation and Land Management.

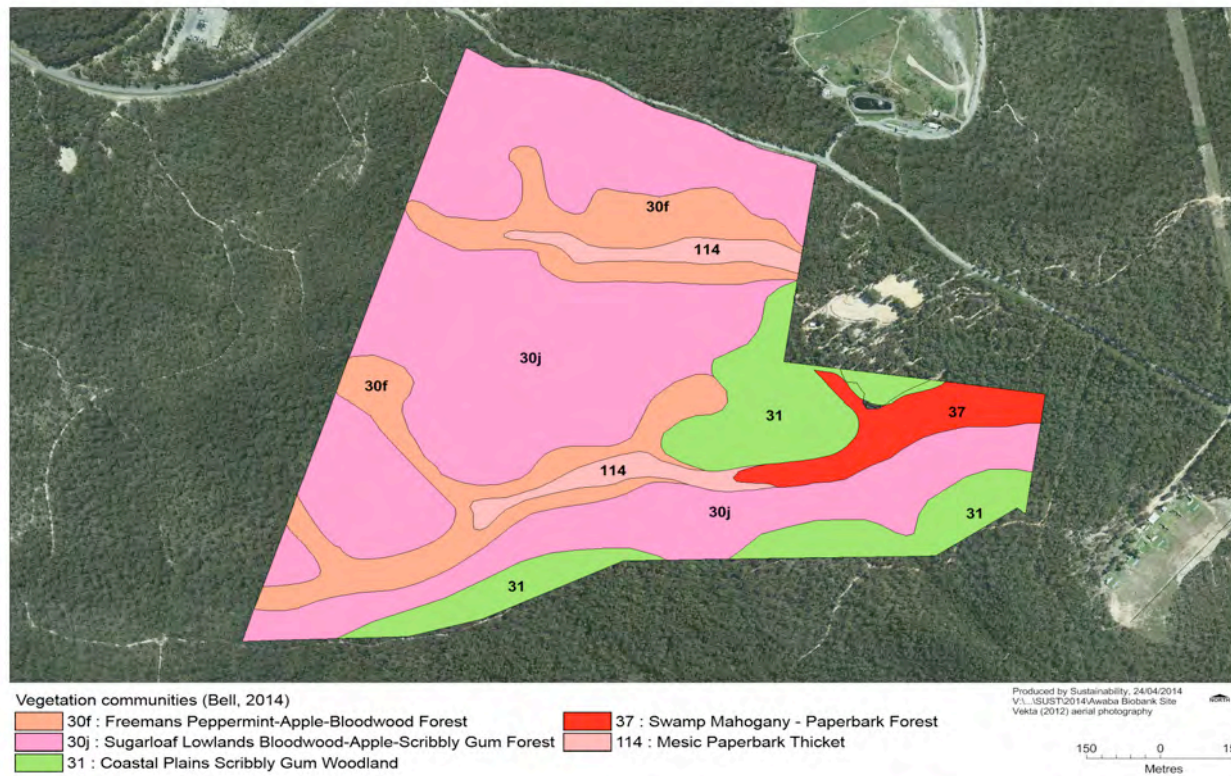
List of maps

Map 1	Location map
Map 2	Vegetation communities on the land
Map 3	Biodiversity management issues
Map 4	Management areas and infrastructure

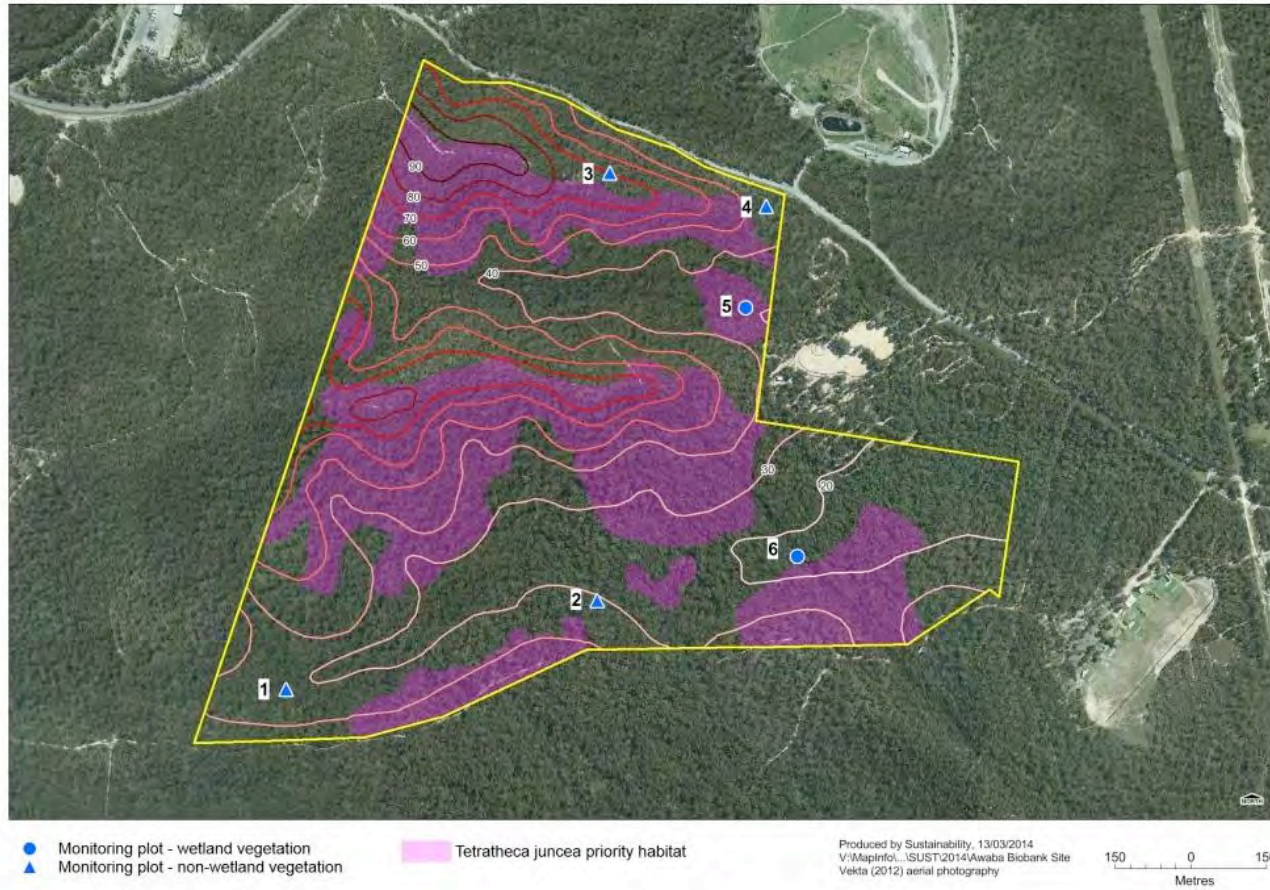
Map 1 Location map



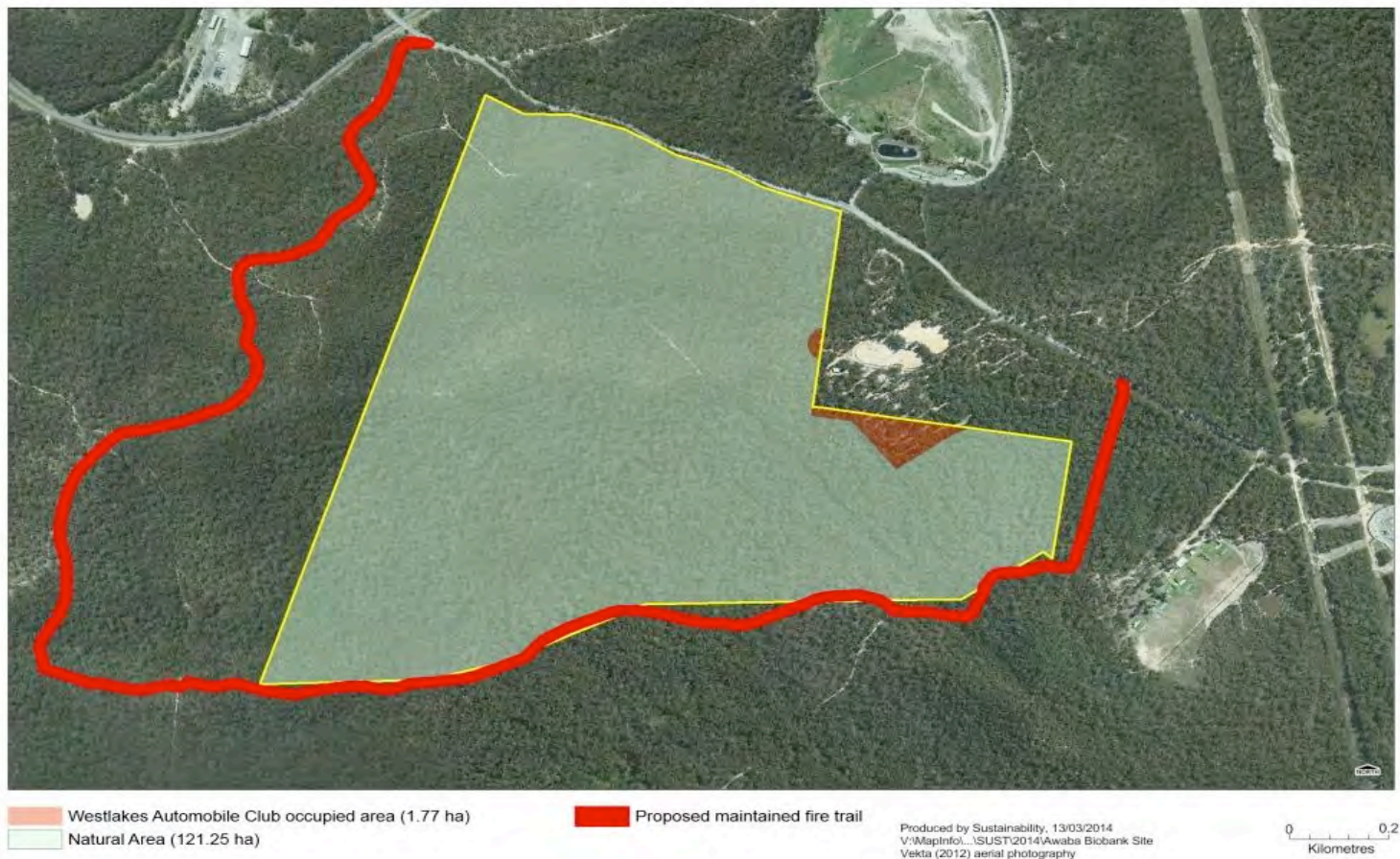
Map 2 Vegetation communities on the land



Map 3 Biodiversity management issues



Map 4 Management areas & infrastructure



Appendix A Flora and Fauna Records for the Site

A1 Flora (native) recorded during the field survey (Niche 2013)

Family	Species	Common name
Acanthaceae	<i>Brunoniella australis</i>	Blue Trumpet
Acanthaceae	<i>Pseuderanthemum variabile</i>	Pastel Flower
Adiantaceae	<i>Adiantum aethiopicum</i>	Common Maidenhair
Alismataceae	<i>Alisma plantago-aquatica</i>	Water Plantain
Apiaceae	<i>Hydrocotyle sibthorpioides</i>	
Apiaceae	<i>Platysace linearifolia</i>	
Apiaceae	<i>Xanthosia tridentata</i>	Rock Xanthosia
Araceae	<i>Gymnostachys anceps</i>	Settler's Twine
Araliaceae	<i>Astrotricha longifolia</i>	
Araliaceae	<i>Polyscias sambucifolia</i>	Elderberry Panax
Asteraceae	<i>Enydra fluctuans</i>	
Bignoniaceae	<i>Pandorea pandorana</i>	Wonga Wonga Vine
Blechnaceae	<i>Blechnum cartilagineum</i>	Gristle Fern
Blechnaceae	<i>Blechnum indicum</i>	Swamp Water Fern
Casuarinaceae	<i>Allocasuarina littoralis</i>	Black She-Oak
Casuarinaceae	<i>Allocasuarina torulosa</i>	Forest Oak
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed
Convolvulaceae	<i>Polymeria calycina</i>	
Cunoniaceae	<i>Bauera rubioides</i>	River Rose
Cunoniaceae	<i>Callicoma serratifolia</i>	Black Wattle
Cunoniaceae	<i>Ceratopetalum gummiferum</i>	Christmas Bush
Cunoniaceae	<i>Schizomeria ovata</i>	Crabapple
Cyperaceae	<i>Baumea articulata</i>	Jointed Twig-rush
Cyperaceae	<i>Carex inversa</i>	Knob Sedge
Cyperaceae	<i>Cyathochaeta diandra</i>	
Cyperaceae	<i>Eleocharis gracilis</i>	
Cyperaceae	<i>Gahnia clarkei</i>	Tall Saw-sedge
Cyperaceae	<i>Gahnia sieberiana</i>	Red-fruit Saw-sedge
Cyperaceae	<i>Lepidosperma laterale</i>	Variable Sword-sedge
Cyperaceae	<i>Ptilothrix deusta</i>	
Cyperaceae	<i>Schoenus melanostachys</i>	
Dennstaedtiaceae	<i>Pteridium esculentum</i>	Bracken
Dicksoniaceae	<i>Calochlaena dubia</i>	Rainbow Fern

Dilleniaceae	<i>Hibbertia aspera</i>	Rough Guinea Flower
Dilleniaceae	<i>Hibbertia dentata</i>	Twining Guinea Flower
Dilleniaceae	<i>Hibbertia obtusifolia</i>	Hoary Guinea Flower
Dioscoreaceae	<i>Dioscorea transversa</i>	Native Yam
Doryanthaceae	<i>Doryanthes excelsa</i>	Gynea Lily
Elaeocarpaceae	<i>Elaeocarpus reticulatus</i>	Blueberry Ash
Elaeocarpaceae	<i>Tetraloche juncea</i>	Black-eyed Susan
Ericaceae	<i>Epacris pulchella</i>	Wallum Heath
Ericaceae	<i>Leucopogon lanceolatus</i>	
Ericaceae	<i>Leucopogon microphyllus</i>	
Ericaceae	<i>Monotoca scoparia</i>	
Fabaceae (Faboideae)	<i>Almaleea paludosa</i>	
Fabaceae (Faboideae)	<i>Bossiaea obcordata</i>	Spiny Bossiaea
Fabaceae (Faboideae)	<i>Dillwynia retorta</i>	
Fabaceae (Faboideae)	<i>Glycine clandestina</i>	Twining glycine
Fabaceae (Faboideae)	<i>Glycine tabacina</i>	Variable Glycine
Fabaceae (Faboideae)	<i>Gompholobium glabratum</i>	Dainty Wedge Pea
Fabaceae (Faboideae)	<i>Gompholobium grandiflorum</i>	Large Wedge Pea
Fabaceae (Faboideae)	<i>Gompholobium minus</i>	Dwarf Wedge Pea
Fabaceae (Faboideae)	<i>Hardenbergia violacea</i>	False Sarsaparilla
Fabaceae (Faboideae)	<i>Hovea linearis</i>	
Fabaceae (Faboideae)	<i>Kennedia rubicunda</i>	Dusky Coral Pea
Fabaceae (Faboideae)	<i>Mirbelia rubiifolia</i>	Heathy Mirbelia
Fabaceae (Faboideae)	<i>Platylobium formosum</i>	
Fabaceae (Faboideae)	<i>Podolobium ilicifolium</i>	Prickly Shaggy Pea
Fabaceae (Faboideae)	<i>Pultenaea rosmarinifolia</i>	
Fabaceae (Faboideae)	<i>Pultenaea tuberculata</i>	
Fabaceae (Mimosoideae)	<i>Acacia bynoeana</i>	Bynoe's Wattle
Fabaceae (Mimosoideae)	<i>Acacia irrorata</i>	Green Wattle
Fabaceae (Mimosoideae)	<i>Acacia irrorata subsp. irrorata</i>	Green Wattle
Fabaceae (Mimosoideae)	<i>Acacia longifolia</i>	
Fabaceae (Mimosoideae)	<i>Acacia suaveolens</i>	Sweet Wattle
Fabaceae (Mimosoideae)	<i>Acacia terminalis</i>	Sunshine Wattle
Goodeniaceae	<i>Dampiera stricta</i>	
Goodeniaceae	<i>Goodenia heterophylla subsp. heterophylla</i>	
Goodeniaceae	<i>Scaevola ramosissima</i>	Purple Fan-flower

Haloragaceae	<i>Gonocarpus teucrioides</i>	Germander Raspwort
Iridaceae	<i>Patersonia glabrata</i>	Leafy Purple-flag
Iridaceae	<i>Patersonia sericea</i>	Silky Purple-Flag
Lamiaceae	<i>Clerodendrum tomentosum</i>	Hairy Clerodendrum
Lauraceae	<i>Cassytha glabella</i>	
Lindsaeaceae	<i>Lindsaea linearis</i>	Screw Fern
Lindsaeaceae	<i>Lindsaea microphylla</i>	Lacy Wedge Fern
Lobeliaceae	<i>Pratia purpurascens</i>	Whiteroot
Loganiaceae	<i>Logania albiflora</i>	
Lomandraceae	<i>Lomandra confertifolia</i>	Matrush
Lomandraceae	<i>Lomandra cylindrica</i>	
Lomandraceae	<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	
Lomandraceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush
Lomandraceae	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	Many-flowered Mat-rush
Lomandraceae	<i>Lomandra obliqua</i>	
Loranthaceae	<i>Dendrophthoe</i> spp.	
Luzuriagaceae	<i>Eustrephus latifolius</i>	Wombat Berry
Luzuriagaceae	<i>Geitonoplesium cymosum</i>	Scrambling Lily
Myrtaceae	<i>Acmena smithii</i>	Lilly Pilly
Myrtaceae	<i>Angophora costata</i>	Sydney Red Gum
Myrtaceae	<i>Corymbia gummifera</i>	Red Bloodwood
Myrtaceae	<i>Eucalyptus capitellata</i>	Brown Stringybark
Myrtaceae	<i>Eucalyptus haemastoma</i>	Broad-leaved Scribbly Gum
Myrtaceae	<i>Eucalyptus piperita</i>	Sydney Peppermint
Myrtaceae	<i>Eucalyptus resinifera</i> subsp. <i>resinifera</i>	
Myrtaceae	<i>Eucalyptus robusta</i>	Swamp Mahogany
Myrtaceae	<i>Eucalyptus umbra</i>	Broad-leaved White Mahogany
Myrtaceae	<i>Leptospermum polygalifolium</i>	Tantoon
Myrtaceae	<i>Leptospermum trinervium</i>	Slender Tea-tree
Myrtaceae	<i>Melaleuca linariifolia</i>	Flax-leaved Paperbark
Myrtaceae	<i>Melaleuca sieberi</i>	
Myrtaceae	<i>Micromyrtus ciliata</i>	Fringed Heath-myrtle
Myrtaceae	<i>Syncarpia glomulifera</i>	Turpentine
Oleaceae	<i>Notelaea longifolia</i>	Large Mock-olive
Orchidaceae	<i>Dipodium punctatum</i>	
Phormiaceae	<i>Dianella caerulea</i> var. <i>producta</i>	

Phormiaceae	<i>Dianella revoluta</i>	Blueberry Lily
Phyllanthaceae	<i>Glochidion ferdinandi</i>	Cheese Tree
Phyllanthaceae	<i>Phyllanthus hirtellus</i>	Thyme Spurge
Phyllanthaceae	<i>Poranthera ericifolia</i>	
Pittosporaceae	<i>Billardiera scandens</i>	Hairy Apple Berry
Pittosporaceae	<i>Bursaria spinosa</i>	Native Blackthorn
Pittosporaceae	<i>Pittosporum revolutum</i>	Rough Fruit Pittosporum
Poaceae	<i>Anisopogon avenaceus</i>	Oat Speargrass
Poaceae	<i>Entolasia marginata</i>	Bordered Panic
Poaceae	<i>Entolasia stricta</i>	Wiry Panic
Poaceae	<i>Imperata cylindrica</i>	Blady Grass
Poaceae	<i>Joycea pallida</i>	Silvertop Wallaby Grass
Poaceae	<i>Microlaena stipoides</i>	Weeping Grass
Poaceae	<i>Oplismenus aemulus</i>	
Poaceae	<i>Oplismenus imbecillis</i>	
Poaceae	<i>Panicum simile</i>	Two-colour Panic
Poaceae	<i>Tetrarrhena juncea</i>	Wiry Ricegrass
Poaceae	<i>Themeda australis</i>	Kangaroo Grass
Polygalaceae	<i>Comesperma ericinum</i>	Pyramid Flower
Proteaceae	<i>Banksia oblongifolia</i>	Fern-leaved Banksia
Proteaceae	<i>Banksia spinulosa</i>	Hairpin Banksia
Proteaceae	<i>Banksia spinulosa</i> var. <i>collina</i>	
Proteaceae	<i>Grevillea humilis</i> subsp. <i>humilis</i>	Linear-leaf Grevillea
Proteaceae	<i>Grevillea sericea</i>	Pink Spider Flower
Proteaceae	<i>Hakea bakeriana</i>	
Proteaceae	<i>Hakea dactyloides</i>	Finger Hakea
Proteaceae	<i>Isopogon anemonifolius</i>	Broad-leaf Drumsticks
Proteaceae	<i>Lambertia formosa</i>	Mountain Devil
Proteaceae	<i>Lomatia silaifolia</i>	Crinkle Bush
Proteaceae	<i>Persoonia levis</i>	Broad-leaved Geebung
Proteaceae	<i>Persoonia linearis</i>	Narrow-leaved Geebung
Proteaceae	<i>Xylomelum pyriforme</i>	Woody Pear
Ranunculaceae	<i>Clematis aristata</i>	Old Man's Beard
Restionaceae	<i>Baloskion tetraphyllum</i> subsp. <i>tetraphyllum</i>	
Restionaceae	<i>Lepyrodia anarthria</i>	
Rubiaceae	<i>Opercularia diphylla</i>	Stinkweed

Rutaceae	<i>Boronia polygalifolia</i>	Dwarf Boronia
Sapindaceae	<i>Dodonaea triquetra</i>	Large-leaf Hop-bush
Schizaeaceae	<i>Schizaea bifida</i>	Forked Comb Fern
Scrophulariaceae	<i>Gratiola</i> spp.	
Smilacaceae	<i>Smilax australis</i>	Lawyer Vine
Smilacaceae	<i>Smilax glyciophylla</i>	Sweet Sarsparilla
Sterculiaceae	<i>Commersonia fraseri</i>	Brush Kurrajong
Thymelaeaceae	<i>Pimelea linifolia</i>	Slender Rice Flower
Xanthorrhoeaceae	<i>Xanthorrhoea media</i>	
Zamiaceae	<i>Macrozamia reducta</i>	

A2 Weeds recorded on the site

Species	Common name	Comment
<i>Chrysanthemoides monilifera</i> <i>ssp. rotundata</i>	Bitou bush	Scattered across site in natural bushland
<i>Andropogon virginicus</i>	Whiskey grass	Primarily along tracks
<i>Hyparrhenia rufa</i> subsp. <i>rufa</i>	Thatch grass (possibly Coolatai grass?)	Along Wilton Road
<i>Rubus fruticosus</i>	Blackberry	Internal track near creek
<i>Ageratina adenophora</i>	Crofton weed	Near edge of WAC track
<i>Axonopus fissifolius</i>	Carpet grass	Internal track near gully crossing
<i>Stenotaphrum secundatum</i>	Buffalo grass	Along Wilton Road
<i>Senna pendula</i>	Cassia	Along Wilton Road
<i>Phoenix canariensis</i>	Phoenix Palm	Along Wilton Road
<i>Asparagus aethiopicus?</i>	Asparagus Fern	Along Wilton Road
<i>saxifraga umbrosa</i>	London Pride	Along Wilton Road
<i>Chloris gayana</i>	Rhodes Grass	Along Wilton Road

A3 Fauna recorded on the site (Niche 2013)

Vegetation Type	30f: Freemans Peppermint - Apple-Bloodwood Forest			30h: Sugarloaf Lowlands Bloodwood-Apple Forest				31: Coastal Plains Scribbly Gum Woodland		37: Swamp Mahogany - Paperbark Forest	42: Narrabeen Alluvial Sedge Woodland		
Waypoint (Figure 4)	03	059	063	136	056	139	143	084	093	088	145	147	Opportunistic
Common Name													
Grey Fantail	H	O			O							O	
Rufous Fantail										O			O
Grey Butcher Bird	H	H											
Pied Butcher Bird													O
Australian Magpie													H
Australian Raven	H	O		H	O	H	H	H	H		O	O	H
Noisy Miner	H												
White-throated Tree Creeper	H		H	H	H	H	H		H		H	H	
Eastern Whipbird	H	H	O					H	H				
White-browed Scrubwren	O		O		O								
Variegated Wren	O								O	O	O	O	
Rufous Whistler	H	H	H	H		H	H	O		O	H		H
Bar-Shouldered Dove	H												H
Eastern Spinebill	O		H							O			H
Channel-billed Cuckoo		H											
Eastern Koel	H												
Powerful Owl			O										
Scarlet Robin													O
Noisy Friarbird	H				H			H					H
New Holland Honeyeater								H					
Sacred Kingfisher								O		H			
Australian White Ibis								O					
Sulphur-Crested Cockatoo								H					
Golden Whistler			H				H	H	H		H		
Rainbow Lorikeet							O	O					H
Currawong								H					
Olive-Backed Oriol								H	H				
Grey Shrike-Thrush	H			H				H		H			
Shining-Bronze Cuckoo										H			
Kookaburra													H

Vegetation Type	30f: Freemans Peppermint - Apple-Bloodwood Forest			30h: Sugarloaf Lowlands Bloodwood-Apple Forest				31: Coastal Plains Scribbly Gum Woodland		37: Swamp Mahogany - Paperbark Forest	42: Narrabeen Alluvial Sedge Woodland		
Waypoint (Figure 4)	03	059	063	136	056	139	143	084	093	088	145	147	Opportunistic
Common Name													
Fantail Cuckoo										H		H	
Red-Browed Finch									O				
Eastern Yellow Robin										O			
Brown Falcon													O
Spangled Drongo													O
Eastern Rosella								H					

H= Heard, O= Observed

Appendix B Bush fire management strategy

Background

This bush fire management strategy applies to Lot 463 DP 1138964, 304 Wilton Road, Awaba. It should be read and applied in conjunction with the current bushland management plan applying to the land.

Lake Macquarie City Council's responsibilities and objectives

Lake Macquarie City Council is the landowner and manager, and is responsible for taking reasonable measures to prevent fires from occurring on the land and from escaping from the land to nearby land.

It is recognised that fire is a naturally occurring phenomenon that has periodically occurred on the land over a long time period, and that the native vegetation communities and plant species are adapted to fire, and in many cases require a fire regime to reproduce and be maintained on the land.

In preparing the strategy, the Council has consulted with the Rural Fire Service and adjoining landowners, including the Westlakes Automobile Club Inc. which occupies adjoining land containing buildings and improvements and is used periodically for events.

Bush fire management strategy

The strategy for managing fire on the land is as follows:

1. Recognise that the land forms part of a large area of continuous native vegetation, and hazard reduction actions on the land must be undertaken in conjunction with the management of adjoining land.
2. Support a designated fire trail around the land in conjunction with adjoining landowners and occupiers, as shown on Map A1.
3. Ecological burning (for maintaining biodiversity on the land) will not be undertaken, with wild fires relied upon to maintain vegetation communities.
4. No tracks will be retained or maintained within the land for the purpose of bush fire management, except for the existing track along the southern boundary. For the purposes of the Rural Fire Service, the trail traversing the land from South-East to North-West will be regarded as a dormant trail.
5. Any wild fires occurring on the land will be managed by Rural Fire Service, using the designated fire trail network and Wilton Road. Existing trails within the land are not to be used for vehicular use.
6. Lake Macquarie City Council will negotiate and seek to reach agreement with the owner of Lot 464 DP 1138964 (currently owned by the NSW Aboriginal Land Council) about obtaining legal access across its land to facilitate the formalisation of a designated fire trail generally along the alignment of the existing track on this land (see Map A1).
7. Upon designation of fire trails in the locality by the Rural Fire Service, Lake Macquarie City Council will take responsibility for maintaining the condition of the designated fire trail generally along the southern boundary of the land. This will be maintained to Rural Fire Service standards in conjunction with sections owned by other landowners.

8. The occupier of Lot 473 DP 1138964 is the Westlakes Automobile Club Inc. which has advised that it is aware of bush fire hazards and has taken measures to manage the risks, and no special measures to contain bush fires are required on the adjoining Lot 463 1138964.
9. Lake Macquarie City Council will take reasonable measures to restrict public access to the land to prevent unauthorised access which may result in accidental or deliberate fire ignition.
10. Where fires occur on the land, the fire perimeter and intensity will be mapped and recorded within 3 months, and a program of monitoring and removing weeds and rubbish shall be undertaken at 3 monthly intervals for the following 12 months.

Review of strategy

The bush fire management strategy is to be reviewed periodically in conjunction with the review of the bushland management plan applying to the land, and following any bush fires on the land.

Map A1 Bush fire strategy map





Office of
Environment
& Heritage

Your reference: MP10-0139
Our reference: DOC14/240924-01
Contact: Robert Gibson, 4908 6851

Mr Brian Bell
General Manager
Lake Macquarie City Council
Box 1906
HUNTER REGION MAIL CENTRE NSW 2310

Attention: Martin Fallding

Dear Mr Bell

RE: AWABA BIODIVERSITY CONSERVATION AREA – BIODIVERSITY OFFSETS AND MANAGEMENT PLAN

I refer to your letter dated 16 October 2014 seeking advice from the Office of Environment and Heritage (OEH) in relation to the Plan of Management for the Awaba Biodiversity Conservation Area (ABCA). OEH understands the conservation area comprises all of Lot 463 in Deposited Plan 1138964 and is being used to fulfil biodiversity offset requirements for three projects:

1. The Awaba Waste Management Facility Expansion Project (MP10-0139)
2. Awaba Alternative Waste Treatment Facility
3. Lake Macquarie Transport Interchange, Glendale (Stage 1).

Of these projects only one, the Awaba Waste Management Facility Expansion Project, a Part 3A project under the *Environmental Planning and Assessment Act 1979* (EP&A Act), required formal consultation with OEH in relation to its offset package. The offsets for the other two projects are being dealt with entirely by Council under Part 4 of the EP&A Act.

Consent conditions 50 to 51 of Schedule 4 of the consolidated consent for the Awaba Waste Management Facility Expansion Project, required that the Biodiversity Offset Management Plan for this project was prepared in consultation with OEH. A copy of the updated Plan of Management was provided with your letter, which OEH has reviewed. OEH encourages the development of such plans to ensure that proponents have determined how they will meet their statutory obligations and designated environmental objectives. However, OEH does not normally approve or endorse these documents as our role is to set environmental objectives for environmental/conservation management, not to be directly involved in the development of strategies to achieve those objectives. In this instance however, the following recommendations and comments are provided for your consideration:

- update Table A2 to include the current Latin name of all exotic plants recorded on the ABCA, so that there is no ambiguity as to which species the management plan is referring to; and
- amend 'Appendix F: Biodiversity Offset Balance Register for the Site' so that it includes a map to identify which parts of the ABCA are used as offsets for any particular development project.

From a review of available information the ABCA generates more than the required number of ecosystem and species credits required to offset the Awaba Waste Management Facility Expansion Project. OEH acknowledges that Council is proposing to use additional estimated credits from the ABCA to provide the offsets required for the other two projects in accordance with Council's offsetting requirements. OEH supports this approach provided the land on the ABCA that provides the credits for the offsets for each of the three developments is identified clearly on a map with an associated explanatory report that may be part of the ABCA Plan of Management. The assignment of the ABCA need not require any formal subdivision of the Lot.

As described in the Plan of Management, Council intends to set aside some ABCA land containing *Tetratheca juncea* plants that may be used to offset future developments that impact this Vulnerable species. The requirement to place all of Lot 463 under a restrictive covenant, as required by consent condition 51A for the Awaba Waste Management Facility Expansion Project, could result in a reduction in offsetting value of those *Tetratheca juncea* plants. This is because existing conservation obligations reduce the number of species credits generated by the application of the BioBanking Assessment Methodology (www.environment.nsw.gov.au/resources/biobanking/09181bioopsman.pdf) and can meet the concept of 'additionality' of OEH's offset policies (available at www.environment.nsw.gov.au/biodivoffsets). Note that any such discounting or additionality may not apply where Council's offset policy alone is being applied in which BBAM is being used as a guide. OEH however would need to consider this aspect of the policy if we have a formal role in future projects with offset components on the ABCA.

Lastly, OEH notes that if BBAM was implemented in full for the three projects listed in your letter and the ABCA, then some of the vegetation communities on ABCA would not be able to be used as an offset for some of the vegetation communities on the development sites. Additionally, the threatened species' credits available from the ABCA would need to be established either by survey or by expert report.

If you require any further information regarding this matter, please contact Robert Gibson, Regional Biodiversity Conservation Officer, on 4908 6851.

Yours sincerely



6 NOV 2014

RICHARD BATH
Senior Team Leader Planning, Hunter Central Coast Region
Regional Operations

Appendix D Plan Preparation Process and Consultation

Preparation of this Plan involved consultation with a range of interest groups and adjoining landowners as outlined below:

Organisation	Nature of consultation
NSW Aboriginal Land Council	Phone discussions and on-site meetings regarding access, track and bush fire management. Adjoining landowner.
Biraban Local Aboriginal Land Council	Phone discussion and on-site meeting. Interested in Aboriginal cultural heritage, access to the land, and potential bushland management contracting opportunities.
Wonnarua Nation Aboriginal Corporation	Phone discussion and meeting. Primarily interested in Aboriginal cultural heritage issues, and legal agreement with Centennial Coal.
Westlakes Automobile Club Inc. (WAC)	Phone discussion and meeting with WAC committee. Adjoining land occupier. Part of WAC track is constructed on Council land.
Centennial Coal	Phone discussion and meeting. Holds mining authorities (surface & sub-surface) and development consent affecting the land and adjoining land.
Rural Fire Service	Phone discussions and meeting. Interested in bush fire hazard reduction and trail management.
NSW Planning and Infrastructure	Phone discussion. Under consent condition is responsible for approval of the Plan.
NSW Office of Environment and Heritage (OEH)	Meeting and site inspection. OEH is required to be consulted in the preparation of the Plan.
Lake Macquarie City Council (LMCC)	LMCC is the management authority for the Plan. A range of people within LMCC have been consulted in relation to bush fire management, leases and licencing, access tracks, and other issues.

Appendix E Historic Aerial Photographs



1961 aerial photograph



1993 aerial photograph

Appendix F Biodiversity Offset Balance Register for the Site

Biodiversity offsets provided on the Awaba Biodiversity Conservation Area (ABCA) at Lot 463 DP 1138964, 304 Wilton Road, Awaba are outlined below. The ABCA will provide biodiversity offsets for three Lake Macquarie City Council development projects, namely the Awaba Waste Management Facility (AWMF), the Lake Macquarie Transport Interchange (LMTI) and the Awaba Alternative Waste Treatment Facility (AWT). The balance and division of biodiversity offsets between the three projects is provided for administrative and management purposes. This information will be included in a biodiversity offset register maintained by the Council.

1 Offset summary (for register)

GENERAL INFORMATION	
Name	Awaba Biodiversity Conservation Area
Property description	Lot 463 DP 1138964
Owner	Lake Macquarie City Council
Land classification	Operational land
Locality	304 Wilton Road, Awaba
OFFSET DESCRIPTION	
Area	121.91 ha
Type of offset	Land managed by Council for biodiversity conservation, subject to a plan of management and a restriction as to user. The land fully offsets three approved development projects, with the cost apportioned between each project.
Projects offset	Awaba Waste Management Facility (AWMF) – 45.6% Lake Macquarie Transport Interchange (LMTI) – 26.2% Awaba Alternative Waste Treatment Facility (AWT) – 28.2%
Available offsets	<i>Tetratheca juncea</i> 1,791 clumps (10,746 assumed 'credits' using Biobanking Assessment Methodology V2.1)

2 'Credit' balance calculation

The calculation of biodiversity offsets on the ABCA is based on 'assumed credits' using the Biobanking Assessment Methodology V2.0 and 2.1.

The Awaba Biodiversity Conservation Area (ABCA) will provide offsets for three LMCC projects, and calculations below indicate how the offsets are provided and how the costs of the offsets are apportioned. The three projects are the Awaba Waste Management Facility (AWMF), the Lake Macquarie Transport Interchange (LMTI) and the Awaba Alternative Waste Treatment Facility (AWT).

The three projects will fully utilise the available biodiversity offset potential of the ABCA, except for 10,746 'assumed credits' for *Tetratheca juncea*. These remaining 'credits' will be available for use in negotiated biodiversity offsets for other future Lake Macquarie City Council projects if required. Note that these are not Biobanking credits created under the NSW Biobanking scheme.

Ecosystem credits are representative of the extent of native vegetation disturbed and the area of offset required. Using the Biobanking Assessment Methodology, the ecosystem credits required for the projects are nearly the same as the ecosystem credits available on the ABCA site, although the vegetation types in the offset site are not the same as the types removed by the projects. The methodology applies a standard of maintaining or improving native vegetation, and the credit balance indicates that this standard has been met in the offset arrangement even though equivalent vegetation types are not offset.

Species credits cannot be balanced due to insufficient ecological survey on the ABCA, except for two species *Tetratheca juncea* and *Acacia bynoeana*. Other species required to be offset for the development projects are likely to occur on the ABCA but cannot be quantified. Because the offset requirement for these species is relatively small and the offset site is reasonably large, it is assumed that the offset for species other than *Tetratheca juncea* is adequate and will be fully utilised.

The proportion of cost of providing the ABCA offset site has been determined based on the proportion of ecosystem credits for each of the three development projects. The final proportion is AWMF 45.6%, LMTI 26.2%, and AWT 28.2% as outlined in the table below.

'Assumed Credit' calculation table

	ABCA available 'credits' (Lot 463)	'Credits' offset on Lot 463			Balance	Unused 'credits'
	ABCA (1)	AWMF (2)	LMTI (3)	AWT (4)		
Vegetation type	Ecosystem 'credits'					
HU546 Forest Red Gum - Rough-barked Apple open forest on poorly drained lowlands of the Central Coast, Sydney Basin			89		-89	
HU591 Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin 11.5 ha	34				+34	
HU610 Scribbly Gum - Red Bloodwood heathy woodland on the coastal plains of the Central Coast, Sydney Basin 21.5 ha	115	260	136	242	-523	
HU621 Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin 54.5 ha	392	132			+260	
HU633 Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin 4.30 ha	42				+42	
HU641 Sydney Peppermint - Smooth-barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and northern Sydney Basin 66.00 ha	286				+286	
TOTAL	869	392	225	242	+10	
Proportion of ecosystem credits for 3 projects		45.6%	26.2%	28.2%		

	ABCA available 'credits' (Lot 463)	'Credits' offset on Lot 463			Balance	Unused 'credits'
		AWMF (2)	LMTI (3)	AWT (4)		
	ABCA (1)					
Species name	Species 'credits'					
<i>Tetratheca juncea</i>	49,938	33,853	15	5,324	+ 10,746	+ 10,746
<i>Acacia bynoeana</i>	6				Full offset assumed	
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Not surveyed but probably present			765	Full offset assumed	
Squirrel Glider	Not surveyed but probably present		82		Full offset assumed	
Little Bentwing-bat	Not surveyed but probably present		49		Full offset assumed	
Eastern Bentwing-bat	Not surveyed but probably present		49		Full offset assumed	
Powerful Owl	Not surveyed but probably present		112		Full offset assumed	
Grey-headed Flying-fox	Not surveyed but probably present		40		Full offset assumed	
Eastern Freetail-bat	Not surveyed but probably present		82		Full offset assumed	
Greater Broad-nosed Bat	Not surveyed but probably present		82		Full offset assumed	
TOTAL	49,944 known	33,853	511	6,089		

ABCA cost apportionment table

PROJECT	Proportion of ABCA ecosystem 'credits'	Notes
Awaba Waste Management Facility (AWMF)	45.6%	Offset proportion increased because a higher proportion of species credits is required
Lake Macquarie Transport Interchange (LMTI)	26.2%	Offset proportion discounted because a lower proportion of species credits is required
Awaba Alternative Waste Treatment Facility (AWT)	28.2%	Offset proportion increased because a higher proportion of species credits is required

Notes:

- (1) 'Credits' refers to estimated Biobanking credits determined using the NSW Biobanking Assessment Methodology. These 'credits' are assumed because they have not been created as formal credits under the NSW Biobanking Scheme.
- (2) Determination of the final balance assumes that more weight should be given to ecosystem credits than species credits.

References	TRIM ref	Biobanking credit report date
1 Niche Environment and Heritage, 2013, Biobanking Assessment Report, Awaba BioBank Site – Lot 463, Wilton Road, Awaba NSW, September 2013	D03428617	24 September 2013
2 Niche Environment and Heritage, 2012, Lot 372 – Awaba Landfill Site Offsetting Assessment Report, August 2012	D02977754	30 April 2012
3 Stefan Rose, 2014, Biobanking credit report for Glendale Transport Interchange	D06977410	1 May 2014
4 Niche Environment and Heritage, 2013, Biobanking Assessment Report, Development Site Awaba Alternative Waste Treatment Facility 413 Wilton Road (Lot 373 DP 723259), Awaba NSW, November 2013	D06829484	15 November 2013

3 Application of biodiversity offset principles

The offsets provided in the Awaba Biodiversity Conservation Area for the three nominated projects conform with the NSW Office of Environment and Heritage Principles for the Use of Biodiversity offsets in NSW and have been taken into account in reviewing biodiversity impacts and determining appropriate offset arrangements. Consideration of these principles is as follows:

1. Impacts must be avoided first by using prevention and mitigation measures.

Measures to avoid and minimise impacts of all three projects have formed part of the project design. Biodiversity offsets will be provided for residual impacts.

2. All regulatory requirements must be met.

Assessment and approval processes for all three projects comply with relevant regulatory requirements.

3. Offsets must never reward ongoing poor performance.

In developing its offset arrangements for the land, Lake Macquarie City Council is meeting best practice standards for biodiversity offsetting, and has committed to establishing and managing an offset site in perpetuity.

4. Offsets will complement other government programs.

The establishment of a biodiversity offset site at Awaba is consistent with the approach outlined in the Lower Hunter Regional Conservation Plan 2009 by the NSW Government, and complements other Council and NSW Government programs.

5. Offsets must be underpinned by sound ecological principles.

The size of the offset requirement has been determined by applying the NSW Biobanking Assessment Methodology for all projects by accredited assessors. This provides a consistent ecological basis for assessment of biodiversity.

6. Offsets should aim to result in a net improvement in biodiversity over time.

Establishing a biodiversity offset site at Awaba and implementing a management plan will at least maintain biodiversity values as an offset for the provision of essential community infrastructure.

7. Offsets must be enduring – they must offset the impact of the development for the period that the impact occurs.

The Awaba Biodiversity Conservation Area provides in perpetuity biodiversity offset, as Lake Macquarie City Council is committed to retaining and managing this land to protect its biodiversity values.

8. Offsets should be agreed prior to the impact occurring.

Offsets have been demonstrated as part of the approval process, and will form a requirement of conditions of consent.

9. Offsets must be quantifiable – the impacts and benefits must be reliably estimated.

Offsets have been quantified using the Biobanking Assessment Methodology, using accredited assessors. The final offsetting arrangement will not be under the NSW Biobanking Scheme, but is a negotiated outcome based on what is possible and reasonable.

10. Offsets must be targeted.

Based on the Biobanking Assessment Methodology, the offsets provided are basically like for like, and ecosystem credits determined are comparable. There is a surplus of species credits for *Tetratheca juncea*. Offsets and management costs for the three projects be apportioned on the basis of the credits determined using the Biobanking Assessment Methodology. It has been determined that the Awaba Biodiversity Conservation Area provides an adequate number of credits, provides conservation security for this land as provided by a restrictive covenant and funded management plan, and it is anticipated that the site will not be used for further offsetting as would otherwise be possible if it was established as a Biobank site, with the exception of surplus *Tetratheca juncea* credits.

11. Offsets must be located appropriately.

The offsets on the Awaba Biodiversity Conservation Area are located in an area with similar ecological characteristics to the areas affected by the development.

12. Offsets must be supplementary.

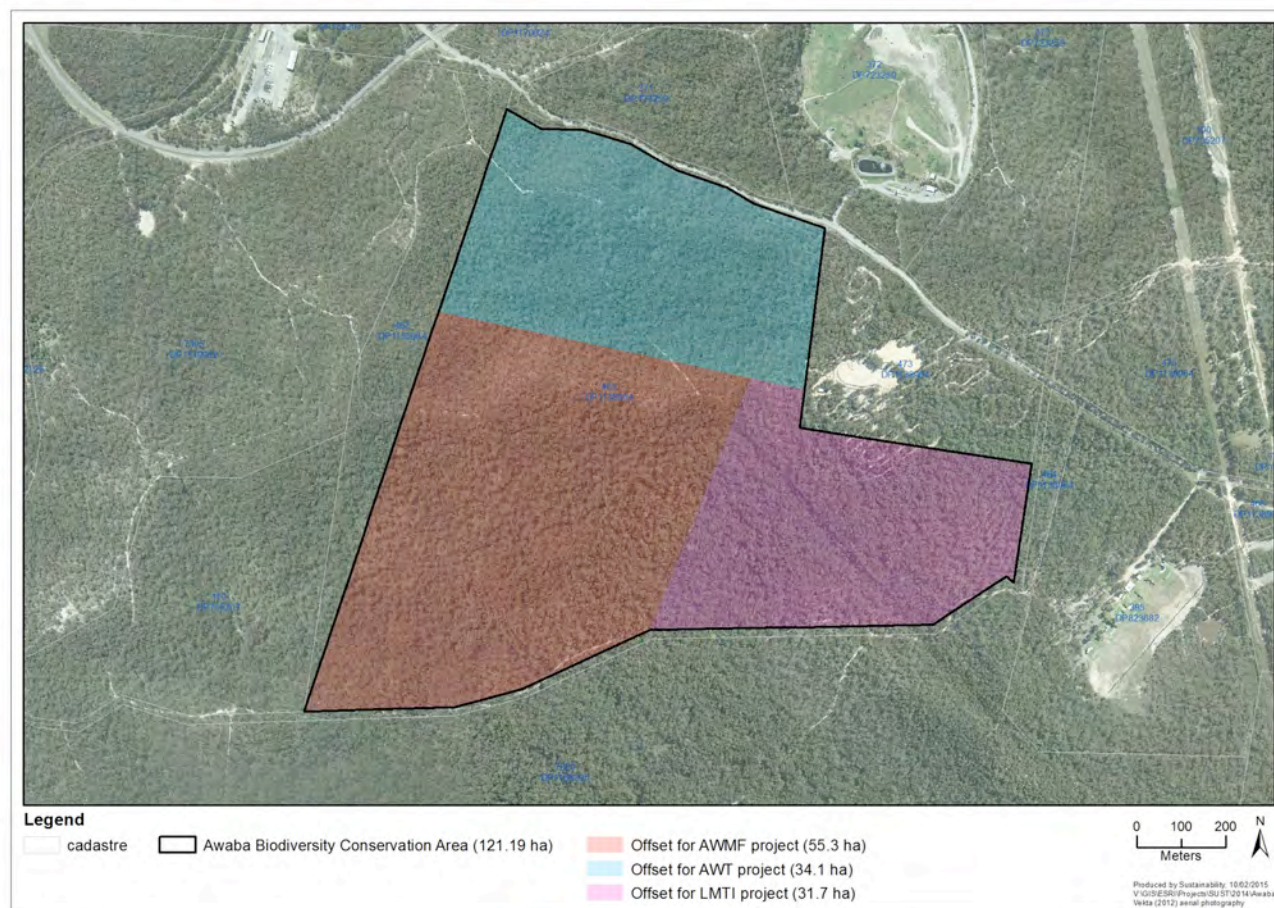
The proposed offset is beyond existing requirements and is not funded under another scheme or arrangement.

13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or contracts.

The offset is enforceable through development consent conditions.

Appendix G Map of Biodiversity Offset Allocation

The map below shows allocated offset areas for the three projects and is based on the calculations in Appendix F.



Appendix K – Greenhouse Gas Management Plan



Lake Macquarie City Council

Awaba Waste Management Facility

Greenhouse Gas Management Plan

August 2014

Disclaimer

This report: has been prepared by GHD for Lake Macquarie City Council and may only be used and relied on by Lake Macquarie City Council for the purpose agreed between GHD and the Lake Macquarie City Council as set out within this report.

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

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

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

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

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Appendices

Appendix A	Solid Waste Calculator 1.8 NGER Model, Assumptions and Justifications
Appendix B	Tabulated Landfill Methane and Landfill Gas Generation Estimates
Appendix C	Plan of Existing Landfill Gas Collection and Treatment System
Appendix D	Tabulated Landfill Methane and Landfill Gas Emission Estimates
Appendix E	Proposed Landfill Gas Monitoring Bore Locations
Appendix F	Greenhouse Gas Manual – National Greenhouse and Energy Reporting – NGER – Procedure – Version 1

Glossary

AWMF	Awaba Waste Management Facility
CER	Australian Clean Energy Regulator
Clean Energy Act	Clean Energy Act (2011)
Council	Lake Macquarie City Council
CPM	Carbon Pricing Mechanism
EPL	Environment Protection Licence
FYE	Financial Year Ending
GHG	Greenhouse Gas
GHGMP	Greenhouse Gas Management Plan
LMS	LMS Energy Pty Ltd
NGER Act	National Greenhouse and Energy Reporting Act (2007)
NSW EPA	New South Wales Environment Protection Authority
Plan	This Greenhouse Gas Management Plan

1. Introduction

1.1 General

GHD Pty Ltd (GHD) was engaged by Lake Macquarie City Council (Council) to provide design and delivery phase services for an expansion of the landfill operations at the Awaba Waste Management Facility (AWMF). As part of this engagement, GHD has been tasked with the preparation of a Greenhouse Gas Management Plan (GHGMP) that satisfies Condition 26, Schedule 4 of the Project Approval Conditions (Specific Environmental Conditions)¹.

This Plan forms part of the AWMF's Landfill Environmental Management Plan (LEMP) and should be read in conjunction with the other documents which form the LEMP.

1.2 Purpose of GHGMP

The purpose of this GHGMP is to meet the requirements detailed in Condition 26, Schedule 4 of the Project Approval Conditions (Specific Environmental Conditions). These requirements are as follows:

26. The Proponent shall develop and implement a Greenhouse Gas Management Plan prior to the commencement of operations of the new landfill cells. The Plan shall include, as a minimum:

(a) proposed active landfill gas management system including flaring and / or combustion to reduce potential greenhouse gas emissions from the landfill;

(b) energy saving measures to be implemented;

(c) detail greenhouse gas monitoring program;

(d) a program to monitor the effectiveness of these measures; and

(e) a protocol to periodically review the Plan.

The Plan shall be documented in the Landfill Environmental Management Plan (see Condition 3 in Schedule 5).

1.3 Scope of GHGMP

This GHGMP:

- Provides an overview of the AWMF and the landfill expansion;
- Identifies key regulatory requirements and recommendations for Greenhouse Gas (GHG) management at the AWMF;
- Estimates and discusses the potential quantity of landfill methane that may be generated at the AWMF;
- Describes the existing and proposed landfill gas management measures (including the landfill gas management system, the GHG monitoring program and how the effectiveness of the measures will be monitored / assessed);
- Estimates and discusses the potential quantity of landfill methane that may be emitted from the AWMF;
- Describes the current and proposed energy saving measures; and
- Contains a protocol to periodically review this GHGMP.

¹ As detailed within Awaba Waste Management Facility Expansion Project - Project Approval - Section 75J of the Environmental Planning and Assessment Act 1979, NSW Government 2013.

1.4 Assumptions

In preparation of this Plan, GHD has made a number of assumptions including the following:

- Previous GHG emission estimates for the AWMF (Cardno, 2012) suggest that landfill methane emissions are likely to constitute >99% of total GHG emission from the AWMF between 2011 and 2100 (the remaining <1% of total GHG emissions was estimated to be derived from diesel use, gasoline use and electricity use). As such this GHGMP primarily focusses on landfill methane management and monitoring; and
- GHD has not and will not be independently confirming the accuracy of any data provided.

