June 2012

VOLUME I

Environmental Assessment - Whytes Gully New Landfill Cell

Submitted to:
NSW Department of Planning and Infrastructure

Report Number. 117625003_159_R_Rev1

REPORT

wollongong
city of innovation

Golder Associates

LIMITATIONS STATEMENT

This environmental assessment has been prepared by Golder Associates Pty Ltd (Golder) for Wollongong City Council. To the best of Golder's knowledge, the project presented herein represents the intentions of Wollongong City Council at the time of printing of the environmental assessment. However, the passage of time, manifestation of latent conditions or impacts of future events may result in the actual project and its impact being modified from that described in this environmental assessment. In preparing the environmental assessment, Golder has relied upon data, designs and plans and other information provided by Wollongong City Council and other individuals and organisations referenced herein. Refer to Volume 1 of the Environmental Assessment for the full limitations statement of Golder.

SUBMISSION OF ENVIRONMENTAL ASSESSMENT

Prepared under Schedule 6A of the *Environmental Planning and Assessment Act 1979*			
Environmental Assessment prepared by:			
Name:	Jacinta McMahon Todd Robinson Gary Schmertmann		
Address:	124 Pacific Highway St LEONARDS NSW 2065 New South Wales, Australia		
In respect of:	Whytes Gully New Landfill Cell – Environmental Assessment		
Applicant name: Applicant address:	Wollongong City Council 41 Burelli Street, Wollongong, NSW		
Proposed development:	Construction and operation of a new landfill Cell at Whytes Gully Resource Recovery Park, Kembla Grange, NSW.		
Land to be developed:	■ Part Lot 501, DP 1079122; ■ Lot 502, DP 1079122; ■ Lot 2, DP 240557; ■ Lot 52, DP 1022266; ■ Lot 53, DP 1022266; and ■ Lot 51, DP 1022266. To be developed within the local government area of Wollongong City Council.		
Environmental Assessment: Declaration:	An Environmental Assessment is attached that addresses all matters in accordance with Schedule 6A (transitional Part 3A) of the *Environmental Planning and Assessment Act 1979.* I certify that I have prepared the contents of this Environmental Assessment and to the best of my knowledge the information contained in the document is neither false nor misleading.		
Signature:			
Name:	Jacinta McMahon	Todd Robinson	Gary Schmertmann
Title	Principal Environmental Engineer	Senior Environmental Planner	Associate
Date:	29 June 2012	29 June 2012	29 June 2012

ABBREVIATIONS

AHD	Australian Height Datum
ARI	Average Recurrence Interval
AUSPLUME	A computer-based air dispersion model
AWT	Alternative Waste Technology
CBD	Central Business District
CEMP	Construction Environmental Management Plan
DGRs	Director General's Requirements
DoPI	NSW Department of Planning and Infrastructure (formerly Department of Planning (DoP)
DP	Deposited Plan
EA	Environmental Assessment
EPA	NSW Environment Protection Authority (formerly Office of Environment and Heritage (OEH), Department of Climate Change and Water (DECCW), Department of Climate Change (DEC), All terms are used interchangeably in this document.
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EP&A Regulation	NSW *Environmental Planning and Assessment Regulation 2000*
EPBC Act	Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*
EPL	Environment Protection Licence
GHG	Greenhouse Gas
ha	Hectares
kg	Kilograms
km	Kilometres
LEMP	Landfill Environmental Management Plan
LEP	Local Environmental Plan
LGA	Local Government Area
m	Metres
ml	Millilitres
MRF	Materials Recycling Facility
MSW	Municipal Solid Waste
Mt	Million tonnes
mtpa	Million tonnes per annum
OEH	NSW Office of Environment and Heritage (formerly Department of Environment, Climate Change and Water (DECCW). All terms are used interchangeably in this document.
LEMP	Landfill Environmental Management Plan
PEA	Preliminary Environmental Assessment
POEO Act	NSW *Protection of the Environment Operations Act 1997*
RTA	NSW Roads and Traffic Authority
SEPP	State Environmental Planning Policy
SEWPAC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities (formerly DEWHA)
SWERF	Solid Waste to Energy Recycling Facility
t	Tonnes
tpa	Tonnes per annum