1.5 Reliance

The following information, provided by Council, has been relied on:

Documents from Council

- Additions to Awaba Waste Management Facility, Environmental Assessment - Volume 1 (Main Report), prepared by Cardno dated 29 August 2012 (herein referred to "the EA report" and referenced as "Cardno, 2012")
- Additions to Awaba Waste Management Facility, Environmental Assessment - Volume 2 (Appendices A to H), prepared by Cardno dated 29 August 2012
- Additions to Awaba Waste Management Facility, Environmental Assessment - Environmental Assessment - Volume 3 (Appendices I to K), prepared by Cardno dated 29 August 2012
- Additions to Awaba Waste Management Facility, Environmental Assessment - Volume 4 (Appendices L to Q), prepared by Cardno dated 29 August 2012
- Additions to Awaba Waste Management Facility, Submissions Report and Revised Statement of Commitments, prepared by Cardno dated March 2013
- Awaba Generating Facility Gas Field Layout (Drawing number 20019-CA-003), prepared by LMS dated 24 March 2012
- Awaba Landfill Facility Accumulation Gas Monitoring Data Sheet April 2013
- Awaba Landfill Facility Accumulation Gas Monitoring Data Sheet August 2013
- Awaba Landfill Facility Accumulation Gas Monitoring Data Sheet December 2012
- Awaba Landfill Facility Accumulation Gas Monitoring Data Sheet February 2012
- Awaba Landfill Facility Accumulation Gas Monitoring Data Sheet February 2013
- Awaba Landfill Facility Accumulation Gas Monitoring Data Sheet June 2012
- Awaba Landfill Facility Accumulation Gas Monitoring Data Sheet July 2012
- Awaba Landfill Facility Accumulation Gas Monitoring Data Sheet March 2012
- Awaba Landfill Facility Accumulation Gas Monitoring Data Sheet May 2012
- Awaba Landfill Facility Accumulation Gas Monitoring Data Sheet October 2012
- Awaba Landfill Facility Accumulation Gas Monitoring Data Sheet September 2012
- Awaba Landfill Facility Surface Gas Monitoring Data Sheet August 2010
- Awaba Landfill Facility Surface Gas Monitoring Data Sheet December 2010
- Awaba Landfill Facility Surface Gas Monitoring Data Sheet February 2010

- Awaba Landfill Facility Surface Gas Monitoring Data Sheet February 2011
- Awaba Landfill Facility Surface Gas Monitoring Data Sheet January 2010
- Awaba Landfill Facility Surface Gas Monitoring Data Sheet January 2011
- Awaba Landfill Facility Surface Gas Monitoring Data Sheet June 2010
- Awaba Landfill Facility Surface Gas Monitoring Data Sheet March 2010
- Awaba Landfill Facility Surface Gas Monitoring Data Sheet March 2011
- Awaba Landfill Facility Surface Gas Monitoring Data Sheet May 2010
- Awaba Landfill Facility Surface Gas Monitoring Data Sheet May 2013
- Awaba Landfill Facility Surface Gas Monitoring Data Sheet November 2010
- Awaba Landfill Facility Surface Gas Monitoring Data Sheet November 2012
- Awaba Landfill Facility Surface Gas Monitoring Data Sheet September 2010
- Awaba Landfill Facility Surface Gas Monitoring Data Sheet September 2013
- Awaba Model Greenhouse Gas Model Extension provided by Council (received 22 January 2014)
- Calibration Test Certificate dated 25 January 2010
- Email correspondence from Ben Maddox (Council) to Matt Welsh (GHD) titled Info for GHG management plan dated 27 November 2013
- Email correspondence from Ben Maddox (Council) to Matt Welsh (GHD) titled Awaba LMS LFG Extraction System Monitoring dated 11 November 2013
- Email correspondence from Ben Maddox (Council) to Matt Welsh (GHD) titled Info for GHG management plan dated 24 February 2013
- Email correspondence from Michael Hilton (Council) to Reinhard Wilkes (GHD) titled Request for Information for Gas Management Plan dated 10 September 2013
- Email correspondence from Michael Hilton (Council) to Reinhard Wilkes (GHD) titled GHDRFI002 - Request for Information for Gas Management Plan - Item 3 dated 20 September 2013
- Email correspondence from Rick Brindley (Council) to Reinhard Wilkes (GHD) titled Greenhouse Gas Management Plan - Request for Information dated 10 October 2013
- Greenhouse Gas Management Plan Meeting – Meeting Minutes dated 24 September 2013
- Greenhouse Gas Manual - National Greenhouse and Energy Reporting – NGER, prepared by Council dated October 2013
- NGER Solid Waste Calculator Awaba Extension Generation Scenario provided by Council (received 22 January 2014)

Information from site visit by GHD staff on the 24 September 2013

- Photographs taken on the day
- Verbal advice / information supplied by Council on the day

Additional information

- NSW EPA Environmental Guidelines: Solid Waste Landfills (1996)

- 2011 Census QuickStats prepared by Australian Bureau of Statistics (ABS) dated October 2012
- 2012-2013 National Greenhouse and Energy Reporting System Measurement Technical Guidelines for the estimation of greenhouse gas emissions by facilities in Australia (NGER Technical Guidelines)

2. Site Description

2.1 Location, access and footprint

The AWMF is situated within the Lake Macquarie Local Government Area (LGA), which covers an area of approximately 645 square km in the Hunter region of NSW, Australia. The estimated population of the LGA was 189,000 in 2011 (ABS, 2012).

The AWMF is located off Wilton Road, Awaba, approximately 1.2 km south-east of the township of Awaba and 4 km west of the suburb of Toronto. Access to the AWMF is via Wilton Road. The location of the AWMF is shown on Figure 1.

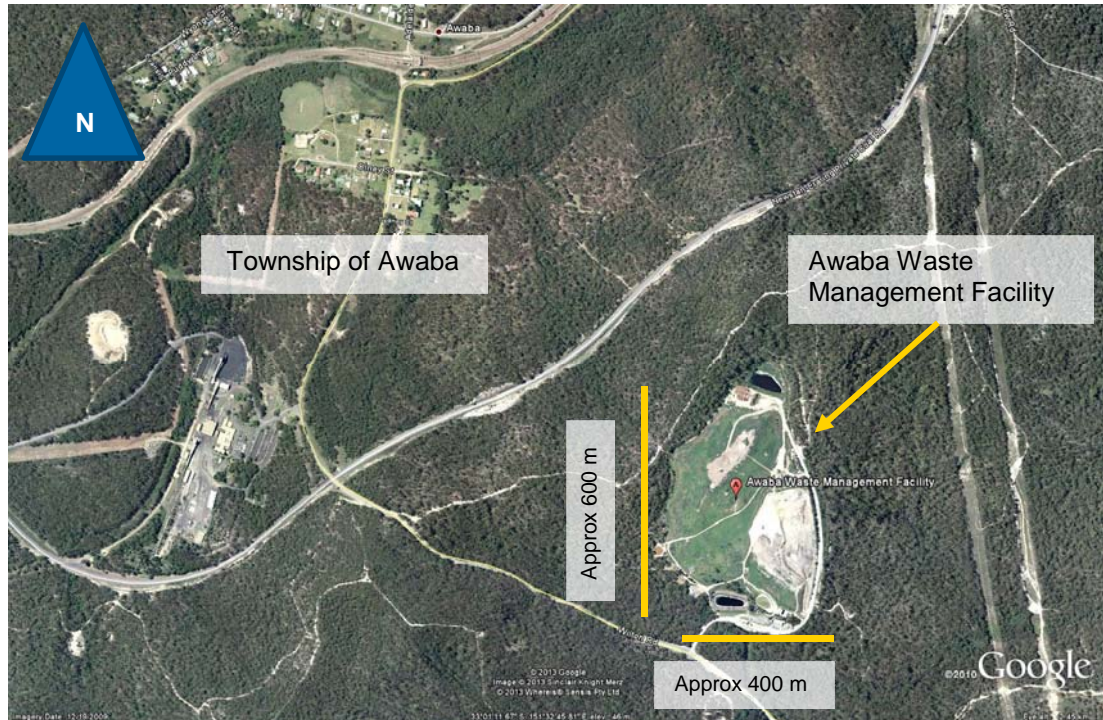


Figure 1 Awaba waste management facility (Google, 2013)

The AWMF currently occupies an area of approximately 32.5 hectares, of which approximately 23.5 hectares has been landfilled. The remaining land at the site has not been landfilled and consists generally of natural bushland (although some areas are occupied by site infrastructure such as buildings and roads). The site is surrounded by natural bushland and significant distances exist between off-site receptors and landfilled waste, with the township of Awaba located approximately 800 metres to the north-west and other residential housing located approximately 1.5 kilometres to the east.

2.2 Site approvals

The current landfill operations at the AWMF are approved by:

- The NSW EPA under Environment Protection Licence Number 5873
- Council under development consents DA 170/1986 (1986) and DA 82/1994 (1995).

Furthermore, Council recently obtained approval from the NSW Government for an expansion of the landfill operations at the AWMF². GHD understands that following commencement of the

² As detailed within Awaba Waste Management Facility Expansion Project - Project Approval - Section 75J of the Environmental Planning and Assessment Act 1979, NSW Government 2013.

landfill expansion, Council is obligated to surrender the existing development consents for the AWMF and that the new development approval will then apply.

2.3 Landfill operations

Prior to operation as a landfill, the AWMF was an undisturbed area of natural bushland. Development consent for waste disposal operations was granted in 1986. This allowed the AWMF to operate as a landfill accepting household wastes, privately transported residential rubbish, construction and municipal wastes and some industrial wastes.

As part of the 1986 development approval, approximately 20 ha of the AWMF was allocated for the landfill and its associated infrastructure. This expanded to the current 23.5 ha in 1995 to allow for a minor extension to the facility (Cardno, 2012). Landfilling operations have been continuous at the AWMF since 1986.

Currently waste is placed and compacted at the AWMF using a landfill compacter, which is supported by a traxcavator loader. Waste materials at the AWMF are covered with either a “spray-on” manufactured cover material or approximately 150 mm thickness of soily material at the end of every day.

It is currently anticipated that the AWMF will reach capacity for landfill waste disposal (in accordance with its current site approvals) by approximately 2016. A landfill expansion was recently approved for the AWMF which is anticipated to provide an additional 20 to 25 years of landfill disposal airspace (i.e. landfill capacity now to be achieved by approximately 2040).

2.4 Existing facilities and infrastructure

Current facilities and infrastructure at the AWMF includes:

- A gatehouse with two weighbridges, entry and exit lanes, security compound and security monitoring system
- A machinery compound
- A reuse centre
- Leachate collection ponds (2), bunded irrigation areas and leachate recirculation system
- A Sediment collection pond (3)
- Roads, drains and berms, fences, gates and signs
- A general waste processing area
- A garden waste receiving and processing area
- A landfill compactor, 2 x traxcavator loaders and pumps
- A landfill gas collection system including an engine and a flare.

2.5 Waste quantities and composition

The AWMF currently receives approximately 100,000 tonnes of waste annually, with an expected increase by approximately 1% to 1.2% each year into the future. Council currently collects information on the volumes of numerous different specific waste streams received at the AWMF, compiled on a monthly basis. These specific waste streams are then categorised into the following three primary waste streams:

- Municipal Solid Waste (MSW):
 - Household weekly bin collection;
 - Parks and gardens waste;

- Bulk domestic waste kerbside collections;
- Self-hauled residential waste;
- Commercial and Industrial (C&I) waste; and
- Construction and Demolition (C&D) waste.

Table 1 shows the total waste landfilled per annum, based on data from the 2003/04 financial year to the 2009/10 financial year, both excluding and including the cover material used to cover the landfill.

Table 1 Waste quantities and compositions landfilled at the AWMF (Cardno, 2012)

Financial year	MSW		C&I		C&D		Total (tpa) (ex. cover material)	Total (tpa) (inc. cover material)
	(tpa)	(% of total)	(tpa)	(% of total)	(tpa)	(% of total)		
2003/04	74,246	45%	14,134	9%	75,490	46%	163,870	200,736
2004/05	77,940	66%	14,540	12%	25,436	22%	117,917	152,680
2005/06	79,625	67%	12,489	10%	27,145	23%	119,258	160,778
2006/07	81,579	73%	12,831	12%	16,740	15%	111,149	158,828
2007/08	90,203	76%	10,725	9%	17,262	15%	118,191	150,230
2008/09	82,311	82%	8,950	9%	9,276	9%	100,537	120,795
2009/10	80,198	85%	6,976	7%	7,034	7%	94,208	109,233

2.6 Topography

2.6.1 Overview

Topographically, the site slopes generally in a south easterly direction from a ridgeline to the north and west of the site boundary towards a drainage line south of the weighbridge. The site has been altered significantly from the natural surface morphology due to the waste containment cell.

Most of the site has been cleared of vegetation. South of the weighbridge, the site slopes to a drainage line, with vegetation in this area typically including shrubs and grasses.

The proposed Cell's 1 and 2 are located to the north of the current operating area and located to the south of a west to east trending ridgeline. The high point of the ridge is located over 100 m to the north of the site. The cell development area will be approximately 200 m long (orientated in a north to south direction) and will range in width from 200 m at its northern end to 380 m at its southern end.

2.6.2 Regional

The natural topography in the vicinity of the AWMF has been significantly altered such that the northern catchment above the landfill is diverted around the central waste mass, with the western section running alongside the facility discharging to the southern creek and the eastern section is routed to the eastern watercourse. The natural topography of the area drains in a

southerly direction towards an unnamed creek, with the entire waste management facility draining to the creek. The receiving unnamed creek is intermittently flowing and drains in an easterly direction for approximately 3 km before draining into Lake Macquarie at Rathmines Bay. Lake Macquarie is a brackish coastal lake with connection to the Pacific Ocean at Swansea Heads, to the southeast of where the unnamed creek discharges into the lake.

The landscapes across the site belong to the Awaba Group (aw), which is characterised by rolling low hills on predominantly coarse grained sediments of the Narrabeen Group and Newcastle coal measures in the Awaba hills. Local relief is of 20 m to 80 m and slope gradient is usually 10 % to 25 % with some localised steep slopes up to 60%.

Drainage lines are narrow and incised. The limitations in this landscape include steep slope (localised), mass movement (localised), very high erosion hazard, shallow and stony soils, strongly acidic soils with low fertility (Geotechnique, 2011).

2.6.3 Local

The AWMF is situated on undulating terrain and the highest point of the site is 82.6 m AHD, with the site sloping down from the north-west to the south-east (The EA Report, 2012). Local topography is typical of the landforms throughout the lower Hunter Region.

2.7 Soils and geology and hydrogeology

2.7.1 Soils

Reference to the Gosford-Lake Macquarie 1:100,000 scale Soil Landscapes sheet indicates that the majority of the AWMF is underlain by the Awaba or Doyalson erosional soil landscape units.

The Awaba soil landscape is characterised by rolling low hills with numerous closely spaced drainage lines. Slope gradients are typically 10% to 25% with local relief between 20 and 80 m. The typical soil profile consists of gravelly loams and / or gravelly sandy loam to sandy clay, overlying gravelly sandy clay and/or gravelly clay, with total depths ranging from less than 0.5 up to about 1.5 m.

The Doyalson soil landscape is characterised by gently undulating rises with slope gradients typically <10% and local relief up to 30 m. The typical soil profile consists of loose loamy sand overlying a hard setting clayey sand, sandy clay loam and/or clay. Total soil depth ranges between 0.5 and 1.5 m (but deeper in drainage lines) and is underlain by sandstone and conglomerate, and/or siltstones and claystone.

2.7.2 Regional geology

As shown in the 1:100 000 scale Newcastle Coalfield Regional Geology map, the site lies across the geological boundary between the Munmorah Conglomerate member of the Clifton Subgroup (Rn) of the Narrabeen Group and the Moon Island Beach Subgroup (Pnm) of the Newcastle Coal Measures. An extract from the geology map is provided in Figure 2 below.

Munmorah Conglomerate is of the early Triassic/late Permian period and typically comprises conglomerate, tuff, sandstone, claystone and coal.

The underlying Moon Island Beach Subgroup is of late Permian period and typically comprises conglomerate, sandstone, siltstone, tuff and coal.

NSW Mine Subsidence Board advised that the proposed landfill cells are underlain by coal seams, which are likely to be mined sometime in the future by Centennial Coal Company Limited, who owns the mining lease.

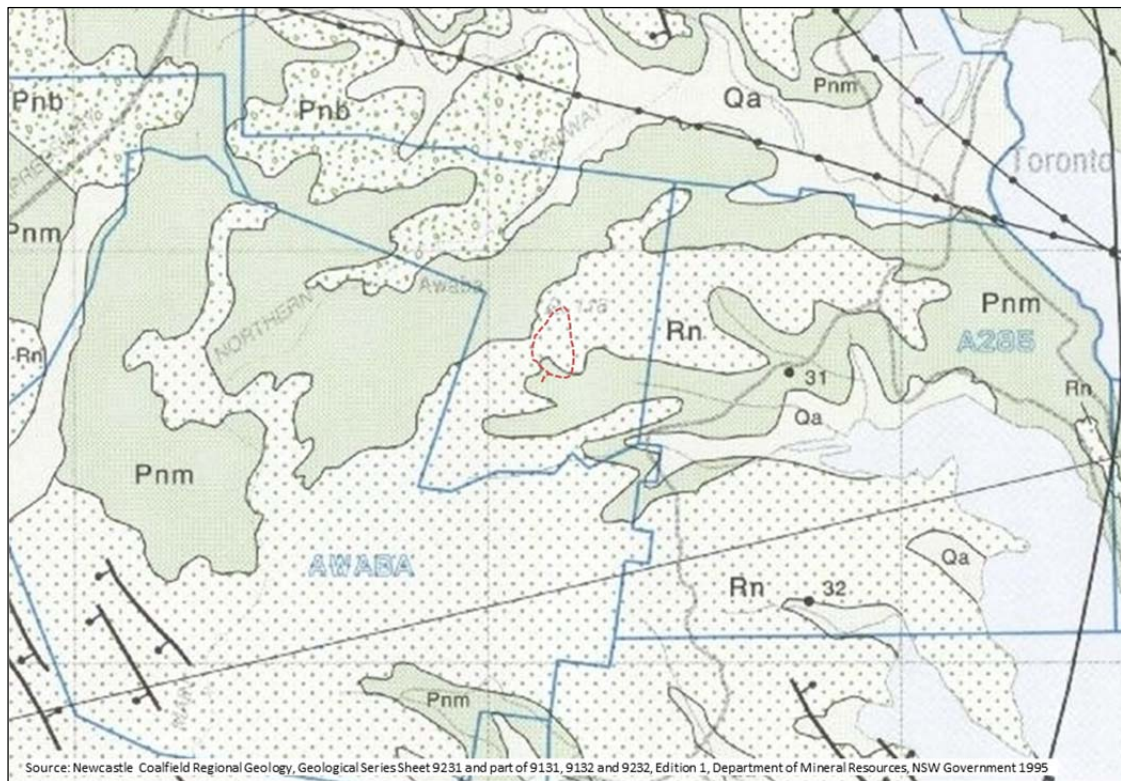


Figure 2 Regional geology for Awaba Waste Management Facility

NSW Mine Subsidence Board advised that the proposed landfill cells are underlain by coal seams, which are likely to be mined sometime in the future by Centennial Coal Company Limited, who owns the mining lease.

2.7.3 Hydrogeology

Investigations undertaken (Geotechnique, 2011) indicate that groundwater was not reached via the constructed boreholes and test pits (to a depth of 2.7 – 3.2 m). The one exception was a borehole (BH4) adjacent to an existing dam, with the level corresponding with the level in the dam at the time of the investigation. The conclusion from Geotechnique was that groundwater is unlikely to be encountered at less than 3.0 meters below existing ground surface except in close proximity to existing dams.

2.8 Local climate

The average annual climatic data for the area is summarised in Table 2 below. The data source is from the Bureau of Meteorology for the Nobbys Signal Station (Station Number 061055) located approximately 25 kilometres north-east of the AWMF.

Table 2 Mean³ annual climatic data for Awaba area (Bureau of Meteorology, 2013)

Parameter	Mean Min. Temp (°C)	Mean Max Temp (°C)	Mean rainfall (mm)	Monthly Evaporation (mm) ⁴
Jan	19.2	25.6	87.9	214
Feb	19.3	25.4	107.9	175
Mar	18.3	24.7	119.7	152

³ Temperature data available between 1862 and 2013, rainfall data available between 1862 and January 2014

⁴ Evaporation data is based on Williamtown RAAF station (061078) located approximately 38 kilometres north-east of AWMF as evaporation data was not available at Nobbys Signal Station. Data available between 1974 and 2013.

Parameter	Mean Min. Temp (°C)	Mean Max Temp (°C)	Mean rainfall (mm)	Monthly Evaporation (mm) ⁴
Apr	15.3	22.8	115.9	114
May	12.0	20.0	117.0	84
Jun	9.7	17.5	117.0	75
Jul	8.4	16.7	94.3	81
Aug	9.2	18.0	73.6	112
Sep	11.4	20.2	72.5	141
Oct	14.0	22.1	72.9	171
Nov	16.1	23.5	70.5	189
Dec	18.0	24.9	81.1	223
Annual	14.2	21.8	1132.6	1730

2.9 Landfill expansion

During 2011, Council engaged GHD and Cardno Pty Ltd (Cardno) to undertake works relating to a potential landfill expansion at the AWMF. As such, a feasibility assessment & concept design (GHD) and Environmental Assessment (Cardno) were prepared and submitted to the NSW Government for approval.

Approval was received from the NSW Government during 2013 for the landfill expansion⁵.

The landfill expansion provides for a number of works at the AWMF including the provision of two additional excavated landfill cells and continued emplacement of waste over the existing landfill area (including incorporation of an innovative piggyback lining system).

It is estimated that the landfill expansion will provide an additional 20 to 25 years of landfill disposal airspace (i.e. landfill capacity will now be achieved by approximately 2040 rather than by approximately 2016).

⁵ As detailed within Awaba Waste Management Facility Expansion Project - Project Approval - Section 75J of the Environmental Planning and Assessment Act 1979, NSW Government 2013.

3. Key regulatory requirements and recommendations for GHG

3.1 Overview

There are a number of national and state regulatory requirements and recommendations in relation to GHG management that apply or are relevant to the AWMF. The key documents are identified in Table 2.

Table 2 Key GHG documents relevant to the AWMF

Required by regulation	Recommended
The Project Approval Conditions ⁶	The NSW EPA Environmental Guidelines: Solid Waste Landfills (1996) (Landfill Guidelines) ⁷
Environment Protection Licence (EPL) No. 5873	
The National Greenhouse and Energy Reporting Act (2007) (NGER Act) ⁸ and its subordinate legislation and guidelines	
The Clean Energy Act (2011) (Clean Energy Act) ⁹ and its subordinate legislation and guidelines	

A summary of the key points contained within the documents identified in Table 2 (as relevant to GHG management) is provided in the following sections.

3.2 Summary of key GHG requirements / recommendations

3.2.1 Project Approval Conditions

Condition 26, Schedule 4 of Project Approval Conditions states the following:

26. The Proponent shall develop and implement a Greenhouse Gas Management Plan prior to the commencement of operations of the new landfill cells. The Plan shall include, as a minimum:

(a) proposed active landfill gas management system including flaring and / or combustion to reduce potential greenhouse gas emissions from the landfill;

(b) energy saving measures to be implemented;

(c) detail greenhouse gas monitoring program;

(d) a program to monitor the effectiveness of these measures; and

⁶ As detailed in Awaba Waste Management Facility Expansion Project - Project Approval - Section 75J of the Environmental Planning and Assessment Act 1979, NSW Government 2013.

⁷ GHD understands that this document is currently being updated by NSW EPA and will likely be released for industry consultation within the next 6 to 12 months.

⁸ GHD notes that Council is currently obligated to report under the NGER Act as Scope 1 emissions at the AWMF exceed s the 25,000 tonnes of carbon dioxide equivalent (CO₂-e) under the Clean Energy Act (which may shortly be repealed by the government).

⁹ The Australian government intends to repeal this legislation shortly.

(e) a protocol to periodically review the Plan.

The Plan shall be documented in the Landfill Environmental Management Plan (see Condition 3 in Schedule 5).

3.2.2 Environment Protection Licence Number 5873

This document states:

R2.6 The licensee must notify the EPA within 24 hours in accordance with condition R2.1 if subsurface monitoring detects methane above 1.25% (v/v), and increase the frequency of monitoring to daily, until the EPA determines otherwise.

M4.1 The following environmental monitoring must be undertaken at the premise:

a) Inside buildings at the premise, Methane must be measured as a %(v/v) on a monthly basis using an In situ sampling method;

b) On the surface of the landfill, Methane must be measured as a %(v/v) on a monthly basis using an In situ sampling method.

For the purpose of this condition in situ means sampling in accordance with the methodology specified in Benchmark 17 of the EPA's publication titled "Environmental Guidelines: Solid Waste Landfills".

The results of all environmental monitoring undertaken in accordance with this condition must be attached and forwarded to the EPA with the annual return required by condition R1.

3.2.3 The NGER ACT (2007)

The NGER Act and its subordinate legislation and guidelines outlines (in detail) a framework for estimating and reporting greenhouse gas emissions from a number of potential sources, including certain landfill sites.

As the NGER Act, its sub-ordinate legislation and guidelines are considerable documents in their own right and contain all the specific details in relation to participation, acceptable estimation methods, reporting procedures etc., only a brief summary of their requirements has been provided below. The reader is directed to the NGER Act, its sub-ordinate legislation and guidelines if further detail is required on Council's obligations in relation to the AWMF under this legislation. GHD note that Council already have NGER recording and reporting systems in place that cover the AWMF.

Under the NGER scheme, a facility or corporation that is estimated to exceed certain GHG emissions and / or energy consumption or production participation thresholds in a financial year is required to estimate these emissions, consumption and / or production and report these figures to the Australian Clean Energy Regulator.

In relation to the AWMF, the only relevant NGER threshold (at present) is the emission of 25,000 tonnes of carbon dioxide equivalent (CO₂-e) of scope 1 emissions in a financial year.

It is noted that the NGER scheme under-pins the Carbon Pricing Mechanism (CPM) that forms part of the Clean Energy Act.

GHD notes that Council estimated that GHG emissions from the AWMF would exceed the 25,000 tonnes of carbon dioxide equivalent (CO₂-e) participation threshold during the 2012-2013 reporting year. As such, Council recently completed and submitted its first annual NGER estimate and report for the AWMF to the Clean Energy Regulator.

3.2.4 Clean Energy Act (2011)

The Clean Energy Act and its subordinate legislation and guidelines outline (in detail) a number of items including the establishment and rules associated with a carbon price in Australia (the carbon pricing mechanism or CPM).

As the Clean Energy Act, its sub-ordinate legislation and guidelines are considerable documents in their own right and contain all the specific details in relation to participation, linkages to other schemes, status of carbon units etc. only a brief summary of the requirements has been provided below. The reader is directed to the Clean Energy Act, its sub-ordinate legislation and guidelines if further detail is required on Council's obligations in relation to the AWMF under this legislation. GHD note that Council already have NGER recording and reporting systems in place that cover the AWMF (and which form the basis for inter-action with the Clean Energy Act).

Under the Clean Energy Act, a facility that is estimated to exceed a certain GHG emission participation threshold in a financial year is required to estimate these emissions and report these figures to the Australian Clean Energy Regulator in accordance with the NGER Act. The facility is then obligated to purchase carbon units for the emissions designated to be "liable" under the CPM for that financial year.

GHD notes that the rules relating to "liable" and "non-liable" GHG emissions at a landfill site are complex. In general, landfills are required to participate in the CPM if the facility emits more than 25,000 tonnes of CO₂-e annually. If this threshold is reached, the landfill will be liable for the portion of landfill methane emissions that result from waste landfilled after the commencement of the CPM (i.e. "Post-Legacy Waste" deposited on or after 1 July 2012) plus any other emissions covered by the CPM (e.g. from composting etc.). In relation to the AWMF, the relevant NGER / CPM participation threshold (at present) is the emission of 25,000 tonnes of carbon dioxide equivalent (CO₂-e) in a financial year.

GHD notes that Council's first year of participation in the CPM for the AWMF is currently estimated to be 2013-2014.

GHD further notes that the Australian Government intends to repeal the Clean Energy Act and replace it with the Direct Action Plan. Consideration of potential future requirements of the Direct Action Plan have not been considered in this GHGMP.

3.2.5 Landfill Guidelines

The NSW EPA Landfill Guidelines identify NSW EPA's environmental goals relating to greenhouse gas and landfill gas management at landfill sites. These are as follows:

- Preventing landfill gas emissions
- Detecting landfill gas emissions
- Remediating landfill gas emissions

The Landfill Guidelines also recommends "Benchmark Techniques" that may be followed to achieve the environmental goals identified above.

The reader is directed to the Landfill Guidelines if further detail is required on NSW EPA's recommended approach to greenhouse and landfill gas management at landfill sites.

3.3 Addressing key GHG management requirements and recommendations

Table 3 below summarises how the requirements / recommendations of the documents identified in Table 2 are addressed in this GHGMP.

Table 3 Summary table demonstrating how requirements are addressed

Requirement	Description	Section of Report
Project Approval Conditions		
26	The Proponent shall develop and implement a Greenhouse Gas Management Plan prior to the commencement of operations of the new landfill cells. The Plan shall include, as a minimum:	This GHGMP fulfils this requirement
(a)	Proposed active landfill gas management system including flaring and / or combustion to reduce potential greenhouse gas emissions from the landfill	See Sections 5 and 6
(b)	Energy saving measures to be implemented	See Section 8
(c)	Detail greenhouse gas monitoring program	See Sections 5 and 6
(d)	A program to monitor the effectiveness of these measures	See Sections 5 and 6
(e)	A protocol to periodically review the Plan	See Section 9
Environmental Protection Licence Number 5873		
R2.6	The licensee must notify the EPA within 24 hours in accordance with condition R2.1 if subsurface monitoring detects methane above 1.25% (v/v), and increase the frequency of monitoring to daily, until the EPA determines otherwise.	See Sections 5 and 6
M4.1	Details monitoring requirements	See Sections 5 and 6
NGER ACT		
	Record and report data as required under NGER Act. GHD note that Council already have NGER recording and reporting systems in place that cover the AWMF.	See Section 5 and 6
Clean Energy Act		
	Record and report data as required under Clean Energy Act and acquit any associated financial liabilities under the CPM. GHD note that Council already have NGER recording and reporting systems in place that cover the AWMF (and which form the basis for interaction with the Clean Energy Act).	See Sections 5 and 6
Landfill Guidelines		
Section 2.2	Landfill Gas Environmental Goals (preventing, detecting and remediating landfill gas emissions)	See Sections 5 and 6

4. Landfill methane and landfill gas generation

4.1 Overview

Council and GHD have prepared a landfill methane generation and emission model for the AWMF considering existing conditions and the landfill expansion discussed in Section 2.9. This model was produced using the NGER *Solid Waste Calculator 1.8* Excel model, which is available from the Australian Clean Energy Regulator's (CER) website.

The model was developed by GHD based on Council's 2012-2013 NGER Solid Waste Calculator model and future estimates for other relevant model inputs required.

The assumptions and justifications made for each of the input parameters used within the model are contained in Appendix A. Furthermore a copy of the NGER *Solid Waste Calculator 1.8* Excel model is also contained in Appendix A.

The model outputs are discussed in further detail in the following Sections.

4.2 Landfill methane and landfill gas generation estimates

The estimated landfill methane and landfill gas generation rates at / from the AWMF (from FYE 1987 to FYE 2112) are shown graphically in Figure 3 and Figure 4 below. These results are shown in tabulated format in Appendix B.

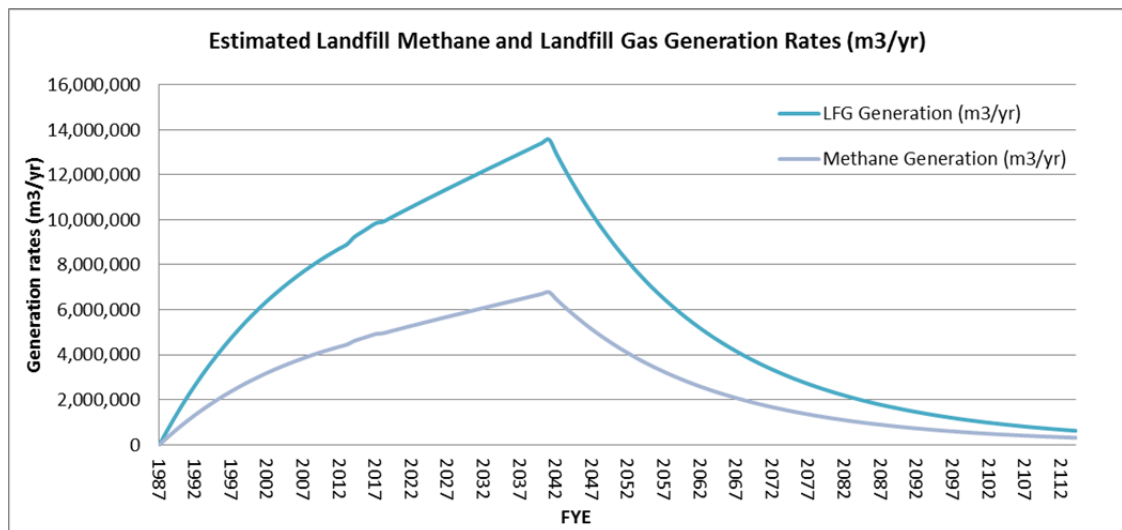


Figure 3 Landfill methane and landfill gas generation rates (m³/yr)

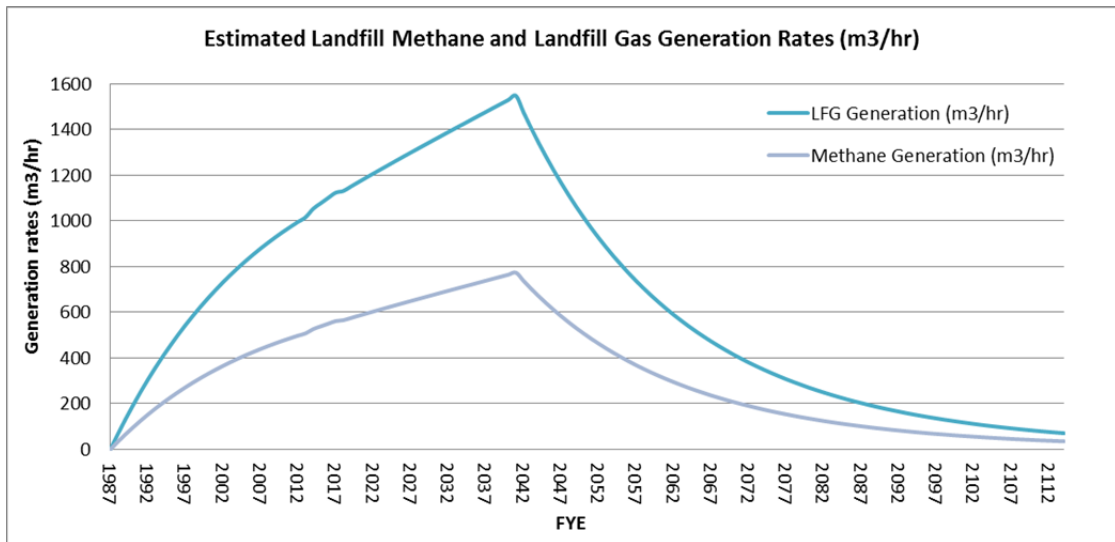


Figure 4 Landfill methane and landfill gas generation rates (m³/hr)

4.3 Review of landfill methane and landfill gas generation estimates

The landfill methane and landfill gas generation estimates suggests that:

- Landfill methane generation (and therefore landfill gas¹⁰ generation) rates have been increasing at the AWMF since FYE 1987;
- Significant quantities of landfill methane and landfill gas are estimated to be generated at the AWMF over the coming decades;
- The landfill methane and landfill gas generation rate at the AWMF will peak in FYE 2041 at 6,780,001 m³/yr of methane and 13,560,001 m³/yr of landfill gas respectively;
- The landfill methane and landfill gas generation rate at the AWMF will peak in FYE 2041 at 774 m³/hr of methane and 1548 m³/hr of landfill gas respectively;
- Landfill methane and landfill gas generation rates are predicted to slowly decrease into the future post FYE 2041; and
- The landfill gas generation rate will be relatively low (i.e. < 100 m³/hr) by FYE 2105.

¹⁰ These figures assume that the typical composition of the generated landfill gas is 50% methane and 50% carbon dioxide

5. Existing landfill gas management measures

5.1 Overview of existing management measures

A number of landfill gas management measures are currently undertaken at the AWMF, including:

- Progressive installation and operation of a landfill gas collection and treatment system. Additional details are provided in Section 5.2 below;
- A regular program for monitoring landfill gas has been developed and is implemented as described in Section 5.3;
- A program of record keeping, data assessment and regular reporting of landfill gas monitoring data has been developed and is implemented as described in Sections 5.4 and 5.5 below;
- Daily covering of the landfilled waste (to minimise rainfall infiltration into the landfilled waste - which can reduce the rate of landfill gas generation - and to minimise uncontrolled fugitive emissions to the atmosphere);
- Intermediate covering of the landfilled waste (to minimise rainfall infiltration into the landfilled waste - which can reduce the rate of landfill gas generation - and to minimise uncontrolled fugitive emissions to the atmosphere);
- Only a limited quantity of waste has been placed below prevailing ground level. This is likely to reduce the potential for lateral subsurface landfill gas emissions; and
- Buildings on-site have been constructed with air voids beneath them and / or are well ventilated. This is likely to reduce the potential for landfill gas emissions impacts upon these buildings.

Furthermore, a program of record keeping, data assessment and regular reporting of NGER / CPM relevant GHG monitoring data has been developed and is implemented as described in Sections 5.6, 5.6.3 and 5.6.4 below.

5.2 Existing landfill gas collection and treatment system

Landfill gas generated at the AWMF is currently managed by an active landfill gas collection and treatment system that is designed, installed and operated by a specialist contractor (LMS Pty Ltd). The term “active” indicates that landfill gas is extracted from the waste mass using a fan (or blower), which directs the extracted gas to the treatment plant (flare or engine). In simple terms, the landfill gas is sucked out of the waste mass and the combustible components (predominantly methane) are ultimately burnt. A plan of the existing landfill gas collection system is contained in Appendix C.

Landfill gas treatment at the AWMF is predominately via combustion in a landfill gas fuelled reciprocating engine (Engine) that drives a generator to create renewable electricity (which is ultimately exported to the electricity grid). GHD understands that during periods of Engine downtime, or when otherwise required, landfill gas can be directed to a landfill gas flare (Flare) located at the AWMF. GHD further understands that the capacity of the landfill gas treatment technologies at the AWMF could / would be expanded as required so that collection and treatment of landfill gas at the AWMF is optimised (i.e. additional Engines and / or Flares would be installed as required to ensure optimal landfill gas control).

Landfill gas collected from the AWMF is drawn through a main pipe (Main) that is constructed from Medium Density Polyethylene (MDPE) and is typically between 160 mm and 300 mm (outer diameter) in size. The Main is sized with consideration to a number of factors including:

- The quantity of landfill gas to be collected from the waste mass (now and in the future);
- Minimising suction losses through the landfill gas collection system; and
- Landfill gas condensate (Condensate) management (see details provided below).

As the Main advances across the waste mass, it branches off into a series of smaller diameter header pipes (Headers), which are also constructed from MDPE pipework and typically between 120 mm and 200 mm (outer diameter) in size.

The Headers are connected to a series of local landfill gas collection points (Well Stations) across the AWMF. Well Stations are also constructed from MDPE pipework and contain monitoring points, orifice plates and control valves for individual landfill gas wells (LFG Wells), and the Well Station itself). Well Stations typically have between 5 and 10 LFG Wells connected to them by small diameter (typically 63 mm to 90 mm outer diameter) MDPE pipework (Flowlines). The use of Well Stations within a landfill gas collection and treatment system allows for control / adjustment on a local level of the composition, applied suction pressure and flow rate of landfill gas collected from the individual LFG Wells in an area of the AWMF (and the overall mixture of landfill gas collected from the Well Station itself).

LFG Wells are typically constructed from Medium Density Polyethylene (MDPE) pipework (typically 90 mm to 160 mm outer diameter in size) that is surrounded by landfill gas permeable material (typically crushed rock / aggregate in the 20 mm to 100 mm diameter range). LFG Wells can be either vertical and / or horizontal and are either drilled or excavated into the waste mass as appropriate. LFG Well designs are often specific to the requirements of their individual location on the AWMF (e.g. varying drill depths due to differing waste depths etc.).

The existing landfill gas collection and treatment system at the AWMF has been designed to ensure adequate management of any Condensate formed within the system. Landfill gas is a “wet” gas and Condensate is the term used for water vapour that was originally entrained within the landfill gas and subsequently condenses out from the landfill gas as it cools within the collection pipework. If inadequately managed, Condensate can block collection pipework (by settling in low spots within the pipework) and / or cause damage to treatment technologies and / or ancillary equipment. Condensate formed within the collection pipework at the AWMF is managed via a combination of pipework grading and a series of Condensate drainage / collection points (constructed from MDPE). The Condensate which is formed within the pipework at the AWMF ultimately drains back into the waste mass.

The majority of the landfill gas collection and treatment system at the AWMF is buried below ground level (with the exception of the Engine, the Flare, some of the Condensate collection / drainage points and the Well Stations).

5.3 Existing landfill gas monitoring program

5.3.1 Overview

The following landfill gas monitoring is currently implemented at the AWMF:

- Monitoring of the landfill gas collection and treatment system.
- Monitoring of landfill gas across areas of the AWMF where intermediate or final cover materials have been placed; and
- Monitoring of landfill gas inside all buildings / structures

All landfill gas monitoring is conducted by appropriately qualified personnel. Quality control procedures are in place to ensure that results of monitoring are representative of field conditions.

Further details on the existing landfill gas monitoring program are provided in the following sections.

5.3.2 Monitoring of the landfill gas collection and treatment system

The landfill gas collection and treatment system is monitored and maintained in accordance with the manufacturer's recommendations and specifications. The current minimum monitoring program is summarised in Table 4 below.

Table 4 Landfill gas collection and treatment system monitoring

Element	Monitoring undertaken	Frequency
Power station (Engine) performance	Operational performance of Power Station (gas flow, energy generation, other key performance parameters including % methane). This is done on-site or via remote access	Monthly
Flare performance	Inspection of Flare, gas flow, % methane and operating parameters	Monthly
Meters (Engine and Flare)	Calibration of flow meters and methane analysers (Flare and Engine) undertaken by independent third parties. Other calibrations undertaken as required.	Annually

5.3.3 Monitoring of landfill gas across areas of the AWMF where intermediate or final cover materials have been placed

Areas of final and / or intermediate cover are monitored monthly as per the EPL and in accordance with the technique identified within Benchmark Technique 17 of the *NSW EPA Environmental Guidelines: Solid Waste Landfills (1996)*.

Parameters monitored include methane concentration and wind speed.

5.3.4 Monitoring of landfill gas inside buildings at the premises

Buildings at the AWMF are monitored on a monthly frequency as per the EPL.

Parameters monitored include methane concentration.

5.4 Existing record keeping

Currently the results of all landfill gas monitoring is recorded and retained for a minimum period of four (4) years after the monitoring event. The records typically include the following:

- Sampling dates(s);
- Sampling time(s);
- Sampling point(s);
- Sampling results;
- Calibration certificates for all instrumentation used;

- Details on all monitoring methods used; and
- The name and qualifications of the person who undertook the sampling / monitoring.

5.5 Existing assessment and reporting

5.5.1 Overview

Council currently undertakes a range of landfill gas assessment and reporting activities in relation to landfill gas monitoring data collected at the AWMF. Further details on these are provided in the following sections.

5.5.2 Annual reporting

Council prepare an Annual Return in accordance with the requirements of the EPL. The Annual Return includes a certified "Statement of Compliance" and a signed "Monitoring and Complaints Summary".

The Annual Return is prepared for the required reporting period, and submitted to the NSW EPA no later than 60 days after the end of the reporting period. Council retain a copy of the Annual Return for a period of at least 4 years after the Annual Return is supplied to the NSW EPA.

Furthermore, the monitoring data and any non-compliances within the EPL limits are made publically available by Council as required by the Protection of the Environment Operations Act 1997.

5.5.3 Placement of monitoring results on Council's website

Council currently publish landfill gas monitoring results on their website within 14 days of obtaining the data as required by the Protection of the Environment Legislation Amendment Act 2011.

5.5.4 Landfill gas hazard reporting

In accordance with Condition R2.6 of the site's EPL, if Council identifies subsurface methane concentrations at or greater than 1.25% v/v, Council:

- Contacts the NSW EPA within 24 hours and advises of the monitoring results; and
- Increases the frequency of such landfill gas monitoring in agreed locations to daily until advised otherwise by the NSW EPA.

5.5.5 Incident Reporting

The NSW EPA is notified in writing without delay (according to new Protection of the Environment Legislation Amendment Act 2011) of any incident that represents a threat to the environment and which may lead to a breach of a licence condition(s). Council notifies all the relevant authorities about the incident, not just the appropriate regulatory authority (ARA). This could include (but is not limited to) the NSW EPA, the Ministry of Health, the WorkCover Authority, the local authority and / or Fire and Rescue NSW. A Pollution Incident Response Management Plan(s) is also be prepared by Council.

Examples of landfill gas incidents that require reporting include but are not limited to:

- The detection of a methane concentration of 500 ppm or greater within 50 mm of the surface of intermediate or final covered areas of the AWMF;
- The detection of a methane concentration of 1.25% v/v or greater in on-site buildings or perimeter bores; and

- Any other landfill gas related incident or observation that could potentially pose an immediate environmental hazard.

The occurrence of any such incidents are recorded in the site's daily logbook as appropriate.

A written incident report is provided to the NSW EPA if requested by an authorised officer. The report includes, but not be limited to, the following details.

- The cause, time and duration of the event;
- The type, volume and concentration of every pollutant discharged as a result of the event;
- The name, address and business hours telephone number of employees of Council or other witnesses;
- Actions taken by the Council in relation to the event; and
- Details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event.

5.6 NGER / CPM GHG monitoring, record keeping, assessment and reporting

5.6.1 Overview

In addition to the landfill gas monitoring, record keeping, assessment and reporting identified in Sections 5.3, 5.4 and 5.5 above, Council also undertakes similar activities relating to the NGER and Clean Energy Act legislation. Further details on these works are provided in the following Sections.

5.6.2 Monitoring

Council currently monitors a range of parameters for NGER / CPM purposes at the AWMF. The key NGER / CPM parameters monitored at the AWMF are identified in Table 5 below.

Table 5 Key NGER / CPM parameter monitoring

Element	Monitoring undertaken	Frequency
Waste landfilled	Tonnage and types landfilled	Monthly
Landfill methane flared	Methane % and gas flow in m ³	Monthly
Diesel consumed	Kilolitres	Monthly
Gasoline consumed	Kilolitres	Monthly
Petroleum based oils and greases consumed	Litres	Monthly
Electricity consumed	Kilowatt hours	Monthly

5.6.3 Existing record keeping

Currently the results of all NGER / CPM monitoring is recorded and retained for a minimum period of four (4) years after the monitoring event. The records include the following:

- Sampling dates(s);
- Sampling time(s);
- Sampling point(s);
- Sampling results;
- Calibration certificates for all instrumentation used;
- Details on all monitoring methods used; and
- The name and qualifications of the person who undertook the sampling / monitoring.

5.6.4 Existing assessment and reporting

5.6.5 Overview

Council currently undertakes a range of NGER / CPM assessment and reporting activities at the AWMF. Further details on these are provided document titled Greenhouse Gas Manual – National Greenhouse and Energy Reporting – NGER – Procedure – Version 1 (Appendix F).

6. Proposed landfill gas management measures

6.1 General

In order to achieve the requirements of the key GHG regulatory and recommended documents (refer Table 2) at the AWMF, Council intends to:

- Continue to undertake the existing landfill gas management measures identified in Section 5 across the existing landfill site;
- Progressively apply the existing landfill gas management measures identified in Section 5 across the landfill expansion area; and
- Undertake certain additional measures across the landfill expansion area as detailed in Section 6.3.

Further details on Council's proposed approach are provided in the following sections.

6.2 Overview of proposed management measures

Council will develop the following existing landfill gas management measures across the expansion area at the AWMF:

- Progressive installation and operation of a landfill gas collection and treatment system. Additional details are provided in Section 5 above and Appendix C;
- Completion of a regular program for monitoring landfill gas as described in Section 5.3 above
- Incorporation of the landfill gas monitoring data obtained from the landfill expansion area into the current program of program of record keeping, data assessment and regular reporting as described in Sections 5.4 and 5.5 above;
- Daily covering of the landfilled waste (to minimise rainfall infiltration into the landfilled waste - which can reduce the rate of landfill gas generation - and to minimise uncontrolled fugitive emissions to the atmosphere);
- Intermediate covering of the landfilled waste (to minimise rainfall infiltration into the landfilled waste - which can reduce the rate of landfill gas generation - and to minimise uncontrolled fugitive emissions to the atmosphere);
- Placement of only a limited quantity of waste below prevailing ground level to reduce the potential for lateral subsurface landfill gas emissions; and
- All new buildings on-site will be designed so as to minimise the likelihood of landfill gas entering and accumulating within them.

Furthermore, Council will develop the existing program of record keeping, data assessment and regular reporting of NGER / CPM relevant GHG monitoring data across the landfill expansion area as described in Section 5.6.

6.3 Proposed additional landfill gas management measures

In addition to undertaking the measures identified in Section 6.2 above across the landfill expansion area, Council will also undertake the following additional measures across the expansion area:

- Basal and side wall lining systems will be designed and constructed in all new landfilling areas to minimise potential for any lateral landfill gas emissions;
- New sub-surface services on-site will be designed and constructed in accordance with relevant standards in relation to landfill gas as applicable (e.g. AS/NZS 2381.1.1:2005);
- The leachate extraction system (e.g. pumps) will be designed and operated in accordance with relevant standards in relation to landfill gas as applicable (e.g. AS/NZS 2381.1.1:2005);
- New leachate collection sumps / points will be designed to be gas tight at ground level. Furthermore, the gas tight lids will be designed to enable them to be connected into the landfill gas collection and treatment system if required;
- Installation and monitoring of a preliminary network of perimeter landfill gas monitoring bores (3 bores) as identified on the plan contained in Appendix E. Further details are provided in Section 6.3.1 below;
- Monitoring of nominated representative sub-surface services / structures on-site. Further details are provided in Section 6.3.2 below; and
- Completion of a formal landfill gas risk assessment following collection of 12 months' worth of data from the network of perimeter landfill gas monitoring bores and nominated representative sub-surface services / structures.

6.3.1 Installation and monitoring of preliminary network of perimeter landfill gas monitoring bores

Landfill gas monitoring bores will be designed and installed with consideration of:

- Environmental Guidelines: Solid Waste Landfills (NSW EPA, 1996); and
- Best Practice Environmental Management Siting, Design, Operation and Rehabilitation of Landfills (EPA Victoria, 2010).

Landfill gas monitoring bores will be monitored with consideration of

- Environmental Guidelines: Solid Waste Landfills (NSW EPA, 1996);
- Best Practice Environmental Management Siting, Design, Operation and Rehabilitation of Landfills (EPA Victoria, 2010);
- Guidelines for the Assessment and Management of sites Impacted by Hazardous Ground Gases (NSW EPA, 2012); and
- Draft Landfill Gas Fugitive Emissions Monitoring Guidelines (EPA Victoria, 2011).

Parameters to be monitored will include methane, carbon dioxide, oxygen, gas pressure, gas flow and standing water level. Concentrations of methane > 1.25% v/v in perimeter bores will be reported to the NSW EPA as per Section 5.5.4.

Monitoring will initially be undertaken on a monthly frequency for a period of 12 months after which data will be reviewed and assessed. Following this assessment, a formal landfill gas risk assessment will be completed that will include consideration of this data (see Section 6.3.3 below). The appropriate long-term monitoring frequency for these bores will be determined and implemented following the completion of the landfill gas risk assessment. The need for additional perimeter landfill gas monitoring bores and / or a more regular monitoring frequency will be considered based on the monitoring data on an on-going basis.

6.3.2 Monitoring of sub-surface services / structures on-site

The regular landfill gas monitoring program will be expanded to include regular monitoring of nominated representative sub-surface services / structures on-site across the existing landfill site and the landfill expansion area.

Sub-surface services will be monitored with consideration of

- Environmental Guidelines: Solid Waste Landfills (NSW EPA, 1996);
- Best Practice Environmental Management Siting, Design, Operation and Rehabilitation of Landfills (EPA Victoria, 2010);
- Guidelines for the Assessment and Management of sites Impacted by Hazardous Ground Gases (NSW EPA, 2012); and
- Draft Landfill Gas Fugitive Emissions Monitoring Guidelines (EPA Victoria, 2011).

Parameters to be monitored will include methane. Concentrations of methane > 1.25% v/v will be reported to the NSW EPA as per Section 5.5.4.

Monitoring will initially be undertaken on a monthly frequency for a period of 12 months after which data will be reviewed and assessed. Following this assessment, a formal landfill gas risk assessment will be completed that will include consideration of this data (see Section 6.3.3 below). The appropriate long-term monitoring frequency for these locations will be determined and implemented following the completion of the landfill gas risk assessment. The need for a more regular monitoring frequency will be considered based on the monitoring data on an on-going basis.

6.3.3 Completion of formal landfill gas risk assessment

Following collection of 12 months' worth of data from the network of perimeter landfill gas monitoring bores and sub-surface services / structures, a formal landfill gas risk assessment for the AWMF will be undertaken.

The landfill gas risk assessment will consider a variety of information / data including:

- Source, pathways and receptors for landfill gas generated / emitted from the site. Geology;
- Site history;
- Waste types and quantities;
- Geology;
- Hydrology / hydrogeology;
- Landfill engineering systems (including landfill gas collection and treatment system); and
- Landfill gas monitoring data.

The landfill gas risk assessment will be undertaken with consideration of AS/NZS 31000:2009 and other relevant guidance as identified at the time of preparation.

Following completion of the landfill gas risk assessment, long term landfill gas management measures and required monitoring frequencies will be confirmed and implemented at the AWMF.