WARR Act	NSW *Waste Avoidance and Resource Recovery Act 2001*
WARR Strategy	Waste Avoidance and Resource Recovery Strategy 2007

EXECUTIVE SUMMARY

Introduction

Wollongong City Council owns and operates Whytes Gully Resource Recovery Park, which currently receives all of the municipal solid waste within the Wollongong local government area. With existing landfill airspace at Whytes Gully Resource Recovery Park projected to expire in late 2013, Wollongong City Council is proposing a staged new landfill cell at this location.

The proposed new landfill cell would create approximately 6 million m^3 of additional landfill capacity at Whytes Gully Resource Recovery Park. The project would consist of the following key components:

- New Landfill Cell Construction (Stage 1, 2A, 2B, 3 and 4)
- New Landfill Cell Operation (Stage 1, 2A, 2B, 3 and 4)
- Progressive Landfill Rehabilitation and Revegetation of the finished Landform
- Surface Water Drains and Surface Water Ponds
- Leachate Ponds
- Landfill Gas Extraction
- Ancillary – demolition of existing buildings, construction of temporary and permanent roads.

The proposed new landfill cell would be developed by constructing the new landfill cell adjacent to the existing waste footprint and then filling the new cell and overfilling (i.e. piggy backing) the existing waste.

The Proponent

The proponent for the project is Wollongong City Council. Established in 1859, Wollongong City Council is a democratically elected local government body, responsible for providing services to the residential, commercial and industrial community of approximately 200,000 people, which is the third largest local government area within New South Wales.

Statutory Framework

The Minister for Planning and Infrastructure is the consent authority for the project, as determined by the relevant New South Wales legislation. This environmental assessment has been prepared by Golder Associates Pty Ltd in accordance with the assessment requirements of transitional Part 3A (Schedule 6A) of the *Environmental Planning and Assessment Act 1979* to provide the Minister for Planning and Infrastructure with the appropriate information to determine the proposed new landfill cell. The environmental assessment addresses the Director General's requirements for the project, which were issued 11 August 2011.

In accordance with *Wollongong Local Environment Plan (West Dapto) 2010* the project is permissible within the existing IN2 Light Industrial zoning and the planning assessment identifies the proposed project is in compliance with all relevant legislation and environmental planning instruments.

The project is subject to a range of environmental planning instruments, which provide structure and context to assessing the potential beneficial and adverse impacts during construction and operation. Mitigation and management measures are proposed throughout the environmental assessment to avoid and reduce the potential impacts of the project and enhance the benefits where feasible and considered appropriate.

Community Consultation

A comprehensive consultation process has been underway for the project since inception. Wollongong City Council has utilised a variety of methods to engage the community and has a history of working together with the community to resolve issues as they are identified, and would continue to do so with regard to the project and the Whytes Gully Resource Recovery Park site.

In accordance with the Director-Generals requirements consultation has been undertaken with a number of government agencies and stakeholders including:

- Office of Environment and Heritage;
- Roads and Maritime Services;
- New South Wales Office of Water;
- Registered Aboriginal Parties; and,
- Relevant government agency and Wollongong City Council officers associated with specific environmental issues.

Wollongong City Council is committed to maintaining regular contact with stakeholders with regard to the Whytes Gully Resource Recovery Park site. Commitments of future and ongoing consultation with regard to the project are made as part of the environmental assessment and Wollongong City Council have welcomed input to the project, with issues raised by stakeholders addressed throughout the environmental assessment.

Project Need and Justification

There are a number of drivers for the strategic need and justification for the project, which are both internal and external to Wollongong local government area. The external and internal drivers of the project arise from environmental, economic and social considerations, which are framed by legislation, policy and strategy documents at the Commonwealth, New South Wales State and local council level.

In summary, the strategic need and justification for the Project includes:

- Providing capacity for landfilling of waste generated within Wollongong local government area. While Wollongong City Council is committed to resource recovery it is considered there is a demonstrated need to provide for additional landfill capacity as no known resource recovery system can achieve a 100 percent landfill diversion performance and consequently resource recovery activities still require the disposal of residual material to landfill. In this regard the Project is considered to be of critical importance to meeting this need within Wollongong City Council's waste management network as identified within the "Wollongong City Council Waste & Resource Recovery Strategy: 2012 to 2022".
- Securing of contingency landfill capacity to address potential risks and uncertainties associated with resource recovery activities.
- Reducing the waste management footprint and subsequent impact to the environment within Wollongong LGA by extending landfill life at an existing facility. This will permit increased utilisation of existing waste management infrastructure at the Whytes Gully Resource Recovery Park site, thereby reducing environmental, economic and social impacts associated with transporting residual waste to landfill.
- Securing landfill capacity at Whytes Gully Resource Recovery Park allowing for the consideration and introduction of additional potential resource recovery facilities on the site including future Alternate Waste Treatment and Materials Recovery Facilities.
- Meeting regional councils and Wollongong LGA community expectations to provide appropriate waste management by Wollongong City Council.
- Suitability of the site, which is consistent with all legislation, guidelines and policies applicable to the site and surrounding area including the planned future use of the surrounding area. Use of the site is also based on consideration of the principles of ecologically sustainable development and consistency with the objectives of the *Environmental Planning and Assessment Act 1979.*

Project Alternatives

It is considered there are no feasible alternatives to Wollongong Council requiring capacity to landfill residual material from waste generated within Wollongong local government area. Given that landfill capacity is projected to expire in late 2013 the 'do nothing' alternative is not a feasible option.

Alternatives considered to the proposed project include transportation of waste to existing or new landfill sites outside of, or within Wollongong local government area. However, due to a number of issues such as increased transport costs, potential liabilities and externalities, increased waste footprint and/or potential underutilisation of existing resource recovery infrastructure, it is considered alternative site locations are not preferred to the proposed project which is considered the most suitable location on economic, social and environmental grounds.

Five alternative landfill design alternatives have been considered during project development with a number of further sub-options considered. Key issues for the preferred design option included consideration of potential environmental and social impacts in addition to available airspace, constructability and operational issues, in addition to cost. The preferred design option for the project is considered to provide the appropriate balance of these considerations.

Environmental Management

The environmental assessment includes a comprehensive review of current environmental management and performance at the Whytes Gully Resource Recovery Park site, which operates in accordance with multiple existing approvals in addition to the environment protection licence 5862. As a result of the Project, consolidation of all existing approvals is proposed in addition to a new environment protection licence.

The draft Landfill Environmental Management Plan for the project is provided within the environmental assessment to demonstrate the management of the site during operation. This includes identifying and focusing on the key environmental, operational and rehabilitation issues for the site. Together with further environmental management documents the draft Landfill Environmental Management Plan would be updated accordingly prior to determination of the project to reflect any further issues identified during the assessment process.

Noise

A comprehensive noise assessment was undertaken by Golder Associates. The assessment provides details of existing noise levels within the project site and surrounding area, determines the noise impact criteria based upon existing noise levels and predicts noise levels that are expected as a result of the Project.

Due to construction and landfill operation predominantly running concurrently, cumulative impacts of these activities are also assessed against relevant criteria modelling minor noise exceedence at isolated residencies during certain stages of the project. Identified appropriate mitigation and management measures would be employed to reduce the impacts of noise to the surrounding area.

Greenhouse Gas

A Greenhouse Gas Emissions assessment has been completed to provide a quantitative assessment of scope 1 and 2 emissions of the Project, calculating the Project would generate a peak emission of approximately 56,290 tonnes per annum of CO_2e in 2053 with a conservative 50 percent landfill gas capture efficiency.

While increasing landfill capacity implementation of the project would also result in significant diversion of waste from landfill through efficient waste management practises, increased resource recovery and recycling initiatives, which would otherwise contribute to landfill gas generation.