7. Estimated emission reductions

7.1 Overview

The operation of the existing landfill gas collection and treatment system currently significantly reduces GHG emissions from the AWMF by collecting and destroying landfill methane generated by the AWMF.

It is anticipated that the continuance of the existing landfill gas management measures at the AWMF, their expansion across the landfill expansion area and the commencement of the additional landfill gas management measures identified in Section 6.3 will continue to result in significant reductions in GHG emissions across the entire AWMF into the future.

Further details on estimated emission reductions that the existing and proposed landfill gas management measures may provide are discussed in the following section.

7.2 Estimated emissions reductions

Council and GHD have prepared a landfill methane generation and emission model for the AWMF considering existing conditions and the landfill expansion discussed in Section 2.9. This model was produced using the NGER *Solid Waste Calculator 1.8* Excel model, which is available from the Australian Clean Energy Regulator's (CER) website.

Using the model, GHD developed two scenarios for landfill methane emissions at the AWMF as follows:

- Scenario 1 – Emissions with no landfill gas collection and treatment system; and
- Scenario 2 – Emissions with existing and proposed landfill gas collection and treatment system.

These two scenarios are discussed in more detail in the following sections.

7.2.1 Scenario 1 – no system

This scenario assumes that no landfill gas collection and treatment system was in operation at the AWMF. In this scenario, landfill methane emissions would be significant now and for many decades into the future. The only emission reduction that would occur would be that approximately 10% of the methane generated would be oxidised to carbon dioxide by microbial action within the landfill cap / cover materials. The methane emissions under this scenario are shown on Figure 5.

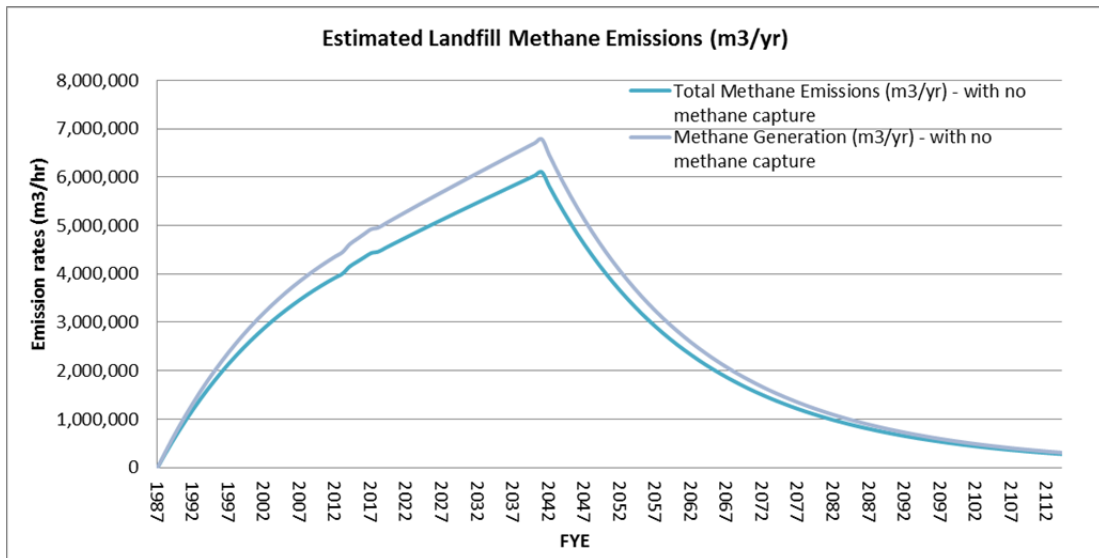


Figure 5 Methane emissions – Scenario 1 – no landfill gas collection and treatment system (oxidation through cap only)

7.2.2 Scenario 2 – existing and proposed approach

This scenario assumes that the proposed approach to landfill gas management detailed in Section 6 is implemented at the AWMF. In this scenario, landfill methane emissions would be significantly lower than identified under Scenario 1 now and for many decades into the future. The methane emissions under this scenario are shown on Figure 6¹¹.

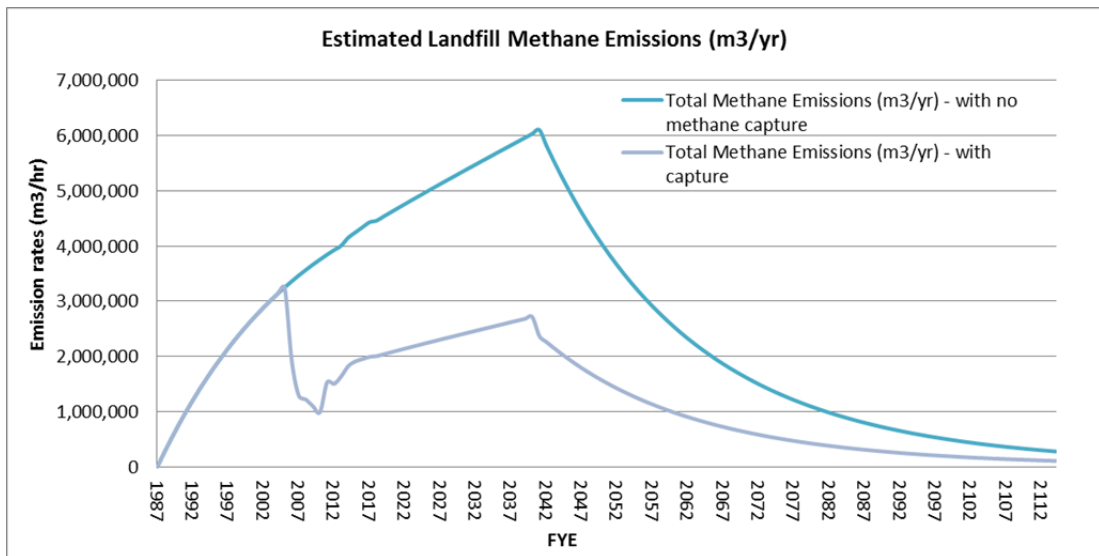


Figure 6 Methane emissions – Scenario 2 – existing and proposed approach

7.3 Comparison of landfill methane emissions under scenarios 1 and 2

A brief comparison of the estimated landfill methane emissions under scenarios 1 and 2 suggests that:

- A significant quantity of landfill methane is likely to be emitted from the AWMF under scenario 1 over the coming decades;

¹¹ This emission reduction estimate assumes a 55% capture efficiency of generated landfill methane each financial year from FYE 2041 to FYE 2114. Data from FYE 2006 to FYE 2013 is actual landfill methane capture data. Landfill methane capture rate estimates from FYE 2014 to FYE 2040 are Council estimates.

- Total methane emissions with no landfill gas collection and treatment (scenario 1) from FYE 1987 to FYE 2114 is estimated to be approximately 374 million m³;
- Total methane emissions with the existing and proposed approach to landfill gas management (scenario 2) from FYE 1987 to FYE 2114 is estimated to be approximately 160 million m³;
- Implementation of the proposed approach to landfill gas management detailed in Section 6 (i.e. scenario 2) would be likely to result in a significant reduction in the quantity of landfill methane potentially emitted from the AWMF (when compared to scenario 1); and
- Overall, adoption of the proposed approach (scenario 2) may reduce landfill methane emission from the AWMF by approximately 214 million m³ of methane between FYE 1987 and FYE 2114 (i.e. a reduction in landfill methane emissions of approximately 48% over the identified period).

8. Energy saving measures

8.1 Overview

Previous GHG emission estimates for the AWMF (Cardno, 2012) suggest that landfill methane emissions are likely to constitute >99% of total GHG emission from the AWMF between 2011 and 2100 (remaining <1% of total from diesel use, gasoline use and electricity use).

As such, no specific energy saving measures are currently undertaken or proposed to be undertaken at the AWMF as part of the landfill expansion project. The need / benefit of implementing energy saving measures at the AWMF will be reviewed on an on-going basis as part of the review of the GHGMP (see Section 9).

9. Review of GHGMP

The GHGMP will initially be reviewed within 18 months of its issue date. The review will assess the on-going suitability / appropriateness of the GHGMP for the AWMF. The review will consider a variety of information / data, including the following:

- The findings / outcomes of the formal landfill gas risk assessment;
- All landfill gas monitoring data;
- New / removed landfill gas emission pathways;
- New / removed landfill gas receptors;
- Landfill filling and engineering works;
- NGER / CPM data;
- Revisions to regulatory requirements / relevant guidance
- Need for / benefits of energy saving measures

Updates / revisions to the GHGMP will be made (if required) based on the most recent available information / data. This review will be organised by Council and discussed / submitted to the NSW EPA as relevant.

Following the initial review, Council will determine the required future frequency of reviews of the GHGMP, which should be no greater than once every three years.

Factors such as observed landfill gas issues at the AWMF and / or revisions to regulatory requirements should also act as triggers for reviews and potential revisions of the GHGMP.

Appendices

Appendix A Solid Waste Calculator 1.8 NGER Model, Assumptions and Justifications

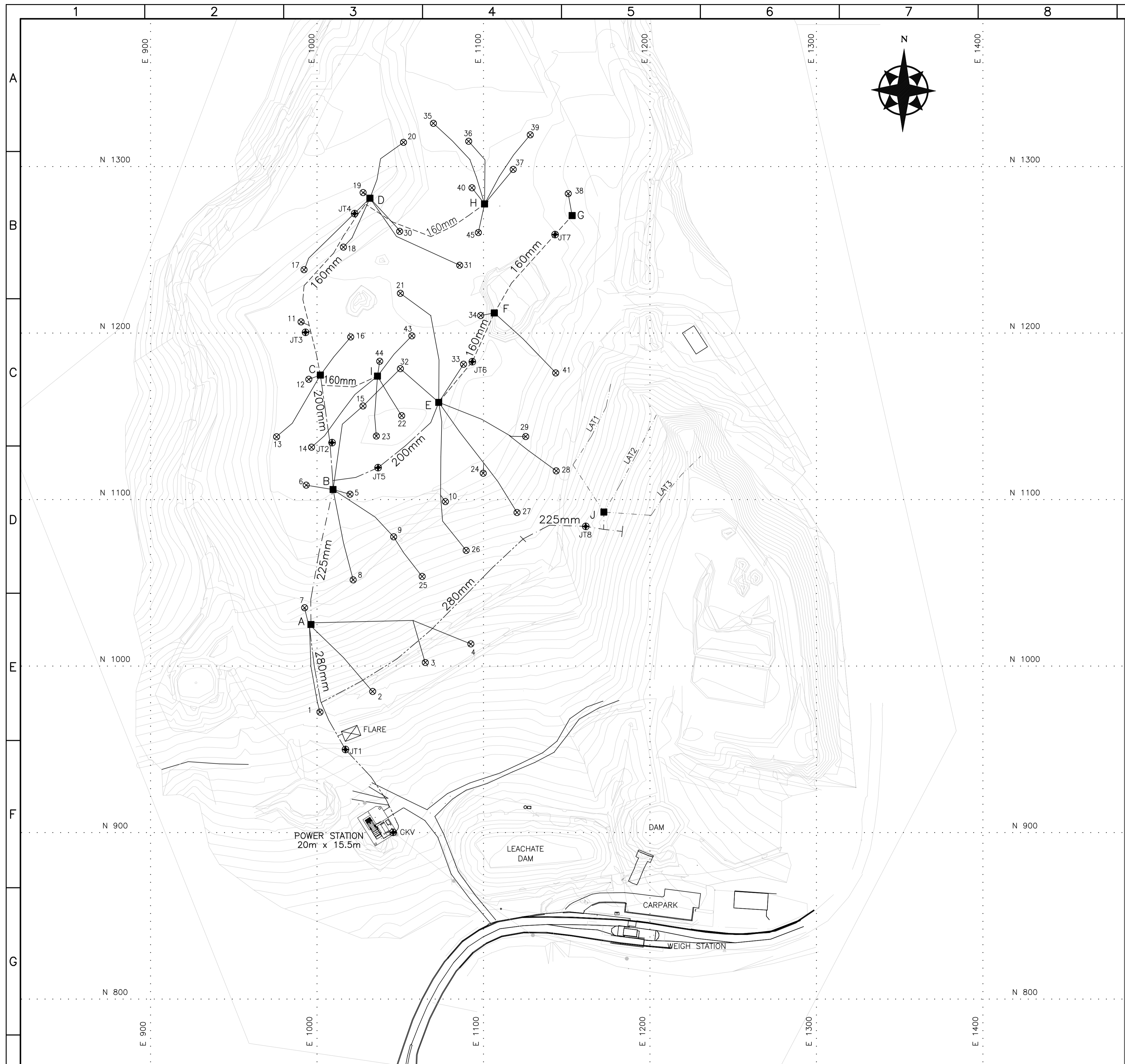
Model assumptions - provided by Council

Parameter	Rate	Comments
Population Growth	0.88% pa	Based on rate of change between 2006 and 2011 Census
Waste generation % increase	0.88% pa	Based on population growth
% of C& D usable for operational material	44.00%	Based on 2012 -13 proportion of material used as cover
Kerbside Organic Diversion Assumptions	Assumptions 80% diversion of Garden and Park from 2013 - 2014 - 50% Food Diversion from 2016 - 2017	
Other Green	0.88% pa	Current average for 2013-14 growing at population rate thereafter
Gas Capture	55%	Current 2013/14 average to November 2013-14 56%
Volume air space consumed	0.88	Volume Conversion (t/m3) waste landfilled excluding cover 5 year average

Appendix B Tabulated Landfill Methane and Landfill Gas Generation Estimates

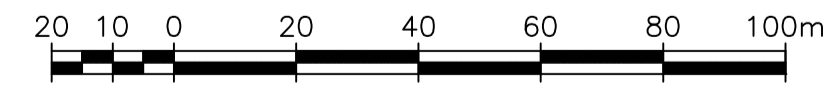
FYE	Total Methane Emissions (T CO ₂ -e) - with no capture	Total Methane Emissions (m ³ /hr) - with no capture	Methane Generation (T CO ₂ -e)*	Methane Generation (m3/hr)	Methane Generation (m3/yr)	LFG Generation (m3/hr)	LFG Generation (m3/yr)
1987	0	0	0	0	0	0	0
1988	3777	30	4196	34	294541	67	589082
1989	7371	59	8189	66	574844	131	1149688
1990	10791	86	11990	96	841631	192	1683262
1991	14047	113	15608	125	1095586	250	2191172
1992	17147	137	19053	153	1337357	305	2674715
1993	20099	161	22332	179	1567559	358	3135118
1994	22910	184	25455	204	1786773	408	3573547
1995	25586	205	28429	228	1995552	456	3991104
1996	28136	225	31263	251	2194418	501	4388836
1997	30565	245	33962	272	2383867	544	4767735
1998	32880	263	36533	293	2564370	585	5128739
1999	35085	281	38983	312	2736371	625	5472742
2000	37187	298	41319	331	2900294	662	5800588
2001	39190	314	43545	349	3056539	698	6113079
2002	41100	329	45667	366	3205487	732	6410974
2003	42921	344	47690	382	3347497	764	6694995
2004	44657	358	49619	398	3482913	795	6965825
2005	46313	371	51459	412	3612057	825	7224114
2006	47892	384	53214	426	3735239	853	7470477
2007	49399	396	54888	440	3852749	880	7705498
2008	50837	407	56485	453	3964866	905	7929732
2009	52208	418	58009	465	4071851	930	8143703
2010	53517	429	59464	476	4173956	953	8347911
2011	54767	439	60852	488	4271416	975	8542831
2012	55960	448	62178	498	4364456	996	8728911
2013	57099	458	63443	508	4453290	1017	8906580
2014	59171	474	65745	527	4614852	1054	9229704
2015	60517	485	67242	539	4719905	1078	9439811
2016	61833	495	68704	551	4822533	1101	9645066
2017	63120	506	70134	562	4922894	1124	9845788
2018	63533	509	70593	566	4955113	1131	9910226
2019	64618	518	71797	575	5039679	1151	10079358
2020	65692	526	72991	585	5123477	1170	10246955
2021	66757	535	74175	594	5206557	1189	10413113
2022	67814	543	75349	604	5288964	1208	10577928
2023	68862	552	76514	613	5370746	1226	10741491
2024	69904	560	77671	622	5451945	1245	10903891
2025	70938	568	78820	632	5532606	1263	11065212
2026	71966	577	79962	641	5612769	1281	11225538
2027	72988	585	81097	650	5692474	1300	11384948
2028	74004	593	82227	659	5771761	1318	11543522
2029	75016	601	83351	668	5850666	1336	11701333
2030	76023	609	84470	677	5929227	1354	11858454
2031	77026	617	85585	686	6007478	1372	12014956
2032	78026	625	86696	695	6085454	1389	12170908
2033	79023	633	87803	704	6163188	1407	12326376
2034	80017	641	88908	712	6240712	1425	12481423
2035	81009	649	90010	721	6318057	1442	12636113
2036	81998	657	91109	730	6395253	1460	12790506
2037	82987	665	92207	739	6472330	1478	12944660
2038	83974	673	93304	748	6549316	1495	13098632
2039	84960	681	94400	756	6626238	1513	13252477
2040	85946	689	95495	765	6703125	1530	13406249
2041	86932	697	96591	774	6780001	1548	13560001
2042	87913	705	97686	783	6856877	1565	13713753
2043	88894	713	98781	792	6933753	1582	13867505
2044	89875	721	99876	801	7010629	1599	14021257
2045	90856	729	100971	810	7087505	1616	14175009
2046	91837	737	102066	819	7164381	1633	14328761
2047	92818	745	103161	828	7241257	1650	14482513
2048	93799	753	104256	837	7318133	1667	14636265
2049	94780	761	105351	846	7395009	1684	14789997
2050	95761	769	106446	855	7471885	1701	14943749
2051	96742	777	107541	864	7548761	1718	15097501
2052	97723	785	108636	873	7625637	1735	15251253
2053	98704	793	109731	882	7702513	1752	15405005
2054	99685	801	110826	891	7779389	1769	15558757
2055	100666	809	111921	900	7856265	1786	15712509
2056	101647	817	113016	909	7933141	1803	15866261
2057	102628	825	114111	918	8010017	1820	16020013
2058	103609	833	115206	927	8086893	1837	16173765
2059	104590	841	116301	936	8163769	1854	16327517
2060	105571	849	117396	945	8240645	1871	16481269
2061	106552	857	118491	954	8317521	1888	16635021
2062	107533	865	119586	963	8394397	1905	16788773
2063	108514	873	120681	972	8471273	1922	16942525
2064	109495	881	121776	981	8548149	1939	17096277
2065	110476	889	122871	990	8625025	1956	17250029
2066	111457	897	123966	999	8701901	1973	17403781
2067	112438	905	125061	1008	8778777	1990	17557533
2068	113419	913	126156	1017	8855653	2007	17711285
2069	114400	921	127251	1026	8932529	2024	17865037
2070	115381	929	128346	1035	9009405	2041	18018789
2071	116362	937	129441	1044	9086281	2058	18172541
2072	117343	945	130536	1053	9163157	2075	18326293
2073	118324	953	131631	1062	9240033	2092	18480045
2074	119305	961	132726	1071	9316909	2109	18633797
2075	120286	969	133821	1080	9393785	2126	18787549
2076	121267	977	134916	1089	9470661	2143	18941301
2077	122248	985	136011	1098	9547537	2160	19095053
2078	123229	993	137106	1107	9624413	2177	19248805
2079	124210	1001	138201	1116	9701289	2194	19402557
2080	125191	1009	139296	1125	9778165	2211	19556309
2081	126172	1017	140391	1134	9855041	2228	19710061
2082	127153	1025	141486	1143	9931917	2245	19863813
2083	128134	1033	142581	1152	10008793	2262	20017565
2084	129115	1041	143676	1161	10085669	2279	20171317
2085	130096	1049	144771	1170	10162545	2296	20325069
2086	131077	1057	145866	1179	10239421	2313	20478821
2087	132058	1065	146961	1188	10316297	2330	20632573
2088	133039	1073	148056	1197	10393173	2347	20786325
2089	134020	1081	149151	1206	10470049	2364	20940077
2090	135001	1089	150246	1215	10546925	2381	21093829
2091	135982	1097	151341	1224	10623801	2398	21247581
2092	136963	1105	152436	1233	10700677	2415	21401333
2093	137944	1113	153531	1242	10777553	2432	21555085
2094	138925	1121	154626	1251	10854429	2449	21708837
2095	139906	1129	155721	1260	10931305	2466	21862589
2096	140887	1137	156816	1269	11008181	2483	22016341
2097	141868	1145	157911	1278	11085057	2500	22170093
2098	142849	1153	159006	1287	11161933	2517	22323845
2099	143830	1161	160101	1296	11238809	2534	22477597
2100	144811	1169	161196	1305	11315685	2551	22631349
2101	145792	1177	162291	1314	11392561	2568	22785101
2102	146773	1185	163386	1323	11469437	2585	22938853
2103	147754	1193	164481	1332	11546313	2602	23092605
2104	148735	1201	165576	1341	11623189	2619	23246357
2105	149716	1209	166671	1350	11700065	2636	23400109
2106	150697	1217	167766	1359	11776941	2653	23553861
2107	151678	1225	168861	1368	11853817	2670	23707613
2108	152659	1233	169956	1377	11930693	2687	23861365
2109	153640	1241	171051	1386	12007569	2704	24015117
2110	154621	1249	172146	1395	12084445	2721	24168869
2111	155602	1257	173241	1404	12161321	2738	24322621
2112	156583	1265	174336	1413	12238197	2755	24476373
2113	157564	1273	175431	1422	12315073	2772	24630125
2114	158545	1281	176526	1431	12391949	2789	24783877
	Figures directly from model	Assumes 1m3 of methane is equivalent to 0.6784 kg/m3 as per NGER Technical Guidelines (2013). Assumes 365.25 days in a year and 24 hours in a day. *Assumes Global Warming Potential (GWP) of methane is 21	Assume 10% oxidation rate through cover soils			Assumes methane is only 50% v/v of the generated LFG and carbon dioxide is the other 50% v/v	

Appendix C Plan of Existing Landfill Gas Collection and Treatment System



LEGEND	
⊗	WELL
■	WELLHEAD STATION
⊠	FLARE
⊕	J-TRAP
A	WELLHEAD STATION NAME
CKV	CONDENSATE KNOCKOUT VESSEL
—	90mm WELL FLOWLINE
- - -	125mm LATERAL
- - - -	160mm MAIN HEADER
- - - - -	200mm MAIN HEADER
- - - - - -	225mm MAIN HEADER
- - - - - - -	280mm MAIN HEADER

DESCRIPTION	COORDINATES			COMMENTS
	EASTING	NORTHING	RL	
FLARE	1015.920	957.735	-	-
A	996.469	1024.995	-	-
B	1009.727	1106.035	-	-
C	1002.107	1174.769	-	-
D	1031.870	1280.980	-	-
E	1073.202	1158.367	-	-
F	1106.612	1212.069	-	-
G	1153.321	1270.587	-	-
H	1100.740	1277.535	-	-
I	1036.412	1174.144	-	-
J	1172.405	1092.498	-	NEW
JT1	1017.180	949.862	-	-
JT2	1009.104	1134.174	-	-
JT3	993.180	1200.403	-	-
JT4	1022.686	1271.717	-	-
JT5	1036.774	1119.146	-	-
JT6	1093.360	1182.791	-	-
JT7	1143.067	1259.131	-	-
JT8	1161.505	1083.895	-	NEW
1	1001.833	972.330	47.331	-
2	1033.487	984.721	47.901	-
3	1065.120	1002.112	48.407	-
4	1092.461	1013.282	49.248	-
5	1019.904	1103.203	71.764	-
6	993.589	1108.640	70.765	-
7	992.619	1034.986	60.199	-
8	1021.808	1051.759	61.472	-
9	1046.127	1077.592	63.142	-
10	1077.194	1098.729	63.734	-
11	990.054	1204.237	74.700	-
12	995.135	1172.189	72.864	-
13	975.804	1137.657	67.357	-
14	996.772	1131.419	71.879	-
15	1027.707	1156.171	77.588	-
16	1020.318	1197.637	75.626	-
17	992.293	1238.019	75.370	-
18	1015.935	1251.606	75.595	-
19	1027.757	1284.327	76.041	-
20	1052.092	1314.539	76.564	-
21	1050.163	1223.875	83.084	-
22	1050.948	1150.345	76.709	-
23	1035.702	1138.133	76.517	-
24	1099.901	1115.811	65.226	-
25	1063.218	1053.814	57.535	-
26	1089.650	1069.433	58.196	-
27	1120.212	1092.226	60.648	-
28	1143.775	1117.235	59.233	-
29	1125.461	1137.846	64.843	-
30	1049.743	1261.058	76.514	-
31	1085.760	1240.709	83.226	-
32	1050.137	1178.568	75.782	-
33	1088.054	1181.265	75.381	-
34	1098.403	1210.527	76.989	-
35	1069.922	1325.992	77.801	-
36	1091.147	1315.153	82.474	REDRILLED
37	1117.896	1298.281	81.704	REDRILLED
38	1150.999	1283.722	72.458	-
39	1128.139	1319.011	80.210	-
40	1093.142	1287.221	83.600	-
41	1143.441	1176.051	63.663	-
42	-	-	-	-
43	1057.063	1198.315	81.44	REDRILLED
44	1037.725	1183.049	82.774	-
45	1096.994	1260.305	83.295	-



SCALE 1:1250 FOR A1 SIZE
SCALE 1:2500 FOR A3 SIZE

AS BUILT

AWABA GENERATING FACILITY

GAS FIELD LAYOUT

No	DATE	DRN	DESN	CHKD	APP	DESCRIPTION
2	12/03/12	JEF	-	AAH	-	MAINS & FLOWLINES ADDED. WELLS REDRILLED. RENUMBERED FROM 2031-CA-003.
1	26/03/09	AAH	SF	GF	SF	MAINS, WELL STATIONS AND WELLS ADDED. WELLS REDRILLED.
0	23/01/06	AAH	DKW	DKW	JF	AB - ORIGINAL ISSUE

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Proposed Additional Gas Capture Infrastructure

ADDITIONS TO AWABA WASTE MANAGEMENT FACILITY ENVIRONMENTAL ASSESSMENT

Legend

- Proposed Gas Monitoring Wells
- Site Boundary
- Proposed Gas Lines and Wells
- Existing Gas Lines
- Existing Engines
- Design Contours
- Cadastral



FIGURE 5.4

1:5,000 Scale at A4



Data Source: Geoscience Australia, GHD
Map Produced by Cardno NSW/ACT Pty Ltd 2812
Date: 2012-04-26
Coordinate System: GDA2011, State MGA Zone 56
Map: G5004_ProposedGasLines.mxd 02
Imagery supplied by LMCC and associated third party suppliers



Appendix D Tabulated Landfill Methane and Landfill Gas Emission Estimates

FYE	Total Methane Emissions (T CO ₂ -e) - with no capture	Total Methane Emissions (m3/yr) - with no methane capture	Methane Generation (T CO ₂ -e)- with no methane capture	Methane Generation (m3/yr) - with no methane capture	Total Methane Emissions (m3/yr) - with capture
1987	0	0	0	0	0
1988	3777	265087	4196	294541	265087
1989	7371	517360	8189	574844	517360
1990	10791	757468	11990	841631	757468
1991	14047	986027	15608	1095586	986027
1992	17147	1203622	19053	1337357	1203622
1993	20099	1410803	22332	1567559	1410803
1994	22910	1608096	25455	1786773	1608096
1995	25586	1795997	28429	1995552	1795997
1996	28136	1974976	31263	2194418	1974976
1997	30565	2145481	33962	2383867	2145481
1998	32880	2307933	36533	2564370	2307933
1999	35085	2462734	38983	2736371	2462734
2000	37187	2610265	41319	2900294	2610265
2001	39190	2750885	43545	3056539	2750885
2002	41100	2884938	45667	3205487	2884938
2003	42921	3012748	47690	3347497	3012748
2004	44657	3134621	49619	3482913	3134621
2005	46313	3250851	51459	3612057	3250851
2006	47892	3361715	53214	3735239	1927514
2007	49399	3467474	54888	3852749	1290315
2008	50837	3568379	56485	3964866	1221194
2009	52208	3664666	58009	4071851	1098617
2010	53517	3756560	59464	4173956	994425
2011	54767	3844274	60852	4271416	1532384
2012	55960	3928010	62178	4364456	1505159
2013	57099	4007961	63443	4453290	1640667
2014	59171	4153367	65745	4614852	1826466
2015	60517	4247915	67242	4719905	1911562
2016	61833	4340280	68704	4822533	1953126
2017	63120	4430604	70134	4922894	1993772
2018	63533	4459602	70593	4955113	2006821
2019	64618	4535711	71797	5039679	2041070
2020	65692	4611130	72991	5123477	2075008
2021	66757	4685901	74175	5206557	2108655
2022	67814	4760068	75349	5288964	2142030
2023	68862	4833671	76514	5370746	2175152
2024	69904	4906751	77671	5451945	2208038
2025	70938	4979345	78820	5532606	2240705
2026	71966	5051492	79962	5612769	2273171
2027	72988	5123227	81097	5692474	2305452
2028	74004	5194585	82227	5771761	2337563
2029	75016	5265600	83351	5850666	2369520
2030	76023	5336304	84470	5929227	2401337
2031	77026	5406730	85585	6007478	2433029
2032	78026	5476909	86696	6085454	2464609
2033	79023	5546869	87803	6163188	2496091
2034	80017	5616641	88908	6240712	2527488
2035	81009	5686251	90010	6318057	2558813
2036	81998	5755728	91109	6395253	2590077
2037	82987	5825097	92207	6472330	2621294
2038	83974	5894384	93304	6549316	2652473
2039	84960	5963615	94400	6626238	2683627
2040	85946	6032812	95495	6703125	2714766
2041	86932	6102001	96591	6780001	2733000
2042	82913	5819955	92126	6466617	2263316
2043	79091	5551680	87879	6168534	2158987
2044	75456	5296475	83840	5884973	2059740
2045	71997	5053676	79996	5615196	1965318
2046	68705	4822652	76339	5358503	1875476
2047	65573	4602808	72859	5114232	1789981
2048	62593	4393579	69547	4881754	1708614
2049	59755	4194428	66395	4660475	1631166
2050	57055	4004848	63394	4449831	1557441
2051	54483	3824359	60537	4249287	1487251
2052	52035	3652503	57817	4058337	1420418
2053	49704	3488849	55226	3876499	1356775
2054	47483	3332987	52759	3703319	1296162
2055	45368	3184528	50409	3538364	1238427
2056	43353	3043103	48170	3381226	1183429
2057	41434	2908364	46037	3231515	1131030
2058	39605	2779978	44005	3088864	1081102
2059	37862	2657631	42069	2952923	1033523
2060	36200	2541025	40223	2823361	988176
2061	34617	2429877	38463	2699863	944952
2062	33107	2323919	36786	2582132	903746
2063	31668	2222895	35187	2469883	864459
2064	30296	2126565	33662	2362850	826997
2065	28987	2034698	32208	2260776	791271
2066	27739	1947077	30821	2163419	757197
2067	26548	1863496	29498	2070551	724693
2068	25412	1783758	28236	1981954	693684
2069	24328	1707678	27031	1897420	664097

2070	23294	1635077	25882	1816752	635863
2071	22307	1565789	24785	1739765	608918
2072	21365	1499653	23739	1666281	583199
2073	20465	1436519	22739	1596132	558646
2074	19607	1376243	21785	1529159	535205
2075	18787	1318687	20874	1465208	512823
2076	18003	1263722	20004	1404136	491448
2077	17256	1211226	19173	1345806	471032
2078	16541	1161079	18379	1290088	451531
2079	15859	1113172	17621	1236858	432900
2080	15207	1067398	16896	1185998	415099
2081	14583	1023657	16204	1137396	398089
2082	13988	981852	15542	1090947	381831
2083	13419	941894	14910	1046549	366292
2084	12874	903695	14305	1004106	351437
2085	12354	867174	13727	963526	337234
2086	11857	832251	13174	924724	323653
2087	11381	798854	12645	887615	310665
2088	10926	766910	12140	852122	298243
2089	10490	736353	11656	818170	286360
2090	10074	707119	11193	785688	274991
2091	9675	679147	10750	754607	264113
2092	9294	652378	10327	724864	253703
2093	8929	626758	9921	696398	243739
2094	8580	602234	9533	669149	234202
2095	8245	578756	9161	643062	225072
2096	7925	556277	8805	618085	216330
2097	7618	534751	8465	594167	207959
2098	7325	514135	8138	571261	199941
2099	7043	494387	7826	549319	192262
2100	6774	475470	7526	528300	184905
2101	6516	457345	7239	508161	177856
2102	6268	439977	6965	488863	171102
2103	6031	423332	6701	470369	164629
2104	5804	407378	6449	452642	158425
2105	5586	392084	6206	435649	152477
2106	5377	377421	5974	419357	146775
2107	5177	363362	5752	403735	141307
2108	4985	349878	5538	388753	136064
2109	4800	336945	5334	374384	131034
2110	4624	324540	5137	360600	126210
2111	4454	312638	4949	347375	121581
2112	4291	301217	4768	334686	117140
2113	4135	290258	4595	322509	112878
2114	3985	279739	4428	310821	108787
	Figures directly from model	Assumes 1m3 of methane is equivalent to 0.6784 Kg/m3 as per NGER Technical Guidelines (2013), Assumes Global Warming Potential (GWP) of methane is 21	Assume 10% oxidation rate through cover soils	Assumes 1m3 of methane is equivalent to 0.6784 Kg/m3 as per NGER Technical Guidelines (2013), Assumes Global Warming Potential (GWP) of methane is 21	Figures for FYE 1987 to FYE 2013 from Council NGER Model

Appendix E Proposed Landfill Gas Monitoring Bore Locations



Proposed Additional Gas Capture Infrastructure

ADDITIONS TO AWABA WASTE MANAGEMENT FACILITY ENVIRONMENTAL ASSESSMENT

Legend

- Proposed Gas Monitoring Wells
- Site Boundary
- Proposed Gas Lines and Wells
- Existing Gas Lines
- Existing Engines
- Design Contours
- Cadastral



FIGURE 5.4

1:5,000 Scale at A4



Data Source: Geoscience Australia, GHD
Map Produced by Cardno NSW/ACT Pty Ltd 2812
Date: 2012-04-26
Coordinate System: GDA 2011, MGA Zone 56
Map: G5004_ProposedGasLines.mxd 02
Imagery supplied by LMCC and associated third party suppliers



Appendix F Greenhouse Gas Manual – National
Greenhouse and Energy Reporting – NGER –
Procedure – Version 1

	<p>Procedure</p> <p>Greenhouse Gas Manual - National Greenhouse and Energy Reporting - NGER</p>	
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Greenhouse Gas Manual - National Greenhouse and Energy Reporting - NGER

1 Purpose

The purpose of this procedure is to describe the data, methodology and governance controls used to support Lake Macquarie City Council's monitoring and reporting of emissions from facilities that may be captured under the Clean Energy Act 2011 and subsequently the National Greenhouse and Energy Reporting (NGER) Act 2007.

This procedure is a controlled document and will be reviewed annually and upon the release of new legislative instruments and direction from the Clean Energy Regulator or equivalent.

2 Current Reporting Status - 2012-13

On 14 July 2012 LMCC received correspondence (**D04633022**) from the Clean Energy Regulator notifying it that LMCC was being added to the Liable Entity Public Database (LEPID), on the basis that Lake Macquarie City Council (LMCC) was likely to be liable under the Clean Energy Act 2011.

"This letter is to notify you in accordance with section 184 of the Clean Energy Act 2011 (CE Act) that the Clean Energy Regulator has reasonable grounds to believe that your organisation is likely to be a liable entity for the 2012-13 financial year"

This potential liability is related to operations at the Awaba Waste Management Facility. It is incumbent on entity covered by the Clean Energy Act 2011, which included local governing bodies to determine if they have a liability, and acquit that liability.

LMCC considered that for due diligence it would address potential liability under the Clean Energy Act 2011 by registering to report under NGER Act 2007 prior to 31 August 2013, and undertake a voluntary Reasonable Assurance Audit to ensure compliance with the 2012-13 NGER Determination.

Third party NGER Accredited auditors (NDEV Environmental) were engaged to review LMCC's compliance with NGER Act 2007. Subsequent analysis and correspondence with the Clean Energy Regulator has indicated that LMCC may not exceed a reporting threshold (25,000 t – CO₂ –e) in the 2012-13 year; however, it is likely that a threshold will be exceeded from 2013-14 onward.

For due diligence and transparency, LMCC will submit an NGER report prior to the 31st of October 2013 and subject its report and third party verification audit to the Clean Energy Regulator. The following document outlines the decision points to determine a compliant report and supporting methodology and data for current and future reporting requirements.

3 Legal Status

The current legal status of local government in NSW is that of a Body Politic¹. This means that LMCC is not considered a corporation under the NGER Act 2007.

¹ <http://www.maddocks.com.au/uploads/articles/local-government-amendment-act-2012.pdf>

4 Organisational Description

LMCC is a Local Governing Body under the NSW Local Government Act 1993. The organisational structure of LMCC is described in **Figure 1**.

It provides services to the community including the operation of community facilities, libraries and pools. It also performs waste management services and operates the Awaba Waste Management Facility as Solid Waste Disposal Facility.

Figure 1 - LMCC Organisational Structure

Lake Macquarie City Council Organisation Structure as of Monday 22 April 2013			
Mayor & Council			
General Manager			
Director Operations	Director City Strategy	Director Community Development	General Manager's Secretariat
Waste, Environment and Rangers	Development Assessment and Compliance	Community Planning	Human Resources
CiviLake	Integrated Planning	Asset Management	Corporate Support
Mechanical Depot and Supply Services	Sustainability	Library, Leisure and Culture	Internal Auditor
Corporate Risk and Compliance Officer	Finance and Administration	City Projects	Corporate Finance Strategy
	Property	Communications and Customer Service	
	Corporate Information	Corporate Planning and Governance	
	Corporate Legal		

5 Carbon Reporting Responsibility Statement

5.1 Council Responsibilities

LMCC determined that in the period between the release of the 2012 -13 NGER determination and the availability of a NGER - compliant solid waste calculator (not available prior to July 20 2013) it would register under section 15 A and report under Section 22A of the NGER act 2007.

LMCC also considers that, due to its status as a Body Politic and not a corporation it is only obliged to report covered scope 1 emissions under section 22A NGER act 2007.

During the time between registration and reporting, LMCC subjected its data and reporting approach, which includes this document to a Voluntary Reasonable Assurance Audit to identify any reporting risks and ensure its approach to reporting is compliant to the NGER 2012-13 Determination (the Determination).

Independent auditors NDEV Environmental were engaged on 1 August 2013. NDEV's interim Audit report is available here D04571179. The final assurance report will be referred to in a future review of this document.

5.2 Staff Roles and Responsibilities

Table one below describes the roles and responsibilities for NGER reporting in LMCC.

Table 1 - NGER Compliance Roles and Responsibilities

Role	Responsibility	Timeframe	Comments
Monitor the release of new legislative instruments and direction from the Clean Energy Regulator or equivalent.	Sustainability Analyst	During the compliance year	
Data collation	Sustainability Analyst	During the compliance year	
Interim Emission Number reporting	Sustainability Analyst	15 June of the relevant financial year	
Section 22A Report Preparation	Sustainability Analyst	Between end of compliance period and report due date Currently 31 October each year post compliance period	
Internal audit and review	Sustainability Analyst Report reviewed by Sustainability Manager, or delegate	Annual after first reporting period which is externally verified	
External audit and review	Sustainability Analyst	First year and subsequently as required	Suggested biennial or upon the release of new legislative instrument or propose change in methodology
Preparing Section 22A report in Emission and Energy Reporting System	Sustainability Analyst	On or before 31 October post compliance period	
Lodging Section 22A report in Emission and Energy Reporting System	Authorised Executive Officer – General Manager	On or before 31 October post compliance period	

5.3 Operational Control and Reporting Boundaries

LMCC has a Greenhouse Gas Emission Reduction Targets Policy - Council Policy that includes a carbon pollution reduction target of 3% pa from a 2007-08 baseline (D02591398).

LMCC tracks the emissions related to its operations. **Table 2** outlines the activities that LMCC undertakes that create scope 1 and 2 emissions, excluding the Awaba Waste Management Facility, which is discussed in section 6.

Table 2 - 2011-12 Organisational Scope 1 & 2 Carbon Emissions for which LMCC has operational control excluding the Awaba Waste Management Facility

Emission Source	Description	Quantity	Unit	Scope 1 t – CO2 –e	Scope 2 t – CO2 –e	GJ
NSW Electricity	15 Large Sites - 196 Small Sites	6,030,208	kWh	0	5367	21709
Natural Gas	8 Sites	1,542,4863	MJ	792	0	15425
Stationary LPG	1 Site	21,000	Litres	32	0	540
Transport LPG post 2004	Issued From Depot	3,704	Litres	6	0	97
Transport ULP post 2004	Issued From Depot	391,301	Litres	896	0	13382
Transport Diesel post 2004	Issued From Depot	1,932,817	Litres	5208	0	74607
Total				6934	5367	125760

Table 3 describes street lighting, which LMCC pays for but does not own or operate.

Table 3 - Other Emission Sources 2011-12 No Operational Control

Emission Source	Quantity	Unit	Scope 2 t – CO2-e	GJ	Operational Control
Street Lighting	6,013	MWh	5,352	21646.8	No - Operated and Maintained by Ausgrid

Emission factors in **Table 2** and Table 3 are based on NGA Factors for 2011-12 released by the Australian Government.

6 Facilities registered to report under NGERs and the carbon pricing mechanism

In reference to the analysis provided in section 5.3, LMCC considers the Awaba Waste Management Facility to be the only facility under the operational control of LMCC that may exceed the 25,000 t CO₂-e facility reporting threshold and therefore be captured by the Clean Energy Act 2011, and subsequently required to report under section 22A of the NGER Act 2007.

6.1 Background and History of Awaba Operations

The Awaba Waste Management Facility operates on a consent issued in October 1986. Up until September 1994, it operated concurrently with Redhead Waste Disposal Facility. Reports to the NSW EPA documenting waste received for the Awaba facility are only available from 1997.

6.2 Operational Control of Activities at the Awaba Waste Management Facility

6.2.1 Operational control definition

The definition of operational control in the NGER Determination 2008 is:

- *you have the authority to introduce and implement any or all of the operational, environmental and health and safety policies for the facility, or*
- *more than one person has this authority, but you have greatest authority to introduce and implement the operational and environmental policies for the facility, or*
- *you are declared by the Clean Energy Regulator to have operational control of the facility.*

6.2.2 LMCC and Third party activities

There are two activities carried by third parties at the Awaba Waste management Facility. They are;

- Landfill Gas Capture and destruction - by LMS Energy
- Green waste removal.- by Remondis and Davis Earthmoving

LMCC has assumed operation control for all activities on site, with the exception of gas combustion at the Awaba Renewable Energy Facility for which landfill gas capture company, LMS Energy, is currently reporting under the NGER Act 2007. The implications for data capture and reporting for activities carried out by third parties are discussed in the following sections

6.2.3 Landfill gas reporting requirements

Emissions from the combustion of landfill gas are not covered emissions and do not have to be reported under in the section 22A report:

"B1.6 Combustion of biomass, biofuels and biogas

Emissions from the combustion of biomass, biofuels and biogas are not covered emissions. Carbon dioxide produced from these sources is part of the natural carbon cycle and does not count towards Australia's emissions obligations. Other greenhouse gases from the combustion of these sources are a minor source of emissions and are excluded for administrative simplicity". p.g 24 supplementary guide to carbon liability (D02948290).

6.2.4 LMS

LMS Energy installed a landfill gas capture system in 2006 and has gas rights under its current contract up until 2026.

LMS Energy currently report energy generated and landfill gas combusted in the Awaba Renewable Energy Facility under the NGER Act. 2007 LMS Energy. It considers that LMS Energy has 'operational control and reporting responsibility for the Awaba Renewable Energy Facility.

LMS Energy considers that it does not have operational control over the gas flare – stating that it cannot control how much gas is being generated by the landfill.

LMS Energy's current NGER reporting commitments for the AWABA site in 2012 - 2013 is described in D04673591

6.2.5 Data entry for landfill gas in the solid waste calculator.

As there are no covered emissions associated with the gas consumption (see Section 6.2.3) and its entry in to the Solid Waste Calculator as gas transferred or gas flared does not change the on-site abatement. Gas consumed in the engine is reported as transferred and gas combusted in the flare is entered as gas flared. This will be covered further in the data entry procedure (see Section 9 Emissions calculation procedure – including data for entry into the NGER Solid Waste Calculator).

6.2.6 Green waste transfer

It is noted that if active composting occurs on a landfill site this activity can result in a covered emission. There is no active composting at Awaba. In 2012-13 green waste was collected then transferred off site by two separate contractors. See Figure 2

Green waste transfer off site at Awaba 2012- 13

Up until April 2013, the removal of green waste was carried out by Davis Earthmoving.

The percentage remaining at the end of the week in Figure 2 refers the green waste stockpile remaining at the end of each week,

No green waste was shredded or removed prior to the 20 September 2012. It was stockpiled as received. The stockpile was then shredded and removed on a campaign basis.

Between 20 September 2012 30 April 2013 Davis Earthmoving ;

- organised the shredding of green waste using equipment they supplied
- Davis Earthmoving undertook shredding under their contract on a campaign basis. ie approximately every 8 weeks they would float their plant onsite undertake shredding, remove the material and then float plant offsite
- Removed the bulk of the green waste (over 99% of green waste transferred off site was by the contractor the remainder removed by the public)
- The process was shred and remove

Green bin collection begins 1st of April 2013

For the first month after the introduction of the kerbside garden waste service, green waste was stockpiled on site.

From the 30 April 2013 Remondis

- organised the shredding of green waste using equipment they supplied/hired

- Removed the bulk of the green waste (over 99% of green waste transferred off site was by the contractor, with the remainder removed by the public)
- The process was shred and remove.

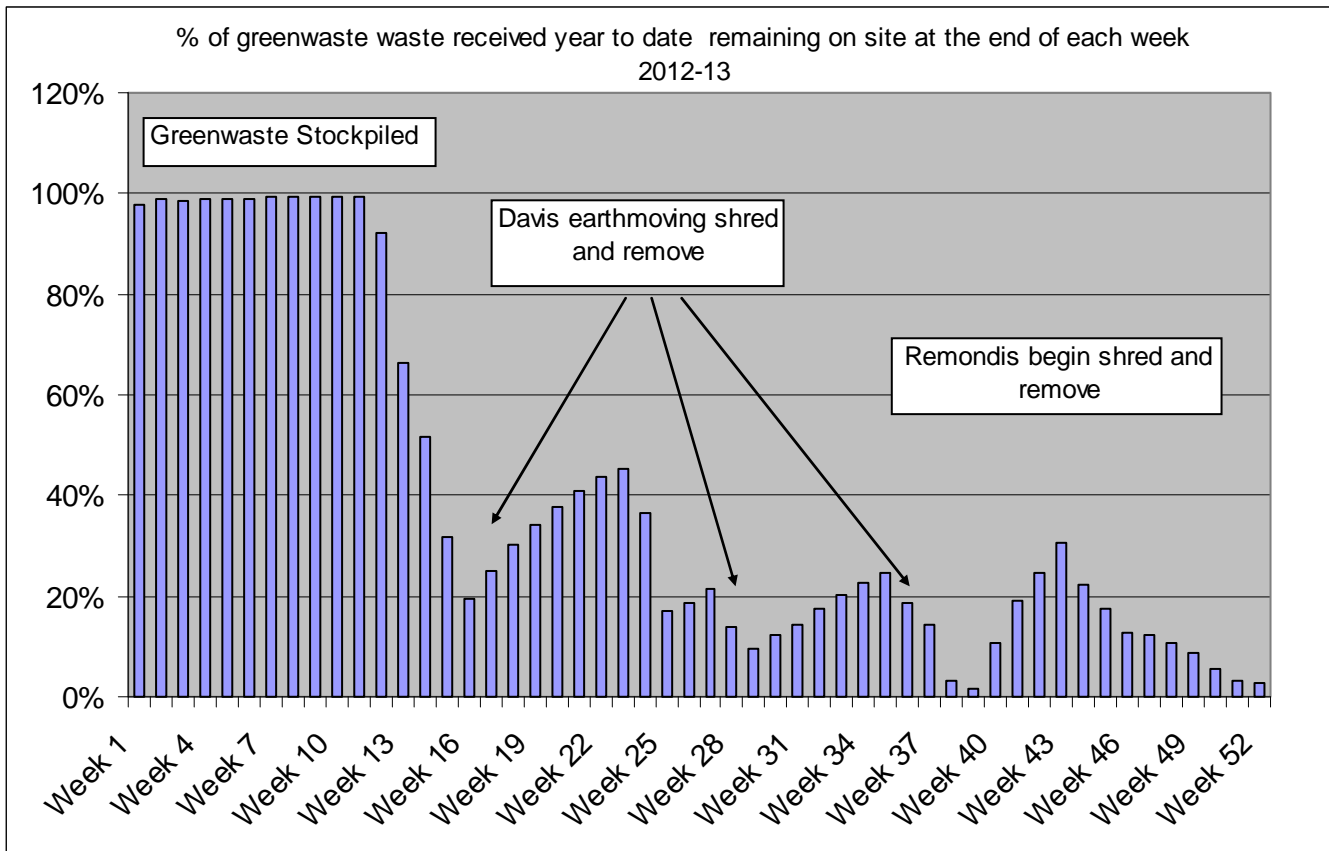


Figure 2 - Green waste handling at Awaba 2012-13

The practice of shred and remove has been reviewed by LMCC’s Auditor NDEVR Environmental. NDEVR Environmental discussed these activities with the Clean Energy Regulator and they concur that the green waste stockpile, shred and remove activities described do not constitute composting and that it is correct to categorise park and garden green waste as transferred. This is documented in D04678148.

6.2.7 Destination of green waste transfer off site at Awaba 2012- 13

Green waste transferred offsite in 2012-13 comes from an uncontaminated source- separated green waste stream and has been primarily transferred as a shredded product. It has not been taken to an AWT for active composting.

6.2.8 LMCC reporting requirements related to green waste handling

While it could be considered that these two operators had operational control over the shredding of the green waste before removal and as such onsite activities that may result in a covered scope 1 emission should be their responsibility. At this time LMCC does not intend to identify the shredding of green waste as a separate facility under the operational control of a third party and as such will estimate the use of petroleum based oils and greases (PBOG) in the shredder and loaders used to remove green waste from the site in 2012-13.

7 Supporting Data

The following section describes data sources and documents that support the generation of an NGER compliant report.

7.1 Awaba landfill gas flaring and generation data - gas flow and analyser calibration certificates -

Description

Data sources for Awaba Gas Flaring

Doc Ref	Title	Purpose
F2004/08547	COUNCIL PROPERTIES - OPERATIONS - 2005 2011 Awaba Tip Methane Gas Extraction Monthly Reports	Gas collection data prior to 2012
F2012/00485	COUNCIL PROPERTIES - OPERATIONS - Awaba Tip Methane Gas Extraction Monthly Reports	Gas collection data from 2012 onward
D04686354	Awaba Methane Gas Extraction Consolidated Monthly Reports	Time series data based on LMS reports for data entry into the solid waste calculator
F2012/00486	LMS Royalties	LMS report stating Electricity Generator output
D04673591	LMS Current NGER reporting commitments for the AWABA site in 2012 - 2013	Correspondence from LMS outlining their NGER reporting in regard to the AWMF
D04733824	LMS Flare Calibrations 2012 -13	Calibration Certificates for the flare dated the 19 th of march 2013
D04733823	LMS Engine Calibrations 2012 -13	Calibration Certificates for the flare dated the 19th of march 2013
D04733822	LMS Confirmation Data Supplied for Flare and engine are NGER compliant	Correspondence from LMS stating that data is NGER compliant and reported in standard cubic metres

7.2 LMS gas extraction operations

Doc Ref	Title	Purpose
D01476844	12342AAA LOCATION OF NEW AND OLD WELLS AT AWABA LANDFILL SITE COMPLETED AT 25/03/09	Gas well location data

7.3 Awaba surface gas monitoring

Description

Surface monitoring data for EPA reporting, includes sensor calibration reports

Doc Ref	Title	Purpose
F2004/08498	: ENVIRONMENTAL MANAGEMENT - MONITORING - Gas - Gas Emissions Awaba Tip	Awaba surface gas monitoring reports

7.4 Awaba Volumetric Survey

Doc Ref	Title	Purpose
D03029732	Electronic LFIC and VSC Jun13 volumetric survey	Example of volumetric survey to EPA
D04684310	Awaba Volumetric Change Survey 1986 - June 2012	Volumetric survey to determine opening stock of Carbon – signed by registered surveyor
D02601504	Awaba Dump Sheet 1 Contour Plan January 2012 to June 30th 2012	Surface survey as at the end of June 2012
D04684531	Awaba Waste Management Facility orthophoto map AWABA U4542-9	Layered PDF showing original landform and contour data
D04684622	AWABA 2m_Contour_Metadata LPI October 2013	Meta data for original landform from NSW LPI
D04684458	Volume calculation for Awaba Landfill Site - Data and Methodology	Description of data sources used to create volumetric survey

7.5 EPA waste contribution reports

Monthly waste contribution reports data compiled as reported to the NSW EPA in monthly returns. Weighbridge data used to generate these reports and recent EPA audit reports.