Soil, Water and Leachate

Extensive investigation and studies of the existing Whytes Gully Resource Recovery Park site has been undertaken with regard to the potential impacts of the project upon soil, surface water and groundwater.

These studies have included review of previous site investigations with the findings of the studies providing input into the design of the project including proposed mitigation and management controls, guidelines and systems to reduce the potential impacts of the project (including contingency measures where applicable).

The results of all soil, water and leachate studies completed for the project indicate that site conditions do not preclude the proposed new landfill cell at the Whytes Gully Resource Recovery Park site. Appropriate design (Appendix O) and management measures identified within the draft statement of commitments would be implemented (in addition to those in the draft Landfill Environment Management Plan provided in Appendix P for landfill operation).

Flora and Fauna

A comprehensive flora and fauna assessment has been undertaken by Biosis Research. This has considered the ecological significance of the general and threatened flora and fauna species and endangered ecological communities that occur, or have the potential to occur, at Whytes Gully Resource Recovery Park with regard to the potential impact of the proposed project.

In accordance with relevant legislation the flora and fauna assessment has included a habitat-based flora and fauna assessment (aquatic and terrestrial), detailed surveys for birds and bats, as well as targeted surveys recording two threatened species in addition to one Endangered Ecological Community (Illawarra Subtropical Rainforest) on the site.

An assessment of significance for these and further species with potential to occur on the Whytes Gully Resource Recovery Park site concluded that, providing recommended avoidance and mitigation measures are adhered to, the proposed project is unlikely to have a significant impact on threatened species or the Illawarra Subtropical Rainforest located on the site.

Air Quality

An air quality and odour assessment has been completed by PAE Holmes to evaluate the odour and dust impacts of the proposed project. Dispersion modelling has been used to predict off-site odour levels due to the activities of two worst-case stages of the project taking into account the local meteorological conditions and terrain information, and using on-site measurements to determine odour emission rates, to predict potential odour impacts at the nearest residences. Dust impacts during construction were also assessed.

Results from the dispersion modelling suggest that the proposed project would comply with the relevant legislative criteria at all potential off site residential receivers with appropriate mitigation and management measures being implemented. These measures would include restricting the size of the active tipping face and daily cover areas (with 150 millimetre cover) during the last operational stage of the project to help reduce odour emissions and potential impacts at the nearest residence to the northeast boundary.

Dust emissions from the proposed construction operations are assessed as low and short-term. Cumulative dust impacts have also been assessed and it was found that the project would be unlikely to result in cumulative impacts above the relevant criterion. It is predicted that annual average dust concentrations are unlikely to make any noticeable contribution to particulate levels at any of the surrounding receptors.

Despite these findings, mitigation measures are proposed for both odour and dust to further reduce emissions.

Traffic and Transport

A traffic and transport assessment has been completed by GTA Consultants to assess the anticipated transport implications of the proposed project including considerations of the existing traffic conditions surrounding the site, the traffic generating characteristics of the project, the suitability of existing access arrangements for the site and the transport impact of the project upon the surrounding road network.

The traffic and transport assessment identified that intersections for access and egress to Whytes Gully Resource Recovery Park are expected to operate satisfactorily as a result of the project. As a result it is considered that additional infrastructure to ameliorate potential traffic and safety impacts associated with the

project are not required. However, appropriate traffic management measures associated with the Project are proposed to be provided during construction and operation of the Project.

Based upon the calculations and assessment it is considered the project will have a low to negligible impact upon the safety and efficiency of the surrounding road network during construction and operation including at intersections within the vicinity of Whytes Gully Resource Recovery Park.

Heritage

An Aboriginal Cultural Heritage Assessment (which included archaeological investigations and extensive consultation) and a historical heritage assessment of non-indigenous heritage have been completed for the Project by Biosis Research.

Findings of the heritage assessment identify that the Project would have negligible impacts upon identified artefact scatters and/or the heritage significance of the local listed heritage building within Whytes Gully Resource Recovery Park.