Doc Ref	Title	Purpose
F2012/00546	WASTE MANAGEMENT - REPORTING - Consolidated Waste Data - Awaba Weighbridge Data	Monthly weighbridge reports
F2010/02509	FINANCIAL MANAGEMENT - LEVIES - ENVIRONMENT PROTECTION AUTHORITY - Waste Contribution Reports Licence No 005783	Monthly Reports to the EPA
D02884256	Waste Levy Compliance Audit - Exit meeting - Awaba Waste Disposal Facility - 367 Wilton Road Awaba 20/3/2013	EPA Audit report
	Waste Contribution Monthly Report and Payment - Procedure	Procedure for monthly reporting of waste data as per EPA licence 5873

7.6 Time series waste data as reported to NSW EPA and in NGER format

Total waste received and then removed from the site or reused for operational purposes is taken from the following documents.

Doc Ref	Title	Purpose and processes
D02666466	WASTE MANAGEMENT - REPORTING - Consolidated Waste Data - Awaba Weighbridge Data	Monthly weighbridge reports
D04359029	waste stream - revision 3 - working file	Data aligned with EPA reporting and NGER solid waste calculator requirements. Each month verified against reports to the EPA . Tab NGER format contains verified data transformed into NGER Format

7.7 Weighbridge Calibration

The weighbridge is calibrated on a regular basis in line with NSW EPA requirements.

Relevant documents are in the files identified below.

Doc Ref	Title	Purpose
D02888996	Lake Macquarie Council Weighbridge Calibration Certificates for Awaba Landfill 2013	Weighbridge calibration certificates for 2012 13
F2012/00481	PLANT EQUIPMENT AND STORES - MONITORING - Calibration - Awaba Tip Weighbridge	Folder containing calibration docs and Waste Levy compliance audits

7.8 Waste Tracking Procedures

Procedure for describing how waste data are entered at the weighbridge, verifications processes in place and training.

Doc Ref	Title	Purpose
D02947976	Waste Classification and Data Entry Procedure - Awaba Waste Management Facility	Procedure for recording waste

8 Opening stock of degradable organic carbon for the first reporting period

The Awaba Waste Management Facility (AWMF) operates on a consent from October 1986. This start data means that opening stock of carbon will be reported from the financial year ending in 1987.

Points of note with regard to waste tracking and determining opening stock of carbon at the AWMF are;

1. Up until September 1994, it operated concurrently with Redhead Waste Disposal Facility and during the time of concurrent operation, the majority of waste went to Redhead.
2. Prior to 1997 the Awaba site operated without a weighbridge.

There is no complete NGER compliant waste received dataset (EPA report, weighbridge or transactional) for the years prior to 1997. There is also no NGER complaint data set that would allow a representative waste split for the years where the AWMF and Redhead operated concurrently. This lack of a complete time series of data either as weighbridge or as reported to the EPA excludes the use of criterion 5.13 (1) (a), which requires data to cover the entire life of the operation.

This would appear to only leave available an estimation method under Section 5.13 (1) (b) (ii) subsection (2) of the NGER Measurement Determination 2008

(2) For subparagraph (1) (b) (ii), the estimated annual tonnage of waste is to be worked out:

(a) by using the average annual tonnage of solid waste disposed of in the landfill for the years for which data is available; or

(b) by conducting a volumetric survey of the landfill in accordance with subsections (3) and (4).

It has been determined through a process of consultation via a voluntary assurance audit with NDEVR environmental and advice from the Clean Energy Regulator that a volumetric method covering the entire period of opening stock and applying waste streams defaults is NGER compliant and the most appropriate method to use. (See D04571179 and Section 3) and correspondence with the Regulator in Attachment 1.

LMCC intends to apply s5.13(2)(b) volumetric surveys to estimate opening stock as outlined in section 8.1.2.

To provide the background to this conclusion the following describes the approaches considered about finding a representative and NGER legislation compliant method for estimating opening stock.

8.1 Approaches considered for determining a compliant method for estimating opening stock.

8.1.1 EPA reports for years known and survey data for unknown years

The approach considered prior to voluntary assurance audit was as follows;

- Take known years of EPA reporting data based on levy reporting requirements broken down into waste streams covering 1 July 2007 – 30 June 2012.
- Pre 2000 EPA reports may contain a combination of weighbridge and vehicle count, multiplied by a vehicle to weight conversion.
- Unknown years between 1986 and 1997 based on and survey data from preconstruction contours to June 1997 and
- Apply NSW waste stream defaults the years covered by survey data (Table 4).

Table 4 - Estimate of waste in place pre - weighbridge

Base survey date	1/07/1986
End survey date	30/06/1997
Years to estimate volume	11
Volume estimate (m ³)	855,561
Annual volume (m ³ /year)	77,778
Density factor (t/m ³)	1.1
Waste per year (t)	85,556

Representativeness

LMCC considered this a representative and reasonable description of waste in place

Representativeness Conclusion - Representative

Compliance

Subsequent information from the 'Supplementary Guideline - Estimating an Emissions Profile at a landfill' (D04570799 pg.8) states that;

“Using a combination of the details of the total tonnage of waste disposed of in the landfill, in each given year prior to the first reporting period (5.13(1)(a)) together with the estimated annual tonnage of solid waste disposed of in the landfill for the years when data is not available (5.13(1)(b)). Using a combination of these methodologies is not allowed,”

Auditor NDEVR Environmental in consultation with the Clean Energy Regulator has concluded that the approach described above is using a combination of methods which does not comply with the supplementary guidelines (see D04571179 for further detail).

Compliance conclusion – Non - compliant

8.1.2 Opening stock of carbon via estimation of yearly waste from Volumetric Survey of entire period before first reporting period

LMCC has a volumetric survey signed by a Registered Surveyor which covers the period from preconstruction in 1986 through to the end of June 2012. The calculations are provided in the document 'Awaba Volumetric change survey 1986-June 2012.pdf' (D04684310)

Calculations in this file show that a net increase in material of 2,271,622 cubic metres from the original land form at the site during the period from pre-construction to June 2012. The average yearly material deposited in 26 years preceding first reporting period is therefore 96,107 tonnes.

Documentation supporting this calculation is found in Section 7.4.

Calculation of yearly waste prior to first reporting period.

Net fill added to site volumetric survey = 2,271,622-m³

1/7/1986 – 30/6/2012 = 26 years inclusive

2,271,622 / 26 = 87,370 m³

Average volume consumed per year = 87370 m³/ year

Default Conversion factor is 1.1 tonnes per m³

87, 370 m³ x 1.1 = 96,107 tonnes

Average yearly material deposited in 26 years preceding 1st reporting period = 96,107 tonnes

LMCC intend to apply s.13 (2)(b) volumetric surveys to estimate opening stock.

Representativeness

The volumetric survey is a fair and reasonable representation of the change in volume from original landform until the end of June 2012. The survey calculation has been signed off by a registered surveyor, the data sources used and supporting documentations are available in Section 7.4.

Representativeness Conclusion - Representative

Compliance

This method has been deemed as compliant via consultation with the regulator and NDEVR Environmental and has been recommended as the best approach for compliance (see D04571179 and D04789501).

Compliance Conclusion - Compliant

8.1.3 Opening stock of carbon via averaging years of known data

The use of averaging methods under s5.13 (2)(a) were considered. This would involve taking years of known total waste received and averaging for unknown years.

The use of weighbridge data only or based on reports to the EPA for years where EPA reporting contained a mix of weighbridge data and vehicle counts with a mass conversion applied was considered. It is unclear which **criterion** under Section 5.5 this may satisfy.

Representativeness

Even if the data for total waste received in known years (EPA , weighbridge or a combination) were deemed to be NGER compliant, this approach it would greatly overestimate the waste in place for the 8 years of concurrent operation where it is generally known that the majority of the local government area's waste was going to the Redhead site. Knowingly overestimating waste in place would have flow on effects and not provide a reasonable representation of legacy and non-legacy gas as well as gas capture percentage.

Representativeness Conclusion – Unrepresentative over estimation

Compliance

In considering the use of average of known data under Section 5.13 (1) (b) (ii) It is unclear which criterion under Section 5.5 may be used to estimate waste received for known years.

Total waste may come from weighbridge data for the years where it covers the entire waste stream or EPA reports which can contain a mix of weighbridge data and vehicle counts multiplied by a vehicle to weight conversion.

It has been determined through correspondence with the Auditor and Clean Energy Regulator (D04678148 and D04789501) that using the breakdown in existing EPA reports could not be used because levy reporting requirements do not extend to the beginning of the landfill operation.

Compliance Conclusion - Unknown

9 Emissions calculation procedure – including data for entry into the NGER Solid Waste Calculator

The following section outlines method choices and data for entry into the solid waste calculator. LMCC is applying method 1 in the 2012-13 determination compatible solid waste calculator. Solid waste calculators for each reporting year can be sourced from the Regulators website:

<http://www.cleanenergyregulator.gov.au/national-greenhouse-and-energy-reporting/forms-and-calculators/Pages/default.aspx>.

9.1 Current Solid Waste Calculator

The solid waste calculator for the current reporting year is stored at (D04691614)

9.2 Opening Stock of carbon for first reporting period

The average yearly material deposited in 26 years preceding 1st reporting period as calculated in Section 8.1.2 is 96,107 tonnes.

This tonnage is entered in Column B of the landfill calculator tab in D04691614 from 1987 to 2012.

9.3 Reporting tonnage of solid waste 2012-13 onward

LMCC is required to provide a Waste Contribution Monthly Report (WCMR) Under the NSW Protection of the Environment Operations (Waste) Regulation 2005.

For reporting waste disposed of at the landfill under s5.5 of the NGER (Measurement) Determination 2008 (the Determination), provision 5.6(b) will be utilised - waste deposited to be reported using information required by state and territory legislation (EPA - levy reports) - satisfying criterion A

LMCC Application = waste must be reported as reported to NSW EPA. See 0

Total waste received = Total waste over the weighbridge as reported in NSW waste contribution reports.

This data is collected in D04359029, verified, and prepared for data entry as follows.

Data are aligned with EPA reporting and NGER solid waste calculator requirements. Data for each month verified against reports to the EPA Tab NGER Format contains verified data transformed into NGER Format (see Table 5).

Table 5 - Data as reported to the EPA and ready for input into NGER calculator

Column in D04359029	A	E	F	G	H	I	J	K
Column in Landfill calculator Tab D04691614		B	M	N	O	CA	BK	BQ
	Financial Year	Total received	% MSW	% C&I	% C&D	total operational material	Total green waste OUT	Total Recyclable OUT
	2012 - 2013	115848.	70.97%	4.27%	24.77%	12679.5	8376.24	642.26

9.4 Estimating waste composition - waste streams

For reporting waste streams under s5.10 of the NGER (Measurement) Determination 2008 (the Determination), provision 5.10(2)(a) will be utilised.

LMCC is required to provide a Waste Contribution Monthly Report (WCMR) under the NSW Protection of the Environment Operations (Waste) Regulation 2005. This report requires waste to be categorised as:

- (a) municipal solid waste;
- (b) commercial and industrial waste; or
- (c) construction and demolition waste.

LMCC Application = Waste composition as reported to NSW EPA (see Section 8.1.1)

Data are entered into the solid waste calculator as per Section 9.3.

9.4.1 Estimating waste composition - Waste Mix

LMCC intend to use the default waste mix type as in 5.11 (2) (c)

9.5 Waste transferred

Waste transferred is recorded as reported to the EPA and are inputted into the solid waste calculator as per Table 5 - Data as reported to the EPA and ready for input into NGER calculator (Section 9.3).

9.6 Gas flared and transferred

A time series of data, as reported by LMS Energy and required for entry in to the solid waste calculator, is stored in D04686354. Documentation supporting the data supplied by LMS energy is referred to in section 7.1

Data are received by LMS and a 50% methane composition consistent with method 1 is applied. The data are entered in a matter consistent with the current operational control status identified in Section 6.2.4 and Section 6.2.5.

In reference to correspondence with LMS stating that meets the requirements of Division 2.3.6 in Figure 3. LMCC is acting in good faith that monthly data supplied by LMS meets criterion AAA under section 2.31 Direct measurement at point of consumption.

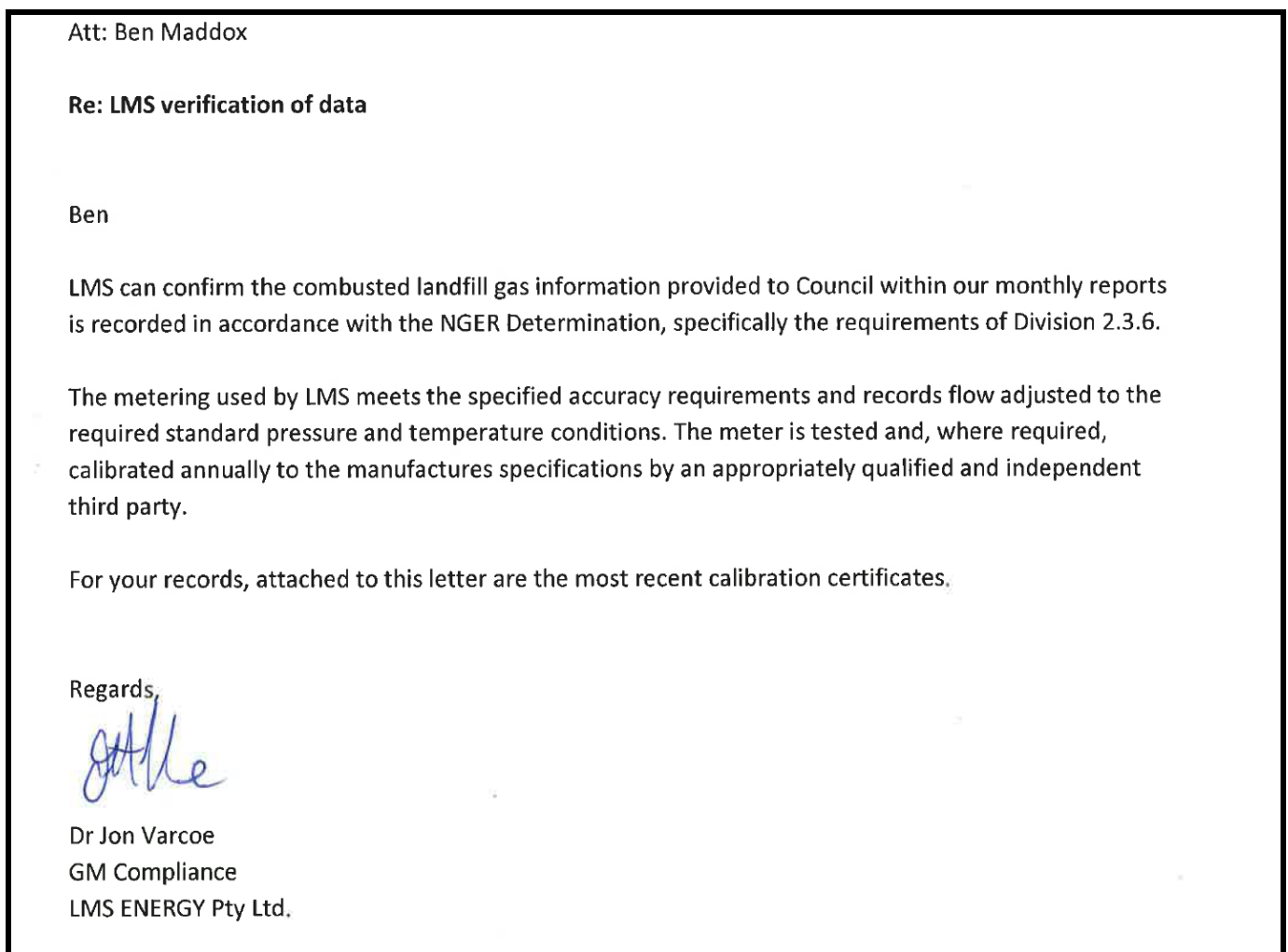


Figure 3 Correspondence from LMS stating gas data supplied meets the requirements of Division 2.3.6

9.7 Climate Data

In the solid waste calculator tab inputs and data checks, the dry temperate climate zone has been determined to be the most appropriate.

The dry temperate climate zone has been determined via the process outlined in Section 5.14 Methane generation constants - (k values) NGER Technical Guidelines-2012-13.

Landfill operators have two options for the selection of k values under method 1. The first option is to select k values based upon the state or territory in which the landfill is located. The second option is to select k values based upon the climatic conditions (mean annual temperature, precipitation and evaporation) at or near the landfill site.

Under option 2, mean annual temperature can be calculated from data available on the Bureau of Meteorology website (<http://www.bom.gov.au/climate/data/>). The BOM provides data on mean maximum and mean minimum temperatures over the entire time-series of weather station data. Mean annual temperature is calculated as the arithmetic average of the mean maximum and mean minimum temperature.

Landfills in the temperate classifications also need an estimate of mean annual evaporation. Mean annual evaporation data are available from certain BOM weather stations. Under the provisions of section 5.14, mean annual evaporation data should be obtained from the closest weather station to the landfill for which evaporation records exist:

Section 5.14 A

Temperate dry, for a landfill, means that the landfill has:

- (a) a mean annual temperature that is 20° centigrade or less; and
- (b) a ratio of mean annual precipitation to mean annual evaporation that is less than 1.

9.7.1 Interpretation of site climate classification

Williamtown RAAF Base is the closest station where evaporation data exist for over 10 years (see Table 6)

Table 6 - Climatic data for Williamtown meteorological station

Station	WILLIAMTOWN RAAF			
Station Number	61078			
Financial Year	Yearly Precipitation in mm	Yearly Evaporation in mm	Average of Maximum temperature Degrees C	Average of Minimum temperature Degrees C

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2003 - 2004	892.20	1821.40	23.74	11.86
2004 - 2005	1380.40	1659.00	23.45	12.26
2005 - 2006	713.20	1857.20	24.15	12.43
2006 - 2007	1491.20	1760.80	23.80	12.13
2007 - 2008	1313.20	1632.40	23.08	12.17
2008 - 2009	1322.00	1767.00	23.44	12.40
2009 - 2010	845.00	1792.40	24.35	12.62
2010 - 2011	1082.60	1647.90	23.75	13.02
2011 - 2012	1291.40	1501.00	22.98	12.40
2012 - 2013	1196.80	1608.70	23.87	12.33

Average	1152.80	1704.80	23.66	12.36
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Doc Ref	Title	Purpose
D04630845	Williamtown - Climate Data	Climate classification data from closest Weather Station with evaporation data

9.7.2 Mean annual temperature calculation

(Average Maximum + Average Minimum)/2

$$(23.66+12.36)/2 = 18.01$$

Temperature dry (a) a mean annual temperature that is 20° centigrade or less

18 < 20 Conclusion: Temperate Dry (a) = Yes

9.7.3 Ratio of precipitation to evaporation calculation

Average Rain / Pan Evaporation

$$1152.80/1704.80 = 0.68$$

0.68 < 1 Conclusion: Temperate Dry (b) = Yes

9.7.4 Climate Zone Conclusion

A climate zone of Dry Temperate is supported

LMCC proposes to use the data above to classify the Awaba Waste Management Facility as being in a Dry Temperate Zone.

10 Waste composition and further considerations for demonstrating green waste diversion under NGER

The 2012-13 measurement determination presents difficulties with regard to demonstrating the diversion of green waste from the waste stream. For the 2012-13 year this does not present a problems for LMCC as all green waste that was diverted was presented at Awaba and then transferred off site.

However, in the future when green waste is diverted directly to a green waste facility this direct reporting of green waste transferred of site will not be possible and will require submissions to Government advocating the ability to use auditing of the kerbside collection to demonstrated the removal of organics.

NOTE : If the current situation remains it appears that the only option available to demonstrate the full extent of green waste removal is for green material to be brought on site and then transferred over the Awaba weighbridge as soon as practicable.

11 Liquid Fuel Consumption

Liquid fuels are not reportable as a covered emission under a section 22A report and are therefore excluded

12 Petroleum based oils and greases

Petroleum based oils and greases (PBOGs) are likely used in some plant and equipment on the Awaba Waste Management Facility site. PBOGs are reportable under s22A when some combustion occurs as described in 2.40A of the NGER Determination. PBOGs used in internally combusting engines will typically have some level of oxidation and associated CO₂-e emissions.

The use of petroleum based oils and greases has been estimated under the incidental emissions provisions under Regulation 4.27 of the NGER Regulations and section 1.13 of the Determination.

Threshold and percentage requirements

For sources to be considered 'incidental', they must fall within the following threshold and percentage amounts (set out in sub-regulations 4.27(5), (6) and (7) of the NGER Regulations) (D04735632):

Greenhouse Gas Emissions

For a given reporting year, an individual source of a GHG emission must be less than both:

- *0.5 per cent of the total amount of GHG emitted from the operation of the facility, and*
- *3 kt of carbon dioxide equivalent emissions.*

Total GHG emissions treated as incidental for a given facility must be less than both:

- *2 per cent of the total amount of greenhouse gases emitted from the facility, and*
- *12 kt of carbon dioxide equivalent emissions*

Table 7 describes the equipment and parameters used to estimate of the use of petroleum based oils and greases in the plant based at the Awaba Waste Management Facility.

Table 7 - Estimation of petroleum based oils and greases consumption

	Description	Current Make Model	Services Per Year	Engine Oil per Service Litres	Litres	Grease used per service Litres	* Grease used per year litres
LMCC	Tractor	JOHN DEERE.3320.25283D	6	5	30	1	6
LMCC	Traxcavator	LIEBHERR.LR634	6	40	240	2.5	15
LMCC	Landfill Compactor	TANA.E520	6	40	240	2.5	15
LMCC	Traxcavator	LIEBHERR.LR634	6	40	240	2.5	15
LMCC	Diesel Powered Water Pump	SYKES.QSHH80..Pump.	6	20	120		0

** Green waste Contractor	Shredder	DOPPSTADT AK435 k	5	32	160	450g per week	25
** Green waste Contractor	Excavator	Catepillar 319 DL	5	18	90	450g per week	25
** Green waste Contractor	Loader	Catepillar 950 c	6	30	180	450g per week	25
Total					1,300		126

* grease dispensed in 450g cartridges and assumed density of grease is 1kg / litre

** Based on information from Remondis (D04689043)

Emission factor 1.08252 t - CO₂-e /kL for both oils and greases pg 16 NGA Factors 2012-13

Emission estimation 1,300 L + 126 L = 1.526 kL

1.526 kL * 1.08252 t - CO₂-e /kL = 1.67 t-CO₂-e

Consumption of petroleum based oils and greases for 2012 - 13 in the plant and equipment in Table 7 have been derived from service interval and PBOG quantity information provided by LMCC service technicians for LMCC plant and Remondis for the green waste shred and remove operations.

13 Managing Key Risks - As currently identified

13.1.1 Reporting risks

There are costs including the potential for chosen methods to overstate emissions and penalties associated with not reporting correctly. This Procedure is focused on mitigating these risks. This procedure and internal and external auditing and logging of report preparation as monitored in this document, which will track how these risks are addressed for each reporting year.

13.1.2 Future Operational considerations that affect reporting

Ability to report true green waste diversion is difficult under the 2012-13 determination and has the potential to force LMCC to overstate its emissions. This needs to be monitored with regard to operation and design decisions for Awaba (see Section 10).

Cooperation with landfill capture company LMS is critical to ensuring gas capture infrastructure is installed efficiently and in a timely manner, design and operation of the Awaba expansion will be key to this.

14 NGER reporting log

Compliance Year	Reviewed By	Signed off By	Doc References
2012-13	Sustainability Analyst – Internal NDEVR Environmental - External	Alice Howe Manager Sustainability	NGER report 2012-13 NGER Assurance Audit 2012-13

15 References

http://www.climatechange.gov.au/sites/climatechange/files/documents/04_2013/nger-technical-guidelines-2012.pdf

http://www.epa.nsw.gov.au/wr/h_wcmr.htm

16 Controlled Document Information

Authorisation Details

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Folder No:	F2009/01954/01/03	TRIM Record No:	D03603356
Audience:	Council Wide - LMCC staff from Departments that have responsibilities under the National Greenhouse and Energy Reporting Act 2007		
Department:	Sustainability		
Officer:	Sustainability Analyst - Ben Maddox		
Review Timeframe: Max < 4 years	Annually and upon the release of legislation that affects its currency	Next Scheduled Review Date:	October 2014
Authorisation:	Manager - Sustainability - Alice Howe - 18 October 2013		

Related Document Information, Standards & References

Related Legislation:	Clean Energy Act 2011 NGER Act 2007 NGER Measurement Determination 2008	Overarching legislative framework that reporting is required under
Related Policies (Council & Internal):		(Relationship/Context)
Related Procedures, Guidelines, Forms, WHS Modules/PCD's, Risk Assessments, Work Method Statements:	Waste Contribution Monthly Report and Payment - Procedure D02947976 Waste Classification and Data Entry Procedure - Awaba Waste Management Facility	(Relationship/Context)
Standards COP's & Other References	(Standard, COP or Other References)	(Relationship/Context)

Definitions

Term / Abbreviation	Definition
NGER	National Greenhouse and Energy Reporting
CER	Clean Energy Regulator
EPA	NSW Environment Protection Agency
LMCC	Lake Macquarie City Council

Version History

Version No	Date Changed	Modified By	Details and Comments
1	16/10/2013	Benjamin Maddox	

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GHD

Level 3 GHD Tower 24 Honeysuckle Drive Newcastle NSW 2300
PO Box 5403 Hunter Region Mail Centre NSW 2310
T: (02) 4979 9999 F: (02) 4979 9988 E: ntlmail@ghd.com.au

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	C. Ng / M. Welsh	M. Welsh	<i>m.welsh</i>	M Gebhard	<i>M Gebhard</i>	20/08/2014

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	<p>Procedure</p> <p>Awaba Landfill Gas Monitoring Procedure</p>	
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Procedure

Awaba Landfill Gas Monitoring Procedure

Purpose & Scope

Ensure surface/accumulated gas monitoring is undertaken at Awaba Waste Management Facility in accordance with the requirements of the NSW EPA Environmental Guidelines: Solid Waste Landfills.

(Second Edition 2016)

That the cover material and gas extraction system is controlling the emission of landfill gas.

Detect the occurrence of gas emissions in excess of prescribed limits.

Detect gas accumulation in buildings within 250 metres of the landfill.

Report any gas levels that exceed the prescribed limits. (Methane 500ppm (parts per million) for surface gas.

Report any gas levels that exceed the prescribed limits. (25% LEL (Lower Explosive Limits) or 12,500ppm of methane) for accumulated gas in buildings.

Process

Areas to be monitored.

The areas to be monitored for **surface gas emissions** include:

Any landfill areas (cells) with intermediate or final cover.

All new cells where cover material has been applied to a depth exceeding 300 cm.

The buildings to be monitored for **accumulated gas** include:

Gatehouse.

Recycle Centre.

Maintenance Sheds

Gatehouse green storage container.

Preparation prior to going into field:

Advise Thermo Fisher Scientific of gas monitoring dates for the upcoming 12 month period.

Contact Sarah Murphy 02 88174253

Gas monitor is sent by courier to LMCC Depot Store the day before monitoring

Prepare the Gas Monitor (GA 5000)) as per manufacturers specification such as:

Check gas monitor has sufficient battery power.

Check monitor against standard calibration gas (Gas monitor is supplied with current calibration certificate. This is Trimmed to F2004/08498.

Clear the stored memory if stored data is to be used.

Check wind speed and temperature;

Record information on gas monitoring sheets

If wind speed below 10km/hr proceed with monitoring.

Monitoring in Field

Place gas monitor onto measuring wheel and ensure sample inlet is approximately 5 cm from the ground in accordance with EPA Environmental Guidelines - Solid Waste Landfill. (Second Edition 2016)

Walk at steady pace whilst surface gas monitoring.

Record time, location and all 4 gas readings on Awaba Landfill Surface Gas Monitoring Data Sheet.

Monitoring in buildings.

Hold gas monitor at specified location for minimum 30 seconds.

Record time, location and all 4 gas parameters on Awaba Landfill Gas Accumulation Monitoring Data Sheet.

Once completed, the data sheets are to be scanned and saved in Trim Folder F2004/08498.

Trim link sent to Web Administrator

The results of monitoring are to be included on the Lake Macquarie City Council web page.

Complete consignment note for return of gas monitor to Thermo Scientific.

Monitor collected by courier from LMCC Depot Store

WHS Management System Information

Record Keeping Requirements

All gas monitoring data is filed Trim F2004/08498 as well as sent to Web page
 Records associated with, and generated in compliance with this document include:-

-
-
-

All records will be managed in accordance with **WHS Module 10 - Records**.

Training Requirements

Specific training required to carry out the requirements of this document includes:-

-

Training requirements will be managed in accordance with **WHS Module 12 – Training**.

Auditing Requirements

Auditing of this process will be managed in accordance with **WHS Module 11 – Auditing**.

Corrective Actions

Corrective actions are to be managed in accordance with **WHS Module 09 – Corrective Actions** whenever it is identified that the requirements of this document and its references are not being met.

Review

This document will be reviewed in accordance with **WHS Module 04 – Document Control** and whenever there is a relevant change to applicable legislation, industry standards, Codes of Practice, the WHS Management System, or the process.

Responsibilities, Authorities & Accountabilities

Responsibility, authority, and accountabilities for all positions within Council are outlined in **WHS Module 01 – WHS Responsibilities** and in the **WHS Responsibilities, Authorities and Accountabilities (RAA) Table** associated with **WHS Module 01**. The RAA table includes responsibility, authority, and accountabilities for employees, managers, supervisors, contractors, visitors, and persons with specialist roles within the organisation.

In addition to **WHS Module 01 – WHS Responsibilities**, the following positions have responsibilities, authorities and accountabilities associated with this document:

Position	Responsibilities, Authorities & Accountabilities
Rick Brindley	

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Controlled Document Information

Authorisation Details

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Department:	Waste, Environment & Rangers		
Officer:	Waste Sites & WH&S Coordinator - Rick Brindley		
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Related Document Information, Standards & References

Related Legislation:	(Legislation Name)	(Relationship/Context)
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Related Procedures, Guidelines, Forms, WHS Modules/PCD's, Risk Assessments, Work Method Statements:	(Document Name) EPA Environmental Guidelines for Solid Waste Landfills	(Relationship/Context)
Standards COP's & Other References	(Standard, COP or Other References) EPA Licence 5873	(Relationship/Context)

Definitions

Term / Abbreviation	Definition
EPA	Environmental Protection Authority
LMCC	Lake Macquarie City Council

Consultation (update for each version created)

Key Departments, Teams, Positions, Meetings:	Rick Brindley Waste Sites & WH&S Coordinator Steve Merrett Waste Site Supervisor
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Version History

Version No	Date Changed	Modified By	Details and Comments
3	6/09/2013	R Brindley	Review for currency
4	7/07/2016	R Brindley	Review for currency

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Appendix L – Air Quality and Odour Management Plan

	Procedure Awaba Waste Management Facility - Air Quality & Odour Management Plan - AWMF	
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Procedure

1 Introduction

1.1 The site

The Awaba Waste Management Facility (AWMF) is located on Wilton Road Awaba on land owned by Lake Macquarie City Council and identified as Lot 372 DP 723259, 367 Wilton Road Awaba. The landfill site occupies a south-facing gully which is surrounded by predominantly uncleared native vegetation on undulating terrain which provides a substantial buffer from nearest residential premises.

An Alternate Waste Treatment (AWT) Facility operated by a contractor is located on an adjacent site known as Lot 373 DP 723259, 413 Wilton Road Awaba. The facility receives organic waste for composting and processing. Composting activities previously carried out on the AWMF site are now located at the AWT. The AWT also receives source separated organic waste from Council's weekly domestic organic waste service which diverts organic & food waste that previously went to landfill.

A second commercial composting operation is also situated on Nomad Road less than 1.5km to the east of the AWMF.

1.2 Plan Objectives

To ensure ongoing air quality and odour management occurs in line with best practice to comply with regulatory obligations and prevent adverse impacts on amenity of neighbouring premises.

1.3 Regulatory Framework

The Programme will guide the operation of the AWMF to ensure compliance with:

- Provisions of the Protection of the Environment Operations (POEO) Act 1997
- Protection of the Environment Operations (Clean Air) Regulation 2010.
- Environmental Protection Licence (EPL) No. 5873.
- Major Project Approval number 10_0139 issued by the NSW Department of Planning and infrastructure.

1.4 Potential Air Emissions

There are several potential sources of air quality and odour emission at the AWMF that require ongoing management.

1.4.1 Dust

Potential dust sources include:

- vehicle movements along unsealed internal roads
- earthworks associated with daily landfilling activities
- wind erosion from operational areas and un-vegetated daily/intermediate landfill cover

1.4.2 Odour

The nature of landfill activities means odour generation is the primary concern in relation to potential impacts on amenity of neighbouring land. Potential sources from routine site operations include:

- waste at the active landfill tip-face

- leachate storage, treatment and irrigation

Greenwaste processing at the adjacent AWT facility also has potential to generate odours, although the activity does not fall under the control of Council and is not considered in this Management Plan.

1.4.3 Methane

Anaerobic decomposition of organic matter in landfill can generate a significant volume of gas, typically consisting of 50% methane gas.

1.4.4 Combustion By-products

Captured methane gas is burnt to fuel an electricity generation turbine or “flared” to prevent discharge of methane gas to the atmosphere.

2 Air Quality and Odour Assessment

2.1 Objective

Air Quality and odour was assessed prior to consent for expansion of the AWMF in a report prepared by Queensland Environment Pty Ltd trading as PAEHolmes, titled Air Quality and Odour Assessment – Awaba Landfill Extension 28 March 2012.

The primary objective of the study was to assess the potential air quality and odour impacts from the expanded facility through:

- a quantitative assessment of the potential air quality and odour impacts of the project, including cumulative impacts; and
- a demonstration that the ongoing operation of the facility is able to comply with the Provisions of the Protection of the Environment Operations (POEO) Act 1997 and Protection of the Environment Operations (Clean Air) Regulation 2010.

2.2 Potential Dust & Odour Receivers

The assessment indicates that the bushland buffer surrounding the AWMF provides significant protection of receivers from dust and odour impact.

Modelling estimates that odour impact assessment criteria is not exceeded beyond 250 metres from the facility and dust deposition will be minor beyond 100 metres.

2.3 Assessment Results

The Odour Assessment was carried out in accordance with the NSW Office of Environment and Heritage (OEH) “Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales” (NSW DEC, 2005).

In general terms the assessment determined that operational air quality and odour emissions are predicted to be well within acceptable criteria when current management practices are correctly applied.

2.3.1 Odour

Dispersion modelling predictions of the proposed Awaba Landfill expansion indicates that local air quality will not be compromised. The predicted odour ground level concentrations are below the most stringent air quality goals at all residential receivers.

2.3.2 Air Quality

Based on a worst case assessment of the onsite power generation plant, air pollutant levels due to the gas turbines and excess flaring of landfill gas are predicted to be well below relevant goals.

2.3.3 Dust

Predicted dust levels during site operation are expected to be low and should be largely controllable through good site environmental practice and commonly applied dust management measures.

3 Air Quality and Odour Management

3.1 Air Emission Controls

3.1.1 Dust Management Strategies

Various site practices will be employed to reduce the amount and frequency of dust emitted at the site.

3.1.1.1 Designated Routes:

All vehicles on site are restricted to maintained roads and speed limits are in place to limit airborne dust generation.

3.1.1.2 Wheel Wash

All vehicles that have collected dust or mud on wheels and undercarriage will be directed to leave the site via the wheel wash facility to prevent build-up of dust on sealed access roads and tracking out onto Wilton Road.

3.1.1.3 Concrete or bitumen sealing:

Sealing of access roads and operational areas will be undertaken where practical.

3.1.1.4 Street Sweeping:

Sweeping of sealed roads by Council broom/vacuum trucks will occur regularly. Council broom trucks are also on-call where the need for additional cleaning is identified.

3.1.1.5 Dust suppression

A water tanker with spray boom and water cannon is permanently located at the AWMF.

Unsealed roads and stockpiles should be wet down as required to suppress dust generation, particularly in windy conditions. Planed work zones may also benefit from prior wetting to reduce fugitive dust emissions from grading or excavation works.

3.1.1.6 Revegetation

Soil stockpiles or intermediate landfill cover should be managed to encourage grass cover thus reducing the likelihood of wind erosion.

3.1.2 Methane Capture

Methane capture infrastructure is in place for existing landfill cells and will be incorporated into the construction of future landfill cells.

Captured methane is currently used for electricity generation or “flared” when the generator is off-line.

The capture and management of methane at the AWMF is carried out by a contractor, currently LMS Energy.

It is anticipated that future landfill methane generation will decline due to the diversion of domestic organic waste to the AWT facility.

3.1.3 Combustion by-products

3.1.3.1 Methane combustion

Electricity generation and gas flaring plant and equipment is maintained by LMS Energy to minimise undesirable combustion by-products.

The electricity generation system is currently being upgraded to provide more efficient burn and electricity generation.

3.1.3.2 Plant and Equipment

All plant and equipment used at the AWMF will be maintained with pollution control equipment in good working order to manufacturer's specification.

Any plant or equipment observed to be producing excessive exhaust emissions will be taken off-line until necessary repairs or modifications are completed.

3.2 Odour Management

3.2.1 Tip Face

Odours from the tip face can be reduced by minimising the active area of the tip-face to that required to accommodate anticipated vehicles tipping at any one time. Typically, the tip face is of a width of approx. 20 to 30 m.

Daily cover is used to temporarily cap the active tip face when not in active use, in accordance with Section 8 of the NSW EPA Environmental Guidelines: Solid Waste Landfills 2016.

Odours from the tip face are also anticipated to reduce with the diversion of the majority of domestic putrescibles to the AWT facility.

3.2.2 Leachate

Leachate typically has a distinctive odour however well managed ponded leachate should not result on off-site impacts.

Aeration of storage ponds will prevent anaerobic conditions which can increase potential for odours from leachate.

Leachate that has been stored in anaerobic conditions should not be irrigated on site.

3.3 Adverse Meteorological Conditions

LMCC Performs a number of pre-emptive and reactive based activities to reduce the impact of dust and odours during adverse meteorological conditions and other extraordinary events.

The meteorological conditions likely to adversely impact air quality or odour nuisance include:

- Strong or gusty winds likely to pick up dust from unsealed surfaces
- Strong prevailing winds in the direction of known sensitive odour receivers
- Temperature inversions with potential to concentrate odours at ground level

Temperature inversions will most commonly occur during still winter nights at a time when the facility is not operational. Odour impacts from temperature inversions are mitigated by existing odour minimisation strategies as detailed in section 3.2 of this plan, in particular application of intermediate cover and daily cover to active tipping areas.

On-site Council staff aware of the increased potential influences of operations on sensitive receivers during adverse meteorological conditions and adjust operations accordingly in response. Further council receives automated alerts of adverse conditions affecting site through the Remondis/Council on-site weather station. Council can manually view weather data collected from the station by accessing the

'WeatherMaiton Live' application through their smart phones or by PC. The features and parameter adjustments available through the site include real-time and historical logs of the following:

- Air temperature
- Rainfall
- Wind Speed
- Peak Wind Gust
- Wind Direction
- Dew Point
- Relative Humidity
- Programming of receiver list and conditions for automated SMS/email alerts

The weather station access portal is available via the following link: <https://www.weathermation.net.au/>

Control measures intended to minimise climatic impacts are focussed on controlling or minimising likely sources of dust and odours that could reach potential off-site receivers. The measures that are implemented to address impacts from adverse weather conditions and other extraordinary events are categorised into two areas, response based and preventative activities.

3.3.1 Response Based Activities

Strategies to minimise the air quality impacts in response to predicted or existing elevated wind intensity and/or coupled with sensitive receiver direction of prevailing winds are:

- **Wetting of Unsealed Surfaces**
 - o Water carts are used on a regular basis to wet the surface and suppress dust from unsealed and trafficable surfaces on the site, as well as for ensuring vegetation establishing on the batters is kept moist. The site water cart and operator deployment is increased for dust suppression activities on a full-time basis during instances of elevated wind and dry weather
- **Efficient and Compaction of Waste**
 - o In order to reduce wind-blown litter, odour and dust, waste from domestic collection vehicles emptied onto the active tipping area is compacted as soon as it is deposited tipping face. The provision for compactor availability for this activity is an operational priority during high wind events
- **Minimisation of Plant Movements Over exposed Waste and Intermediate Cover**
 - o Vehicle and plant movements over exposed waste and intermediate cover is limited to essential only access. Plant movements over exposed waste are limited to compactor operation only.
- **Minimisation of Any Other Non-Essential Works That Will result in Exposure of Un-Capped Waste**
 - o Removal of cover from previously filled areas is not carried out during high winds or whilst wind direction is towards sensitive receivers
 - o No previously filled waste is to be exhumed in non-emergency scenarios during adverse windy meteorological conditions

- **Wind Blown Litter**

o Wind-blown litter collection crews are routinely deployed at site to remove waste items that have escaped from the active tipping face. The frequency of litter collections is increased in response to windy conditions to ensure wind-blown litter does not escape off-site to the surrounding environment, enter waterways or other any place that is a non-designated waste collection area.

3.3.2 Preventative Strategies and Related Activities

- **Alternative Spray on cover**

o Council has been given EPA approval for use of the alternative spray-on daily cover 'Posi-Shell'. Application of the Posi-Shell material binds any exposed waste together creating an effective barrier against unintentional deposition of litter, odour and dust because of higher winds. Posi-shell has the added advantage over traditional VENM being the elimination for unnecessary handling of the VENM as material entirely as daily cover. Removing the need to handle VENM stockpiles for use as daily cover reduces potential for deposition of material into wind. This also ensures reduction of odour potential resulting from unnecessary plant movements over previously filled waste.

- **Size of Active Tipping Face**

o Operations are managed to ensure the active exposed tipping areas are kept to an absolute minimum at all times. A small exposed tipping area reduces potential for dust and odour impacts during both normal and adverse meteorological conditions.

- **Increasing the amount of sealed and vegetated surfaces on-site**

o On an as required/as possible basis unsealed access roads are converted to sealed surfaces as operations permit, therefore reducing potential for dust to become airborne

o The filling plan for the existing cells comprises a series of vertically stacked lifts, limiting capping until the final lift is complete. Vegetation is continuously established by seeding on the batter slopes to reduce potential for dust and odour escape

4 Complaint Management

4.1 Complaint History

Council has a recent history of occasional odour complaints, primarily from residents in the Awaba township. Investigations by AWMF staff generally pointed to the likely source of odours being from greenwaste composting and pasteurising activities being carried out in the north-west corner of the site. Odours were typically associated with the green waste pasteurisation process including the turning of the compost mounds and loading and transportation of pasteurised compost off site.

Since the greenwaste composting activities have relocated to the adjacent AWT site and ceased on the AWMF site, Council has not received any odour complaints.

4.2 Responding to Air Quality and Odour Complaints

Complaint relating to dust and odour will be investigated and actioned in accordance with Awaba Waste Management Facility / Green Waste Processing Facility – Complaints Management Procedure.

Controlled Document Information

Authorisation Details

Folder No:	F2005/01720-01	TRIM Record No:	
Audience:	Departmental - AWMF Operations Staff		
Department:	Waste, Environment & Rangers		
Officer:	Principal Environmental Officer - Public Health - Andrew Ireland		
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Authorisation:			

Related Document Information, Standards & References

Related Legislation:	(Legislation Name) Provisions of the Protection of the Environment Operations (POEO) Act 1997 Protection of the Environment Operations (Clean Air) Regulation 2010	(Relationship/Context)
Related Policies (Council & Internal):	(Policy Name)	(Relationship/Context)
Related Procedures, Guidelines, Forms, WHS Modules/PCD's, Risk Assessments, Work Method Statements:	(Document Name) NSW EPA Environmental Guidelines: Solid Waste Landfills 2016	(Relationship/Context)
Standards COP's & Other References	(Standard, COP or Other References) Air Quality And Odour Assessment – Awaba Landfill Extension, PAEHolmes 28 March 2012 Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, DEC 2005	(Relationship/Context)

Definitions

Term / Abbreviation	Definition
AWT	Alternative Waste Treatment
AWMF	Awaba Waste Management Facility
EPL	Environmental Protection Licence
POEO	Protection of the Environment Operations

Consultation (update for each version created)

Key Departments, Teams, Positions, Meetings:	
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Appendix M – Operational Noise Management Plan


	<p>Procedure</p> <p>Awaba Waste Management Facility - Operational Noise Management Plan</p>	
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Procedure

1 Introduction

1.1 The Site

The Awaba Waste Management Facility (AWMF) is located on Wilton Road Awaba on land owned by Lake Macquarie City Council and identified as Lot 372 DP 723259, 367 Wilton Road Awaba. The landfill site occupies a south-facing gully which is surrounded by predominantly uncleared native vegetation on undulating terrain.

An Alternate Waste Treatment (AWT) Facility operated by a contractor is located on an adjacent site known as Lot 373 DP 723259, 413 Wilton Road Awaba. The facility receives organic waste for composting and processing. The AWT facility is accessed from Wilton Road via the same entrance provided for the AWMF.

1.2 Plan Objectives

The objective of the Operational Noise Management Plan (ONMP) is to ensure that noise emissions from activities associated with the operation of the AWMF do not result in adverse impacts on neighbouring sensitive receivers by:

- Identifying legislative obligations and noise targets for environmental noise control.
- Identification of significant noise generating activities and surrounding sensitive noise receivers.
- Providing guidance on appropriate measures to reduced operational noise emissions.
- Providing a framework for noise complaint investigation and response.
- Identifying responsibilities for implementation of noise control measures.

This plan forms part of the overarching AWMF Landfill Environmental Management Plan and is a requirement of the approval issued by the NSW Department of Planning and Infrastructure.

1.3 Regulatory Framework

The Operational Noise Management Plan (ONMP) is intended to guide the ongoing operation of the AWMF to ensure compliance with:

- Provisions of the Protection of the Environment Operations Act 1997 and the Protection of the Environment Operations (Noise Control) Regulation 2017.
- The Environmental Protection Licence (No. 5873) issued by the NSW EPA.
- Schedule 4 of Major Project Approval number 10_0139 issued by the NSW Department of Planning and Infrastructure (DoPI).

2 Noise Receivers

2.1 Existing Noise Receivers

The AWMF is bounded by a sizable bushland buffer however there are various commercial, industrial and residential landuses in the surrounding environment which are within the acoustic range of the facility. These receivers are described below, categorised by their relative location to the AWMF.

2.1.1 North:

To the north and northwest is the township of Awaba. The closest dwellings are approximately 800 metres from the nearest AWMF boundary. Additional noise sources potentially impacting Awaba include the passenger/freight railway line which dissects the township, Wilton Road, Awaba Road, Awaba Colliery and an associated coal haul road located halfway between the township and the AWMF.

To the northeast is the Toronto industrial precinct and the south-western fringes of Toronto residential areas.

2.1.2 East:

A primary school and manufactured home estate are located on Wangi Road to the east. A greenwaste composting facility is also located off Nomad Road on a site adjacent to the manufactured home estate and a golf club is located opposite the primary school on Wangi Road.

2.1.3 South:

Recreational facilities to the south include a shooting range occupied by the Lake Macquarie Clay Target Club, and an off-road motorsport venue occupied by the Westlakes Automobile Club Inc.

2.1.4 West:

Awaba Colliery is located to the west of the AWMF.

2.2 Sensitive Noise Receivers

Based on the nature of surrounding development, sensitive noise receivers that warrant consideration are limited to:

- Residential premises in Awaba township
- Toronto Adventist Primary School
- Leisure Life Caravan Village
- Toronto residential areas

2.3 Potential Noise Generating Activities

The noise generating activities with potential to create off-site issues are most likely to occur on the landfill cell tip face and the access haul road. This is due to the elevated topography of these sites which does not provide as much shielding of sensitive noise receivers from the natural terrain.

Table 1 sets out the sound power levels generated by relevant plant operating in the most critical zone, that is the haul road and tip face.

AWMF expansion resulted in some modification to the way waste is disposed of on site. Previously all waste delivered to the facility was deposited directly to the landfill site, however the revised operation will incorporate a waste transfer station for cars, trailers and utility vehicles which will significantly reduce the total vehicle movements via the haul road and tip face.

It should also be noted that the Alternate Waste Facility (AWF) being operated by an independent contractor will also carry out noise generating activities. This facility is adjacent to the AWMF site and is located in closer proximity to sensitive noise receivers to the east of the site. Effected noise receivers are unlikely to be able to make a distinction between noise detected from either waste facility.

3 Approval Conditions and Licencing Requirements

3.1 Environmental Protection Licence

The operations of the AWMF are subject to an Environmental Protection Licence (EPL) issued by the NSW Environment Protection Authority.

Condition L4 of the EPL sets acceptable noise limits at noise sensitive receivers, and defines the location that these noise levels must be achieved, as shown in Figure 1.

Figure 1 – EPL Noise Condition

L4 Noise limits

L4.1 Noise from the premises must not exceed:

- a) an LA10 (15 minute) noise emission criterion of 45 dB(A) (7am to 6pm) Monday to Sunday; and
- b) an LA10 (15 minute) noise emission criterion of 45 dB(A) during the evening (6pm to 10pm) Monday to Friday; and
- c) at all other times, an LA10 (15 minutes) noise emission criterion of 35 dB(A), except as expressly provided by this licence.

L4.2 Noise from the premises is to be measured at any point within six metres of the nearest effected residential residence or other noise sensitive areas in the vicinity to determine compliance with this condition.

The limits in the condition refer to specific times of day and days of the week, which align with the definition of Day, Evening, and Night time periods set out in the EPA's Noise Policy for Industry.

3.2 NSW Department of Planning and Infrastructure Approval

The DoPI noise limits set out in condition 27 are a reproduction of the requirements of the EPL. All operational noise requirements in the consent are shown in Figure 2.

Figure 2 – Noise Conditions of Consent

NOISE

Noise Limits

27. Noise from the premises shall not exceed:
 - (a) an LA10(15 minute) noise emission criterion of 45dB(A) (7am to 6pm) Monday to Sunday;
 - (b) an LA10 (15 minute) noise emission criterion of 45 dB(A) during the evening (6pm to 10pm) Monday to Friday; and
 - (c) at all other times, an LA10 (15 minutes) noise emission criterion of 35dB(A), except as expressively provided by the EPL.

Noise from the Site is to be measured at any point within six (6) metres of the nearest effected residential receiver or other noise sensitive areas in the vicinity to determine compliance with this condition.

Operational Noise Validation

28. By 21 January 2016 or at a date approved by the Director-General, the Proponent shall undertake a Noise Validation of activities at the Site. The Validation shall be performed in accordance with the *NSW Industrial Noise Policy* (EPA, 2000) or the relevant policy adopted by the EPA at the time of the Validation and submitted to both the Director-General and EPA. The Validation shall include, but not be limited to, the following information:
 - (a) identification of any noise sensitive locations ('sensitive receivers') likely to be affected by activities at the Site, such as residential properties, schools, hospitals and passive recreation areas. The location of any noise sensitive locations in relation to the Site shall be mapped;
 - (b) existing background (L_{A90}) and ambient (L_{Aeq}) noise levels determined for each sensitive receiver in accordance with the *NSW Industrial Noise Policy* (EPA, 2000) or the relevant policy adopted by the EPA at the time of the validation;
 - (c) derivation and identification of the Project specific noise levels for each sensitive receiver in accordance with the *NSW Industrial Noise Policy* (EPA, 2000) or the relevant policy adopted by the EPA at the time of the validation;

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- (d) the expected noise level and noise character (for example tonality, impulsiveness, vibration(etc) likely to be generated from noise sources during Operation. Include noise source data for each source in 1/1 or 1/3 octave band frequencies including methods or references used to determine noise source levels;
- (e) the noise levels likely to be received at the most sensitive receivers, including potential impacts for any identified significant adverse meteorological conditions, including:
- a plan showing the assumed location of each noise source for each prediction scenario;
 - a list of the number and type of noise sources used in each prediction or direct monitoring scenario to simulate all potential significant operating conditions on the Site;
 - any assumptions made in the predictions such as source heights, directivity effects, shielding from topography, buildings or barriers;
 - methods used to predict noise impacts including identification of any noise models used. Where modelling approaches other than the ENM or SoundPlan computer models are adopted, the approach should be appropriately justified and validated;
 - an assessment of appropriate weather conditions for the noise predictions, including reference to any weather data used to justify the assumed conditions;
 - the predicted noise impacts for each noise source as well as the combined noise level for each prediction scenario under any identified significant adverse weather conditions as well as calm conditions where appropriate;
 - an assessment of the need to including modification factors as detailed in Section 4 of the NSW Industrial Noise Policy (EPA 2000) or the relevant policy adopted by the EPA at the time of the Validation.
- (f) discuss the findings of the predictive modelling and direct monitoring and, where relevant noise criteria have not been met, recommend additional mitigation measures;
- (g) include details of any mitigation proposed including the attenuation that will be achieved and the revised noise impact predictions following mitigation;
- (h) after application of all feasible and reasonable mitigation measures, quantify the residual level of noise impact by identifying:
- locations (if any) where the noise level exceeds the criteria and the extent of exceedance;
 - numbers of people (or areas) affected;
 - times when criteria will be exceeded;
 - likely impact on activities (speech, sleep, relaxation, listening etc);
 - likely impact on activities (speech, sleep, relaxation, listening etc);
 - change in ambient conditions; and
 - the result of any community consultation or negotiated agreement.