Visual

The visual assessment for the project has been completed by Corkery Consulting Landscape Architects. The first step in the visual assessment process was to determine and describe the existing landscape character of the project site and surrounding areas. The assessment provides a baseline against which the potential visual impact of the proposed project can be assessed.

The baseline component of the visual assessment addresses all of the existing elements of the current landfill infrastructure (leachate ponds and treatment plants, recycling facility, amenities and administration buildings, internal road network and other infrastructure) as well as the current landfill operations. The assessment identifies the extent to which the landfill operations are currently visible from public roads, residences, work places and recreational areas located in surrounding areas.

While 24 view situations are identified and assessed, the visual assessment identifies the Project will have a moderate impact at five key view situations. Given this result the overall potential visual impact of the project is assessed as generally low to moderate, with mitigation measures proposed to reduce the potential impact of the project, including planning of the project to reduce the extent to which operations would be visible from surrounding areas of the landfill site. In addition a Landscape Strategy to reduce potential long term visual impacts has been prepared.

Socio-Economic Implications

An assessment of the economic and social impacts of the proposed project has been undertaken, demonstrating that the project would result in a net benefit to the community. This includes direct and indirect benefits to the local, regional and state economies during construction and operation, including providing for ongoing and efficient waste management and resource recovery within Wollongong LGA to greatly assist in securing the waste management needs within Wollongong LGA thereby providing the community with equitable access to waste management services.

Direct economic benefits in the form of local employment opportunities during construction and operation of Whytes Gully Resource Recovery Park would be realised through the generation of employment opportunities and potential income to local businesses, in addition to securing long term cost efficiencies such as aggregation (waste activities being located closer together) and densification of waste resources. These cost efficiencies would be passed on to the rate payers.

Overall the Project is estimated to create 6 jobs for construction and a further 6 associated with operation and maintenance. As identified the Project is consistent with all relevant strategies for the site and surround area including the West Dapto land release. The Project provides for an accessible, reliable and affordable waste facility within an area identified as appropriate for this activity.

Hazards and Risk

Hazards and risk have been assessed for the Project including a preliminary hazard analysis and bushfire risk assessment undertaken by Golder Associates. The preliminary hazard analysis for the project has been completed in accordance with the general principles of risk evaluation and assessment and documentation as outlined in *Guidelines for Hazard Analysis: Hazardous Industry Planning Advisory Paper No. 6* (Department of Planning, 2011), addressing the requirements of State Environmental Planning Policy No. 33 (Hazardous and Offensive Development).

The hazardous materials of the Project do not exceed screening thresholds and therefore the preliminary hazard analysis for the project is qualitative, finding that while the hazards and risk assessment identified potential hazardous scenarios, these are well understood with the existing operation of Whytes Gully RRP. It is considered that with identified safeguards and mitigation measures, the project would not result in a significant risk to human health, life or property or the biophysical environment.

Rehabilitation and Final Landform

In accordance with the Landscape Strategy for the project (refer to Appendix N), rehabilitation activities are proposed to be undertaken progressively throughout the construction and operation of the project to reduce impacts upon the site and surrounding area. This includes staged revegetation, construction of the capping system, and screening for visual amenity associated with the surrounding area.

The proposed final landform is designed to provide for passive open space following completion of the landfill operations and closure of the Whytes Gully RRP site. Management measures proposed to be adopted from the Landscape Strategy and the Visual Assessment (refer to Appendix K) will ensure the rehabilitation and final land use is appropriately integrated with the surrounding area, including topography of the final landform, and providing access and view areas to the coast.

Draft Statement of Commitments

The environmental assessment includes a statement of commitments outlining environmental management and monitoring measures proposed for the project as identified throughout the environmental assessment. The commitments aim to reduce potential impacts of the project including consideration of the existing mitigation and management measures in place for Whytes Gully RRP.

The draft Statement of Commitments is provided in Chapter 21 of the environmental assessment.