Operating Conditions

29. The Proponent shall:
- (a) implement best management practice, including all reasonable and feasible noise management and mitigation measures to prevent and minimise operational, low frequency and traffic noise generated by the Project;
 - (b) minimise the noise impacts of the Project during adverse meteorological conditions when noise criteria do not apply;
 - (c) maintain the effectiveness of any noise suppression equipment on plant at all times and ensure defective plant is not used operationally until fully repaired; and
 - (d) regularly assess noise monitoring data and relocate, modify and/or stop operations to ensure compliance with the relevant conditions of this consent.

Operating Hours

30. The Proponent shall comply with the construction and operation hours detailed in Table 2 for the Site, unless otherwise agreed in writing by the Director-General.

Table 2: Construction and Operation Hours

Activity	Day	Time
Construction	Monday - Friday	7.00am – 6.00pm
	Saturday	8.00am – 1.00pm
	Sunday and Public Holidays	Nil
Operation	Monday to Friday	7.30am – 4.30pm

	Saturdays, Sundays and Public Holidays	8.00am – 4.00pm
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Noise Management Plans

31. The Proponent shall prepare and implement an Operational Noise Management Plan for the Project in consultation with the EPA and to the satisfaction of the Director-General. The Plan shall:
- be prepared and implemented by a suitably qualified and experienced person;
 - be submitted for approval by the Director-General prior to commencement of operations;
 - describe the measures that will be implemented to ensure:
 - best management practice is being employed on site;
 - traffic management noise is effectively managed; and
 - the noise impacts of the Project are minimised during any meteorological conditions when the noise criteria in this consent do not apply;
 - compliance with the relevant conditions of this consent.
 - describe the noise management system;
 - includes a noise monitoring program that:
 - is capable of evaluating the performance of the Project;
 - includes a protocol for determining exceedances of the relevant conditions of this consent and responding to complaints; and
 - adequately supports the noise management system; and
 - evaluates and reports on the effectiveness of the noise management system.

The Plan shall be documented in the Landfill Environmental Management Plan (see Condition 3 in Schedule 5).

4 Noise Impact Assessment

Operational noise of the expanded AWMF was assessed in the Environmental Assessment prepared by Cardno Pty Ltd dated 29 August 2012. The assessment concluded that the operation of the expanded facility was not significantly different from the existing facility and would not result in any net increase in noise impact on surrounding receivers.

With consideration of the topography of the AWMF site, the most critical zone of activity will be operation of the landfill cells and haul road leading up to the cells. The relative elevation of these areas provide greater opportunity for propagation of noise to distant receivers.

The introduction of a waste transfer station will mean that there will be less vehicle movements along the access road to the elevated waste disposal cells, however all heavy vehicle waste deliveries will still traverse the haul road to dump at the tip face.

Routine noise generating activities in the landfill zone include truck movements between the waste transfer station and the tip face, and heavy earth moving machinery and compaction of the active landfill cell. Predicted sound power levels from heavy machinery used at the facility are shown in Table 1. This will account for the highest level of noise generating activity during typical operation of the facility.

Due to shielding of residential premises in Awaba by a ridgeline beyond the western boundary of the AWMF site, the most effected noise receivers are predicted to be the school and manufactured home estate located 1300 metres to the east on Wangi Road.

Premises on Wangi Road are also currently shielded from by an intervening ridgeline however they are more likely to perceive noise from the operation in future years as the working platform of the landfill increases in elevation towards the final design landform.

Predicted sound power levels for heavy machinery used at the facility are shown in Table 1 and are based on operational sound power levels provided by the manufacturer or from the NSW EPA Interim Construction Noise Guideline.

Predicted Equipment Noise Levels dB(A)			
Plant Type	Model	Indicative Sound Power Level - SWL dB(A)	Predicted Noise Level at 1300m dB(A) _{max} (School & Manufactured Home Estate)
Traxcavator	Liebherr LR634	110	40
Compactor	Tana E520	110	40
Truck	Model TBC (24T GVM)*	107	37
Combined level**			44

*SWL sourced from DECC 2009

**assuming simultaneous operation of 1 compactor, 1 truck, and 1 traxcavator.

The predicted levels are derived from linear distance attenuation predictions, which do not account for various other losses including ground loss, vegetation and shielding topography that would reduce received noise levels further. Accordingly the actual maximum noise levels at nearest sensitive receivers are predicted to be significantly lower than shown in Table 1.

Additionally the predicted levels represent maximum predicted noise levels, being more stringent than the regulatory noise targets which are based on an L_{10(15 min)} statistical calculation (noise level exceeded 10% of the time).

The predicted noise levels indicate that noise targets set out in the EPL and DoPI conditions for the facility will be achieved.

5 Noise Management

5.1 Noise Control Equipment

Noise control measures in relation to plant and equipment used on site by Council or a contractor of Council will be:

- selected for use on site with consideration to acoustic performance.
- have noise control devices fitted at all times.
- be maintained in good working order.

Any equipment identified as being responsible for exceeding specified noise limits or resulting in a noise complaint must be removed from service where maintenance and repair are required to prevent elevated noise emission.

5.2 Use of Plant & Equipment

The potential noise impact of plant and machinery can be influenced by the location, manner of use, and time of day. Considerations for reducing likelihood of noise impacts include:

- Truck drivers and plant operators should be made aware of relevant noise minimisation practices including adherence to the site speed limit, minimising the use of engine brakes while descending the haul road, and observing operational time restrictions.
- Noisy activities outside typical operational practices that have potential to impact on nearby residences should only be conducted for short durations and/or incorporate additional noise

management practices such as additional muffling of equipment or installation of temporary noise barriers.

- Any significant construction works should have a project specific Construction Noise Management Plan prepared prior to commencement.

5.3 Noise Monitoring Program

5.3.1 Performance

Due to the appreciable buffer to the worst effected sensitive noise receiver it is not anticipated that regular acoustic measurements will be required to monitor performance of this management plan.

Performance should be gauged by monitoring of complaint history and feedback from community engagement undertaken in line with the Community Education Program.

Any significant upward trend in noise complaints received by Council must initiate a review of noise management measures at the Facility and update of this noise management plan as required.

5.3.2 Complaint Management

Complaints regarding alleged noise from the AWMF will be managed in line with Council's established customer service protocols and in line with Council's Customer Charter.

With regard to allegations of offensive noise being generated at the site, it will be necessary for Council to confirm whether the subject of the noise complaint is the AWMF or the independently operated AWF. The AWMF Environmental Officer will investigate the noise complaint in consultation with the Waste Site Supervisor and Group Coordinator Waste Operations to ensure the source of the alleged offensive noise is correctly identified.

Detailed procedural guidance can be found in the Awaba Waste Management Facility – Complaints Management Procedure which forms part of the Landfill Environmental Management Plan (LEMP).

5.3.3 Record Keeping and Reporting

The Environment Protection Licence (EPL) issued by the NSW EPA requires the following in relation to record keeping for pollution incidents as set out in Figure 3.

Figure 3 – EPL Condition M5

M5 Recording of pollution complaints

- | | |
|------|---|
| M5.1 | The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies. |
| M5.2 | The record must include details of the following: <ol style="list-style-type: none"> a) the date and time of the complaint; b) the method by which the complaint was made; c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect; d) the nature of the complaint; e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and f) if no action was taken by the licensee, the reasons why no action was taken. |
| M5.3 | The record of a complaint must be kept for at least 4 years after the complaint was made. |
| M5.4 | The record must be produced to any authorised officer of the EPA who asks to see them. |

Council's Customer Relationship Management (CRM) system and procedures provide compliance with the requirements of the EPL. Detailed procedural guidance can be found in the Awaba Waste Management Facility – Complaints Management Procedure which forms part of the Landfill Environmental Management Plan.

Reporting of noise pollution incidents will be carried out in accordance with the protocols set out in section 7.2 of the LEMP.

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Authorisation Details

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Department:	Waste, Environment & Rangers		
Officer:	Principal Environmental Officer - Public Health - Andrew Ireland		
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Related Document Information, Standards & References

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Related Policies (Council & Internal):	(Policy Name)	(Relationship/Context)
Related Procedures, Guidelines, Forms, WHS Modules/PCD's, Risk Assessments, Work Method Statements:	(Document Name)	(Relationship/Context)
Standards COP's & Other References	(Standard, COP or Other References) AWMF Environment Protection Licence 5873 Major Project Approval number 10_0139 issued by the NSW DoPI Environmental Guidelines: Solid Waste Landfills, NSW EPA, 2016 Noise Policy for Industry, NSW Environment Protection Authority 2017 Department of Environment and Climate Change 2009, Interim Construction Noise Guideline, Additions to Awaba Waste Management Facility Environmental Assessment, Cardno Pty Ltd 29 August 2012 Lake Macquarie City Council Awaba Waste Management Expansion Facility Construction Environment Management Plan August 2017	(Relationship/Context) EPA licence to operate the AWMF Conditions of approval for the extension of the AWMF landfilling operations

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Definitions

Term / Abbreviation	Definition
AWMF	Awaba Waste Management Facility
AWT	Alternate Waste Treatment
ONMP	Operational Noise Management Plan
LEMP	Landfill Environmental Management Plan
DoPI	NSW Department of Planning and Infrastructure
EPL	Environment Protection Licence
CRM	Customer Relationship Management

Consultation (update for each version created)

Key Departments, Teams, Positions, Meetings:	Acting Manager Waste Environment and Rangers – Derek Poulton Group Coordinator Waste Operations – David Brake
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Version History

Version No	Date Changed	Modified By	Details and Comments

Appendix N – Cultural Heritage Management Plan



INSITE HERITAGE

PTY LTD

PO Box 98

Wangi Wangi NSW 2267

admin@insiteheritage.com.au

P 0249755818

ABN 70 110 716 080

Awaba Waste Management Facility Expansion Project

Cultural Heritage Management Plan

(Project Approval 10_0139 (Consolidated))

Prepared for

Lake Macquarie City Council

May 2015



INSITE HERITAGE
PTY LTD

Acknowledgements

This CHMP has been prepared with input from the Registered Aboriginal Parties (RAPs) for the project. LMCC and Insite Heritage thank the Registered Aboriginal Parties for their participation in this project and for their valuable contribution to this Cultural Heritage Management Plan.

LMCC and Insite Heritage pay their respect to Elders – past, present and future - and pay respect to their cultural heritage, beliefs and continuing relationship with the land.

LMCC and Insite Heritage also acknowledge the role of the RAPs in the development of this document and support their custodial and legislative rights and obligations to manage Aboriginal cultural sites and landscape features and participate in Caring for Country.

Statement of Significance

The following Statement of Significance has been provided by ADTOAC on behalf of the Awabakal and Guringai Peoples

The Awaba area is part of our Traditional Awabakal and Guringai Country and is considered by our People to be of great importance within our Cultural Heritage. This area has not just a physical presence within the Cultural Heritage of the Awabakal and Guringai People, but it is part of our oral history and a place of spiritual significance. The landforms and resources of this locale fulfilled not just the basic needs that underpinned our Peoples subsistence but also satisfied the many other aspects that made up what can be described here as being part of the Cultural foundations of our People.

As already previously stated, this area is of high significance to our People and therefore it would be expected that after the many generations of our People that have walked the pathways of their Ancestors, it is obvious that there would be many areas that contain evidence of this connection, resulting from occupation on varying levels.

There are physical reminders left by our Ancestors which provide us as Descendants of the Awabakal People an opportunity to make a physical connection through time with our Ancestors. This connection is one of those avenues that produce in us the sense of perception, appreciation, familiarity and recognition of who we are and where we belong as Awabakal and Guringai Peoples, which is our birthright.

Therefore the Cultural Value and Significance remains high, which is attributed to our Cultural Heritage understanding of the connectivity and aspects of the regions holistic perspectives, thus emphasizing the importance of the whole, instead of a Scientific/Archaeological Value aspect of the independence of its site specific parts.

Statement of Significance by the Awabakal and Guringai Peoples:

Awabakal and Guringai is one of the 600 or more language groups or 'nations' that existed across Australia at the time of European contact and are part of the oldest and continuous living culture in human history. The Awabakal and Guringai presence within the Lake Macquarie Region extends from the present day back many thousands of years and is reflected in both

tangible and intangible aspects of Aboriginal culture and history. Past survey and assessment within the Lake Macquarie Region has identified Aboriginal Cultural Heritage Sites (the tangible evidence of occupation) and landscape features of cultural value embedded within a landscape that provided physical and spiritual sustenance (often intangible aspects) to the Awabakal and Guringai and those Aboriginal People they invited into their Country.

The Awabakal and Guringai people also have a continuing, contemporary history of trying to protect and preserve the Lake Macquarie Region. They maintain concerns over Development licences being approved in the region and the adverse impacts this has on their cultural values and landscape features and footprints of their ancestors which are being impacted through cumulative and overlapping development activity and unmonitored and unmanaged human recreational activity.

As indicated by the statements provided by the Awabakal and Guringai peoples within the document, the mental, physical and spiritual wellbeing of the Awabakal and Guringai People and those Aboriginal Peoples that feel a connection to this landscape is a contemporary phenomenon and not just 'a thing of the past'.

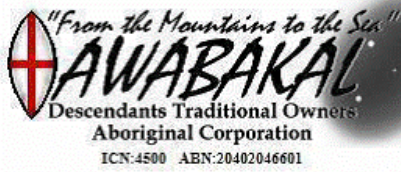
The Lake Macquarie Region contains a plethora of registered Aboriginal cultural heritage sites identified as having Aboriginal cultural value and significance. The sites and landscape features link contemporary Awabakal and Guringai People with generations of their ancestors and are extremely important teaching places and places of spiritual renewal.

Although the impact of European invasion dramatically changed Aboriginal life in Australia forever, the recent history of the Lake Macquarie Region is also characterised by the cultural resilience of Aboriginal Peoples, for both those who have retained connection to Country and those that are reconnecting to Country. Recent history is also characterised by the movement of other Aboriginal Peoples into the Country of the Awabakal and Guringai and the development of their own more recent attachments to the area. Whilst a diversity of attachment and experience is recognised, it is also recognised that the landscape, vegetation and watercourses of the Lake Macquarie Region form part of an Aboriginal cultural landscape of traditional and contemporary cultural and spiritual value to many Aboriginal People.

Aboriginal lore requires that the Aboriginal cultural landscape (which includes Aboriginal heritage sites, landscape features of cultural value, the plants, animals and water) of the lake Macquarie Region is cared for so that it will survive for future generations of our Peoples.

The custodial rights and obligations of Aboriginal people for Caring for Country underpin the principles of this document. It is highlighted, however, that the Awabakal and Guringai peoples in no way support any impact to Aboriginal sites, landscape features of Aboriginal cultural value or any aspect of the natural environment within the Lake Macquarie Region. Aboriginal people inherit the right and obligation to Care for Country, and endorsing any form of harm is assessed as culturally and ethically inappropriate.

(Awabakal Traditional Owners Aboriginal Corporation and Guringai Tribal Link Aboriginal Corporation March 2010) © 2010.



Biraban Local Aboriginal Land Council



With Input By	Awabakal Descendants Traditional Owner Aboriginal Corporation Awabakal Traditional Owner Aboriginal Corporation Biraban Local Aboriginal Land Council Cacatua Culture Consultants	
Project Coordinators	Lake Macquarie City Council Insite Heritage P/L	D Lovell Senior Development Planner Angela Besant Director Elizabeth Wyatt Snr Archaeologist
Our Reference	Awaba Waste Management Facility Expansion Project Cultural Heritage Management Plan (AWMFEP CHMP)	
Date	May 2015	
Version	Final 15.05.2015	

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Abbreviations

ACHAR Aboriginal Cultural Heritage Assessment Report
ADTOAC Awabakal Descendants Traditional Owners Aboriginal Corporation
AHIMS Aboriginal Heritage Information Management System
AWMFEP Awaba Waste Management Facility Expansion Project
AWMF Awaba Waste Management Facility
ATOAC Awabakal Traditional Owners Aboriginal Corporation
BLALC Biraban Local Aboriginal Land Council
CCC Cacatua Culture Consultants
CoC Conditions of Consent
CHMP Cultural Heritage Management Plan
CMP Construction Management Plan
DECCW Department of Environment Climate Change and Water
DII Department of Industry and Investment
DoP Department of Planning (now DP&I)
DP&I Department of Planning and Infrastructure
EP&A Act *Environmental Planning and Assessment Act 1979*
Lake Macquarie Local Government Area (LGA)
Lake Macquarie City Council (LMCC)
NPWS National Parks and Wildlife Service
OEH Office of Environment and Heritage (previously DECCW)
PAD Potential Archaeological Deposit
RAP Registered Aboriginal Party
RAPs Registered Aboriginal Parties
SoC Statement of Commitments

1.0 Introduction

1.1 Project Information

Lake Macquarie City Council has received approval (PA 10_0139 (Consolidated)) under Part 3A of the Environmental Planning and Assessment Act 1979 for the Awaba Waste Management Facility Expansion Project.

The following information for the project has been provided by Lake Macquarie City Council.

The Awaba Waste Management Facility Expansion Project (AWMFEP) involves the extension of the existing Awaba Waste Management Facility (AWMF) located off Wilton Road Awaba and includes the construction and installation of a sewer pipeline to the waste water pumping station at Rathmines. The project is located within the Lake Macquarie Local Government Area (LGA).

The landfill operates under an existing development consent and Environment Protection Licence (EPL) No 5873. LMCC advise that the existing AWMF is expected to reach capacity by 2017. The proposed development will enable the lifespan of the existing AWMF to be extended by an estimated 20 years.

The key components of the project include the following:

- Site clearing and excavation of two new areas on-site to create additional landfill space;
- Additional emplacement “piggy back” over the existing landfill;
- Expansion and integration of the onsite leachate management system;
- Installation of a package pumping station onsite and a rising main to transfer excess leachate to Hunter Water’s No. 6 Waste Water Pump Station (WWPS) at Rathmines;
- Installation of additional sediment drainage basins;
- Expansion of the landfill gas management system;
- Demolition and removal of existing buildings;
- Construction of a permanent on-site waste transfer station;
- Construction of a wheel wash facility;
- Replacement and relocation of the existing weigh bridges;
- Construction of a reuse centre with amenities;
- Site fencing and physical security;
- Seagull type intersection to Wangi Road and Wilton Road intersection;
- Acquisition and management of the Biodiversity Offset Area;
- Staged land filling plan;
- Final capping and rehabilitation plan
- Operational and construction management plans to meet all requirements of the Project Approval.

The project was subject to an approved modification which was sought for alterations to the staging plan for the landfill cells and alterations to the stormwater and leachate management infrastructure including the removal of a 6-8 mega litre leachate dam in the southwest portion of the site.

A locality plan and figures of the approved project are provided in Figures 1-4 below.

1.2 Scope & Objectives of the CHMP

Insite Heritage was commissioned by LMCC to prepare a Cultural Heritage Management Plan (CHMP) to satisfy the relevant Conditions of Consent issued by the NSW Department of Planning and Infrastructure (DoPI) and LMCC's Statement of Commitments for the project.

The intent of this CHMP is to provide guiding policies and principles for the management of Aboriginal heritage and cultural values and historic heritage, throughout the project area. The CHMP provides the framework for the protection of cultural values throughout construction and operation of the project.

The CHMP will be incorporated into the Construction Management Plan for the project.

The Aboriginal Cultural Heritage component of the CHMP has been prepared by Insite Heritage in consultation with the RAPs for the project to address the rights and obligations of the RAPs to manage their own Cultural Heritage.

1.3 Statutory Requirements

The AWMFEP has been assessed under Part 3A of the *EP&A Act*. Projects assessed and approved under Part 3A do not require subsequent approval under Part 6 of the *National Parks and Wildlife Act 1974 (NPW Act 1974)*.

All activities are still subject to Section 91 and Section 96 of the *NPW Act 1974* that requires the reporting of all new sites. Section 96 requires a Care and Control Permit be in place for the long term storage and management of any artefacts salvaged, should this be required. A Care and Control Permit requires the support of all Aboriginal stakeholders.

The Conditions of Consent and the proponents Statement of Commitments which relate to cultural heritage for the approved project are outlined in Section 1.3.1 and 1.3.2 below.

1.3.1 Conditions of Consent (Heritage Management)

Condition No. 44

The Proponent shall consult with and involve all the registered Aboriginal parties for the Project in the ongoing management of the Aboriginal cultural heritage values. Evidence of this consultation shall be collated and provided to the Director-General upon request (**refer Appendix B**).

Condition No. 45

The Proponent shall prepare and implement a Cultural Heritage Management Plan (CHMP) to the satisfaction of the Director-General. The Plan shall:

- a) be prepared in consultation with the OEH by a suitably qualified and experienced expert;
- b) be approved by the Director-General prior to the commencement of any ground disturbance or development works;
- c) be implemented in consultation with the registered Aboriginal parties;
- d) detail:

- procedures for managing the Aboriginal cultural heritage values associated with the Project (**Section 3.0 & 4.0**);
- the involvement and responsibilities of the Aboriginal stakeholders in the implementation of all cultural heritage management actions (**Section 2.3, 2.4, 3.0 & 4.0**)
- the responsibilities of all other stakeholders (**refer Section 1.3.2**);
- all mitigation and management strategies (including monitoring program, further investigations etc) (**refer Section 4.0**);
- procedures for the identification and management of previously unrecorded sites (including human remains) (**refer Section 3.3 & 3.4**);
- an appropriate keeping place agreement with local Aboriginal community representatives for any Aboriginal objects salvaged through the development process (**refer Section 3.2.1**) ;
- the Aboriginal Cultural Heritage Education Induction Program for all contractors and personnel associated with construction activities (**refer Section 3.2**); and
- compliance procedures in the unlikely event that non-compliance with the CHMP is identified (**refer Section 3.1**).

Condition No. 46

The Proponent is to provide fair and reasonable opportunities for the registered Aboriginal parties to monitor any initial ground disturbance activities associated with the Project. In the event that additional Aboriginal objects are uncovered during the monitoring program, the objects are to be recorded and managed in accordance with the requirements of Sections 85A and 89A of the National Parks and Wildlife Act 1974 (**refer Section 4.3 & 4.4**).

Condition No. 47

All Aboriginal sites impacts by the Project shall have an Aboriginal Site Impact Recording (ASIR) form completed and be submitted to the AHIMS Registrar within three (3) months of being impacted (**refer Section 4.4**).

Condition No. 48

If human remains are located in the event that surface disturbance occurs, all works shall halt in the immediate area to prevent any further impacts to the remains. The NSW Police are to be contacted immediately. No action is to be undertaken until the NSW Police provide written notification to the Proponent. If the skeletal remains are identified as Aboriginal, the Proponent shall contact the Environment Line on 131 555 and representatives of the local Aboriginal community. No works are to continue until the NSW OEH provides written notification to the Proponent (**refer Section 3.4**).

Condition No. 49

An Aboriginal Cultural Education Induction Program shall be developed for the induction of all personnel and contractors involved in the construction activities on Site. Records are to be kept of which staff / contractors were inducted and when for the duration of the Project. The program should be developed and implemented in collaboration with the registered Aboriginal parties (**refer Section 3.2**).

1.3.2 Proponents Statement of Commitments (Aboriginal & Non-Aboriginal Heritage)

SOC8 – Aboriginal Heritage

- LMCC will ensure that a Cultural Heritage Management Plan is prepared in partnership with the registered Aboriginal stakeholders and implemented for the construction phase of the

proposed works. The CHMP will demonstrate that effective community consultation with local Aboriginal communities has been undertaken during the preparation of the Plan. The CHMP will include procedures for ongoing Aboriginal consultation and involvement, management of all Aboriginal cultural heritage values associated with the project area, the responsibilities of all stakeholders, details of proposed mitigation and management strategies of all sites; including any additional investigation processes, salvage activities, monitoring, etc.; procedures for the identification and management of previously unrecorded sites (excluding human remains), and compliance procedures in the unlikely event that non-compliance with the CHMP is identified (**refer Section 2.0,3.0,4.0**).

- LMCC will ensure that further archaeological survey around the creek lines at the AWMF site and sub-surface testing of the midden site identified along the pipeline route is undertaken prior to the commencement of construction works to determine the full nature and extent of these archaeologically sensitive areas. These investigations will initially comprise a series of 1m² probes spaced evenly over the area of impact along the creek line, but may be expanded if artefact densities warrant further investigation or salvage. A monitoring and collection program will then be undertaken by the registered Aboriginal stakeholders during all proposed sub-surface excavations to allow collection of any artefacts that may be disturbed in this area (with subsequent relocation and reburial “in country” and in a location that will not be subject to any future impacts) (**refer Section 4.0**).

- LMCC will ensure that a minimum buffer of 5m around culturally modified trees to be retained will be delineated and enforced to reduce the impacts on these sites. LMCC will conduct further investigations during the detailed design phase as to whether an increase in the size of the buffer distance around culturally modified trees of the project is achievable given site constraints (**refer Section 3.5.1**).

- LMCC will provide an opportunity for the Registered Aboriginal Parties (RAPs) to monitor the initial ground disturbance works associated with all sections of the excavations (ground surface impacts) so that any potentially impacted artefacts may be collected by the RAPs (**refer Section 4.3**).

- LMCC will develop and implement an Aboriginal Cultural Heritage Induction Program for all personnel associated with the project, to make them aware of the site’s Aboriginal heritage values and artefacts that are to be conserved at the site (**refer Section 3.2**).

- LMCC will ensure that any new Aboriginal artefacts located uncovered due to the development and/or sub-surface excavation or monitoring activities will be recorded and registered with the EPA as part of the assessment process in accordance with the requirements of Section 89A of the NPW Act (**refer Section 3.3 & 4.4**).

- LMCC will ensure that work is ceased immediately in the event that any bone or stone artefacts, discrete distributions of shell or any other objects of potential cultural association are uncovered during earthmoving or other activities, in accordance with the National Parks and Wildlife Act 1974, “stop work” provisions (**Section 3.3 & 3.4**).

- LMCC will ensure that strategies for the management of Aboriginal sites will be developed in collaboration with the Registered Aboriginal Parties and documented in an Aboriginal Cultural

Heritage Management Plan, as recommended by the two Aboriginal Cultural Heritage Assessment Reports (ACHAR) (**Section 3.0 and 4.0**).

- LMCC will ensure that archaeological excavations of known or Potential Archaeological Deposit/archaeological sensitivity will be conducted (as recommended by the ACHAR) where impacts may result from construction works. The objective of any such excavations will be to confirm whether there is a likelihood of any objects being present (and therefore impacted by the works), and where this is the case to develop appropriate management strategies in collaboration with the Registered Aboriginal Parties and to formalise these in an Aboriginal Cultural Heritage Management Plan (**refer Section 4.0**).

S09 – Non- Aboriginal Heritage

- LMCC will ensure that none of the non-Aboriginal heritage items identified in the vicinity of the proposed works will be impacted by the proposed works by making the Contractors aware of the items and ensuring the Contractors avoid them (**Section 5.0**).

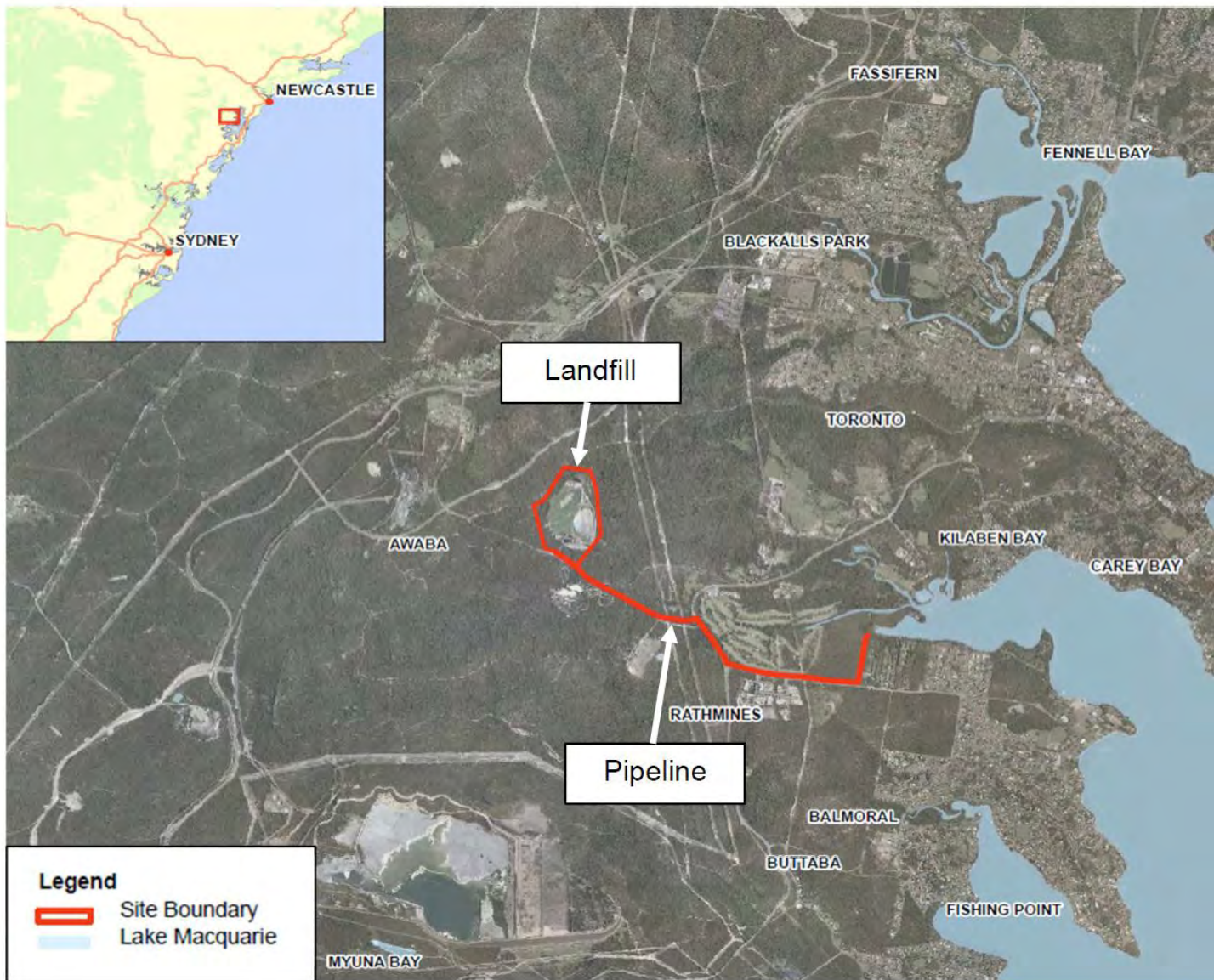


Figure 1 Locality Plan (courtesy LMCC)

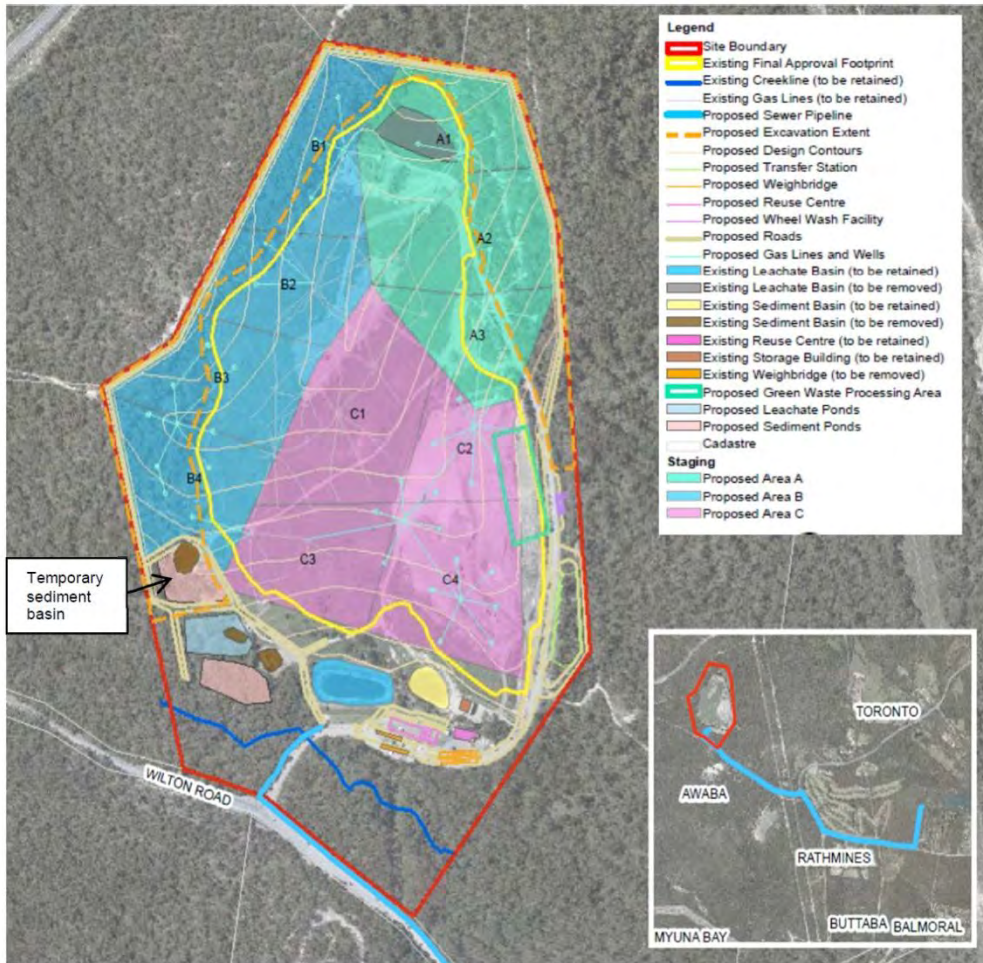


Figure 2 – Approved Landfill Layout

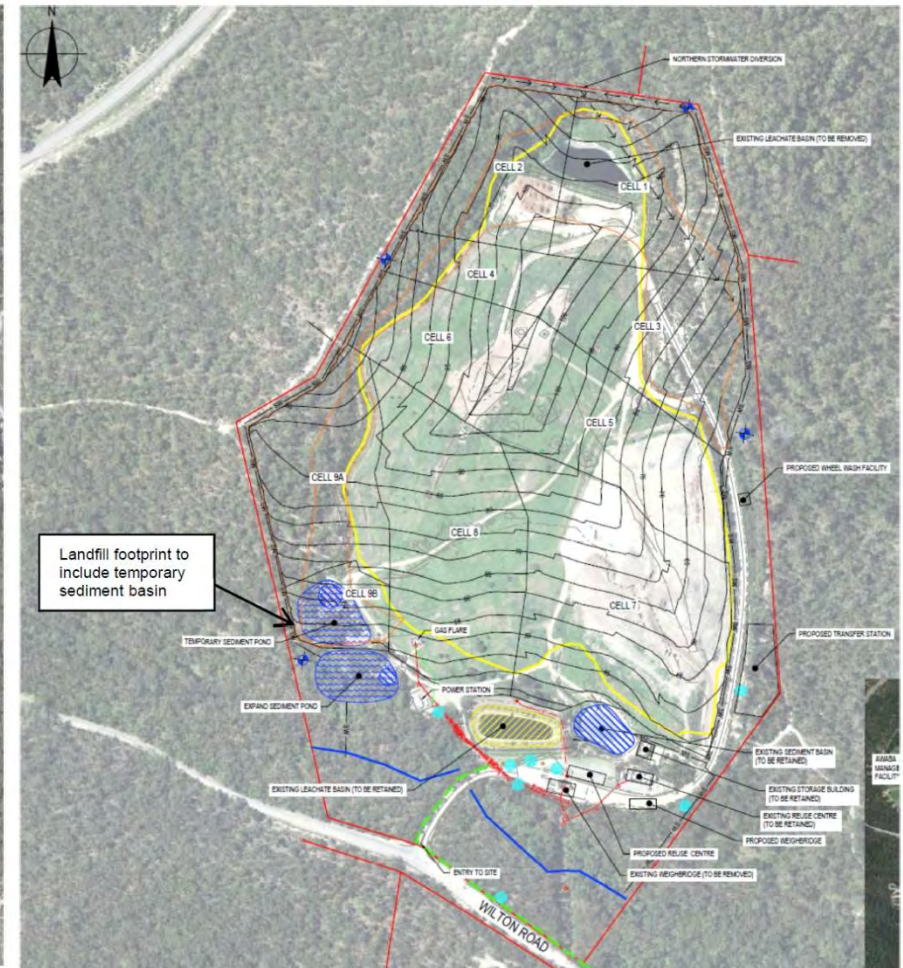


Figure 3 – Modified Landfill Layout (correction to plan only)

Figure 2 Approved & modified landfill layout (courtesy LMCC)

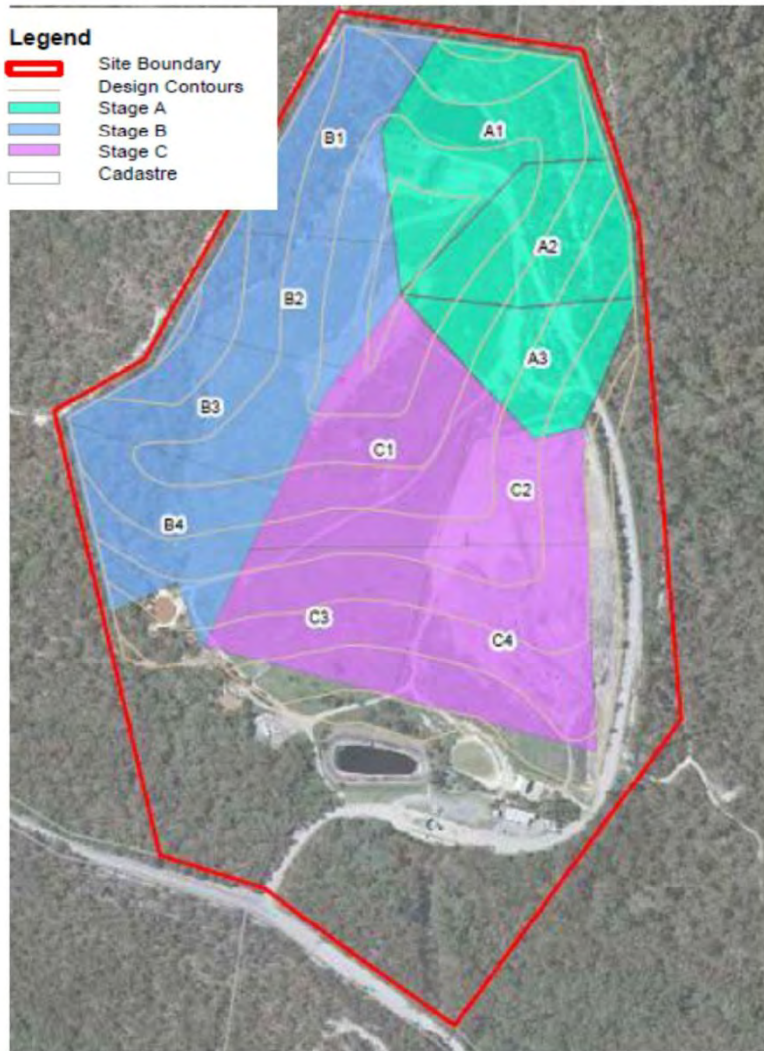


Figure 4 – Approved Staging Plan

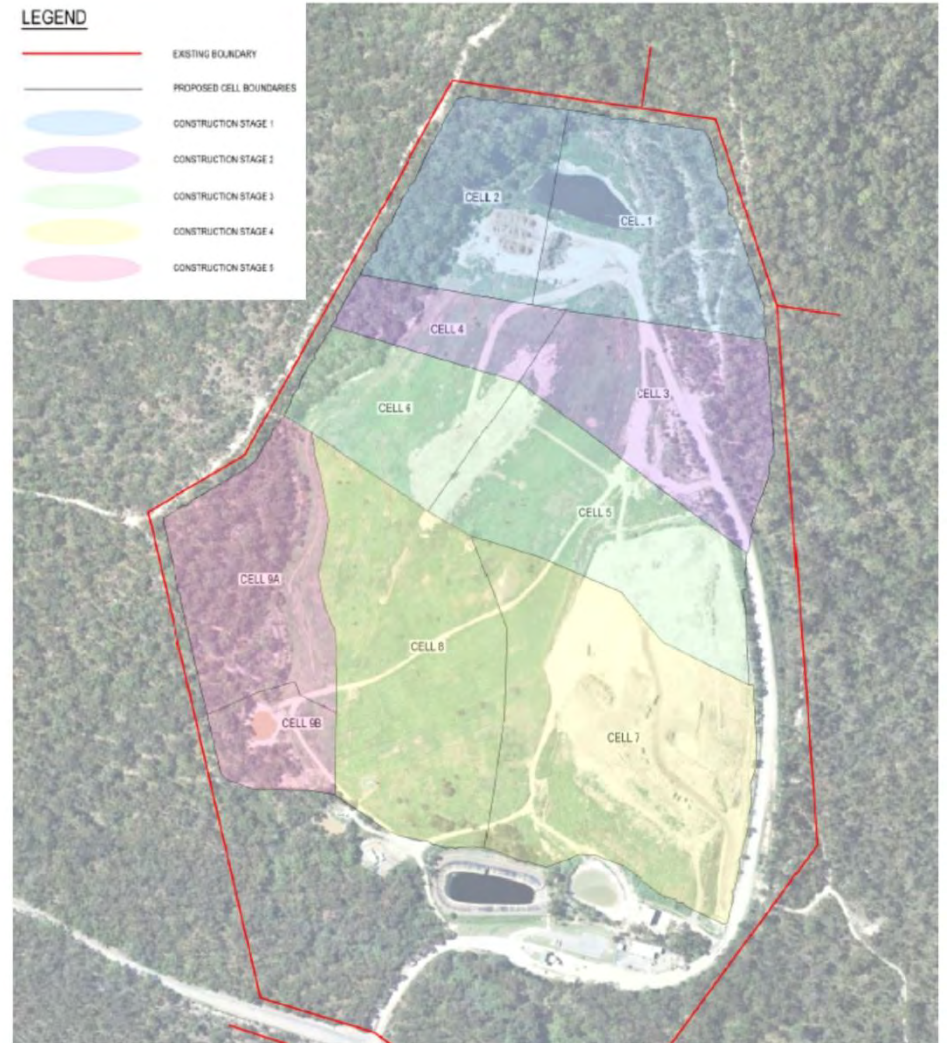


Figure 5 – Modified Staging Plan

Figure 3 Approved and modified staging plan (courtesy LMCC)

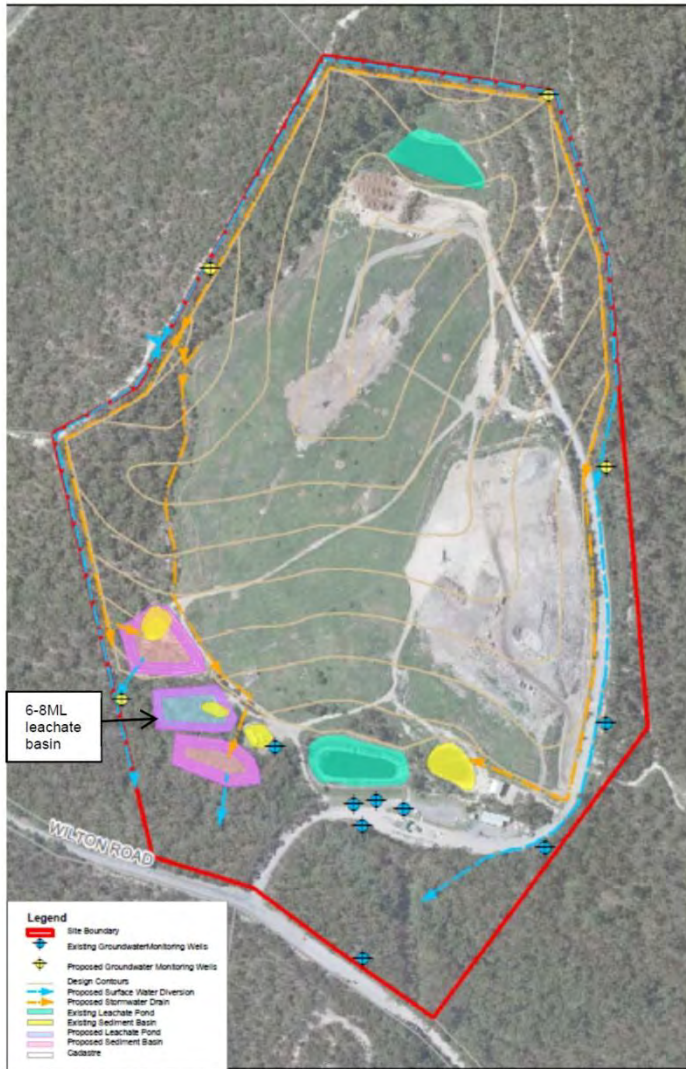


Figure 6 – Approved Stormwater and Leachate Management Infrastructure

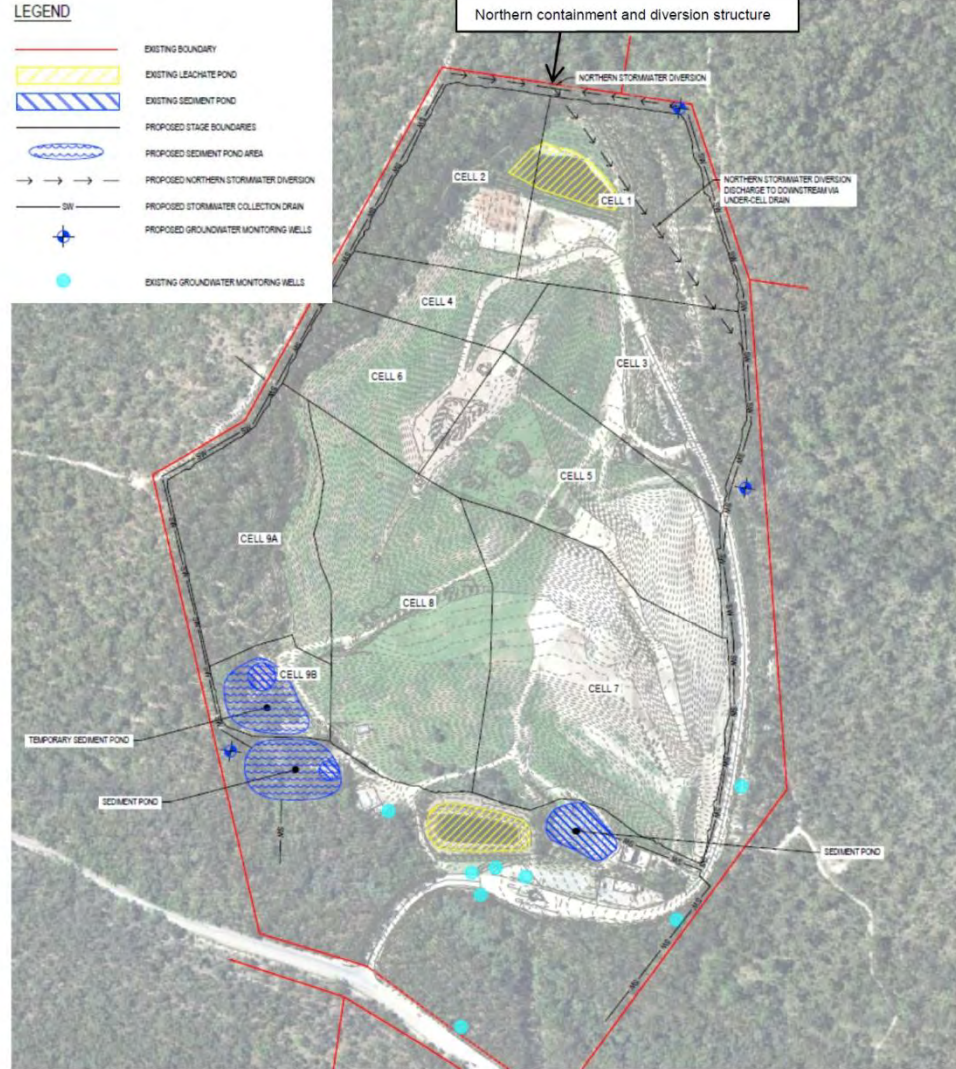


Figure 7 – Modified Stormwater and Leachate Management Infrastructure

Figure 4 Approved and modified stormwater and leachate management infrastructure (courtesy LMCC)

2.0 Aboriginal Cultural Heritage Management

Statements of cultural significance have been prepared by the Registered Aboriginal Parties participating in the preparation of this Cultural Heritage Management Plan and are included in the front of this document. The statements of Aboriginal cultural significance include rights and obligations to Care for Country. Readers of this CHMP should recognise the cultural heritage values and importance to the Awabakal People of Lake Macquarie which incorporates the AWMFEP area.

2.1 Known Aboriginal Cultural Heritage Resource

2.1.2 Known Aboriginal Archaeological Sites within the AWMFEP area

The AWMFEP area was subject to two Aboriginal cultural heritage assessments for the expansion of the waste management facility and the proposed pipeline;

Aboriginal Cultural Heritage Impact Assessment - Proposed Expansion Awaba Waste Treatment Facility, Awaba (Insite Heritage 2011).

Aboriginal Cultural Heritage Assessment, Awaba Waste Management Facility Proposed Pipeline, Awaba (Niche 2011).

These assessments identified seven Aboriginal archaeological sites within the AWMFEP development footprint.

Within the existing waste management facility expansion area the sites identified comprised of a Potential Archaeological Deposit (PAD) with artefact which was identified following test investigation works and a possible modified tree (AWTF ST1 TP7 - AHIMS No.45-7-0331) and two possible culturally modified trees. These two trees have been recorded twice on the AHIMS system; (AWTF ST 2 AHIMS No. 45-7-0325/45-7-0332) and (AWTF ST 3. AHIMS No. 45-7-0326/45-7-0333). AHIMS will be notified of the double up of the recording so that they may amend their records.

Four Aboriginal archaeological sites were identified during the assessment for the pipeline component of the AWMFEP. These comprise of a shell midden and PAD (AWMF Pipeline Midden 1 AHIMS No.45-7-0323), two locations of PAD (AWMF Pipeline PAD 1 AHIMS No. 45-7-0336 and AWMF Pipeline PAD 2 AHIMS No. 45-7-0335) and an isolated find (AWMF Pipeline Isolated Find 1 AHIMS No.45-7-0322).

An additional site, an isolated find (RPS NEWST 16 AHIMS No. 45-7-0309) is also located with the AWMFEP area. The site was recorded by RPS Australia for Centennial Coal and lodged with AHIMS following the assessment undertaken for the expansion of the AWMF. This site will be inspected with RAPs prior to commencement of construction works. An assessment of subsurface potential and the need for further testing works will be undertaken as per Section 4.0 of this CHMP. Following any required additional salvage works the site will be managed in accordance with Section 4.4 and 4.5 of this CHMP.

Table 1 below provides the details of the recorded archaeological sites within the project area, the predicted impact and management recommendations as developed during the

archaeological assessments and CHMP process. The locations of the recorded archaeological sites are outlined in Figures 5 and 6 below.

2.1.3 Known Aboriginal Archaeological Sites adjacent to the AWMFEP development footprint

There are three previously identified Aboriginal archaeological sites located in proximity to the AWMFEP which will not be impacted by the proposed project (refer to Figure 6 below for location).

AHIMS No. 45-7-0330 Awaba AWT IF1 is an isolated find identified by the Niche 2011 assessment for the project. The site is located approximately 170m from the boundary of the waste management facility expansion and will therefore not be impacted by any proposed works. The site will remain insitu and no further mitigation measures are required.

AHIMS No. 45-7-0246 Stockyard Creek - Locus B and AHIMS No.45-7-0247 Stockyard Creek - Locus A are two sites comprising of midden and midden with an artefact and are located within 100m of the northern end of the pipeline route. The RAPs have recommended that the boundary of the footprint of the pipeline area is clearly demarcated in this area during construction works so that unintentional impacts on these sites are avoided. If additional works areas are required i.e. other than the 3m impact area for the 600mm wide pipeline trench which will be excavated in the existing dirt access track, then additional investigation and salvage works may be required in accordance with the procedures outlined in Section 4.0.

Table 1 Known Aboriginal Archaeological Sites within the AWMFEP

AHIMS No.	Site Name	Site Type	AHIMS Coordinates	Predicted Impact	Management
45-7-0331	AWTF ST1 TP7	Possible culturally modified tree, PAD with artefact	Easting:364468 Northing: 6345051	Modified tree to remain insitu. A portion of the identified PAD will be impacted by the approved sediment dam.	Conservation of ST1. Protective fencing to be placed as per Section 3.5 of this CHMP. Ongoing monitoring of trees health following establishment of sediment dam. That portion of the PAD identified around TP7 to be impacted by the sediment dam to be salvaged as per Section 4.0 of this CHMP.
45-7-0325 / 45-7-0332	AWTF ST2	Possible culturally modified tree	Easting: 364449 Northing: 6345264	To be impacted by project.	Tree to be salvaged and relocated into the designated repatriation location in accordance with procedures outlined in Section 3.0
45-7-0326 / 45-7-0333	AWTF ST3	Possible culturally modified tree	Easting:364546 Northing:6345488	Located outside of AWMFEP area. Site will not be impacted by project.	Site to remain insitu. Protective fencing erected during construction works to ensure no unintentional impacts as per Section 3.5.
45-7-0323	AWMF Pipeline Midden 1	Midden and PAD	Easting: 364901 Northing: 6344577	Partial impacts to the portion of midden and PAD located within the pipeline corridor.	Test investigation and salvage works to be undertaken within portion of site to be impacted by proposed works in accordance with procedures outlined in Section 4.0.
45-7-0336	AWMF Pipeline PAD 1	PAD	Easting: 365304 Northing: 6344358	Partial impact to the portion of the PAD located within the pipeline corridor.	Test investigation and salvage works to be undertaken within portion of site to be impacted by proposed works in accordance with procedures outlined in Section 4.0.
45-7-0335	AWMF Pipeline PAD 2	PAD	Easting: 365839 Northing: 6344029	Partial impact to the portion of the PAD located within the pipeline corridor.	Test investigation and salvage works to be undertaken within portion of site to be impacted by proposed works in accordance with procedures outlined in Section 4.0.
45-7-0322	AWMF Pipeline Isolated Find 1	Isolated Artefact	Easting:366291 Northing: 6343775	Isolated artefact to be impacted by pipeline.	Site to be salvaged and reburied in repatriation location in accordance with procedures outlined in Section 4.0.
45-7-0309	RPS NEWST 16	Isolated Artefact	Easting: 364857 Northing:6345409	To be impacted by AWMFEP	Site to be ground truthed with RAPs prior to construction. Artefact to be salvaged and reburied into designated area in Biodiversity Offset Area. Further investigation works to be undertaken if required.



Figure 5 Location of identified Aboriginal archaeological sites within AWMFEP area.



2.2 Aboriginal Community Consultation

2.2.1 Registered Aboriginal Parties

The project has the following Registered Aboriginal Parties (RAPs):

Awabakal Traditional Owners Aboriginal Corporation (Ms Kerrie Brauer)
Awabakal Descendants Traditional Owners Aboriginal Corporation (Mr Peter Leven)
Biraban LALC (Ms Jessica Wegener & Mr Craig Foresheew).
Cacatua Cultural Consultants (Mr George Sampson)

The CHMP was developed in consultation with the RAPs for the project (refer to Appendix B for consultation log).

2.2.2 LMCC Commitment to RAPs

LMCC is committed to working in partnership with the Registered Aboriginal Parties in a spirit of cooperation, mutual understanding and respect and compliance with the CHMP. To this end, the following principles are identified to form the basis of ongoing engagement by LMCC with the Registered Aboriginal Parties - reflecting the principles of *Ask First – a guide to respecting Indigenous heritage places and values* (Australian Heritage Commission 2002) and the *Aboriginal cultural heritage consultation requirements for proponents* (DECCW 2010).

- Aboriginal people, as the first peoples of Australia, have unique cultural relationships to the lands and waters of Australia.
- Aboriginal people have custodial rights and responsibilities to Country under traditional lore's and customs.
- Protection and conservation of Aboriginal cultural heritage is important in maintaining the cultural identity and wellbeing of Aboriginal people.
- Aboriginal people are the primary source of information on the cultural value of their heritage and how this is best managed.
- Aboriginal people have the right to well-informed participation in the Aboriginal Cultural Heritage assessment and management process.
- Aboriginal people have the right to a primary role in decision-making in relation to Aboriginal Cultural Heritage and its management, so they can continue to fulfil their obligations towards their heritage.
- Aboriginal Cultural Heritage outcomes should consider a continuing role for Aboriginal people in 'Caring for Country'.
- Aboriginal people have the right to retain control of their cultural knowledge, including intellectual property considerations.

2.2.3 Principles of the Relationship between LMCC and RAPs

The success of this CHMP is dependent upon building and maintaining a respectful, open, culturally and project management/timeframe aware, relationship between LMCC and the RAPs for the Project Area. All participating parties will be required to commit to working together with mutual understanding and respect.

The relationships between participating parties should be based on the following principles:

- Respect for the cultural attachments, responsibilities and obligations the RAPs have for the Aboriginal Cultural Heritage sites, landscape features and the landscape in general within the AWMFEP area;
- Commitment to building an active and respectful partnership based on regular and open communication and consultation, and open dealings between LMCC and the RAPs;
- Commitment by LMCC / the principal contractor to provide the required resources to implement the CHMP, recognising that RAPs also have other obligations and time constraints and thus require time to organise their resources; and
- Commitment by the RAPs to participate in the implementation of the CHMP recognising the requirements to meet project related timeframes and to operate in accordance with statutory requirements.

2.2.4 CHMP Consultation Process

The following consultation steps were undertaken during the development of the CHMP.

- 1 All RAPs were invited to attend a CHMP inception meeting (24.02.2015).
- 2 Circulation of a draft CHMP for RAP review and comment (28 day period).
- 3 CHMP review meetings held with RAPs during review period (01.05.2015 & 13.05.2015).
- 4 Incorporation of RAPs comments into draft CHMP document and circulation for final review.
- 5 Finalisation of CHMP document.

Refer to Appendix B for additional detail.

2.3 Ongoing Consultation

Registered Aboriginal party involvement in all stages of cultural heritage assessment and management is fundamental to the process, as stated in the 'Ask First' guidelines prepared by the Australian Heritage Commission (2002:6):

In recognising the rights and interests of Indigenous peoples in their heritage, all parties concerned with identifying, conserving and managing this heritage should acknowledge, accept and act on the principles that Indigenous people:

- are the primary source of information on the value of their heritage and how this is best conserved;
- must have an active role in any Indigenous heritage planning process;
- must have input into primary decision-making in relation to Indigenous heritage so they can continue to fulfil their obligations towards this heritage; and
- must control intellectual property and other information relating specifically to their heritage, as this may be an integral aspect of its heritage value.

2.3.1 Cultural Protocols

Incorporation of Aboriginal cultural protocols into the CHMP was a key outcome of the consultation process with the Registered Aboriginal Parties. Cultural protocols can be described as a set of guidelines about the way people work together and communicate, which reflect traditional customs and lore's of the Aboriginal people involved. Adoption of

cultural protocols when working with Aboriginal people is based on recognition of and respect for Aboriginal people, their cultures and their heritage and it also aims to communicate Aboriginal cultural practices to the broader community to promote respect and understanding.

2.3.2 Periodic Review & Ongoing Consultation

This CHMP will be subject to review following completion of the initial archaeological salvage works for the pipeline. The CHMP will then be reviewed following completion of salvage / collection works for the following stages of the waste treatment facility expansion; Stage 1 (Cells 1 & 2), Stages 2 and 3 (Cells 3 - 6) and Stages 4 and 5 (Cells 7-9B). Following this, the CHMP will be reviewed on a five yearly basis thereafter or prior if required. A newsletter or project updates may also be provided by LMCC on an annual basis to keep RAPs updated on the AWMFEP. Ongoing consultation with RAPs will also be undertaken through the procedures outlined in Section 3.0 if triggered.

2.4 Ongoing RAP Engagement

LMCC or their principal contractor will provide clear Terms of Engagement for the ongoing participation of RAPs in ongoing work undertaken for the AWMFEP.

The principal contractor or LMCC will provide adequate notice i.e. a minimum of two weeks notice where possible, for undertaking works required under this management plan in order to enable RAPs to organise their staffing allocation.

LMCC / the principal contractor are committed to providing the following workplace conditions:

- Safe, injury free and fatality free workplace that enhances the wellbeing of employees, contractors and communities;
- Fair treatment and equality;
- Commitment to addressing any form of workplace discrimination, bullying, harassment or physical assault.

2.5 Confidentiality & Intellectual Property

The RAPs and LMCC agree to protect each Party's Confidential Information from unauthorised disclosure, use, dissemination, or publication.

The following information is confidential:

- Any information that is provided by a party to another party that is not available on the public record and that is identified as being 'confidential' or/for 'non-disclosure'; and
- Any material identified as sacred knowledge;

Other than in accordance with the written agreement of LMCC and the RAPs, no Confidential Information will be provided to any persons for any purpose other than:

- To enable the carrying out of the activities of the AWMFEP and CHMP works;
- As required by law; or
- As agreed in writing by all parties.

In the event that LMCC and the RAPs co-develop any materials, then such materials shall be jointly owned and each party shall be able to use such materials while referencing the other. The exclusion to this will be any information developed in relation to culturally sensitive material which may be identified by a RAP for 'non-disclosure' and the party retain copyright.

All cultural intellectual property rights are protected under law.

3.0 Aboriginal Cultural Heritage Management Procedures

The CHMP is the tool for the management of cultural heritage during the construction and operation of AWMFEP.

The construction of the AWMFEP will be required to comply with environmental protection procedures instigated by conditions of approval and State standards and requirements. The following principles can be integrated into broader environmental management systems for the site.

3.1 Incident and Complaint Management

All incidents impacting or potentially impacting on the Aboriginal cultural heritage values of the AWMFEP will be reported to the AWMFEP construction project manager or site supervisor. An internal incident report shall be prepared. The RAPs shall be informed of the incident and the actions taken where required.

Incidents will be reported to the Office of Environment and Heritage as per legislative requirements, for example, if a site is impacted outside of the approved AWMFEP boundary.

3.2 Site Inductions

The induction of site workers, sub-contractors and visitors shall include a brief of the Aboriginal cultural heritage values of the AWMFEP development footprint and a procedure for identifying previously unknown objects.

This must include the Cultural Heritage Awareness Induction PowerPoint presentation which has already been compiled by LMCC on behalf of Remondis for the Awaba Alternative Waste Treatment Facility. This presentation should be incorporated into the induction programme for the AWMFEP (including the sewer pipeline component) and accompanied with a hard copy print out of the presentation to give to inductees.

Records and sign off sheets for Cultural Heritage Awareness Inductions will be kept by the project manager / site supervisor and made available on request.

3.3 Discovery of Previously Unknown Objects

The following procedure should be adopted when a previously **unidentified Aboriginal object** is located or suspected. This is applicable to suspected Aboriginal stone objects, bone or discrete distributions of shell or any other objects of potential cultural association which may be uncovered during construction works for the AWMFEP.

- Work will immediately cease in the area and the find reported to the project manager / site supervisor. In consultation with the RAPs the potential significance of the object will be assessed, or extra input from an archaeologist requested.
- The methodology for the management of the object or site will be consistent with the principles of this CHMP i.e. position recorded by GPS, an assessment of subsurface potential and requirement for further salvage works undertaken.

- Where the site can remain in-situ the site will be recorded and an AHIMS site card submitted. The site will be fenced if it is located within 20m of a construction area, or otherwise managed in a manner commensurate with other sites in the locality.

3.4 Discovery of Potential Human Remains

The following procedure is to be followed if **possible human remains** are uncovered in accordance with the *Policy Directive – Exhumation of Human Remains* (NSW Department of Health 2008), *Skeletal Remains – Guidelines for the Management of Human Skeletal Remains under the Heritage Act 1977* (NSW Heritage Office 1998) and the *Aboriginal Cultural Heritage Standards and Guidelines Kit* (NPWS 1997):

- In the event that any potential human skeletal remains are uncovered during works, all work in the immediate area of the remains will halt immediately. The incident will be immediately reported to site supervisor, the NSW Police and RAPs.
- No action is to be undertaken until the NSW Police provide written notification to the Proponent. If the skeletal remains are identified as Aboriginal, the Proponent shall contact the Environment Line on 131 555 and representatives of the local Aboriginal community. No works are to continue until the NSW OEH provides written notification to the proponent.

Human skeletal remains can be subject to three different acts: Coroner's Act 1980, the National Parks & Wildlife Act 1974 and the Heritage Act 1977. The appropriate Act and therefore management of the site will be determined by the NSW Police and OEH.

- a physical or forensic anthropologist should inspect the remains *in situ*, and make a determination of ancestry (Aboriginal or non-Aboriginal) and antiquity (pre-contact, historic or forensic);
- if the remains are identified as forensic the area is deemed as crime scene; or
- if the remains are identified as Aboriginal, the site is to be secured and the OEH and all registered Aboriginal parties are to be notified in writing; or
- if the remains are non-Aboriginal (historical) remains, the site is to be secured and the Heritage Branch is to be contacted.

The above process functions only to appropriately identify the remains and secure the site. From this time, the management of the remains is to be determined through liaison with the appropriate stakeholders (New South Wales Police Force, forensic anthropologist, OEH, Heritage Branch, and registered Aboriginal parties etc.) and in accordance with the *Public Health Act 1991*.

Any skeletal remains uncovered during the course of ground disturbing activities will be removed in a sensitive and dignified manner. Approval from NSW Health, under the *Public Health Act 1991*, will be required prior to removing/exhuming any skeletal remains. Controlled excavation and removal by the site archaeologists and other appropriate specialists (forensic anthropologist, registered Aboriginal parties, New South Wales Police Force, as appropriate) will be undertaken in accordance with Heritage Branch Skeletal Remains Guidelines and any requirements of the OEH and NSW Health.

A site specific management policy for the removal of any potential human skeletal remains uncovered during archaeological investigation will be developed, in consultation with a physical anthropologist, the Heritage Branch, OEH and relevant stakeholder groups, if any

skeletal remains are identified. The management policy would consider the issues detailed in the Heritage Branch Skeletal Remains Guidelines. These issues include but are not limited to:

- Excavation issues - including personnel who may need to be required, Occupational Health and Safety and recording.
- Access issues - including limited access, security and public and professional participation.
- Management issues – including management during excavation and analysis, publicity, interpretation, location of interim resting place (in consultation with relevant stakeholders), ongoing curation of recovered materials and professional access to data Re-interment and commemoration

The procedure undertaken will be documented in an incident report. The report will be made available to OEH / NSW Police on request.

3.5 Protection of Sites

3.5.1 Protective Fencing – Culturally Modified Trees

As per the Statement of Commitments for the project LMCC will ensure that a minimum buffer of 5m around culturally modified trees to be retained (45-7-0331 & 45-7-0333) will be delineated and enforced to reduce impact on these sites. LMCC will conduct further investigations during the detailed design phase as to whether an increase in the size of the buffer distance around culturally modified trees of the project is achievable given site constraints.

Temporary fencing will comprise of star pickets with yellow top caps and orange plastic high visibility mesh.

Ongoing monitoring of ST1 (45-7-0331) should also be undertaken and will involve periodic inspection by an arborist to assess the health of the tree and impacts of the sediment dam. Should impacts to ST1 be identified appropriate management strategies for the tree will be developed with the project RAPs.

Where specific cultural sites have been fenced the fencing will carry signage stating:

“Protection Zone – Do Not Enter”

Contact - (*project manager / site supervisor details*)”

3.5.2 Protective Fencing – Known Sites in Proximity to Works Area

In order to avoid unintentional impacts sites (or the portion of) which lie outside of the AWMFEP area, the boundary of the construction area will be fenced / clearly demarcated, including any access routes, laydown areas and compounds. This will ensure that contractors confine their impacts to the approved project areas and ensure protection of those sites such as 45-7-0246 and 45-7-0247 which lie outside of the project boundary.

Temporary fencing will comprise of star pickets with yellow top caps and orange plastic high visibility mesh.

Along the pipeline route there are three recorded Aboriginal archaeological sites which will be partially impacted by the project (45-7-0323, 45-7-0336 and 45-7-0335). The portion of these sites located outside of the pipeline impact area and which have not been subject to archaeological salvage works will be clearly demarcated by the RAPs and archaeologist during construction works and carry appropriate signage stating:

“Protection Zone – Do Not Enter”

Contact - *(project manager / site supervisor details)*”

3.6 Topsoil

No topsoil is to be removed off site. The soil will be re-used on site for capping and rehabilitation purposes. Excess spoil from the pipeline works to be reused in the AWMF if unable to be reused on the pipeline component.

3.7 Repatriation Location for Salvaged Sites

3.7.1 Repatriation Location for Salvaged Artefacts & 45-7-0332 (Culturally Modified Tree)

The salvaged culturally modified tree (45-7-0332) will be stored vertically supported on a concrete slab with drainage and top cover/small roof surrounded by wire mesh fence. A small commemorative plaque to be included on the base slab for educational purposes.

Artefacts or any cultural material recovered from the salvage works undertaken for the AWMFEP will be reburied around the base of the slab for 45-7-0332.

The repatriation location for salvaged sites will be determined by the RAPs and LMCC in consultation with the archaeologist prior to the commencement of archaeological salvage works. This will require an inspection of potential reburial locations / culturally modified tree relocation areas within the repatriation location to confirm suitability for reburial and placement. The repatriation location will be included on all Aboriginal Site Recording forms submitted for relocated / reburied sites (refer Section 4.4 below).

LMCC will ensure, in consultation with the RAPs that the repatriation location will be cleared of any identified rubbish (e.g. car bodies, illegal dumping) prior to reburial/placement. LMCC in partnership with the RAPs will ensure that the designated location will be made secure from public access either by appropriate secure fencing or by placement of sandstone blocks/boulders over reburial locations to ensure that these are not impacted by the public.

Ongoing monitoring of any repatriation location site protection measures will be undertaken by LMCC on an annual basis to ensure that any necessary repairs to fencing work is undertaken in a timely manner. The repatriation location and effectiveness of any site protection measures will also be included in the CHMP periodic reviews.

Prior to the deposition of objects within the repatriation location, LMCC will develop a protocol with the RAPs regarding the management and monitoring measures associated with the proposed repatriation location. The protocol will address, in the minimum, the

physical process of depositing items in the repatriation location, the likely location of reburial / relocation and the annual monitoring measures to be undertaken. LMCC have a preference for repatriation locations to be in proximity to one another for ease of ongoing management.

3.7.2 Future Works in the BOA

Any required rehabilitation works such as planting or weed clearing that LMCC are required to undertake in the BOA to satisfy their project approval is to be subject to archaeological investigation with RAPs prior to the commencement of any surface disturbance works. The investigation will identify if any of the required works are likely to impact on any Aboriginal archaeological sites.

Should impacts be identified then in consultation with the RAPs for the project the identified sites will be managed in accordance with Section 3.3 and Section 4.0 of this CHMP.

Should any revegetation / land management works be required in the BOA, BLALC would like to be given the opportunity to tender for any required works.

3.8 Construction works located outside of AWMFEP Area

If additional compound / laydown areas are required that have not been previously subject to archaeological investigation works then the areas will be subject to an archaeological investigation with RAPs prior to the commencement of any surface disturbance works. The investigation will identify if any of the required works are likely to impact on any Aboriginal archaeological sites.

Should impacts be identified then in consultation with the RAPs for the project, the identified sites will be managed in accordance with Section 3.3 and Section 4.0 of this CHMP.

For the AWMFEP pipeline, the area assessed comprised of the 3m wide construction corridor along the existing cleared road reserve and existing track way. If additional laydown / compound areas are required then the process outlined above will be triggered.

4.0 Aboriginal Archaeological Salvage Program

4.1 Salvage of Isolated Finds 45-7-0309 & 45-7-0322

Prior to commencement of construction works a surface walkover of the locations of the isolated finds will be undertaken with the RAPs and an archaeologist. The artefact and any additional identified objects will be flagged, their locations recorded with a GPS and site condition recorded. The artefacts will be recorded in the field prior to reburial in the designated repatriation location.

If 45-7-0309 is required to be salvaged the site will also be assessed for subsurface potential and subject to further archaeological test investigation/salvage works if warranted.

4.2 Salvage of Culturally Modified Tree (45-7-0332)

As identified in the 2011 assessment the culturally modified tree 45-7-0332 is not a living tree. Prior to commencement of construction work the tree will be cut down by a suitably qualified arborist. The trunk containing the scar of the tree will be wrapped in protective cover before transportation to the previously identified and prepared location within the repatriation location (Section 3.7.1). The RAPs will be invited to attend the relocation process in order to undertake any appropriate ceremonies that they would like to conduct for the tree removal and relocation and to have input into how process is undertaken. Appropriate notice of the tree removal works should be provided.

4.2 Excavation methodology identified areas of PAD and Midden

The methodology involves the following:

- Surface walk over by RAPs and archaeologist to collect and record any identified material located on the surface.
- Establishment of transects within area of project impact for test probes. Test probes to be extended over the sample area at appropriate spacing's being no more than 15m between initial probe locations.
- Excavation of test probes in 50cm x 50cm units by to identify areas of artefact / midden distribution.
- Excavate first test probe in 50mm spits to identify stratigraphy. Subsequent probes to be excavated stratigraphically.
- Spoil to be processed in 5mm aperture sieves in the testing phase. 3mm aperture sieves to be used for testing midden sites.
- Salvage excavation to be carried out where test investigations confirms artefact bearing deposits.
- Spoil will be sieved in 3mm aperture sieves at the probe expansion stage. Probes extended until boundary of deposit within impact area identified.
- Evidence or otherwise of bioturbation and taphonomic processes to be recorded in detail.

4.3 RAP Opportunities for Monitoring / Collection

Following completion of archaeological salvage works within the AWMFEP area, additional monitoring / collection opportunities will be provided by undertaking grader scrapes at targeted locations along the pipeline route. Targeted locations will be decided by the RAPs and will focus on the identified areas of PAD/Midden previously salvaged and sample locations along the pipeline route.

Scrapes will be undertaken in 100mm passes until the B Horizon (clay) is reached. Isolated finds and small disturbed scatters to be recorded, collected and their location recorded by GPS. Lenses of objects (i.e > 5 per sqm) to be excavated in sq m units. Caches, hearths or special features to be excavated at finer details in consultation with the RAPs and OEH (if required).

Following completion of trenching and backfilling works for the pipeline, the RAPs have requested the opportunity to walk the pipeline route to undertake a final collection of any objects that may be visible.

Artefacts collected during the grader scrapes / collection works will be analysed in the field before reburial in the designated location in the BOA.

A protocol will be developed with LMCC and RAPs regarding monitoring and collection for the waste management facility expansion component of the project. This will be refined once the methodology for vegetation clearing for each stage is developed. This will involve a walk over after vegetation clearing for each stage, prior to mulching to allow for collection opportunities as per Condition 46 of the CoC.

Engagement of RAPs for collection works to be undertaken in accordance with Section 2.4.

4.4 Management of Aboriginal Objects

Recording of objects retrieved by excavation / collection will be undertaken in the field. Artefacts will be bagged and identified by probe / excavation unit, spit, project name, date and excavator.

Artefacts may then be removed to the agreed temporary storage locations for secure storage and detailed recording if there are too many artefacts to record in the field. If required, selected artefacts may be forwarded to a specialist for detailed analysis.

Artefacts to be reburied in the designated repatriation location following any required analysis works as outlined in Section 3.7 or placed in temporary storage until the repatriation location is prepared. Temporary storage may be the locked offices of the consultant archaeologist or the locked offices of a RAP or an alternative location, such as LMCC offices, as agreed to by the majority of RAPs.

As per the conditions of consent for the project all sites subject to archaeological salvage works will have Aboriginal Site Impact Recording Forms (ASIRF) submitted to OEH within three months of impacts being undertaken at the site.

Sites reburied in the repatriation location will have new Aboriginal Site Recording Forms completed and submitted to OEH detailing the GPS coordinates of their new location and any other relevant information.

4.5 Salvage Reporting

A report detailing the methodology and results of the salvage of Aboriginal archaeological sites on the AWMFEP shall be produced.

Artefacts will be recorded in accordance with the AHIMS Feature Recording Form and Feature Recording Table – Artefact.

Midden material will be recorded in accordance with the OEH Code of Practice Requirement 24. The analysis will include the record of the full range of shells to species level, the rank and order of abundance by numbers and weight. Sections will be drawn and photographed as will any features such as pits or hearths.

The report will be finalised within twelve months of completion of the archaeological salvage works and submitted to OEH AHIMS, and the RAPs for the project.

5.0 Historic Cultural Heritage Management

There are no identified items of historic heritage significance within the project area.

5.1 Discovery of a Previously Unknown Object.

Section 146 of the *Heritage Act, 1977* requires that the discovery of a previously unknown relic be reported to the Heritage Council within a reasonable time of its discovery.

If any items of potential heritage value are identified during construction works an assessment of potential significance of the item will be undertaken by an archaeologist and the Heritage Branch notified of the discovery as required.

5.2 Discovery of Potential Human Remains

The procedure outlined in Section 3.4 above is to be followed if possible human remains are uncovered during the course of project works:

In the event that any potential human skeletal remains are uncovered Work will not proceed in the immediate area until clearance is provided by the relevant authority.

6.0 References

Insite Heritage Pty Ltd 2011 *Aboriginal Cultural Heritage Impact Assessment - Proposed Expansion Awaba Waste Treatment Facility, Awaba*. Unpublished report to Cardno Pty Ltd on behalf of Lake Macquarie City Council.

Niche Environment & Archaeology 2011 *Aboriginal Cultural Heritage Assessment, Awaba Waste Management Facility Proposed Pipeline, Awaba*. Unpublished report to Cardno Pty Ltd for Lake Macquarie City Council.

OEH 2010 *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*.

Appendix A RAP Responses

From: [jessica](#)
To: ["Liz Wyatt"](#)
Cc: craig@birabanLALC.com.au
Subject: RE: Awaba Waste Management Facility Expansion Project
Date: Thursday, 14 May 2015 1:44:03 PM
Attachments: [image003.png](#)
[image001.png](#)

Hi Liz,

Thank you for our consideration in the consultation process and taking the time to come and see Biraban as we are unable to make comment on the 15/05/15,

Please see below regarding the discussion with yourself yesterday the 13/05/15.

Biraban LALC accept the changes to the document Awaba Waste Management Facility Expansion (AWMFEP) Project with the following changes to be considered:

- That the use of the word 'Keeping place' be removed, due to the meaning being of significance to a registered area that makes allowances for any type of relic, artefacts, or repatriations to continue to be repatriated in this area, I suggest that the place be called the 'Repatriation of Artefacts location'.
- Biraban LALC accept the high standard of protection for the scare tree, but due to the tree already starting decomposition and considering the fact that the tree will not be in an area that will allow for education I would suggest that the tree be allowed to naturally continue its decomposition process. If however the scare tree is placed in an area that allows for education than Biraban LALC would be fully supportive to the high standard that has been reflected in the draft document AWMFEP.

Please continue to keep Biraban Local Aboriginal Land Council up to date with any further changes

Kind Regards,

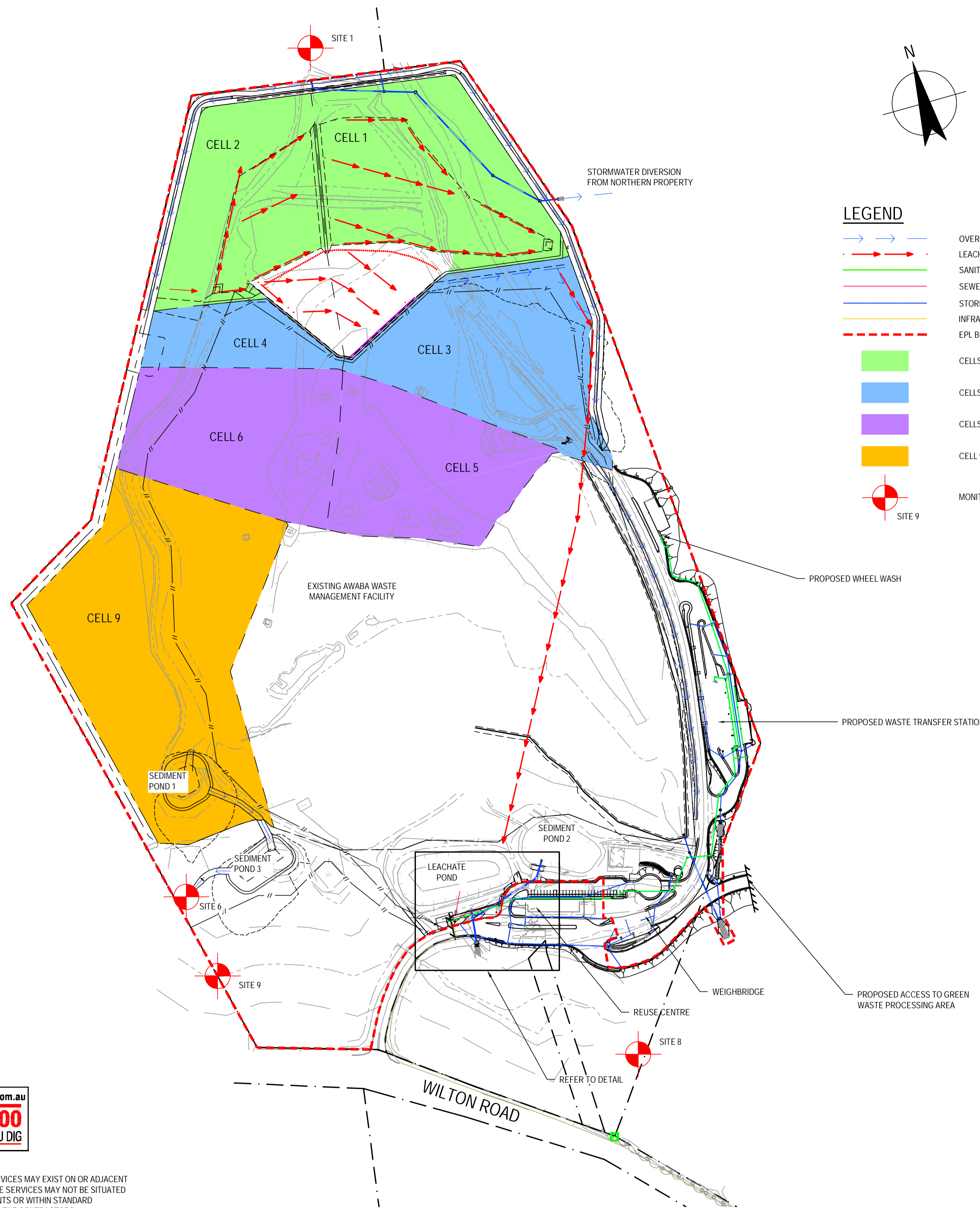
Jessica Wegener

Projects Manager
Biraban Local Aboriginal Land Council
p: (02) 4959-1829 f: (02) 4959-3574
m: 04 0036 1764
68/A Middlepoint Rd – Bolton Point NSW 2283
P.O. Box 212 Toronto NSW 2283

Appendix B CHMP Consultation Log

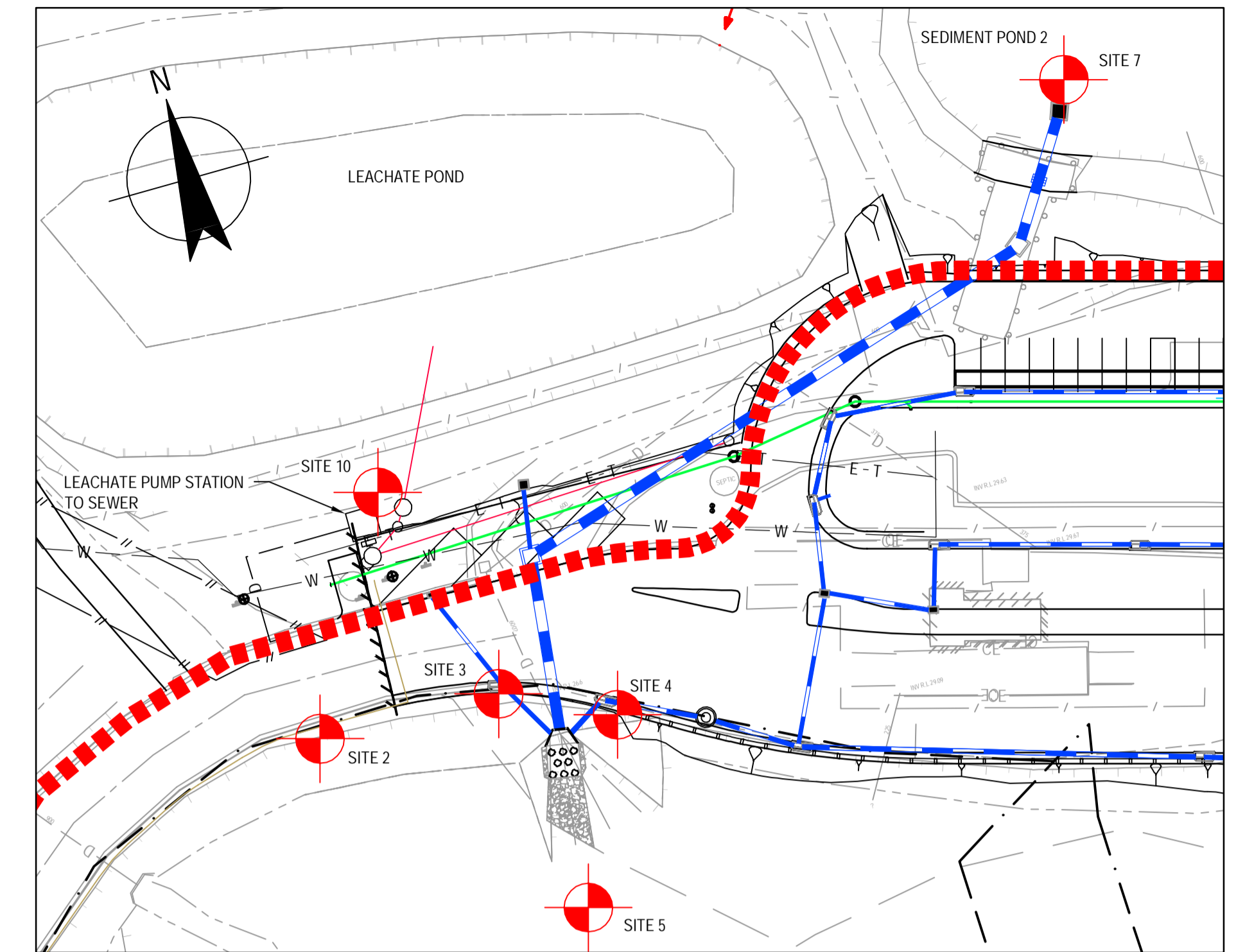
Date	Action	Details	Recipients / Attendees
10.2.2015	Invitation to attend CHMP inception meeting	Invitation to attend inception meeting emailed to all RAPs from Insite Heritage	BLALC ADTOAC ATOAC CCC
19.2.2015	Provision of background information to RAPs prior to inception meeting.	Background information including previous assessments and SoC, CoC emailed to RAPs from Insite Heritage	BLALC ADTOAC ATOAC CCC
24.02.2015	Inception meeting held with RAPs	Review of project with RAPs, discussion about CHMP process and commencement of discussion regarding content of CHMP	Apologies received from CCC Meeting attended by BLALC - Jessica Wegener, ATOAC - Kerrie Brauer, ADTOAC- Peter Leven & Insite Heritage - Liz Wyatt
13.04.2015	Circulation of draft CHMP for 28 day review and comment period.	Draft CHMP emailed to all RAPs in PDF format. Close of review period 13.01.15. Invitation to attend CHMP draft review meeting 01.05.15.	BLALC, ADTOAC, ATOAC, CCC
01.05.2015	Draft CHMP review meeting held with RAPs	Review of draft CHMP on a page by page basis by all meeting attendees. RAPs provided amendments / recommendations which were directly entered into the document.	Apologies received from BLALC. Meeting attended by CCC - Donna Sampson, ADTOAC - Peter Leven & ATOAC - Kerrie Brauer & Insite Heritage - Liz Wyatt
05.05.15	Provision of additional information for inclusion into CHMP by ADTOAC	ADTOAC provided information regarding legislative requirements and 'stop work' provisions for inclusion into Section 3.4 of the CHMP	Insite Heritage
12.05.2015	Amended draft with recommendations following review meeting emailed to RAPs	Draft with amendments resulting from 1.5.15 review meeting emailed to all RAPs for approval. Amendments marked in red.	BLALC ADTOAC ATOAC CCC
13.05.2015	Draft CHMP Review meeting held with BLALC as BLAC unable to attend meeting on 1.5.15	Review of draft CHMP document and amendments/recommendations which were developed at the review meeting 1.5.15.	BLALC - Jessica Wegener & Insite Heritage - Liz Wyatt
14.05.2015	Response received from BLALC	Response to draft CHMP received from BLALC via email	Insite Heritage

Appendix O – Drawing 22-16920-C1601 EPL
Requirements: Site Detail Plan



LEGEND

- OVERLAND STORMWATER
- LEACHATE
- SANITARY DRAINAGE
- SEWER GRAVITY MAIN
- STORMWATER UNDERGROUND
- INFRASTRUCTURE
- EPL BOUNDARY
- CELLS 1 AND 2
- CELLS 3 AND 4
- CELLS 5 AND 6
- CELL 9
- MONITORING POINT
- SITE 9



DETAIL
SCALE 1:500

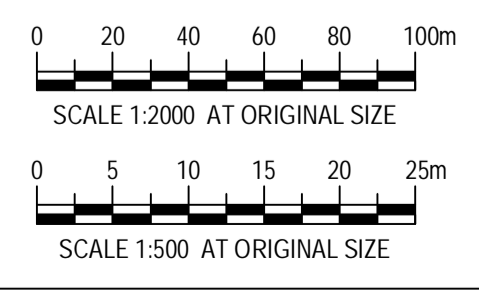
SETOUT POINTS		
SITE NUMBER	EASTING	NORTHING
1	364715.598	6345634.786
2	364625.217	6344926.550
3	364644.159	6344925.974
4	364655.356	6344920.578
5	364647.039	6344902.276
6	364438.293	6345016.902
7	364717.413	6344970.959
8	364747.777	6344800.023
9	364445.078	6344950.036
10	364637.871	6344949.345



WARNING: PUBLIC UTILITY SERVICES MAY EXIST ON OR ADJACENT TO THE SITE OF WORKS. THESE SERVICES MAY NOT BE SITUATED WITHIN REGISTERED EASEMENTS OR WITHIN STANDARD FOOTPATH ALLOCATIONS. IT IS THE CONTRACTORS RESPONSIBILITY TO IDENTIFY THE LOCATION OF ALL SERVICES PRIOR TO CONSTRUCTION WORKS AND TO AVOID DISTURBANCE OF THESE SERVICES

THIS DRAWING INCLUDES COLOURED INFORMATION. IF YOU HAVE A BLACK AND WHITE COPY YOU DO NOT HAVE ALL THE INFORMATION. THIS NOTE IS COLOURED RED.

PLAN
SCALE 1:2000



Client:

Lake Macquarie City Council
126-138 Main Road, Speers Point, NSW 231

Levels 2 & 3 GHD Tower, 24 Honeysuckle Drive
Newcastle NSW 2300 Australia
T 61 2 4979 9999 F 61 2 4979 9988
E ntmill@ghd.com.au W www.ghd.com.au

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Drawn R. COCKS	Designer M. PARSONS
Drafting Check	Design Check
Approved (Project Director)	Date
Scale AS SHOWN	This Drawing must not be used for Construction unless signed as Approved

Client **MAITLAND CITY COUNCIL**
Project **MT VINCENT ROAD WASTE MANAGEMENT CENTRE**
Title **EPL REQUIREMENTS SITE DETAIL PLAN**
Original Size **A1** Drawing No: **22-16920-C1601** Rev: **B**

Appendix P – QA Plans



SITE LOCATION

Lake Macquarie City Council Awaba Waste Management Facility Cell 1 and 2 Construction Quality Assurance Plan

September 2018

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1. Introduction

1.1 General

This plan presents the Construction Quality Assurance (CQA) requirements for the construction of the Works at the *Awaba Waste Management Facility* (the Site) and must be read in conjunction with the Contract Documents.

1.2 Purpose

The purpose of this CQA Plan is to define for the Works the construction quality assurance procedures and requirements necessary to demonstrate compliance with the requirements of the Contract Documents.

1.3 Scope of works

The Works to be undertaken are detailed in the Contract Documents, however, in general the Works include:

- Protect the Works Area to prevent unauthorised pedestrian and vehicular access and damage to existing infrastructure including after hours security for the works (if needed). This shall include, but not be limited to, locate and protect existing environmental monitoring wells, gas infrastructure and services to the satisfaction of the Superintendent and other authorities, providing site and traffic management such as temporary signage, fencing, gates, lighting (if necessary) and protection barriers.
- Set out the Works including all associated survey work.
- Install and maintain during construction all necessary erosion and sedimentation control measures.
- Supply and construct all necessary temporary works to facilitate the construction of the works.
- Excavate, fill, compact and grade as necessary to develop the design surface shown on the drawings.
- Decommissioning of northern leachate pond including excavation of waste materials and dewatering.
- Construction of a working platform to allow subsequent construction of a bridging layer.
- Supply and install a landfill gas drainage system beneath the leachate barrier system.
- Supply and install a leachate dewatering system to maintain leachate levels beneath the cell floor.
- Construction of a reinforced bridging layer to limit strains on the leachate barrier system during anticipated settlement of the cell floor.
- Supply and install the leachate barrier systems (inclusive of slopes, base and piggyback area).
- Conduct field trial for the placement of leachate drainage aggregate.
- Supply and install leachate collection and conveyance system.
- Supply and install the surface water drainage works.
- Supply Record Drawings in both digital and hardcopy format.

- Cooperate with Principal to maintain landfilling operations and associated works.

2. General requirements

2.1 Responsible parties

The responsible parties for implementation of this CQA Plan, as set forth herein, are as follows:

Principal

[the Client]

Contact:

.....

Phone:

.....

Superintendent

.....

Contact:

.....

Phone:

.....

Contractor

.....

Contact:

.....

Phone:

.....

CQA Consultant

.....

Contact:

.....

Phone:

.....

Regulatory Authority

NSW Environment Protection Authority

Contact:

.....

Phone:

.....

2.2 Definitions

- Principal Lake Macquarie City Council (LMCC)
- Superintendent Appointed representative of LMCC
- Contractor Party engaged by LMCC to perform the construction works
- Installer Party engaged to install the geosynthetic liner
- CQA Consultant Suitably qualified professional responsible for overseeing completion of construction quality assurance
- Works Area As shown in the Contract Drawings

3. General requirements

3.1 General

The CQA Consultant will consist of personnel with specific experience in the inspection and CQA monitoring of activities related to the construction of the Works.

3.2 Superintendent

All CQA functions will be under the Superintendent's authority. All coordination, reporting and issues related to non-compliance shall be directed through the Superintendent.

3.3 CQA Consultant

The CQA Consultant shall be responsible for assessing the compliance of the completed Works with the Contract Documents. This shall involve a range of activities that are described in this CQA Plan. Generally, the tasks will include:

- Review the Contract Documents.
- Review the CQA Plan.
- Review approved changes to the Contract Documents.
- Review and recommend rejection or approval of site-specific documentation including Contractor submittals, manufacture's information, installer's information and referenced standards. The Superintendent shall make the final decision on approval or disapproval of submittals.
- Verify construction is performed in accordance with the Contract Documents. CQA Monitors (refer Section 3.4) shall be assigned to every major construction activity related to the construction of the Works. A minimum of one CQA Monitor shall be on-site during the relevant Works.
- Attend required meetings.
- Coordinate CQA Monitors to observe all CQA activities requiring monitoring.
- Educate CQA Monitors on site specific CQA requirements and procedures.
- Verify calibrations of CQC and CQA conformance testing equipment are correctly performed and recorded.
- Verify that CQC and CQA conformance tests are properly performed, recorded, and the results meet specified requirements.
- Review Contractor qualifications to verify conformance with the Contract Documents.
- Review warranty submittals to verify they comply with the specified warranty requirements.
- Verify that the Contractor is following the approved CQC plan.
- Review required submittals and recommend rejection or approval.
- Report any unapproved deviations from the CQA Plan to the Superintendent.
- Note any activities that could result in damage to installed Works.
- Prepare and maintain required CQA documentation.

- Oversee the collection, marking, packaging, and shipping of CQA conformance samples for testing.
- Review 'as-built' surveys and Works as Executed Drawings.

The CQA Consultant is to work with the Superintendent to determine whether sufficient evidence has been provided to adequately document that the Works comply with the requirements of the Contract Documents.

3.4 CQA Monitors

The CQA Consultant may appoint CQA Monitors in consultation with the Principal, typically permanent site staff (such as the Superintendent) or specialist personnel (such as Geotechnical Engineers), who will observe the Works on behalf of the CQA Consultant to provide a basis for concluding that the Works conform with the Contract Documents.

3.5 Meetings

In order to facilitate CQA, close coordination between the CQA Consultant, the Superintendent and other concerned parties is essential and communication shall be ongoing during the construction. The Superintendent shall document all meetings and minutes shall be distributed to all parties. Construction and design issues shall be reviewed on an as-needed basis and shall be resolved and documented by the Superintendent.

3.5.1 Pre-construction meeting

Prior to initiating construction, the following items will be considered by the CQA Consultant:

- Any appropriate modifications to the CQA requirements.
- Review of the responsibilities of each party.
- Review of the lines of authority and communication.
- Review of the Contract Documents.
- Review of the procedures for Works documentation and reporting, and distribution of documents and reports.
- Review of the procedures for field and laboratory CQA conformance testing.
- Establishment of procedures for correcting and documenting construction deficiencies.
- Conducting a Site tour.
- Review of the Construction Program.

3.5.2 Weekly progress meetings

Weekly progress meetings shall be held between the Superintendent, CQA Consultant (including appropriate CQA Monitors) and other concerned parties. The purpose of these meetings is to discuss current progress, planned activities for the next week, issues requiring resolution, and any revisions to the Works. The CQA Consultant shall report any deficiencies noted during the previous week.

3.5.3 Special meetings

Special meetings will be conducted as required to discuss problems or deficiencies and to formulate comprehensive solutions.

3.6 Hold points

The Contract Documents include a number of Hold Points that require the Contractor to obtain the approval of the Superintendent prior to proceeding with the Works. The CQA Consultant shall advise the Superintendent on the release of Hold Points as required. The Superintendent shall make the final decision on the release of Hold Points.

3.7 Regulatory authority requirements

The Regulatory Authority shall be provided with the opportunity to observe key elements of the Works such as:

- Northern clean water diversion construction.
- Gas drainage lines installed prior to construction of the bridging layer and/or installation of leachate barrier system.
- Construction of working platform and bridging layer in cell floor.
- Leachate barrier system construction.
- Leachate collection and conveyance system construction.
- Field trials.
- Completed Works.

3.8 Construction quality assurance conformance testing

3.8.1 CQA Conformance sampling

CQA conformance samples shall be collected at locations designated by the CQA Consultant. The CQA Consultant shall collect CQA conformance samples and ensure they are collected, cut, labelled, and packaged in accordance with the Contract Documents and/or CQA Plan. The CQA Consultant shall ensure conformance samples are labelled with the following:

- Sample number.
- Date sampled.
- Project name.
- Geosynthetic manufacturer or soil borrow source.
- Intended use of soil or geosynthetic.

The location, sample number, and purpose of the samples shall be noted on the daily report. The daily report should also include as a minimum the following:

- Weather.
- MQA documents received / reviewed.
- Deliveries to site.
- Testing undertaken.
- Failures and remediation actions taken.
- Meetings.

3.8.2 CQA Conformance testing

Except for field tests, all CQA conformance testing shall be undertaken by authorities accredited by the National Association of Testing Authorities (NATA) to test in the relevant field, or an

organisation outside Australia recognised by NATA through a mutual recognition agreement. Subsequent sections of this CQA Plan describe the conformance testing to be performed.

3.8.3 CQA Conformance results

The CQA Consultant shall verify the following when reviewing CQA conformance test results:

- Geosynthetic samples and borrow soils used for CQA conformance testing are identical to the materials used for full-scale construction.
- The correct conformance tests have been performed and specified test procedures have been used.
- Test results meet the requirements of the Contract Documents.

The CQA Consultant shall immediately notify the Superintendent of problems with CQA conformance testing procedures or non-compliance of conformance test results.

3.9 Non-conformance and corrective action procedures

All non-conformances that arise from non-compliance with the contract documents shall be duly noted and appropriately recorded by the CQA Consultant, in the form of a non-conformance report, and made available to the Superintendent within 24 hours.

Where a non-conformance occurs, the non-conformance report is to include the following information:

- The location of the non-conformance.
- The time of the non-conformance.
- The time that the CQA Consultant was made aware of non-conformance.
- The suspected cause of the non-conformance.
- A description of the resulting impacts of the non-conformance.

The Superintendent, in consultation with the CQA Consultant, shall prepare a corrective action plan to address the non-conformance. The corrective action plan will at least address the following:

- The nature of the non-conformance and its level of effect on the project.
- Determination if the non-conformance is an isolated incident or a recurring problem.
- The nature of corrective action to be applied to rectify that specific non-conformance (eg re-compaction and testing).
- How amendments to procedures to prevent future occurrences of the non-conformance will be implemented.
- The need to report the non-conformance to the Regulatory Authority (eg. major exceptions / variations to the approved Contract Documents).

4. Earthworks

4.1 General

The CQA Consultant or CQA Monitor shall verify the CQA requirements described in this section for earthworks specific to the Works. Additional requirements for specific material types are discussed in subsequent Sections.

4.2 Weather conditions

Verify that earthworks do not occur during periods of excessive rain, freezing temperatures, or if other detrimental weather conditions exist.

4.3 Subgrade preparation

During subgrade preparations verify the following:

- The subgrade is smooth, free of voids, and composed of satisfactory materials.
- The subgrade is compacted as specified.
- The lines and levels of the top surface of the subgrade is correct.
- The subgrade surface is scarified as specified prior to placement of the first lift of fill.

4.3.1 Floor preparation over previously landfilled areas

Where the floor of Cells 1 and 2 is located over previously landfilled areas, a working platform and reinforced bridging layer is required.

The CQA Consultant must verify the following during construction of these layers:

- Ensure that the horizontal and vertical extent of waste is accurately defined and surveyed by the Contractor.
- Gas trenches are installed as per the Contract Drawings.
- The finished surface of the working platform provides a relatively uniform and smooth surface, suitable for placement of the overlying bridging layer, and is within the required tolerances for elevation.
- Select fill material used in the bridging layer complies with the material requirements of the Technical Specification.
- Each bridging layer is compacted sufficiently such that it passes a proof roll satisfying the following conditions:
 - Adverse non-uniform deformation is no longer apparent
 - Remaining deformation is within acceptable limits, noting the design intent and underlying landfilled materials
- Each bridging layer provides a relatively uniform and smooth surface, suitable for placement of the overlying reinforcing geogrid, and is within the required tolerances for layer thickness.
- Ensure that the reinforcing geogrid used in the Works is conforming to the requirements of the Technical Specification.
- Ensure that uniaxial geogrid is placed in the correct alignment as shown on the Contract Drawings.

- Ensure that transverse and longitudinal joints are completed using the required overlaps to provide sufficient bond length between adjacent panels.
- Ensure that geogrid is placed sufficiently beyond the defined extent of waste so that sufficient anchorage is provided.
- Select fill material used in the sub-base layer complies with the material requirements of the Technical Specification.
- The select fill sub-base layer is compacted as per the requirements of the Technical Specification, and sufficient CQC tests are provided to show conformance with these requirements.
- Review the as-built survey of the final sub-base surface and assess against the design intent. Provide direction to the Superintendent regarding any final trimming required to achieve the design intent.
- Ensure the sub-base layer provides a smooth and uniform surface, free of defects and imperfections, and is suitable for subsequent placement of the overlying leachate barrier system.

4.4 Filling

During filling, verify the following:

- Sudden braking or sharp turns are not made.
- Slippage of filling and compaction equipment is not occurring on side slopes. This is especially important when the fill layer is underlain by Geosynthetics.
- Areas of soft or otherwise deleterious underlying material are identified by the Contractor for review of bridging layer requirements
- There are no thin areas of fill which could allow underlying geosynthetics to be punctured or torn.
- Loose lifts are no greater than the specified maximum allowable thickness.
- Fill contains no oversize particles or other material prohibited by the Contract Documents.
- Fill is placed to the lines and levels shown in the Contract Documents.

4.5 Compaction

- Verify the specified minimum number of passes are being made over all areas of each lift of fill (if applicable).
- Visually observe fill placement around all penetrations and verify that fill placed around penetrations does not contain voids and is adequately compacted.
- Inspect pipes which penetrate fill layers for damage due to placement and compaction equipment.
- Verify the surface of each lift is adequately scarified prior to placement of the next lift of fill.
- Verify low ground pressure equipment is used when compaction is required over piping, geosynthetics, or other appurtenances.

4.6 Conformance testing

4.6.1 Borrow tests

- Check CQC borrow test results to verify that the borrow material is uniform and matches the required properties given in the Contract Documents.
- Advise the Superintendent about the need to do additional borrow source assessment testing if the properties of a borrow source appear to have changed significantly.

4.6.2 In-place moisture content and density tests

Verify the following during testing of the in-place fill:

- CQC moisture content and density tests are performed at the specified frequency.
- Additional CQC tests are taken where test results are not in compliance with the Contract Documents or the fill is visibly suspect.
- The Contractor performs corrective action as a result of failed tests in compliance with the Contract Documents and submits documentation describing the corrective measures taken.
- The Contractor uses nuclear gauges in the direct transmission mode to measure density.

4.7 Protection

- Verify the Contractor removes puddles and excess moisture from the fill surface prior to placement of additional fill.
- Look for areas of erosion after each rainfall event.
- Inspect for damage due to freezing and/or desiccation.
- Ensure the Contractor repairs damaged areas and re-establishes grades.

4.8 Repairs

If a fill layer does not conform to the Contract Documents, assist the Superintendent in defining the extent of the area requiring repair. This shall be done through the use of additional testing and visual inspection.

After repairs have been made, ensure CQC retests are performed to check the repaired areas. In general, CQC retests shall be performed at the same frequency as the rest of the project. Additional CQC testing shall be performed in suspect areas.

5. Leachate drainage aggregate

5.1 General

In addition to the CQA inspection requirements described in Section 4 of this CQA Plan, the CQA Consultant or CQA Monitor shall verify the following during placement of the leachate drainage aggregate.