Next steps

Wollongong City Council is seeking approval from the Minister for Planning and Infrastructure for the construction and operation of a new landfill cell at Whytes Gully Resource Recovery Park. The next steps in the process are:

- **Exhibition of the Environmental Assessment** for a minimum of 30 days and invitation to the community and stakeholders to make submissions.
- **Consideration of submissions**. Submissions received by the Director-General of the Department of Planning and Infrastructure would be provided to Wollongong City Council and any relevant public authorities. Wollongong City Council may then be required to prepare and submit:
  - A submissions report, which contains responses to issues raised in the submissions, and/or further design development.
  - A preferred project report, outlining any proposed changes to the project to minimise its environmental impacts.
  - A revised Statement of Commitments.

- **Determination of the Environmental Assessment.** The Director-General of the Department of Planning and Infrastructure provides an assessment report on the Environmental Assessment to the Minister for Planning and Infrastructure, who then makes a decision on the project and, if approved, can set Conditions of Approval.

Consultation with the community and stakeholders would continue throughout the detailed design and construction phases.

Further details on the submissions process are available on the Department of Planning and Infrastructures' website (http://www.planning.nsw.gov.au/).

All submissions and information obtained during the public exhibition period will be used in accordance with the *Privacy Act 1988*. All submissions received are regarded as public documents and any information contained in them can be published in subsequent assessment documents. Copies of the submissions received on the project may be issued to interested parties. If the author of a submission does not wish the information to be distributed, this needs to be clearly stated in the submission.

Table of Contents

TABLES

FIGURES

PHOTOS

APPENDICES

Volume II

APPENDIX A
Director-General's requirements, outlines key issues requiring consideration in the Environmental Assessment.

APPENDIX B
Wollongong City Council Waste and Resource Recovery Strategy to 2022

APPENDIX C
Community Engagement and Consultation Materials

APPENDIX D
Noise Assessment

APPENDIX E
Greenhouse Gas Assessment

APPENDIX F
Flora and Fauna Assessment

APPENDIX G
Soil and Water

Volume III

APPENDIX H
Air Quality Assessment

APPENDIX I
Traffic and Transport Assessment

APPENDIX J
Cultural Heritage Assessment

APPENDIX K
Visual Amenity Assessment

APPENDIX L
Preliminary Hazard Analysis

APPENDIX M
Bushfire Risk Assessment

APPENDIX N
Landscape Strategy

Volume IV

APPENDIX O
Preliminary Design Report

APPENDIX P
Landfill Environment Management Plan (draft)

1.0 INTRODUCTION

1.1 Project Overview

Golder Associates Pty Ltd (Golder) has been engaged by Wollongong City Council to prepare documentation to support a project application for the Whytes Gully New Landfill Cell Project (the Project). Wollongong City Council is seeking approval of the Project in accordance with transitional Part 3A Project in accordance with the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The objectives of the Project are to:

- Meet the waste disposal needs of the Wollongong Local Government Area (LGA).
- Secure future capacity for waste disposal as a baseline facility to complement future alternate resource recovery management options in the Wollongong LGA.

The existing Whytes Gully RRP is owned and operated by Wollongong City Council and comprises:

- Part Lot 501, DP 1079122;
- Lot 502, DP 1079122;
- Lot 2, DP 240557;
- Lot 51, DP 1022266;
- Lot 52, DP 1022266; and
- Lot 53, DP 1022266.

Located at the existing Whytes Gully Resource Recovery Park (Whytes Gully RRP), the Project would create approximately 6 million m^3 of additional landfill capacity in addition to associated infrastructure. The new landfill cell would be constructed by placing new waste over the existing landfill cells on the site.

A summary table of the existing operations at Whytes Gully RRP and the proposed aspects of the Project is provided in 1.1. The existing infrastructure and operations is described in detail in Chapter 7 and the Project is described in detail in Chapter 8 of this Environmental Assessment (EA).

Figure 1.1 presents the existing site layout. The current extent of waste (blue dashed line) and the proposed extent of waste (yellow line) are both shown on this drawing for comparative purposes.