5.2 Conformance testing

Table 5-1 lists the conformance tests that shall be performed on the leachate drainage aggregate.

Table 5-1 Leachate drainage aggregate conformance testing

Test Type	Test Method	Frequency	Comments
Particle Size Distribution	AS 1141.11	1 per 10,000 m3	In-place sample

5.3 Field trial

Verify the following during the field trial:

- The field trial is carried out as per the Contract Documents.
- Geosynthetic layers are installed and seamed as per the Contract Documents.
- Oversize and angular material which could damage geosynthetics has been removed prior to placement.
- Geosynthetics are not being damaged by placement equipment. Placement equipment shall be observed from the front side as leachate drainage aggregate is being spread over the geosynthetics. The leachate drainage aggregate shall be carefully removed and the underlying geosynthetics observed.
- Excessive fines have not been generated as a result of handling and placement of the leachate drainage aggregate.

5.4 Execution

Verify the following during leachate drainage aggregate placement:

- Oversize and angular material which could damage geosynthetics has been removed prior to placement.
- Geosynthetics are not being damaged by placement equipment. Placement equipment shall be observed from the front side as leachate drainage aggregate is being spread over the Geosynthetics.
- Excessive fines have not been generated as a result of handling and placement of the leachate drainage aggregate.
- Wind-borne and water-borne fines do not contaminate the leachate drainage aggregate after placement.
- Erosion controls are placed such that the leachate drainage aggregate is not contaminated by fines.
- Watch for ponds of water on top of the leachate drainage aggregate which may be an indication that it is contaminated by an excessive amount of fines.

6. Geosynthetics

6.1 General

The CQA Consultant or CQA Monitor shall verify the following during the construction of geosynthetic layers. Additional requirements for specific types of geosynthetics are discussed in subsequent Sections.

6.2 Equipment

Verify equipment used to place and cover geosynthetics is in accordance with the Contract Documents, the manufacturer's recommendations and the field trial.

6.3 Delivery, storage, and handling

The CQA Consultant or CQA Monitor shall be present during delivery and unloading and shall verify the following:

- Geosynthetics are shipped, handled, and stored in such a manner that no damage occurs to the Geosynthetics.
- GCLs, geotextiles, geonets, and geocomposites are packaged in opaque, waterproof, protective coverings.
- Each roll of geosynthetics is labelled in accordance with the Contract Documents.
- Rolls of geosynthetics which are damaged beyond use are removed from the Site.

6.4 Weather conditions

- Verify weather conditions are acceptable for placement of Geosynthetics.
- Ensure the subgrade has not been damaged by inclement weather.
- Ensure winds are not so high as to cause damage to geosynthetics during deployment. Inspect any geosynthetic rolls or panels which have been displaced by wind.

6.5 Manufacturer quality control testing

The CQA Consultant shall review manufacturing quality control test results to verify that geosynthetic rolls are sampled and tested in accordance with the manufacturer's approved quality control manual and that test results not meeting the requirements result in the rejection of applicable rolls.

6.6 Conformance testing

- The CQA Consultant shall ensure CQA samples are collected at the rate specified in the following Sections and forwarded to the CQA Laboratory for testing.
- Unless otherwise specified or approved, verify CQA samples are not taken from the outer wrap of the roll and samples are a minimum of 1 metre in length by the roll width.

6.7 Subgrade

The subgrade surface shall be inspected and approved each day that geosynthetics are installed. Additional inspections shall be performed if weather, vehicular traffic or other factors may have damaged the subgrade after approval. The CQA Consultant shall verify the following during subgrade inspections:

- The subgrade is compacted in accordance with the Contract Documents.
- The subgrade is smooth and free of ruts, erosion rills, or protrusions which are greater than specified.

6.8 Deployment

The CQA Consultant shall verify the following during deployment:

- Geosynthetics are laid reasonably flat with a minimum of wrinkles so that they contain no areas that can fold over during covering.
- Geosynthetics are placed with the correct side facing up.
- There are no broken needles present in the Geosynthetics.
- The Contractor cuts out and repairs waves that are so large as to cause folding of the geosynthetics when they are covered.
- There are no tensile stresses in the deployed Geosynthetics.
- Geosynthetics are not damaged during deployment.
- The Contractor has adequate ballasts (e.g., sandbags) on hand and they are properly deployed to prevent uplift of the geosynthetics by wind.
- Seams are lapped in the correct direction and are of the manufacturers recommended width(s).
- Verify geosynthetics are not dragged across the surface of a textured geomembrane. This can result in damage to the geosynthetics. A sacrificial rub sheet may be used to alleviate this problem.

6.9 Damage

The CQA Consultant shall visually inspect geosynthetics for damage (e.g., holes, blisters, and creases) after placement. Damaged areas shall be marked. The CQA Consultant shall document the location of the damaged panels, repairs which were performed, and panels which were rejected.

6.10 Field seams, overlaps, and splices

The CQA Consultant shall visually inspect seams and overlaps and verify the following:

- Seams are oriented parallel to the line of maximum slope.
- Geosynthetics are positioned with the overlap width as specified.
- Protective cover soil is not inadvertently pushed into seam overlaps.

6.11 Penetrations

- Verify penetrations are located as shown on the plans.
- Verify penetrations are constructed and tested as recommended by the manufacturer and as specified.

6.12 Anchor trenches

Verify the following when inspecting anchor trenches:

- The anchor trench is constructed to the correct dimensions.

- Termination points of geosynthetic layers within the anchor trench are correct.
- Corners of the anchor trench are slightly rounded to avoid sharp bends in the Geosynthetics.
- Loose fill or objectionable materials such as geosynthetic scraps and food containers are removed from the bottom of the anchor trench prior to placement of Geosynthetics.
- The anchor trench is dewatered (pumped out) if standing water is present in the bottom of the trench.
- The anchor trench is backfilled with approved fill placed at the specified moisture content and density.
- Compaction work within the anchor trench does not damage the Geosynthetics.

6.13 Final inspection

The CQA Consultant shall visually inspect and verify that all deficiencies have been repaired in accordance with the Contract Documents prior to covering.

7. Geotextile

7.1 General

The CQA Consultant or CQA Monitor shall verify the following during geotextile layer construction.

7.2 Conformance testing

Table 7-1 lists the conformance tests that shall be performed on the geotextile during construction.

Table 7-1 Geotextile quality assurance testing

Test Type	Test Method	Frequency	Comments
Grab Tensile	AS 3706.2b	1 per 5,000 m ²	All geotextiles
Apparent Opening Size	AS 3706.7	1 per 10,000 m ²	Separation and filtration geotextiles only
Permittivity	AS 3706.9	1 per 10,000 m ²	Separation and filtration geotextiles only
CBR Burst Strength	AS 3706.4	1 per 5,000 m ²	Protection and sacrificial geotextiles only
Trapezoidal Tear	AS 3706.3	1 per 5,000 m ²	Protection and sacrificial geotextiles only

7.3 Execution

- Verify sewn, heat bonded, and overlapped seams are constructed in the specified locations.
- Verify sewn seams are constructed using the correct overlap, thread type, and stitch type.
- Inspect for skipped stitches in stitch bonded seams.
- Inspect for discontinuities in heat bonded seams.
- Ensure the geotextile is not being burned through during the fabrication of heat bonded seams.
- Inspect geotextile for damage if it has been placed on a textured geomembrane surface and then removed from the membrane.
- Check the Contract Documents to determine the maximum allowable exposure time for the deployed geotextile. If the allowable exposure time has been exceeded, determine if the geotextile has been damaged. If needed, request the performance of additional CQA tests to verify the physical properties of the textile have not diminished due to exposure.
- Ensure that staples or pins are not used to hold geotextiles in place if the geotextile will be placed immediately above other Geosynthetics.
- Inspect the geotextile for evidence of clogging from eroded or windblown soil.

8. Geonet drainage geocomposite

8.1 General

In addition to the CQA inspection requirements described in Section 6 of this CQA Plan, the CQA Consultant shall verify the following during geocomposite layer construction.

8.2 Conformance testing

Table 8-1 lists the conformance tests that shall be performed on the geonet drainage geocomposite.

Table 8-1 Geonet drainage geocomposite conformance testing

Test Type	Test Method	Frequency	Comments
Ply Adhesion	ASTM D7005	1 per 5,000 m ²	Laboratory measurement
Transmissivity	ASTM D4716	1 per 10,000 m ²	Laboratory measurement
Compressive strength	ASTM D1621	1 per 10,000 m ²	Laboratory measurement

8.3 Execution

- During deployment, verify ribs of the geocomposite are continuous and are securely attached to each other.
- Verify seams are constructed as specified. Also verify seams are not placed in locations prohibited by the Contract Documents.
- Verify plastic fasteners are used to join adjacent rolls and they are placed at the specified spacing.
- Verify fasteners are of contrasting colour with the geocomposite to facilitate visual inspection.
- Verify the geocomposite is not being damaged during the fabrication of heat bonded geotextile seams.
- Inspect geocomposite for evidence of clogging from eroded or windblown soil.

9. Geosynthetic clay liner

9.1 General

The CQA Consultant or CQA Monitor shall verify the following during geosynthetic clay liner (GCL) construction.

9.2 Conformance testing

Table 9-1 lists the conformance tests that shall be performed on the GCL.

Table 9-1 Geosynthetic clay liner conformance testing

Test Type	Test Method	Frequency	Comments
Bentonite Mass	ASTM D5993	1 per 3 rolls	Laboratory measurement
Montmorillonite content	CSIRO x-ray diffraction	1 per 10,000 m ²	Laboratory measurement
CBR Strength	AS 3706.4	1 per 15 rolls	Laboratory measurement
Peel Strength	ASTM D6496	1 per 15 rolls	Laboratory measurement
Swell Index	ASTM D5890	1 per 3 rolls	Laboratory measurement
Permeability	ASTM D5887	1 per 10,000 m ²	Laboratory measurement

9.3 Subgrade preparation

Each day during placement of GCL, the CQA Consultant and GCL installer shall inspect the surface on which GCL is to be placed.

9.4 GCL Deployment

The CQA Consultant shall verify that GCL which has been hydrated prior to being covered is removed and replaced. Hydrated GCL is defined as material, which has become soft as determined by squeezing the material with finger pressure or material that has exhibited swelling.

9.5 Field seams and overlaps

The CQA Consultant shall visually inspect seams and overlaps and verify the following:

- Granular bentonite is placed along the entire overlap width at the rate recommended by the GCL manufacturer.
- Adhesives or other approved seaming methods recommended by the manufacturer are used if horizontal seams are allowed on slopes.

9.6 Protection

The CQA Consultant shall visually inspect and verify that only those GCL panels which can be anchored and covered before the end of the day are removed from the packaging. If exposed

GCL cannot be covered before the end of the day, verify it is covered with a plastic cover material and ballasted until construction can resume.

10. Geomembrane

10.1 General

The CQA Consultant or CQA Monitor shall verify the following during geomembrane installation.

10.2 Resin certifications

Prior to installation of geomembrane, the CQA Consultant shall review quality control certificates issued by the resin supplier. The CQA Consultant shall compare resin source lot numbers from the manufacturer with the manufacturer's roll listing to verify the proposed resin was used to manufacture the rolls delivered to the site.

10.3 Conformance testing

Table 10-1 lists the conformance tests that shall be performed on the geomembrane.

Table 10-1 Geomembrane conformance testing

Test Type	Test Method	Frequency	Comments
Thickness	ASTM D5994 or ASTM D5199	1 per 6 rolls	All geomembrane
Density	ASTM D1505 or D792 (method B)	1 per 6 rolls	All geomembrane
Asperity Height	ASTM D7466	1 per 6 rolls	All textured geomembrane
2% Modulus	ASTM D5323	1 per 10,000 m ² or 1 per resin batch	LLDPE only
Tensile Strength and Elongation	ASTM D6693	1 per 6 rolls	All geomembrane
Tear Resistance	ASTM D1004	1 per 6 rolls	All geomembrane
Puncture Resistance	ASTM D4833	1 per 6 rolls	All geomembrane
Dimensional Stability	ASTM D1204	1 per 10,000 m ² or 1 per resin batch	All geomembrane
Axisymmetric Break	ASTM D5397	1 per 10,000 m ² or 1 per resin batch	LLDPE only
Carbon Black Content	ASTM D4218 ⁽¹⁾	1 per 6 rolls	All geomembrane
Carbon Black Dispersion	ASTM D5596	1 per 6 rolls	All geomembrane
Standard OIT	ASTM D3895	1 per 10,000 m ² or 1 per resin batch	All geomembrane
High Pressure OIT	ASTM D5885	1 per 10,000 m ² or 1 per resin batch	All geomembrane
Stress Crack Resistance	ASTM D5397	1 per 10,000 m ² or 1 per resin batch	HDPE only

10.4 Subgrade Preparation

Each day during placement of geomembrane, the CQA Consultant and geomembrane installer shall inspect the surface on which geomembrane is to be placed.

¹ Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.

10.5 Field panel placement

The CQA Consultant shall visually inspect and verify that field panels are installed at the locations and positions indicated on the Contractor's approved layout drawings. The CQA Consultant shall verify that the identification code, location, and date of installation of each field panel are recorded.

10.6 Deployed geomembrane

The CQA Consultant shall visually inspect the deployed geomembrane to verify the following:

- Wrinkles do not exceed specified requirements.
- The geomembrane installer provides sufficient slack in the deployed geomembrane to account for the temperature fluctuations anticipated.
- After a significant drop in temperature, the geomembrane has not pulled away from the subgrade or anchor trench.

10.7 Seam layout

- The CQA Consultant shall verify the proposed seam layout is in accordance with the specified requirements.
- The CQA Consultant shall verify that field seams are laid out as shown on the approved panel layout drawing.

10.8 Seams

The CQA Consultant shall verify that:

- Trial seams are made under field conditions.
- Seaming equipment is in good condition and is functioning properly.
- Seams are of high quality. Pay special attention to high stress points such as valleys, ridges and at penetrations.
- Seam areas are clean and free of moisture, dust, dirt, and foreign material.
- If grinding of the surfaces to be seamed is required, the grinding marks are oriented perpendicular to the seam direction and no marks extend beyond the extrudate after placement.
- The depth of the grinding marks are no greater than 10% of the sheet thickness.
- Where extrusion welds are terminated long enough to cool, they are ground prior to applying new extrudate over the existing seams.

10.9 Non-destructive seam testing

The CQA Consultant shall verify:

- All seams are non-destructively tested as seaming work progresses and seams which fail are repaired.
- The outcome of all non-destructive seam test results are documented.

10.10 Destructive seam testing

The CQA Consultant shall:

- Select locations where seam samples will be cut out for CQA and CQC strength testing. The Contractor shall not be informed in advance of the locations where the seam samples will be taken.
- Verify seam strength testing is done as the seaming work progresses, not at the completion of field seaming.
- Verify seams are labelled in accordance with the Contract Documents.
- Document CQA seam test results and repairs.
- Verify seams which fail CQA and/or CQC destructive seam testing are repaired in accordance with the Contract Documents.

10.11 Penetrations

The CQA Consultant shall verify that:

- Installation and connection of the geomembrane to penetrations has been done in accordance with the Contract Documents.
- The geomembrane has not been damaged while being connected to penetrations.
- Each pipe boot is properly constructed and attached to the penetration. Verify the boots have not pulled away from the penetration if they are subjected to cyclic warming and cooling.

11. Geogrid

11.1 General

In addition to the CQA inspection requirements described in Section 8 of this CQAP, the CQA Engineer shall verify the following during geogrid layer construction.

11.2 Conformance testing

The CQA Engineer shall verify the following CQA test results are in compliance with the requirements of the specifications.

Table 11-1 Geogrid conformance testing

Test Type	Test Method	Frequency	Comments
Ultimate tensile strength	ISO 10319	1 per 5,000 m ²	Floor area (bridging layer) geogrid only. Machine direction only.
Elongation at ultimate tensile strength	ISO 10319	1 per 5,000 m ²	Floor area (bridging layer) geogrid only. Machine direction only.
Tensile strength @ 5% strain	ISO 10319	1 per 5,000 m ²	Floor area (bridging layer) geogrid to be tested in machine direction only. Piggyback area geogrid to be tested in both machine and cross directions.

11.3 Execution

- Inspect all in-place geogrid, geogrid anchors, and geogrid connections prior to covering.
- Notify the Superintendent if the contractor proposes to splice rolls of geogrid together on slopes.
- For penetrations through the geogrid, ensure load carrying members of the geogrid are not cut and are spread around the penetration.

12. Plastic Pipework

12.1 General

The CQA Consultant or CQA Monitor shall verify the following for plastic pipework, valves, fittings and other items associated with plastic pipework during construction of the Works.

12.2 Equipment

Verify equipment used to place and cover pipe is in accordance with the Contract Documents and the manufacturer's recommendations.

12.3 Delivery, storage, and handling

The CQA Consultant shall be present during delivery and unloading and shall verify the following:

- Pipe and appurtenances are not damaged during shipping, storage, and handling.
- Deliveries are properly recorded.
- The correct material type, strength, and pipe sizes have been delivered.
- The size, number and location of pipe perforations are as specified.
- Pipes with gouges deeper than 10% of the wall thickness are rejected or repaired before use.
- Out-of-round pipe which cannot be properly joined together is rejected.

12.4 Manufacturer quality control testing

The CQA Consultant shall verify that pipe is sampled and tested in accordance with the approved manufacturer's quality control manual and test results not meeting the requirements specified lead to the rejection of applicable pipe.

12.5 Construction quality assurance testing

Table 12-1 lists the CQA tests that shall be performed on the plastic pipework during construction.

Table 12-1 Plastic pipe quality assurance testing

Test Type	Test Method	Frequency	Comments
Standard Pipe Dimensions	-	Spot check each shipment of pipe	Field measurement
Pipe perforation dimensions	-	Spot check each shipment of pipe	Field measurement

12.6 Execution

Verify the following during pipe placement:

- Pipe is carried to the place of installation and not dragged.
- Defective or damaged pipe is not used.
- Pipe is not laid when trench conditions or weather is unsuitable.
- Pipe is not installed if standing water is present.

- Pipe and accessories are carefully lowered into the trench.
- Pipe is placed at the lines and grades indicated in the Contract Documents. Verify the Contractor does not lay pipe on blocks to produce the specified grade.
- Specified bedding is used and the bedding is graded to provide a cradle for proper support of the pipe.
- The full length of each section of pipe rests solidly upon the pipe bedding layer with recesses excavated to accommodate couplings and joints.
- Compaction requirements are being met for bedding layers located around the pipe.
- Perforated pipe is installed in accordance with the Contract Documents.
- Pipe and fittings are free of dirt, oil, or other contaminants.
- The interior of pipe and accessories are thoroughly cleaned of foreign matter before being lowered into the trench.
- Pinch bars and tongs for aligning or turning pipe are used only on the bare ends of pipe.
- When work is not in progress, open ends of pipes, fittings, and valves are securely plugged or capped so that no trench water, earth or other substance enters the pipe and fittings.

13. Riprap and other runoff control features

13.1 General

CQA requirements for riprap and other runoff control features are discussed in this section.

13.2 Delivery, storage, and handling

The CQA Engineer shall be present during delivery and unloading and shall verify the following:

- Individual pieces of stone protection are free from cracks, seams, and other defects that will cause rapid deterioration during service.
- Riprap and bedding material visually appear to be reasonably well-graded and falls within the limits of the riprap specification.
- Riprap consists of stones which are approximately rectangular in cross section and free from thin slabby pieces, dirt clods, mud and other deleterious materials.
- No rock is furnished from any source which has not been sampled, tested, and approved for use.

13.3 Material properties

13.3.1 Quality control testing

The CQA Engineer shall review certified test results from the quarry to verify that riprap meets specified requirements.

13.3.2 Quality assurance testing

NOTE: The following are examples of CQA tests typically performed. This paragraph should be modified on a site-specific basis.

The CQA Engineer shall visually inspect and measure riprap delivered to the site. No formal CQA conformance testing for riprap shall be performed unless deemed necessary by the Superintendent. The CQA Engineer shall advise the Superintendent on the need for CQA testing. If CQA testing is performed, the CQA Engineer shall verify representative samples are used for this testing.

13.4 Execution

By visual inspection, the CQA Engineer shall verify placement of bedding material and stone protection are in compliance with the following paragraphs.

13.4.1 Bedding material

Verify the following during placement of bedding and intermediate course material:

- Bedding material is spread uniformly on the prepared subgrade;
- Any damage to the subgrade during placement of bedding material is repaired before proceeding with work;
- Bedding material is finished to present a reasonably even surface free from depressions, mound, or windrows; and

- Particle size separation does not occur during placement.

13.4.2 Riprap placement

Verify the following during riprap placement:

- Stone protection is placed in a manner to produce a reasonably well-graded mass of stone with the minimum practicable percentage of voids;
- Damage to bedding material does not occur;
- The entire mass of stone in their final position is roughly graded to conform to the gradation specified; and
- Dumping stone at the top of slopes and rolling or pushing into place does not occur.

13.5 Gabions

Verify the following during gabion construction:

- All adjoining empty gabion units are connected by wire lacing along the perimeter of their contact surfaces;
- Lacing is accomplished as described in the specifications;
- Welded wire fabric structures are not damaged and there is a minimum of voids between the stones during filling operations;
- The last layer of stone is level with the top of the gabion to allow for proper closing of the lid and to provide an even surface that is uniform in appearance;
- Lids are stretched tight over the stone fill until the lid meets the perimeter edges of the front and end panels. The lid should be tightly laced with tie wire along all edges, ends, and internal cell diaphragms by continuous stitching;
- All projections or wire ends are turned into the baskets; and
- Where a complete gabion unit cannot be installed, the basket is cleanly cut, folded, and wired together to suit existing site conditions.

13.6 Grout bags

- Ensure grout bags are not pulling out of the anchor trench as the bags are filled with grout.
- Ensure grout bags are fully expanded with grout.

13.7 Benches and channels

- Visually inspect for dips and reverse grades along bench and channel bottoms.
- For channels at the toe of a landfill cover, verify the outlet pipes for the cover drainage layer are not obstructed or damaged during construction of the toe channel.

14. Appurtenances

14.1 General

The CQA Consultant or CQA Monitor shall verify the following.

14.2 Swales and channels

- Visually inspect for dips and reverse grades along swales and channel bottoms.
- Verify inlets and outlets are not obstructed or damaged during construction.
- Verify transitions from shotcrete to grass lined are rock grouted (if applicable).

14.3 Sumps

- Carefully inspect placement of aggregate to ensure underlying geosynthetics are not being damaged.
- Ensure pipe perforations meet specified requirements and are placed at the correct locations.

14.4 Access ramps

- Verify that construction equipment is not braking sharply while on the ramps.
- Inspect the access ramp daily for cracks and slippage of the protective soil layer. Also verify the protective soil layer is not thinning due to traffic or erosion.

14.5 Trenches

- Verify that trenches are constructed at the proper depth and alignment.
- Verify that any pipes in the trenches are placed at the proper lines and grades.
- If geosynthetics are included in trenches, ensure that subgrade/sidewall protrusions or backfill placement does not damage the Geosynthetics.

15. CQA Documentation

15.1 General

To provide evidence of satisfactory work performance, all construction stages of the Works shall be documented. The Superintendent will maintain daily records of all key activities associated with the work. The Superintendent will maintain all CQA documentation onsite at all times.

15.2 Photographic documentation

The Superintendent will prepare a photographic record of each stage of the Works and this record will be readily available or kept onsite as part of the construction control activities. Photographs will be in colour and will include photographs of construction activities, problem areas, corrective actions, and final constructed features.

Photographs will be identified with the site designation, the date taken, the location, and a description of the activity covered by the photograph.

15.3 Works as executed drawings and reporting

As the Works are completed, a report shall be prepared by the CQA Consultant in consultation with the Superintendent utilising records prepared during construction. The report shall be retained as a permanent record of construction. "As constructed" information shall include a laboratory test results summary and discuss typical construction conditions and procedures. The following Works as Executed Drawings shall be included:

- Finished installed contours of the subgrade (determined prior to placement of the leachate barrier system)
- Finished installed contours of the prepared groundwater drainage system
- Finished installed contours of the upper surface of the leachate barrier system (determined prior to the placement of the leachate collection and conveyance system)
- The installed leachate risers and the installed alignments and grades of the leachate collection pipework (all determined prior to placement of the leachate drainage aggregate)
- Finished installed contours of the leachate drainage aggregate and separation geotextile
- Finished installed lines and levels of all surface water features (incl. drains, pipes, culverts incl. Northern Diversion Drain etc.)
- All test and re-test locations, showing as a minimum: location, identification number, date sampled and type of testing completed

The report shall contain an opinion by a suitable qualified person, such as a Chartered Professional Engineer, that the Works and materials were installed in accordance with the Contract Documents and shall be submitted to the Regulatory Authority, as required.

GHD


Level 3 GHD Tower 24 Honeysuckle Drive Newcastle NSW 2300
PO Box 5403 Hunter Region Mail Centre NSW 2310
T: (02) 4979 9999 F: (02) 4979 9988 E: ntlmail@ghd.com

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3	Jeremy Dawes	David Barrett		David Barrett		07/09/2018

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Appendix Q – Work Health and Safety Policy

WORK HEALTH AND SAFETY POLICY



OUR COMMITMENT

We are committed to the wellbeing of our workers, visitors, and the communities associated with our business.

OUR GOAL

We aim to reduce the incidence and severity of accidents, injuries, and workplace illnesses caused by our activities, and to improve the health and wellbeing of people working for or on behalf of Council.

OUR PLAN

We are committed to:

- Developing, effectively implementing, and reviewing this Work Health and Safety (WHS) Policy.
- Promoting a culture of continuous improvement in work health, safety, and wellbeing.
- The risk management process and ensuring consistency with the nature of our workplace activities and scale of WHS risks.
- Complying with relevant WHS legislation and other requirements placed upon the organisation or to which we subscribe.
- Establishing measureable objectives and targets for work health and safety to ensure continuous improvement aimed at eliminating work-related illness and injury.
- Providing appropriate WHS training to all workers.
- The consultation process to ensure all workers and affected Persons Conducting Business or Undertaking (PCBU) are included in the decision-making processes impacting on work health and safety.
- The dissemination of WHS information to all workers, PCBU's and others at the workplace.
- Implementing the provisions of this Policy consistently in all areas of our business activity and on all sites where our activities are undertaken.

RESPONSIBILITIES:

Persons Conducting Business and Undertaking (PCBU)

As the PCBU, Council has the responsibility, so far as is reasonably practicable, to eliminate risks to the health and safety of its workers, and when elimination is not possible, to minimise those risks. Further, Council will ensure, so far as is reasonably practicable, that other persons are not put at risk from works being undertaken on Council's behalf.

Officers

As Council's Officers for the purposes of the WHS Act 2011, the General Manager and each Director, are committed to exercising due diligence by ensuring Council complies with its WHS duties and obligations. This is achieved by acquiring knowledge of, and keeping up to date with, WHS matters, understanding the hazards and risks associated with Council's operations, and providing and verifying the adequacy of resources and processes to eliminate and reduce workplace risks to their workers. Council's Officers consider information regarding incidents, hazards and risks, and commit to responding in a timely way to that information.

- **The General Manager:**

The General Manager is involved in the development of this Policy and therefore endorses and supports the implementation of the Policy and the associated WHS programs.

The General Manager is committed to exercising due diligence in accordance with Council's Work Health and Safety Management System, ensuring the appropriate resources to establish and maintain a consultative and systematic approach to WHS and injury management under this Policy.

- **Directors:**

Each Director is responsible and accountable for implementing this Policy and WHS programs in their areas of control and will support workers in fulfilling their WHS obligations and responsibilities. Each Director will consult with their staff on issues that affect their health and safety, and refer any concerns to the General Manager.

Workers

Workers are everyone who conducts work for, or with Council at Council's workplace and includes the Executive, Managers, Coordinators / Supervisors, employees, volunteers, contractors, and labour hire staff.

Each worker is required to take reasonable care for his or her own health and safety, and make sure that their acts or omissions do not adversely affect the health and safety of other persons.

Workers must also comply, so far as the worker is reasonably able, with any reasonable instruction that is given by Council regarding work health and safety and to abide by the policies and procedures of Council relating to health or safety.

- **Health and Safety Committee:**

The Health and Safety Committee ensures a consultative approach is maintained and employees are advised and involved in changes that affect WHS.

Others at Work

All visitors entering Council's premises or locations are required to comply with the Work Health and Safety Policy, procedures and programs of Council and to observe directions on Work Health and Safety from designated workers of Council. Failure to comply or observe a direction will result in expulsion from all Council's premises and locations.

The WHS Management System used by Council provides the framework for setting and reviewing measurable objectives and targets to ensure continual improvement aimed at the elimination of all workplace injury and illness. Individual commitment and a team effort is essential to ensure that hazard identification and risk management become everyone's responsibility. Periodic reviews of the system will ensure that it remains relevant and effective for all of Council's operations.

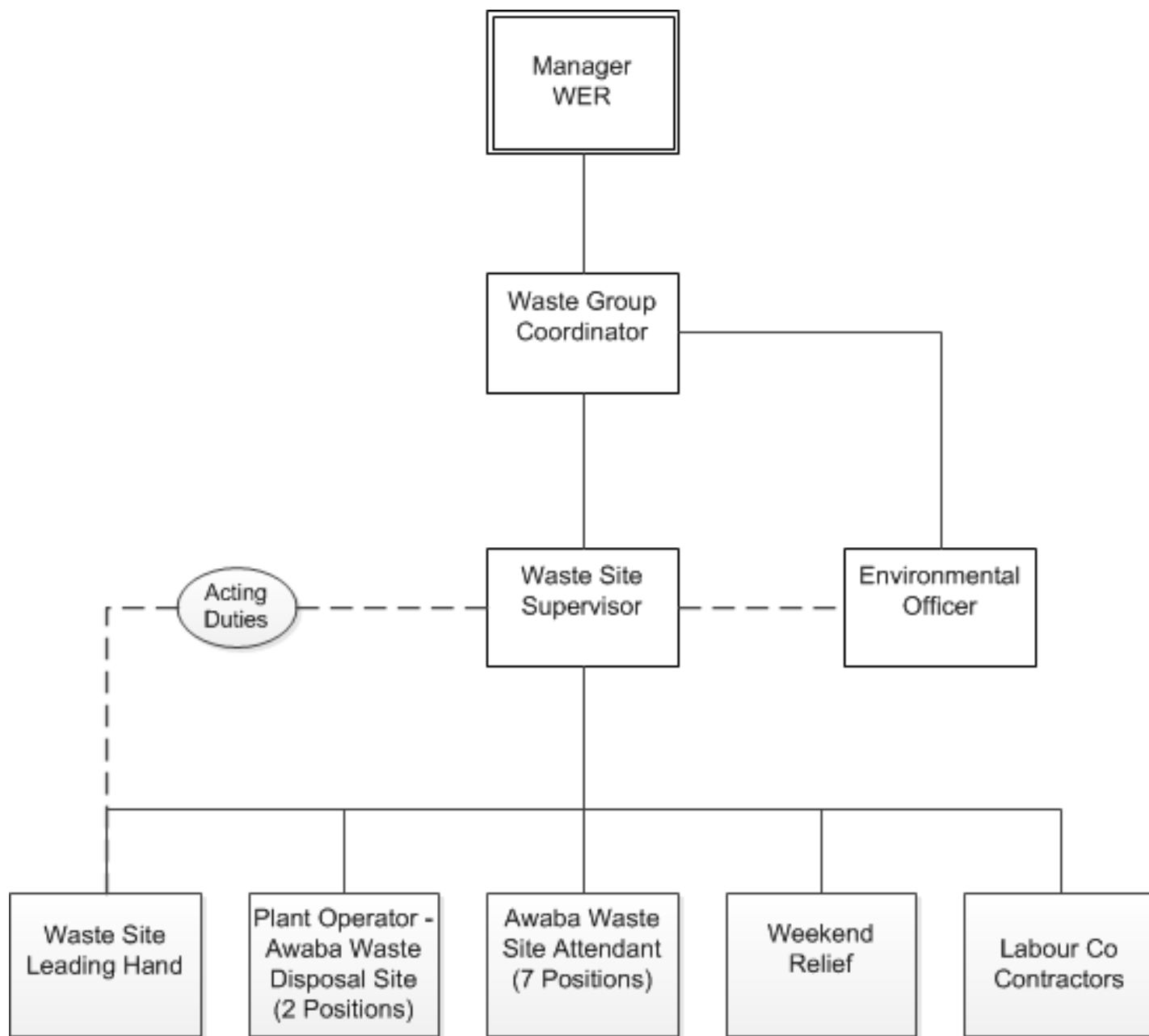
Brian Bell

General Manager

Brooke Humphries

Health and Safety Committee Chairperson

Appendix R – Management Structure and Position Descriptions





Position Description
Waste Site Field Supervisor

Position Title:	Waste Site Field Supervisor
Occupant:	Steven Merrett
Reports To:	Waste Sites Co-ordinator
Grade:	11
Division:	City Services
Department:	Waste Environment & Rangers
Section:	Waste
Effective Date:	June 2006
Folder No:	F2004/00538

1 Organisational and Purpose Context

The position of Waste Site Field Supervisor will be based at the current Awaba Waste Management Centre. The position will be responsible for the daily rostering of staff, plant and contractors. The position will be responsible for conducting regular OH&S and environmental inspections as necessitated through site operational plans. Maintenance of associated records shall also be undertaken. The position shall be responsible for ensuring effective and efficient performance of plant and operation of the site on a proactive basis. The position will report directly to Council's Waste Sites Co-ordinator

2 Key Selection Criteria

Essential

- Demonstrated understanding of and ability to deal with equal employment opportunity, discrimination and harassment issues.
- Certificate IV in Business `Front Line Management` or 5 years experience and demonstrated skills to ensure effective and efficient supervision of site infrastructure.
- Demonstrated judgement skills in the planning and prioritising of work routines.
- Comprehensive understanding of OH&S legislation, obligations and demonstrated ability to implement and comply with the same.
- Demonstrated understanding of environmental legislation and EPA guidelines in relation to the operation of a landfill site.
- Demonstrated ability to implement organisational plans and goals in order to achieve desired outcomes
- Demonstrated experience in GIS/GPS systems
- Ability to control and formulate budgets
- Ability to liaise with external organisations
- Report writing skills
- Computer literacy skills.
- Class C Drivers Licence

Highly Desirable

- Demonstrated understanding of operational plans for landfill facilities.
- Demonstrated understanding of the Environmental Protection Authorities (EPA) Licence for the Awaba Waste Management Centre and the EPA's document "Environmental Guidelines: Solid Waste landfills".

- Demonstrated understanding of waste disposal site plant and operational parameters.
- Demonstrated ability to identify efficiency gains and implement the same.
- Capable of acting in other supervisory areas.
- Knowledge of Department of Fair Trading legislation in relation to weighbridge operation
- Ability to supervise waste disposal type contracts

Desirable

- Knowledge of waste collection and disposal operations.
- Knowledge of environmental management systems associated with landfill facilities and an understanding of their operation.
- Capable of Monitoring and benchmarking trends in the waste industry.

3 Duties

- Plan on a proactive basis, a work routine to ensure effective and efficient site operations.
- Maintain diary, document work routines, inspection and monitoring results and maintain documents on Council's records system.
- Accurately record the daily position of the tipping face at the landfill.
- Approve timesheets leave forms and invoices.
- Determine labour, plant and subcontractor needs, place orders daily, order and requisition materials as required.
- Arrange servicing and maintenance of all site plant and equipment.
- Schedule and arrange staff, plant and contractors to meet planned work routine.
- Supervise staff, contractors and site operations to ensure efficient economical operation of Council's Waste Disposal Site including landfill, resource recovery and weighbridge functions.
- Promote teamwork and foster a supportive environment for staff and contractors.
- Carry out scheduled OH&S and environmental inspections in accordance with documented procedures.
- Monitor work performance of staff plant and contractors on site and direct to ensure effective, efficient and economical operation.
- Monitor maintenance schedules, tipping and covering operations and leachate disposal operations direct same to meet planned outcomes.

- Conduct and document risk assessments to develop safe work practices.
- Maintain the health and safety of workers and the general public by ensuring the implementation of safe work practices on site
- Respond to customer enquiries in a timely and courteous manner.
- Review and make recommendations in relation to waste disposal technology, leachate control and waste site development.
- Ensure that staffing levels at the waste site are adequate to ensure safety and environmental compliance.
- Monitor expenditure within budgetary constraints and make recommendations to management on budget formulation.
- Monitor trends within the waste disposal industry and make recommendations to management on budget formulation.
- Ensure environmental compliance relating to waste disposal is enforced.
- Prepare training schedules and carry out training of staff.
- Carry out all reasonable requests from the Waste Sites Co-Coordinator, Manager Waste Environment and Rangers and the Director City Services.

4 Relevant Position Information

- A restricted leaseback of Council vehicle is available.
- Appointment to the position will be on an open spread of hours. The position will be based at the Awaba Waste Management Facility. The facility operates seven (7) days a week, subsequently it may be necessary to work weekends on an as needs basis.

5 Personal Characteristics

- Versatile
- Well organised
- Positive attitude
- Honest and trustworthy
- Practical
- Loyal to colleagues, the team, and the Council
- Willing to embrace change
- Service-oriented

6 Equal Employment Opportunity, Anti-Discrimination, and Harassment Responsibilities

Managers and Supervisors

Must take all reasonable measures to ensure the prevention of inappropriate discrimination or harassment of employees or customers and ensure compliance with legislation, Council's policies, procedures, and business rules relating to discrimination, harassment, and equal employment opportunity.

7 Competencies

Council has a competency based salary system. Newly appointed persons will be assessed for competency after six months and salary adjusted accordingly. Details of competencies required are given below. It should be noted that further information on the competencies will not be made available to prospective applicants but will be available to the successful applicant upon appointment.

<u>UNIT</u>	<u>COMPETENCY</u>	<u>ELEMENTS</u>
<u>CORE</u>		
<i>LM00001</i>	Work effectively in a team environment	
LM00002	Provide effective services to customers	
CU07021	Follow defined OH&S policies and procedures	
CU09026	Undertake workplace learning	
LM00004	Apply EEO policies, procedures and principles	
LM00012	Maintain an environmentally sound workplace	

<u>SKILL STEP 1</u>		
WM00011	Respond to waste emergency	1,2,4&5
WM00013	Receive waste	1
WM00015	Move waste using load shifting equipment	1, 4&9
WM00020	Place and compact waste	1,4&9
WM00021	Cover waste	1,4&7
WM00022	Monitor disposal site	1,2&3
WM00023	Maintain a disposal site	All
WM00031	Organise and monitor waste activities	1,2,3&4
WM00032	Supervise personnel	1,2,3&4
WM00045	Respond to customer enquiry	All
WM00064	Monitor and maintain OH&S standards in the workplace.	1&2

<u>SKILL STEP 2</u>		
WM00030	Undertake process improvement to reduce costs and improve quality service	1,3,6,7&9
WM00031	Organise and monitor waste activities	5&8
WM00032	Supervise personnel	5&6
WM00036	Minimise business operation risks	1,2&4
WM00052	Implement training development and support systems	1&2
WM00064	Monitor and maintain OH&S standards in the workplace	3&4
WM00070	Identify wastes and hazards	All

<u>SKILL STEP 3</u>		
WM00024	Rehabilitate landfill site	All
WM00030	Undertake process improvement to reduce costs and improve quality customer service	4&5
WM00033	Prepare and implement employee arrangements	2
WM00034	Monitor and review personnel performance	3
WM00052	Implement training development and support systems	3,4&5
WM00061	Monitor and maintain OH&S standards in the workplace	5,6&7

8. Signatures

Job Occupant: **Date:**

Immediate Supervisor: **Date:**

Department Manager: **Date:**

8 Councils Online User Profile (System User Roles & Purchasing Authority)

Councils Online is the name given to Council's main computer system, which is made up of integrated software application components. Within the system, each application has different levels of access that can be assigned to a user; depending on what they need to do their job. Levels of access are referred to as 'User Roles'.

Within the Oracle Purchasing module, a financial limit is assigned to each user for the purpose of self-approving purchase requisitions. Where an employee is assigned a \$0 limit, any purchase requisition they enter escalates to their Supervisor/Manager for authorisation.

Oracle Purchasing Authority Limit: \$

The default is \$0 unless a limit is assigned for this position.

Core System User Roles - all positions:

Oracle (Purchasing) PO Receiver, PO Requisitioner & PO Inquiry

Oracle (Accounts Payable) AP Inquiry

Mat-Man (Inventory) INV Inquiry

Mat-Man (Asset Management) AWM Inquiry

Oracle (Customer Relationship Management) CRM CI Level 1

Oracle (General Ledger) GL Inquiry

TRIM (Document Management) TRIM End User & TRIM Inquiry

GEAC Pathway (Property) PA Inquiry

GEAC Pathway (Name & Address Register) NAR Counter Officer

Kronos (Time & Attendance) Employee

Intaz (OH&S) Default Employee

Recruit Online Employee Candidate, Standard

Self Service Employees Online, Standard

Additional System User Roles:

9 Councils Online Responsibilities

Nil

10 Occupational Health and Safety Responsibilities

All other Supervisory positions	(ie: below Manager Level)			
Authority	Responsibility	Key Activities	Ref	Accountability Mechanism
<p>Stop work considered unsafe within own area of control</p> <p>Identify, assess and control hazards and non-compliances for activities within their control</p> <p>Conduct and/or assist in workplace Risk assessments (as required)</p> <p>Ensure staff under their direction undertake only those tasks for which training has been provided</p>	<p>Ensure OH&S Compliance</p> <p>Provide supervision of a standard that will ensure employee, contractor and public safety</p> <p>Identify, assess and control hazards and non-compliance for activities within their control</p> <p>Ensure Safe Work Method Statements are developed when a need is identified by risk assessment</p> <p>Ensure employees are trained in and adhere to Safe Work Method Statements</p> <p>Ensure OH&S performance improvements are achieved</p> <p>Provide appropriate assistance and support for injured or ill employees under their control</p> <p>Assess OH&S and welfare needs of individuals</p>	<p>Ensure Safe Work Method Statements include OH&S considerations and comply</p> <p>Eliminate where possible or control any unsafe work practices</p> <p>Conduct regular recorded risk assessments and ensure suitable controls are implemented on a priority basis</p> <p>Monitor contractor OH&S performance</p> <p>Train employees in safe work practices and procedures and ensure compliance</p> <p>Conduct regular workplace inspections specifically for OH&S problems</p> <p>Report and analyse all accidents and incidents, take account of risk potential and initiate preventative actions.</p> <p>Ensure employees report all accidents and incidents</p> <p>Identify OH&S performance shortfalls and initiate suitable corrective actions</p> <p>Identify jobs/duties suitable for rehabilitation purposes</p> <p>Access support services as required</p>	HINCS	<p>Performance review</p> <p>Quality and accuracy of accident and incident investigation</p> <p>Inspection and audits by Managers and auditors (internal and external)</p> <p>Accident frequency and potential in supervised group</p>

Position: Waste Site Field Supervisor

NAME:

SIGNATURE

I accept this position, have read and understood the position description, and agree to bound by the conditions of the Lake Macquarie City Council Code of Conduct.

OCCUPANT: _____ DATE: _____



Lake Macquarie
City Council

Position Description

Group Coordinator Waste Operations

Position Title:	Group Coordinator Waste Operations
Occupant:	TBA
Reports To:	Manager Waste Environment and Rangers
Grade:	21
Division:	Operations
Department:	Waste Environment & Rangers
Section:	Waste Services
Effective Date:	September 2009
Folder No:	F2007/00504

1 Organisational and Purpose Context

The Group Coordinator Waste Operations reports directly to the Manager Waste Environment and Rangers (WER) and is responsible for the provision of Council's waste management and amenity cleaning services. It is responsible for coordinating Council's domestic waste collection, park and commercial garbage collection, bulk waste collection, amenity cleaning functions and waste sites including the Awaba waste management facility and Teralba Worm Farm.

The position is also responsible for administering any contracts associated with the delivery of these services.

The position has a key role in developing and implementing strategies for the long term sustainable management of waste collection and disposal, and meeting Council's statutory environmental obligations.

The position provides high level support directly to the Manager WER in meeting departmental and corporate objectives and is required to relieve in the position of Manager as required.

2 Key Selection Criteria

Essential

- Degree qualifications in a relevant field e.g. Environmental Engineering Degree or Diploma, Environmental Science Degree or demonstrated equivalent experience
- Extensive experience in waste management, particularly related to the local government context
- Proven experience in contract administration and financial management
- Proven record in dealing with high level key stakeholders involved with waste management and government agencies
- Demonstrated effective communication and interpersonal skills including ability to negotiate and resolve conflict and implement positive change
- Demonstrated advanced analytical and process management skills
- Demonstrated commitment to delivering excellent customer service
- Class C drivers licence

Highly Desirable

- Ability to identify trends and technologies that provide opportunities for improvement in waste management practices
- Sound computer skills, including Microsoft applications

Desirable

- Evidence of continuing professional development
- Experience in managing a business in a competitive environment
- Experience in the local government sector

3 Duties

1. Coordinate the delivery of waste management and amenity cleaning services to the community in an efficient and cost effective manner.
2. Develop and implement strategies that provide continuous improvement in processes and services.
3. Investigate and project manages the introduction of new technologies and process improvements associated with the delivery of waste services and waste stream management practices.
4. Ensure departmental and corporate objectives related to the waste services section are met.
5. Administer contracts and the performance of contractors relating to waste management services that are the responsibility of WER.
6. Provide leadership, guidance, direction and motivation to staff.
7. Manage the performance of staff and ensure compliance with relevant policies, standards and legislation associated with the operations of the department.
8. Develop and proactively manage and monitor operational budget relating to the section's activities
9. Ensure the currency and effectiveness of Council policies and legislative information relating to the Waste Services Section and report to the Manager recommending amendments/additions thereto.
10. Ensure that the section's responsibilities regarding Council's OH&S management system are maintained.
11. Liaise and foster positive relationships with internal and external stakeholders.
12. Prepare reports, submissions and represent Council at meetings, media interviews and conferences as required.
13. Market and promote WER and ensure delivery of excellent customer service
14. Relieve in the position of Manager Waste Environment & Rangers as required.

4 Relevant Position Information

- The position operates on a nine (9) day fortnight
- A vehicle is available for private use in accordance with Council's leaseback policy

5 Personal Characteristics

- Versatile
- Well organised
- Positive attitude
- Honest and trustworthy
- Practical
- Loyal to colleagues, the team, and the Council
- Willing to embrace change
- Service-oriented
- Ability to think strategically and find creative and innovative solutions to problems
- Good leadership qualities whilst retaining the ability to be a team player
- Excellent time management

6 Equal Employment Opportunity, Anti-Discrimination, and Harassment Responsibilities

Managers and Supervisors

Must take all reasonable measures to ensure the prevention of inappropriate discrimination or harassment of employees or customers and ensure compliance with legislation, Council's policies, procedures, and business rules relating to discrimination, harassment, and equal employment opportunity.

7 Competencies

Council has a competency based salary system. Newly appointed persons will be assessed for competency after six months and salary adjusted accordingly. Further competency assessment will occur at six monthly intervals. Employees are able to access the LMCC Core Competencies via the IMS Controlled Documents Register.

8 Councils Online User Profile (System User Roles & Purchasing Authority)

Councils Online is the name given to Council's main computer system, which is made up of integrated software application components. Within the system, each application has

different levels of access that can be assigned to a user; depending on what they need to do their job. Levels of access are referred to as 'User Roles'.

Within the Oracle Purchasing module, a financial limit is assigned to each user for the purpose of self-approving purchase requisitions. Where an employee is assigned a \$0 limit, any purchase requisition they enter escalates to their Supervisor/Manager for authorisation.

Oracle Purchasing Authority Limit: \$100,000

The default is \$0 unless a limit is assigned for this position.

Core System User Roles - all positions:

Oracle (Purchasing) PO Receiver, PO Requisitioner & PO Inquiry

Oracle (Accounts Payable) AP Inquiry

Mat-Man (Inventory) INV Inquiry

Mat-Man (Asset Management) AWM Inquiry

Oracle (Customer Relationship Management) CRM CI Level 1

Oracle (General Ledger) GL Inquiry

TRIM (Document Management) TRIM End User & TRIM Inquiry

GEAC Pathway (Property) PA Inquiry

GEAC Pathway (Name & Address Register) NAR Counter Officer

Kronos (Time & Attendance) Employee

Intaz (OH&S) Default Employee

Recruit Online Employee Candidate, Standard

Self Service Employees Online, Standard

Additional System User Roles:

9 Councils Online Responsibilities

Nil

10 OH&S Responsibilities

Council is committed to providing a safe and healthy workplace for our personnel, visitors, contractors, and volunteers. Every employee is required to meet their Occupational Health and Safety (OH&S) responsibilities and accountabilities as a condition of their employment.

OH&S responsibility, authority and accountabilities for individuals are included in the OHS Management system Module 1, OHS Responsibilities and the associated tables.

Annually employees will be appraised using the responsibility, authority, and accountabilities tables to verify activities conducted on day-to-day tasks meet organisational OHS requirements

Council will provide support, training, supervision, resources, and tools to ensure every individual meets their OHS responsibilities and accountabilities. Employees who disregard their OHS responsibilities place themselves and others at risk. Those employees who disregard their OHS responsibilities may be subject to disciplinary procedures in accordance with Lake Macquarie City Council policy.

Position: Group Coordinator Waste Operations

Name: **TBA**

Signature

I accept this position, have read and understood the position description, and agree to be bound by the position description and the conditions of the Lake Macquarie City Council Code of Conduct.

OCCUPANT: _____ DATE: _____



Position Description
Waste Site Leading Hand

Position Title:	Waste Site Leading Hand
Occupant:	
Reports To:	Waste Sites Supervisor
Grade:	11
Division:	Operations
Department:	Waste Environment & Rangers
Section:	Waste Operations
Effective Date:	October 2013
Folder No:	F2007/00504

1 Organisational and Purpose Context

List the objectives and key accountabilities of the position:

The Waste Site Leading Hand position reports to the Waste Sites Supervisor and is responsible for assisting the Waste Site Supervisor in the daily operations of the Awaba Waste Management Facility. The position also relieves the Waste Site Supervisor during periods of leave or absences from the site including managing the Awaba Waste Management Facility team; rostering of staff, plant, equipment, and contractors; ensuring OH&S and environmental compliance; and record and data management.

When not assisting or relieving the Waste Site Supervisor, the Waste Site Leading Hand will undertake one of the roles covered by the Awaba Waste Site Attendant position description, including:

- Garden Waste Controller
- Tip Hand
- Reuse Centre Operator
- Labourer; and
- Gatekeeper

2 Key Criteria

Essential

- Certificate IV in Business “Front Line Management” or relevant supervisory experience
- Demonstrated understanding of landfill site operations including environmental legislation, licence conditions and EPA guidelines.
- Demonstrated skills in the planning and prioritising of work activities to achieve operational and organisational desired outcomes
- Experience in managing operational budgets
- Basic computer skills
- Effective verbal and written communication skills
- Ability to work with minimal supervision and as a team member and have exhibited a high level of performance in previous positions
- Demonstrated understanding of Work Health Safety Policy and legislative requirements
- Sound customer service skills
- Class C Motor Vehicle drivers licence
- WorkCover General Induction Certificate

Highly Desirable

- Knowledge of Department of Fair Trading legislation and EPA requirements in relation to weighbridge operation and calibration.
- Knowledge of environmental management controls associated with landfill facilities.
- Ability to manage contracts relating to waste disposal and resource recovery.
- Ability to identify prohibited wastes, noxious weeds and reusable and recyclable materials.
- Traffic Controllers ticket.

Desirable

- Class MR Motor Vehicle drivers license.
- Skid steer ticket or current skid steer permit.
- Experience in operating landfill plant or other items of heavy plant and equipment.
- Understanding of levels and the ability to read plans.
- Ability to operate a weighbridge, collect, receipt and balance cash and EFTPOS payments.
- Effective conflict resolution skills.
- Ability to provide on the job training.
- Ability to monitor, maintain and arrange repairs to onsite infrastructure including pumps, buildings, plant, fencing, spray irrigators, pipes etc.

3 Duties

When not assisting the Waste Sites Supervisor, the Waste Site Leading Hand will undertake one of the roles covered by the Awaba Waste Site Attendant position description, including:

- Garden Waste Controller;
- Tip Hand;
- Reuse Centre Operator;
- Labourer; and
- Gatekeeper.

- 1 Supervise and organise staff, contractors and site operations to ensure the efficient operation of Council's Waste Disposal Site, including landfill, resource recovery, weighbridge functions and plant requirements.