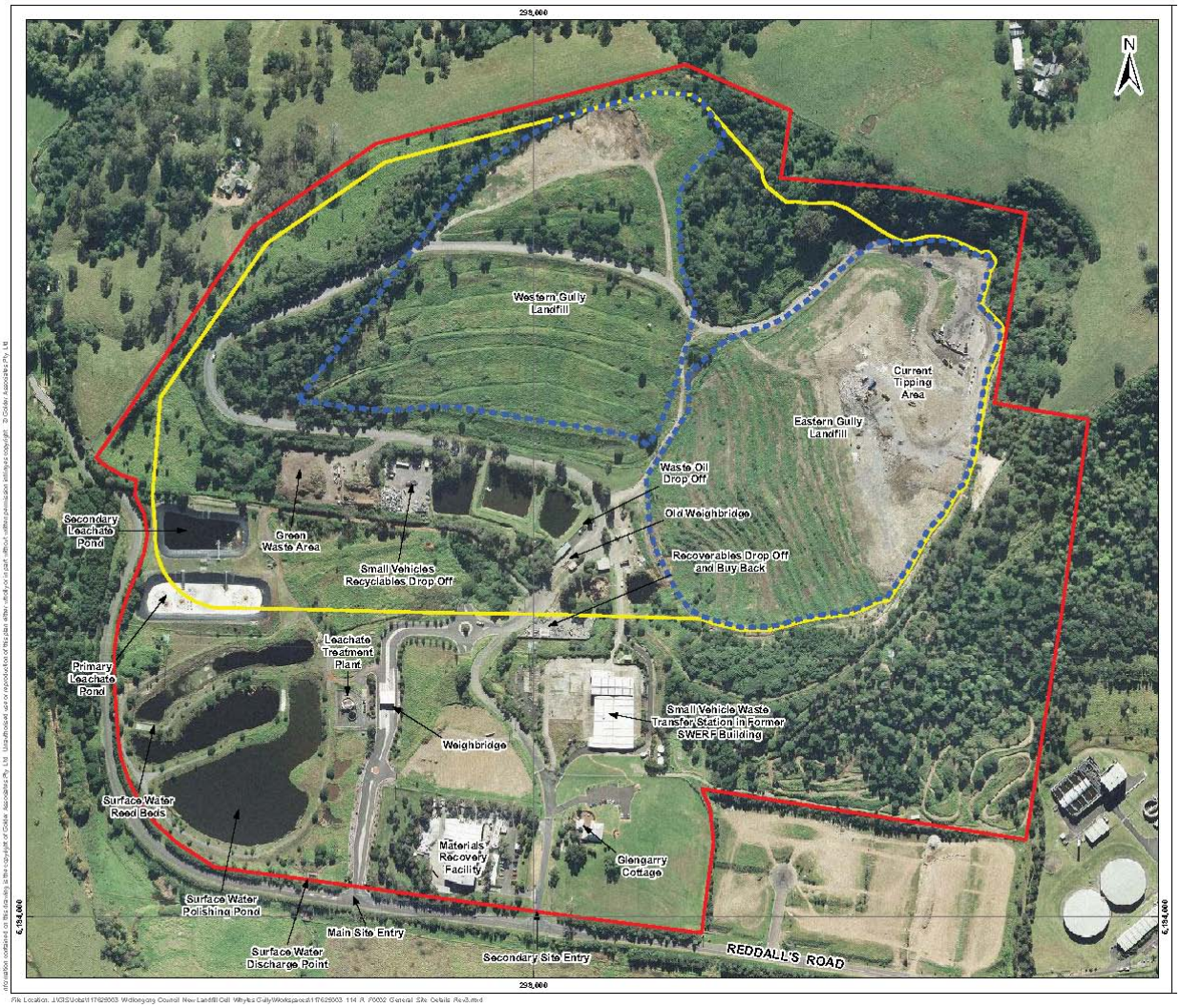


Figure 1.1: Existing Site Layout

Figure 1.2 presents the Project Layout and shows the proposed site infrastructure.

Figure 1.2: Project Layout

Figure 1.3 presents the staging for development of the new landfill cell.