- 2 Maintain diary, document work routines, (including the recording of the daily tipping face), inspection and monitoring results.
- 3 Authorise timesheets, leave requests and invoices.
- 4 Determine labour, plant and subcontractor needs, place orders daily and arrange requisition materials as required.
- 5 Coordinate servicing and maintenance of all site plant and equipment.
- 6 Promote teamwork and foster a supportive environment for staff and contractors.
- 7 Carry out scheduled WHS and environmental activities in accordance with Council procedures.
- 8 Respond to customer enquiries in a timely and courteous manner.
- 9 Review and make recommendations in relation to waste disposal technology, leachate control, and waste site development.
- 10 Monitor expenditure within budgetary constraints and make recommendations to management on budget formulation as well as monitoring trends within the waste industry.
- 11 Carry out site induction training of staff and contractors as well as organised site visitors.
- 12 Direct vehicles accessing the various waste disposal areas in a safe orderly manner.
- 13 Ensure all vehicles are driven safely on site and are in a safe position to facilitate unloading operations by ensuring appropriate signage is suitably erected and maintained.
- 14 Meet and greet customers and assist customers in unloading waste, reusable and recyclable items in a safe manner.
- 15 Inspect loads prior to and during unloading to ensure that appropriate waste, reusable and recyclable items are disposed of at the correct areas.
- 16 Ensure that storage receptacles, stockpiles, and tip face space is maximised by efficient disposal of materials, and maintain disposal areas in a neat and tidy manner.
- 17 Ensure waste, recyclable and reusable materials are disposed of at the correct location by directing customers, liaising with other site staff, and separating inappropriate materials.
- 18 Arrange for site plant to push up stockpiles and backload inappropriate waste to appropriate location.
- 19 Undertake weighbridge operations including collection, receipt and balancing of money; ensuring gatehouse security, activate and deactivate alarms; and direct customers to appropriate areas.
- 20 Operate site plant in an efficient manner including optimising compaction rates and maintaining correct levels.
- 21 Ensure that an environmentally sound workplace is maintained and report any

potentially hazardous waste, site-prohibited waste, incidents or accidents to the Waste Sites Supervisor.

- 22 Ensure that all workplace procedures are carried out in accordance with Council's Work Health Safety Policy.
- 23 Encourage correct customer use of Awaba Waste Site by providing appropriate customer advice and education.
- 24 Promote the image of Council by exhibiting an overall interest in the Awaba Waste Site operations
- 25 Undertake general site duties as required by the Waste Sites Supervisor.
- 26 Undertake Plant Operator duties as directed by the Waste Sites Supervisor.
- 27 Act as Waste Sites Supervisor when the Waste Sites Supervisor is away from the site.

4 Relevant Position Information

- This position is based at the Awaba Waste Management Facility, Wilton Road, Awaba.
- 38 hour (Outdoor) working week with an open spread of hours between 6.00am and 6.00pm
- The Awaba Waste Management Facility operates seven (7) days per week, subsequently weekend work may be necessary.
- When the Waste Sites Supervisor is away from the site (for periods of two consecutive days or more) this position will act as Waste Sites Supervisor and be paid at Grade 15.
- This position will be required to stagger morning tea and lunch breaks in order to relieve Awaba Waste Site Attendants to ensure that all functions are maintained at all times during site operational hours
- Appointee will be required to work overtime as directed by the Waste Sites Supervisor.
- This is a multi function position to enable the efficient operation of the Awaba Waste Management Facility.
- Assistance where required in the performance of general duties associated with the operations of the Waste, Environment and Rangers Department.
- A roster day every three weeks is available.
- Travelling allowance applies to this position.

Please note prior to an offer of employment being made, recommended candidates may be subject to the following pre employment checks:

- Medical assessment or Medical assessment with Council Doctor

This position may require:

- Shift and Weekend Work
- On Call Work
- Travel
- Work in confined spaces

5 Personal Characteristics

- Versatile
- Well organised
- Positive attitude
- Honest and trustworthy
- Practical
- Loyal to colleagues, the team, and the Council
- Willing to embrace change
- Service-oriented

6 Equal Employment Opportunity, Anti-Discrimination, and Harassment Responsibilities

Managers and Supervisors

Must take all reasonable measures to ensure the prevention of inappropriate discrimination or harassment of employees or customers and ensure compliance with legislation, Council's policies, procedures, and business rules relating to discrimination, harassment, and equal employment opportunity.

7 Capability Framework

LMCC has a capability framework that applies to all positions in the organisation.

The following core capabilities apply to all roles.

Capability	Elements
1. Customer Focus	
Identifies and anticipates the needs of customers and clients (internal and/or external), delivers services that meet and exceed expectations, and helps customers, clients, and business partners achieve their goals through the application of their own skills, behaviours, and knowledge.	<ul style="list-style-type: none"> • Understands Customer Needs • Ensures Quality Service Delivery • Resolves Issues • Strives for Continuous Improvement • Demonstrates Professional Empathy

2. Teamwork	
Works within a team environment, cooperates with others, considers the needs of others, and helps team members to achieve team objectives.	<ul style="list-style-type: none"> • Demonstrates Commitment to the Team • Plans and Organises • Adapts to Change • Understands Operational Environment • Acts with Integrity
3. Corporate Governance and Risk Management	
Understands and applies legislation, frameworks and policies for ensuring a safe and healthy workplace, sustainable business practices, privacy, and risk management.	<ul style="list-style-type: none"> • Work Health and Safety • Governance • Risk Management

Each position has specific functional capabilities that will be provided to you by your supervisor.

8 Councils Online User Profile (System User Roles & Purchasing Authority)

Councils Online is the name given to Council's main computer system, which is made up of integrated software application components. Within the system, each application has different levels of access that can be assigned to a user; depending on what they need to do their job. Levels of access are referred to as 'User Roles'.

Within the Oracle Purchasing module, a financial limit is assigned to each user for the purpose of self-approving purchase requisitions. Where an employee is assigned a \$0 limit, any purchase requisition they enter escalates to their Supervisor/Manager for authorisation.

Oracle Purchasing Authority Limit: \$

The default is \$0 unless a limit is assigned for this position.

Core System User Roles - all positions:

Oracle (Purchasing) PO Receiver, PO Requisitioner & PO Inquiry

Oracle (Accounts Payable) AP Inquiry

Mat-Man (Inventory) INV Inquiry

Mat-Man (Asset Management) AWM Inquiry

Oracle (Customer Relationship Management) CRM CI Level 1

Oracle (General Ledger) GL Inquiry

TRIM (Document Management) TRIM End User & TRIM Inquiry

GEAC Pathway (Property) PA Inquiry

GEAC Pathway (Name & Address Register) NAR Counter Officer

Core System User Roles - all positions:

Kronos (Time & Attendance) Employee

Intaz (WHS) Default Employee

Recruit Online Employee Candidate, Standard

Self Service Employees Online, Standard

Additional System User Roles:

9 Councils Online Responsibilities

Nil

10 WHS Responsibilities

Council is committed to providing a safe and healthy workplace for our personnel, visitors, contractors, and volunteers. Every employee is required to meet their Work Health and Safety (WHS) responsibilities and accountabilities as a condition of their employment.

WHS responsibility, authority and accountabilities for individuals are included in the WHS Management system Module 1, WHS Responsibilities and the associated WHS Responsibilities, Authorities, and Accountability Table.

Annually employees will be appraised using the responsibility, authority, and accountabilities tables to verify activities conducted on day-to-day tasks meet organisational WHS requirements.

Council will provide the necessary authority, support, training, supervision, resources, and tools to ensure every individual meets their WHS responsibilities and accountabilities. Training needs are identified through the WHS Skills Matrix for each position. Employees who disregard their WHS responsibilities place themselves and others at risk. Those employees who disregard their WHS responsibilities may be subject to disciplinary procedures.

Position: Waste Site Leading Hand

Name:

Signature

I accept this position, have read and understood the position description, and agree to be bound by the position description and the conditions of the Lake Macquarie City Council Code of Conduct.

OCCUPANT: _____ DATE: _____



Draft Position Description
Awaba Waste Site Attendant

Position Title:	Awaba Waste Site Attendant
Occupant:	
Reports To:	Waste Sites Supervisor
Grade:	Broadbanded (4 to 8)
Division:	Operations
Department:	Waste Environment & Rangers
Section:	Waste Operations
Effective Date:	March 2012
Folder No:	F2007/00504

1 Organisational and Purpose Context

List the objectives and key accountabilities of the position:

The Awaba Waste Site Attendant position reports to the Waste Sites Supervisor and is responsible for the functions and activities previously undertaken by the following Awaba Waste Management Facility positions and as directed by the Waste Sites Supervisor:

- Garden Waste Controller;
- Tip Hand;
- Reuse Centre Operator;
- Labourer; and
- Gatekeeper.

The Awaba Waste Site Attendant will also be responsible to fill the position of Plant Operator, as directed by the Waste Sites Supervisor.

This position has been created recognising the multi-functional work arrangements currently undertaken by the above individual positions in acting in other positions in order to maintain satisfactory customer service levels at the Awaba Waste Management Facility.

2 Key Selection Criteria

This position is broad banded and all requirements can be found in Appendix A.

Essential

- General knowledge of landfill site operations
- Ability to work with minimal supervision and as a team member and have exhibited a high level of performance in previous positions
- Effective verbal communications skills
- An understanding of Work Health Safety Policy principles
- Effective customer relations skills
- Class C Motor Vehicle drivers licence
- Basic computer skills
- WorkCover General Induction Certificate

Highly Desirable

- Experience in the waste management industry
- Understanding of the Licence conditions for the Awaba Waste Management Facility
- Ability to identify prohibited wastes, noxious weeds and reusable and recyclable materials
- Traffic Controllers ticket
- Understanding of operations of and environmental issues associated with the operation of landfill sites

Desirable

- An understanding of the EPA's "Environmental Guidelines; Solid Waste Landfills
- Class MR Motor Vehicle drivers license
- Skid steer ticket or current skid steer permit
- Experience in operating landfill plant or other items of heavy plant and equipment including an understanding of the operations and abilities of Council and Contractors plant and equipment
- Understanding of levels and the ability to read plans
- Ability to operate a weighbridge, collect, receipt and balance cash and EFTPOS payments
- Ability to prepare and issue accounts
- Effective conflict resolution skills
- Ability to provide on the job training

3 Duties

The Awaba Waste Site Attendant position is responsible for the duties undertaken by the following Awaba Waste Management Facility positions and as directed by the Waste Sites Supervisor:

- Garden Waste Controller;
- Tip Hand;
- Reuse Centre Operator;
- Labourer; and

- Gatekeeper.
 - 1 Direct vehicles accessing the various waste disposal areas in a safe orderly manner.
 - 2 Ensure all vehicles are driven safely on site and are in a safe position to facilitate unloading operations by ensuring appropriate signage is suitably erected and maintained.
 - 3 Meet and greet customers and assist customers in unloading waste, reusable and recyclable items in a safe manner.
 - 4 Inspect loads prior to and during unloading to ensure that appropriate waste, reusable and recyclable items are disposed of at the correct areas.
 - 5 Ensure that storage receptacles, stockpiles, and tip face space is maximised by efficient disposal of materials, and maintain disposal areas in a neat and tidy manner.
 - 6 Ensure waste, recyclable and reusable materials are disposed of at the correct location by directing customers, liaising with other site staff, and separating inappropriate materials.
 - 7 Arrange for site plant to push up stockpiles and backload inappropriate waste to appropriate location.
 - 8 Undertake weighbridge operations including collection, receipt and balancing of money; ensuring gatehouse security, activate and deactivate alarms; and direct customers to appropriate areas.
 - 9 Operate site plant in an efficient manner including optimising compaction rates and maintaining correct levels.
 - 10 Ensure that an environmentally sound workplace is maintained and report any potentially hazardous waste, site-prohibited waste, incidents or accidents to the Waste Sites Supervisor.
 - 11 Ensure that all workplace procedures are carried out in accordance with Council's Work Health Safety Policy.
 - 12 Encourage correct customer use of Awaba Waste Site by providing appropriate customer advice and education.
 - 13 Promote the image of Council by exhibiting an overall interest in the Awaba Waste Site operations.
 - 14 Undertake general site duties as required by the Waste Sites Supervisor.
 - 15 Undertake Plant Operator duties as directed by the Waste Sites Supervisor.

4 Relevant Position Information

- This position is based at the Awaba Waste Management Facility, Wilton Road, Awaba.
- 38 hour (Outdoor) working week with an open spread of hours between 6.00am and 6.00pm
- The Awaba Waste Management Facility operates seven (7) days per week, subsequently weekend work may be necessary.
- This position will be required to stagger morning tea and lunch breaks in order to relieve other Awaba Waste Site Attendants to ensure that all functions are maintained at all times during site operational hours
- Appointee will be required to work overtime as directed by the Waste Sites Supervisor.
- This is a multi function position to enable the efficient operation of the Awaba Waste Management Facility.
- Assistance where required in the performance of general duties associated with the operations of the Waste, Environment and Rangers Department.
- A roster day every three weeks is available.
- Travelling allowance applies to this position.

Grade at Appointment and Progression:

- The commencement grade will be determined in consultation with the successful applicant prior to the formal offer of employment being finalised. The process will require the applicant to demonstrate competency and achievements in the duties applicable to the position. See Appendix A for Performance Matrix and more information.
- Satisfactory work performance is a requirement to progress to the next grade irrespective of experience gained.
- Review of the occupant's placement in the broad banded scale will take place after 6 months, and thereafter, progression to the next grade will be reviewed once a year.
- Progression through the grades will be contingent upon successful evaluation against Duties of the Position and Performance Matrix.
- Ongoing staff development and coaching will be a component of the position.

5 Personal Characteristics

- Versatile

- Well organised
- Positive attitude
- Honest and trustworthy
- Practical
- Loyal to colleagues, the team, and the Council
- Willing to embrace change
- Service-oriented

6 Equal Employment Opportunity, Anti-Discrimination, and Harassment Responsibilities

Employees

Must take all reasonable measures to ensure they do not inappropriately discriminate against or harass other employees or customers and that they comply with legislation, Council's policies, procedures, and business rules relating to discrimination, harassment, and equal employment opportunity.

7 Competencies

Council has a competency based salary system. Newly appointed persons will be assessed for competency after six months. Further competency assessment will occur at six monthly intervals. Employees are able to access the LMCC Core Competencies via the IMS Controlled Documents Register.

8 Councils Online User Profile (System User Roles & Purchasing Authority)

Councils Online is the name given to Council's main computer system, which is made up of integrated software application components. Within the system, each application has different levels of access that can be assigned to a user; depending on what they need to do their job. Levels of access are referred to as 'User Roles'.

Within the Oracle Purchasing module, a financial limit is assigned to each user for the purpose of self-approving purchase requisitions. Where an employee is assigned a \$0 limit, any purchase requisition they enter escalates to their Supervisor/Manager for authorisation.

Oracle Purchasing Authority Limit: **\$**

The default is \$0 unless a limit is assigned for this position.

Core System User Roles - all positions:

Oracle (Purchasing) PO Receiver, PO Requisitioner & PO Inquiry

Oracle (Accounts Payable) AP Inquiry

Core System User Roles - all positions:

Mat-Man (Inventory) INV Inquiry

Mat-Man (Asset Management) AWM Inquiry

Oracle (Customer Relationship Management) CRM CI Level 1

Oracle (General Ledger) GL Inquiry

TRIM (Document Management) TRIM End User & TRIM Inquiry

GEAC Pathway (Property) PA Inquiry

GEAC Pathway (Name & Address Register) NAR Counter Officer

Kronos (Time & Attendance) Employee

Intaz (OH&S) Default Employee

Recruit Online Employee Candidate, Standard

Self Service Employees Online, Standard

Additional System User Roles:

9 Councils Online Responsibilities

Nil

10 WHS Responsibilities

Council is committed to providing a safe and healthy workplace for our personnel, visitors, contractors, and volunteers. Every employee is required to meet their Work Health Safety (WHS) responsibilities and accountabilities as a condition of their employment.

WHS responsibility, authority and accountabilities for individuals are included in the WHS Management system Module 1, WHS Responsibilities and the associated WHS Responsibilities, Authorities, and Accountability Table.

Annually employees will be appraised using the responsibility, authority, and accountabilities tables to verify activities conducted on day-to-day tasks meet organisational WHS requirements.

Council will provide the necessary authority, support, training, supervision, resources, and tools to ensure every individual meets their WHS responsibilities and accountabilities. Training needs are identified through the WHS Skills Matrix for each position. Employees who disregard their WHS responsibilities place themselves and others at risk. Those employees who disregard their WHS responsibilities may be subject to disciplinary procedures.

Position: Awaba Waste Site Attendant

Name:

Signature

I accept this position, have read and understood the position description, and agree to be bound by the position description and the conditions of the Lake Macquarie City Council Code of Conduct.

OCCUPANT: _____ DATE: _____

**APPENDIX A - PERFORMANCE MATRIX - GRADE 4 TO GRADE 8 - BROADBANDED AWABA
WASTE SITE ATTENDANT**

Performance Criteria	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
Qualification / Licenses / Certificates.	Class C license Traffic controllers ticket WorkCover General Induction Certificate	Class C license Traffic controllers ticket WorkCover General Induction Certificate	Class C license Traffic controllers ticket WorkCover General Induction Certificate	Class MR license Traffic controllers ticket WorkCover General Induction Certificate	Class MR license Traffic controllers ticket Skid steer ticket WorkCover General Induction Certificate
General labouring skills	Evidence of competency in lawn mowing, litter patrols, erection of litter fencing, erection of sediment controls, turfing and seeding.	Evidence of competency in lawn mowing, litter patrols, erection of litter fencing, erection of sediment controls, turfing and seeding.	Evidence of competency in lawn mowing, litter patrols, erection of litter fencing, erection of sediment controls, turfing and seeding.	Evidence of competency in lawn mowing, litter patrols, erection of litter fencing, erection of sediment controls, turfing and seeding.	Evidence of competency in lawn mowing, litter patrols, erection of litter fencing, erection of sediment controls, turfing and seeding.
Customer service	Evidence of customer service skills.	Evidence of customer service skills.	Evidence of customer service skills.	Evidence of customer service and conflict resolution skills.	Evidence of customer service and conflict resolution skills.
Work Health and Safety	Understanding of Council's Work Health and Safety Policy	Understanding of Council's Work Health and Safety Policy	Understanding of Council's Work Health and Safety Policy	Understanding of Council's Work Health and Safety Policy	Understanding of Council's Work Health and Safety Policy
Small plant use	Demonstrated ability to use small	Demonstrated ability to use small plant	Demonstrated ability to use small plant	Demonstrated ability to use small plant	Demonstrated ability to use small plant

Performance Criteria	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
	plant items such as mowers, and whipper snippers.	items such as mowers, and whipper snippers.	items such as mowers, and whipper snippers.	items such as mowers, whipper snippers, grinders, drills, saws etc.	items such as mowers, whipper snippers, grinders, drills, saws etc.
Waste and resources identification	NA	Ability to identify reusable and recyclable materials, prohibited wastes and noxious weeds	Ability to identify reusable and recyclable materials, prohibited wastes and noxious weeds	Ability to identify reusable and recyclable materials, prohibited wastes and noxious weeds	Ability to identify reusable and recyclable materials, prohibited wastes and noxious weeds
Waste Management Operations	NA	Demonstrated understanding of waste disposal site operations	Demonstrated understanding of waste disposal site operations	Demonstrated understanding of Council's waste management operations particularly in regard to waste minimisation activities. Demonstrated understanding of waste disposal site operations	Demonstrated understanding of Council's waste management operations particularly in regard to waste minimisation activities Demonstrated understanding of waste disposal site operations
Awaba Landfill Licence Conditions	NA	NA	Demonstrated understanding of the Awaba Waste Management Facility Licence conditions	Demonstrated understanding of the Awaba Waste Management Facility Licence conditions	Demonstrated understanding of the Awaba Waste Management Facility Licence conditions
EPA's Environmental Guidelines: Solid	NA	NA	NA	Demonstrated understanding of the EPA's	Demonstrated understanding of the EPA's Environmental

Performance Criteria	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
Waste Landfills				Environmental Guidelines: Solid Waste Landfills	Guidelines: Solid Waste Landfills
Computer literacy	Basic computer skills	Basic computer skills	Basic computer skills	Demonstrated ability to operate weighbridge software.	Demonstrated ability to operate weighbridge software.
Cash Handling	NA	NA	NA	Demonstrated ability to collect, receipt, and balance, cash and EFTPOS payments. Demonstrated knowledge of waste site security procedures.	Demonstrated ability to collect, receipt, and balance, cash and EFTPOS payments. Demonstrated knowledge of waste site security procedures.
Provide Training	NA	NA	NA	Evidence of training other waste site attendants in duties.	Evidence of training other waste site attendants in duties
Surveys and plans	NA	NA	NA	NA	Demonstrated ability to interpret survey plans and apply levels in the field.



Lake Macquarie
City Council

Position Description

Manager - Waste Environment & Rangers

Position Title:	Manager - Waste Environment & Rangers
Occupant:	
Reports To:	Director Operations
Grade:	
Division:	Operations
Department:	Waste Environment & Rangers
Section:	
Effective Date:	
Folder No:	F2007/00504

1 Organisational and Purpose Context

This position reports directly to the Director Operations and is responsible for the management of the Waste Environment and Rangers Department. The Manager is also responsible for Council's responsibilities relating to the operations of the State Emergency Service (SES), Rural Fire Services (RFS) and is Council's nominated Local Emergency Management Officer (LEMO) under the State Emergency and Rescue Management Act.

The Manager has 9 direct reports and 96 FTE staff. There are 770 volunteers involved in the SES and RFS.

The Department has 8 sections, namely:

- Waste Operations
- Bulk Waste
- Waste Disposal Sites, (including Worm Farm)
- City Cleaning
- Environmental Management
- Rangers
- Emergency Services/LEMO
- Vegetation & Noxious Weed control

A Coordinator is responsible for the operational management of the each section.

The Manager is a member of Council's Corporate Management Team and plays an active role in the management of the organisation as a whole. This position reports directly to the Director Operations and is responsible for leading and managing the department to ensure it operates efficiently and effectively to meet the organisational objectives as listed in the Management Plan developed and approved annually.

2 Key Selection Criteria

Essential

- Degree qualification in relevant field or extensive equivalent relevant experience
- Demonstrated ability to implement positive changes to work practices and processes
- Demonstrated ability in the analysis of business processes and change management
- Demonstrated high level of communication and interpersonal skills, including ability to negotiate and resolve conflict
- Demonstrated ability in managing a diverse department, motivating staff and fostering team relationships
- Extensive budgeting and financial management, strong business ethics and analytical problem solving
- Demonstrated ability to manage multiple projects and prioritise effectively to achieve

- outcomes
- Demonstrated calm, objective approach in a high pressure environment or disaster situation
 - A current motor vehicle driver licence

Highly Desirable

- Experience in OH&S environmental and quality management systems
- A record of achievement in managing work programs that deliver results on time and within budget
- Extensive Local Government experience

Desirable

- Demonstrated experience in Emergency Management including the capability to understand Council's legal obligations in regard to the role of Local Emergency Management Officer

3 Duties

1. Develop, maintain and monitor strategies to meet organisational objectives and expectations as listed in corporate documents including the Management Plan, budgets, performance appraisals, Council resolutions and other directives set for this department
2. Provide effective leadership for all staff in the WER department including completion of annual performance appraisals and setting business and personal development objectives
3. Monitor and report department activity updates to Director Operations, Executive, Corporate Management Team and Council or public forums as required
4. Contribute positively to senior management discussions to address organisational issues and provide advice of WER core business functions where appropriate
5. Monitor and report on Council's emergency management preparedness to meet statutory responsibilities including relationships with RFS and SES and acting as chair for the Local Emergency Management Committee
6. Develop strategies to implement technological changes to produce cost effective service delivery for the business of the department
7. Ensure community and Councillor service requests are actioned meeting established business rules for timeliness and confidentiality
8. Ensure OHS responsibilities of the staff and Council are compliant
9. Establish and maintain strategic development in each section of the department to meet long term organisational and community objectives
10. Review and monitor delivery of services in the department on an annual basis

4 Relevant Position Information

- The occupant is required to work such reasonable hours as are necessary to carry out the duties and functions of the position and the employee's obligations. This may include working outside normal hours and attending Council meetings and functions
- This position will be located at the Lake Macquarie City Council Works Depot TC Frith Avenue, Boolaroo

5 Personal Characteristics

- Positive attitude
- Practical
- Outcome focused
- Service oriented
- Honest and trustworthy
- Well organised
- Loyal to colleagues, the team and Council
- Versatile and willing to embrace and drive change
- Personally productive with a commitment to the team goals
- Able to think strategically and find creative and innovative solutions to problems
- Able to foster and promote a culture of continuous improvement
- Ability to juggle multiple projects and deadlines

6 Equal Employment Opportunity, Anti-Discrimination, and Harassment Responsibilities

Managers and Supervisors

Must take all reasonable measures to ensure the prevention of inappropriate discrimination or harassment of employees or customers and ensure compliance with legislation, Council's policies, procedures and business rules relating to discrimination, harassment and equal employment opportunity.

7 Competencies

Council has a competency based salary system. Newly appointed persons will be assessed for competency after six months and salary adjusted accordingly. Further competency assessment will occur at six monthly intervals. Employees are able to access the LMCC Core Competencies via the IMS Controlled Documents Register.

8 Councils Online User Profile (System User Roles & Purchasing Authority)

Councils Online is the name given to Council's main computer system, which is made up of integrated software application components. Within the system, each application has different levels of access that can be assigned to a user; depending on what they need to do their job. Levels of access are referred to as 'User Roles'.

Within the Oracle Purchasing module, a financial limit is assigned to each user for the purpose of self-approving purchase requisitions. Where an employee is assigned a \$0 limit, any purchase requisition they enter escalates to their Supervisor/Manager for authorisation.

Oracle Purchasing Authority Limit: \$100,000

The default is \$0 unless a limit is assigned for this position.

Core System User Roles - all positions:

Oracle (Purchasing) PO Receiver, PO Requisitioner & PO Inquiry

Oracle (Accounts Payable) AP Inquiry

Mat-Man (Inventory) INV Inquiry

Mat-Man (Asset Management) AWM Inquiry

Oracle (Customer Relationship Management) CRM CI Level 1

Oracle (General Ledger) GL Inquiry

TRIM (Document Management) TRIM End User & TRIM Inquiry

GEAC Pathway (Property) PA Inquiry

GEAC Pathway (Name & Address Register) NAR Counter Officer

Kronos (Time & Attendance) Employee

Intaz (OH&S) Default Employee

Recruit Online Employee Candidate, Standard

Self Service Employees Online, Standard

Additional System User Roles:

9 Councils Online Responsibilities

Nil

10 OH&S Responsibilities

Council is committed to providing a safe and healthy workplace for our personnel, visitors, contractors and volunteers. Every employee is required to meet their Occupational Health and Safety (OH&S) responsibilities and accountabilities as a condition of their employment.

OH&S responsibility, authority and accountabilities for individuals are included in the OHS Management system Module 1, OHS Responsibilities and the associated tables.

Annually employees will be appraised using the responsibility, authority, and accountabilities tables to verify activities conducted on day-to-day tasks meet organisational OHS requirements.

Council will provide support, training, supervision, resources and tools to ensure every individual meets their OHS responsibilities and accountabilities. Employees who disregard their OHS responsibilities place themselves and others at risk. Those employees who disregard their OHS responsibilities may be subject to disciplinary procedures in accordance with Lake Macquarie City Council policy.

Position: Manager - Waste Environment & Rangers

Name:

Signature

I accept this position, have read and understood the position description, and agree to be bound by the position description and the conditions of the Lake Macquarie City Council Code of Conduct.

OCCUPANT: _____ DATE: _____



Position Description
Plant Operator Waste Sites AWABA

Position Title:	Plant Operator Waste Sites
Occupant:	
Reports To:	Waste Sites Coordinator
Grade:	
Division:	City Services
Department:	Waste Environment & Rangers
Section:	Waste Sites
Effective Date:	August 2007
Folder No:	F2007/00504

1 Organisational and Purpose Context

Responsible for the completion of all duties associated with the safe and efficient operations of the Waste disposal site plant and equipment

2 Key Selection Criteria

Essential

- Holder of a relevant certificate for plant operation
- Ability to work with minimum supervision as a team member and have exhibited a high level of performance in previous positions
- Demonstrated understanding of operational constraints associated with plant performance on landfill sites

Highly Desirable

- Demonstrated understanding of basic environmental issues associated with the operation of landfill sites

Desirable

- Has a general competency profile in an area relevant to Council's waste disposal operations
- Experience in operating landfill plant or other items of heavy plant and equipment
- Demonstrated understanding of operational plans associated with the operation of the landfill site

3 Duties

1. Ensuring optimum and efficient use of the waste disposal site plant and equipment
2. Achieving maximum productivity with minimum inconvenience to the public during execution of duties
3. Adherence to current working hours, award conditions and OH&S regulations
4. Assisting management as required to keep detailed written records
5. Undertaking any courses of study or obtain any certificates required for satisfactory and safe execution of work

6. Completion of appropriate training courses for the operation of landfill compaction equipment
7. Identification and correct handling of materials unacceptable to the landfill
8. Application of skills in the control of fire outbreaks on the tip face
9. Completing additional duties as required
10. Maintain correct operational levels when placing, compacting and covering garbage
11. Place and compact garbage in a manner that optimises compaction rates

4 Relevant Position Information

- Appointment to the position will be in accordance with Council's enterprise agreement. The position will be based at the Awaba Landfill. Assistance could be required in the performance of general duties at the landfill, including the tip-hand role or any other reasonable request made by senior staff

5 Personal Characteristics

- Versatile
- Well organised
- Positive attitude
- Honest and trustworthy
- Practical
- Loyal to colleagues, the team, and the Council
- Willing to embrace change
- Service-oriented

6 Equal Employment Opportunity, Anti-Discrimination, and Harassment Responsibilities

Employees

Must take all reasonable measures to ensure they do not inappropriately discriminate against or harass other employees or customers and that they comply with legislation, Council's policies, procedures, and business rules relating to discrimination, harassment, and equal employment opportunity.

7 Competencies

Council has a competency based salary system. Newly appointed persons will be assessed for competency after six months and salary adjusted accordingly. Further competency assessment will occur at six monthly intervals. Employees are able to access the LMCC Core Competencies via the IMS Controlled Documents Register.

8 Councils Online User Profile (System User Roles & Purchasing Authority)

Councils Online is the name given to Council's main computer system, which is made up of integrated software application components. Within the system, each application has different levels of access that can be assigned to a user; depending on what they need to do their job. Levels of access are referred to as 'User Roles'.

Within the Oracle Purchasing module, a financial limit is assigned to each user for the purpose of self-approving purchase requisitions. Where an employee is assigned a \$0 limit, any purchase requisition they enter escalates to their Supervisor/Manager for authorisation.

Oracle Purchasing Authority Limit: \$

The default is \$0 unless a limit is assigned for this position.

Core System User Roles - all positions:

Oracle (Purchasing) PO Receiver, PO Requisitioner & PO Inquiry

Oracle (Accounts Payable) AP Inquiry

Mat-Man (Inventory) INV Inquiry

Mat-Man (Asset Management) AWM Inquiry

Oracle (Customer Relationship Management) CRM CI Level 1

Oracle (General Ledger) GL Inquiry

TRIM (Document Management) TRIM End User & TRIM Inquiry

GEAC Pathway (Property) PA Inquiry

GEAC Pathway (Name & Address Register) NAR Counter Officer

Kronos (Time & Attendance) Employee

Intaz (OH&S) Default Employee

Recruit Online Employee Candidate, Standard

Self Service Employees Online, Standard

Additional System User Roles:

9 Councils Online Responsibilities

Nil

10 Occupational Health and Safety Responsibilities

EMPLOYEES				
Authority	Responsibility	Key Activities	Ref	Accountability Mechanism
<p>Identify and report hazards, accidents and incidents</p> <p>Conduct and/or assist in workplace Risk assessments (as required)</p> <p>Undertake only those tasks for which training has been provided</p> <p>Stop work considered unsafe</p>	<p>Comply with Legal Statutory OH&S requirements and IMS standards</p> <p>Follow reasonable and lawful instructions</p> <p>Act responsibly to ensure the safety of self and others</p> <p>Follow safe work methods</p> <p>Wear appropriate PPE</p> <p>Ensure tools and materials are in a safe condition before use</p> <p>Identify and report hazards, accidents and incidents</p> <p>Conduct and/or assist in workplace Risk assessments (as required)</p> <p>Undertake only those tasks for which training has been provided</p> <p>Participate in and support OH&S improvement activities</p> <p>Participate in return to work programs following a work related injury</p> <p>Maintain first aid kit in any vehicle assigned to them</p>	<p>Support and cooperate with all OH&S programs within the section</p> <p>Report all incidents/injuries and plant or equipment damage</p> <p>Report all unsafe situations and near misses immediately to Supervisor</p> <p>Take corrective actions within own ability and report to supervisor</p> <p>Ask about and keep informed of work hazards</p> <p>Participate in training sessions</p> <p>Advise Supervisor of any training requirements</p> <p>Encourage all employees to improve OH&S performance and to work in a healthy and safe manner</p> <p>Support the LMCC OH&S Committee</p>		<p>Be able to demonstrate an understanding of Risk Assessment process</p> <p>Observation of supervisor, Management and peers</p> <p>Audits and inspections and disciplinary procedures if required</p>

Position: Plant Operator Waste Sites

Name:

Signature

I accept this position, have read and understood the position description, and agree to bound by the conditions of the Lake Macquarie City Council Code of Conduct.

OCCUPANT: _____ DATE: _____

Appendix S – Site Induction

	<p style="text-align: center;">Procedure Awaba Waste Facility Site Induction</p>	
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Procedure

This procedure sets out what information visitors and contractors will receive when they visit or carry out work at the Awaba Waste Management Facility. Once instructed of the hazards etc they will sign the site register.

Process

VISITOR AND CONTRACTOR SITE SPECIFIC INDUCTION

AWABA WASTE MANAGEMENT FACILITY

INTRODUCTION

Lake Macquarie City Council is committed to protecting its employees/contactors/day labour, the general public and property from injury, loss or damage. In fulfilling this commitment, Council will provide and maintain a safe and healthy work environment as required by using proven best practices and all relevant legislation and standards.

AIM

To ensure people entering the Awaba Waste Management Facility who are not disposing of waste are aware of site specific risks and the methods used to minimise these risks. This induction process seeks to assist with ensuring your time at the centre is as safe as possible.

POTENTIAL SITE RISKS

The Awaba Waste Management Facility is an active site and all people entering should be aware of the following potential risks

General:

1. **Vehicle Accidents** – The centre can process up to 350 vehicles per day. This means the tipping face and roadways are constantly very busy. Vehicles may operate randomly in different parts of the site, including off-road areas where they have restricted vision. A site speed of 25 Klm/hr is enforced
2. **Landfill Gases** - The site produces landfill gases such as methane. These gases may be flammable or explosive if of sufficiently high concentration. Due to there being a number of potentially dangerous areas on the site **DO NOT SMOKE ON SITE NORTH OF THE GATEHOUSE COMPOUND OR WITHIN THE GATEHOUSE COMPOUND**. Prior to undertaking works using naked flames, contact the Waste Site Supervisor on 0408 485 707. Strictly No Smoking at the tipping face
3. **Uneven Ground, Steep Slippery Slopes and Trip Hazards** – The areas north of the main leachate holding pond have been filled with waste. Surfaces are therefore uneven and may present slip, trip or fall risks. Always exercise extreme caution when making your way around the site. If you observe any potential problems please report them to the **Site Supervisor on 0408 485 407**.

4. **Risk of Contact with Hazardous Materials** – The Centre operates an extensive waste screening program, however at times materials such as hypodermic needles and unwrapped asbestos enter the site. Do not walk on or have any direct contact with uncovered or uncompacted waste. If you observe any needles on site, report their position to the **Waste Site Supervisor on 0408 485 407**.
5. **Risk of Bites or Stings** – The Centre is surrounded by bushland and subsequently there is the potential for animals or insects that bite or sting to be present on site. Exercise caution when walking on site. If you observe any animals or insects that may bite or sting remove yourself from the area and report their location to the **Waste Site Supervisor on 0408 485 407**.
6. **Vandalism** – The Centre is an isolated site. Instances of illegal entry have occurred in the past. If you are leaving plant or equipment on site, please ensure it is appropriately secured.
7. **Personal Protective Clothing** -High visibility sunsafe clothing, broad brimmed hats, steel toe capped footwear and any protective clothing or equipment as stated in risk assessments and work method statements must be worn by all staff and contractors performing work on site.
8. **Fire** – Due to the presence of landfill gas and other combustibles on site, the Facility has a site specific, fire management plan. If you observe a fire on site, immediately report it to the **Waste Site Supervisor on 0408 485 407** or the Fire Brigade on 000. Move to an upwind position of the fire. If you are directed to evacuate the site, make your way to the gatehouse compound where you will be marked off a role. At all times you are to obey all instructions by the Council staff. You will then be directed to leave the site. Due to there being a number of potentially dangerous areas on the site **DO NOT SMOKE ON SITE NORTH OF THE GATEHOUSE COMPOUND OR WITHIN THE GATEHOUSE COMPOUND**. The Waste Site Supervisor is the Emergency Warden
9. **Use of Small Plant** – If you are to operate plant items on site, you are not to do so until you receive direction on the how to operate the item and have been issued with appropriate PPE. Licence checks are carried out by Site Supervisor
10. **Housekeeping** Drinking water is available within the gatehouse... At the commencement of any breaks or when you leave your workplace, ensure you thoroughly wash your hands. A sink, soap and hand towels are provided in the lunchroom in the gatehouse. Water for washing is also available at the Recycle Shed
11. **First Aid** – A First Aid Kit is located in the gatehouse. The Waste Site Supervisor is the First Aid Officer on site and he can be contacted on 0408 485 407.
12. **Amenities-** Toilets and lunchroom are located in the gatehouse.
13. **Leachate and Sediment Dams** – The main leachate dam is lined with plastic and has very steep slopes. Therefore, if you fall in you cannot climb out. Rescue chains are located on the corners of the pond and in the middle. Do not enter the main leachate holding pond compound unless permission has been obtained from the Waste Site Supervisor. If you are to conduct maintenance work on the pond it will be necessary to wear a flotation device which can be obtained from the gatehouse. If accessing the sediment ponds be aware of the grassy slopes which can be slippery.

14. **Leachate Spray Areas** – Do not enter any area where the spray irrigation is in operation as a sudden change in wind direction could cause you to come in contact with leachate spray. If you have to enter this area after sprays have been turned off, remember that the grass could be damp and slippery. Please notify Site Supervisor immediately if over spray is detected on windy days

15. **Gatehouse Compound**- Observe for vehicle movements. Observe for boom gate operation as these are controlled by the weighbridge computer and operate relative to vehicle movement. Do not walk under the boom gates and do not walk on or the sides of the weighbridge.

16. **Risk Assessments.-** All staff/workers on site have read and been issued with the following Risk Assessments. These are located in Trim Folder F2004/10096-02
 1. Operation of Awaba Waste Facility
 2. Awaba Waste Management Facility Community Recycling Centre**Site Supervisor to ensure latest version by checking Trim Folder**

BEFORE SIGNING THE SITE REGISTER ENSURE YOU UNDERSTAND THIS DOCUMENT.

Contact Phone Numbers – Waste Site Supervisor 0408 485 407, Gatehouse 49593337

Acting Waste Site Supervisor- 0418 831 118

WHS Management System Information

Record Keeping Requirements

Records associated with, and generated in compliance with this document include:-

-
-
-

All records will be managed in accordance with **WHS Module 10 - Records**.

Training Requirements

Specific training required to carry out the requirements of this document includes:-

-

Training requirements will be managed in accordance with **WHS Module 12 – Training**.

Auditing Requirements

Auditing of this process will be managed in accordance with **WHS Module 11 – Auditing**.

Corrective Actions

Corrective actions are to be managed in accordance with **WHS Module 09 – Corrective Actions** whenever it is identified that the requirements of this document and its references are not being met.

Review

This document will be reviewed in accordance with **WHS Module 04 – Document Control** and whenever there is a relevant change to applicable legislation, industry standards, Codes of Practice, the WHS Management System, or the process.

Responsibilities, Authorities & Accountabilities

Responsibility, authority, and accountabilities for all positions within Council are outlined in **WHS Module 01 – WHS Responsibilities** and in the **WHS Responsibilities, Authorities and Accountabilities (RAA) Table** associated with **WHS Module 01**. The RAA table includes responsibility, authority, and accountabilities for employees, managers, supervisors, contractors, visitors, and persons with specialist roles within the organisation.

In addition to **WHS Module 01 – WHS Responsibilities**, the following positions have responsibilities, authorities and accountabilities associated with this document:

Position	Responsibilities, Authorities & Accountabilities
Waste Site Supervisor	
Waste Site Attendant	
Day labour staff	
Contactors/Visitors	

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Controlled Document Information

Authorisation Details

Folder No:	F2005/01720-02	TRIM Record No:	D07985880
Audience:	Departmental - This document applies to visitors, contractors and external staff at Awaba Waste Facility		
Department:	Waste, Environment & Rangers		
Officer:	Waste Site Field Supervisor - Steven Merrett		
Review Timeframe: Max < 4 years	4 years	Next Scheduled Review Date:	5 August 2020
Authorisation:	Acting Manager Waste Environment & Rangers - Derek Poulton - 5 August 2016		

Related Document Information, Standards & References

Related Legislation:	EPA Protection of the Environment Act	(Relationship/Context)
Related Policies (Council & Internal):	(Policy Name)	(Relationship/Context)
Related Procedures, Guidelines, Forms, WHS Modules/PCD's, Risk Assessments, Work Method Statements:	Awaba Waste Management Facility, Community recycling Centre Risk Assessment. Department Induction checklist	(Relationship/Context)
Standards COP's & Other References	(Standard, COP or Other References) Environmental Guidelines for Solid Waste Landfills.	(Relationship/Context)

Definitions

Term / Abbreviation	Definition
EPA	Environmental Protection Authority

Consultation (update for each version created)

Key Departments, Teams, Positions, Meetings:	LabourCo, Contractors and Site Visitors to the Awaba Waste Facility
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Version History

Version No	Date Changed	Modified By	Details and Comments
2	August 2010	RB	Template update
3	May 2016	RB	Template update and review
3	August 2016	RB	Changes to reflect Day Labour and contractors

Appendix T – Trade Waste Agreement



HUNTER WATER CORPORATION

AND

LAKE MACQUARIE CITY COUNCIL

TRADE WASTEWATER DEED

367 WILTON RD, AWABA

DEED PARTICULARS

Item	Matter	Variable		
1	Deed Date	30/06/2020		
2	Customer	<p style="text-align: center;">Name: LAKE MACQUARIE CITY COUNCIL</p> <p style="text-align: center;">ABN: N/A</p> <p style="text-align: center;">Representative: DAVID BRAKE</p> <p style="text-align: center;">Address: PO BOX 1906, HRMC NSW</p> <p style="text-align: center;">Telephone: 02 4921 0094 Mobile: 0407 404 794</p> <p style="text-align: center;">Email: dbrake@lakemac.nsw.gov.au</p> <p style="text-align: center;">Account No: 0676510000</p> <p style="text-align: center;">Type of Customer: MAJOR</p>		
3	Hunter Water Representative	<p style="text-align: center;">Name: Plumbing and Trade Waste</p> <p style="text-align: center;">Telephone: 02 4979 9712</p> <p style="text-align: center;">Email: plumbing@hunterwater.com.au</p>		
4	Discharge Point	Property sewer point of connection - via Non Standard Sewer Service.		
5	Premises	367 WILTON RD, AWABA		
6	Activities Undertaken on Premises	WASTE DISPOSAL CENTRE		
7	Commencement Date	30/06/2020		
8	Expiry Date	5:00pm on 30/06/2021		
9	Treatment Plant	TORONTO		
10	Sampling and Testing	6 Inspection per year 12 Samples per year		
11	Treatment Equipment	Name	Size / Capacity	Quantity
		Leachate Pond (Awaba)	6,000,000L	1
		Temporary Leachate Pond (Awaba)	4,000,000L	1
		Leachate Pond (Remondis)	6,000,000L	1
		Pump Well	7,500L	1
		Odour Dosing Unit	N/A	N/A
12	Substances	Name	Concentration	Maximum Daily Discharge Mass
		BOD (Biochemical Oxygen Demand)	Not to be greater than 500 mg/L	N/A
		NFR (Non Filterable Residue)	Not to be greater than 500 mg/L	N/A
		COD (Chemical Oxygen Demand)	Not to exceed 2000 mg/L	N/A
		TKN (Total Kjeldahl Nitrogen)	Not to exceed 700 mg/L	N/A

Item	Matter	Variable		
		pH	not to be less than 6.5 or greater than 10	N/A
		TPH (Total Petroleum Hydrocarbons)	Less than 30mg/L	N/A
		Nitrogen Ammonia		Not to exceed 12kg per day
		Sulphate	Not to exceed 2000mg/L	N/A
		Zinc	Not to exceed 1.5mg/L	N/A
		Copper	Not to exceed 2mg/L	N/A
		Chromium	Not to exceed 2mg/L	N/A
		Pesticides	Prohibited	N/A
		PFAS	Refer to Special Conditions	N/A
13	Permitted Discharge Days	7 Days		
14	Permitted Discharge Hours	<ul style="list-style-type: none"> Between 12pm and 12am (Awaba leachate/amenities) Between 12pm and 12am (Remondis leachate/amenities) 		
	Maximum Instantaneous Discharge Rate	Not to exceed 11 Litres/Second		
	Maximum Daily Discharge Volume	See Special Conditions		
15	Reporting Obligations	Frequency	Obligation	
		Immediate Reporting	The applicant must report by telephone to the Hunter Water Corporation Contact Centre (1300 657 000) and by Facsimile Transmission to the Manager, Treatment Operations (Fax 49799492) any event that causes or is likely to cause an exceedance of Deed conditions.	
		General Reporting Format	Data compiled, collected or recorded during the currency of this Deed must be identified by the name of the Applicant and the location of the discharge point(s). The following reference number must be reported in all correspondence to the Hunter Water Corporation, regarding the reporting of data compiled, collected or recorded as required by the Deed.	
16	Fees and Payments	<p>The Customer shall pay such amounts as Hunter Water may from time to time determine for the discharge of Trade Waste to the Sewer. These costs will be levied on the Customer with the normal water sewer account.</p> <p>Such amounts based on the fees for allowable concentration of the discharge to Sewer as determined by The Independent Pricing and Regulatory Tribunal of NSW (IPART). These fees and allowable concentrations are published in the HWC Trade Wastewater Policy and on the Hunter Water website at www.hunterwater.com.au</p>		
17	Backflow Prevention	Compliant / Non-Compliant		
		Compliant	The property is currently compliant with the Hunter Water's requirements for site containment backflow prevention on all property service connections.	

Item	Matter	Variable
18	Special Conditions	<p>Concentration Limit: The Sample Concentration is to be determined for each of the above substances, and checked against the above Concentration Limit (mg/L) for each sample obtained. Exceeding the Concentration Limit constitutes a Breach.</p> <p>Rate of discharge of Trade Wastewater to Sewer: (i) Instantaneous rate of discharge - not to exceed 11 Litres/Second (ii) Wastewater discharge must be balanced through multiple pump runs over the allowed discharge period. This is to ensure that the entire volume of high strength ammonia (i.e. the pumped volume to meet Hunter Water requirements) is not discharged through the sewerage system to Toronto WWTW in a short period of time.</p> <p>Maximum daily discharge – not to exceed 12 kilograms/day of Nitrogen Ammonia.</p> <p>It is the responsibility of Awaba Waste Management Facility to monitor the Nitrogen Ammonia levels and make changes to the waste water discharge volume so that a maximum of 12 kilograms/day of Nitrogen Ammonia is not breached.</p> <p>Monitoring to be undertaken:</p> <ul style="list-style-type: none"> • 2 times weekly (Tuesday & Thursday) using onsite testing equipment • on a weekly basis with sample analysed by a NATA laboratory <p>The results of testing during the week may be utilised to configure weekend wastewater discharge volumes. In wet weather, if Rathmines 6 WWPS goes into “High Well” alarm, Hunter Water dispatch operators will inhibit pumping from Awaba. Pumping to be re-enabled once Rathmines 6 WWPS well level returns to normal (Hunter Water System Controller to decide when pumping from the Awaba Waste Management Facility can be re-enabled). It is recommended that LMCC ensure onsite leachate storage capacity for such instances. Variation to the nominated wastewater discharge allowance above may be implemented following pre-treatment facility installation, recognised improvements in leachate quality, and subsequent formal acceptance by Hunter Water.</p>
	Special Conditions (continued)	<p>Times of discharge</p> <p>Days of week when discharge is permitted - 7 days, Hours of the day on day when discharge is permitted: Between 12pm and 12am (Awaba leachate/amenities). Between 12pm and 12am (Remondis leachate/amenities).</p> <p>Prior to forecast wet weather and after wet weather events when a large volume of low strength ammonia (<30mg/L) accumulates in storm ponds, these storm ponds can be pumped to sewer over 24 hours not exceeding 11 litres/second until the storm ponds are empty. This is to be done by liaising with Hunter Water each day to receive approval of daily volume to be pumped and the concentration of ammonia. 12kg/day ammonia limit still applies. The results of testing during the week may be utilised to configure weekend and Public Holiday wastewater discharge volumes.</p> <p>Hunter Water performs routine and ad-hoc maintenance works at our wastewater treatment works. During specified periods, Hunter Water will require LMCC to cease discharge of leachate form the Awaba Waste Management Facility, or limit discharges to low strength leachate (ammonia less than 30mg/L) provided liaison with Hunter Water occurs each day to receive approval of daily volume to be pumped and the concentration of ammonia. Hunter Water will aim to provide advance notice where possible, however on some occasions notice will be minimal if there are</p>

Item	Matter	Variable
		breakdowns/emergency events. LMCC will need to gain daily Hunter Water approval for low strength discharges during these periods.
	Special Conditions (continued)	<p>Sampling & Analysis Whilst this is a twelve (12) month Agreement, valid until 30th June 2021, the sampling and monitoring shall align with the following annual configuration:</p> <p>Hunter Water will collect and monitor the analytes specified in "Item 12 – Substances", twelve (12) times per annum on a monthly schedule (Jan, Feb, Mar, Apr, May, June, July, Aug, Sept, Oct, Nov, Dec).</p> <p>The customer (Awaba Waste Management) is required to collect and monitor the analytes specified in "Item 12 – Substances", six (6) times per annum on a bimonthly schedule (Jan, Mar, May, July, Sept, Nov). Sample analysis to be completed by a NATA accredited laboratory. Results forwarded to Hunter Water plumbing@hunterwater.com.au</p>
	Special Conditions (continued)	<p>(a). For the purpose of avoiding unintended discharges to the Sewer or the stormwater drainage system, all matter and substances on the Premises must be processed, handled, moved and stored in a proper and efficient manner.</p> <p>(b). Any substance on the Premises which, if discharged to the Sewer, may pose a danger to the environment, the Sewer or workers at a waste water treatment plant or may harm any sewage treatment process must be handled, moved and stored in areas where leaks, spillages or overflows cannot drain by gravity or by automated or other mechanical means to the Sewer or the stormwater drainage system.</p>
	Special Conditions (continued)	PFOS/PFOA is currently not regulated by the NSW Environment Protection Authority (EPA), with draft regulation and guideline values dependent on the receiving water environment. In the absence of regulation, Hunter Water is in the process of identifying background PFOS/PFOA levels in Hunter Water's wastewater systems to enable setting concentration and mass limits for trade wastewater customers.
	Special Conditions (continued)	<p>The volume of Trade Wastewater discharged into the Sewer must be obtained from the reading of the total flow on the Customer's flow metering system.</p> <p>The rate of Trade Wastewater discharged is to be obtained by the reading of the instantaneous flow rate indicator on the Customer's flow metering system, or from any chart recorder interfaced to the Customer's flow metering system.</p> <p>The flow metering system is to be installed and maintained by the Customer at the Customer's expense, including calibration at least annually by an approved person or company. A copy of the calibration certificate is to be provided to Hunter Water.</p> <p>If the Customer's flow-metering system fails to record data for any period or may not be recording data accurately for any reason, Hunter Water is to be advised in writing by the Customer within 7 days of any such failure becoming known by the Customer.</p> <p>If in Hunter Water's opinion the Customer's flow-metering system fails to record data for any period or may not be recording data accurately for any reason, Hunter Water may calculate an Estimate as follows: Average of the waste discharged, registered for the four weeks before and/or after the failure to record.</p> <p>The Customer may request a review of the Estimate. It is the Customer's responsibility, at its own cost, to obtain and provide to Hunter Water, evidence in support of any such request. Hunter Water may refuse to undertake a review of its Estimate in the event that any amount payable by the Customer to Hunter Water under this Agreement is unpaid, including any fees charged on the basis of the Estimate. Hunter Water may undertake its own investigations of any evidence required in order to review its Estimate. Any costs incurred by Hunter Water in undertaking a review of its Estimate are a debt due and payable by the</p>

Item	Matter	Variable
		Customer to Hunter Water on demand. Hunter Water may at its absolute discretion issue an adjustment of its Estimate, including any adjustment of the fees payable by the Customer. Any such adjustment may increase or decrease the Estimate and the associated fees payable by the Customer.

EXECUTED as a Deed in **Newcastle**

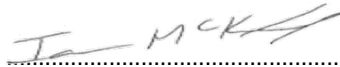
SIGNED, SEALED AND DELIVERED as a deed for)
and on behalf of **Hunter Water Corporation** by its)
authorised representative in the presence of:)
))



.....
Signature of Witness

Greg Heaney

Print Name



.....
Signature of Authorised Representative

Ian McKensey

Print Name

SIGNED, SEALED AND DELIVERED as a deed by)
the Customer in accordance with section 127 of the)
Corporations Act 2001 (Cth):)
))



.....
Signature of Director

.John Ferguson.....

Print Name



.....
Signature of Director / Secretary

Samantha Sutton.....

Print Name