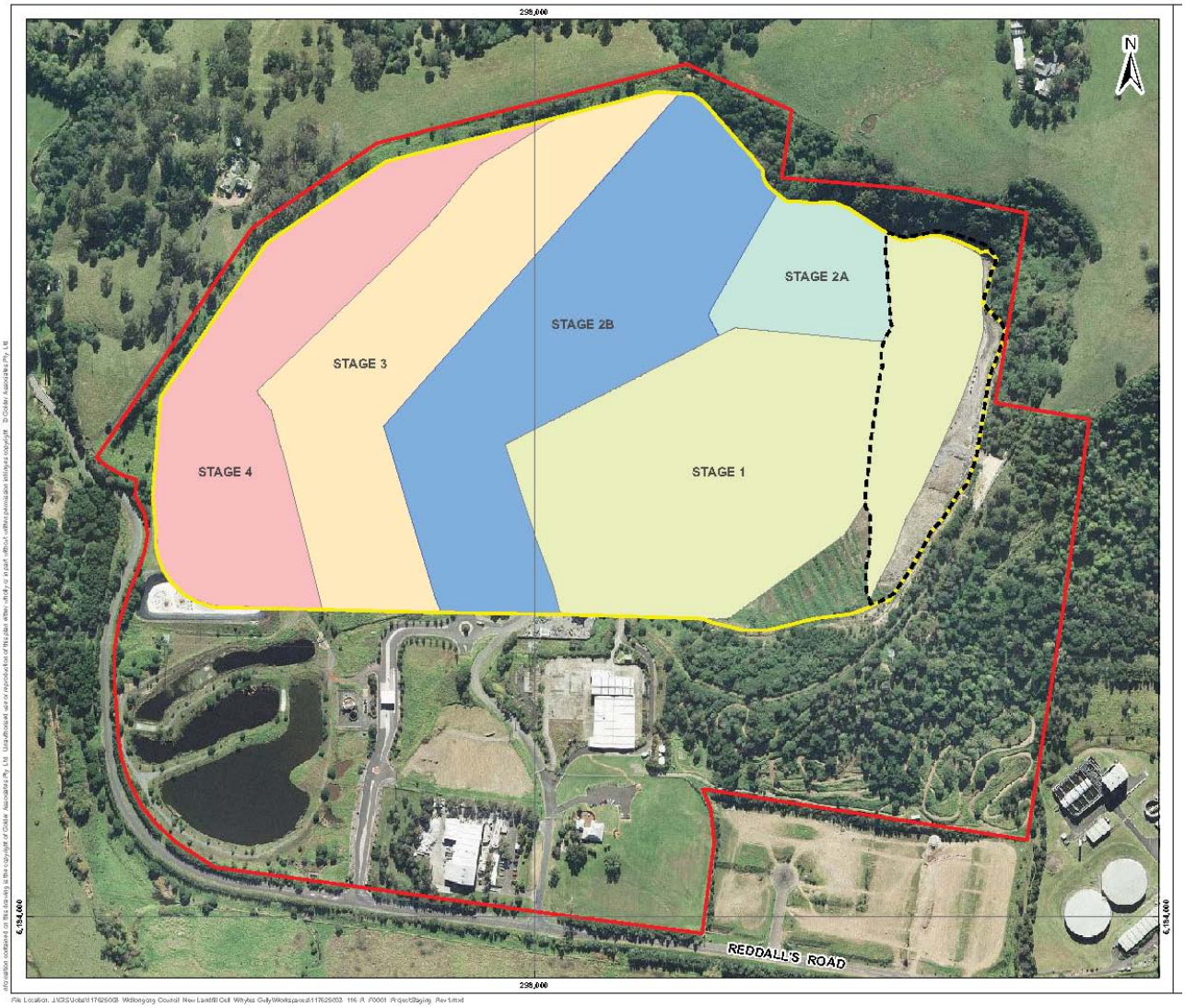


Figure 1.3: Project Staging

Table 1.1: Summary Table of Existing and Proposed Aspects of the Project

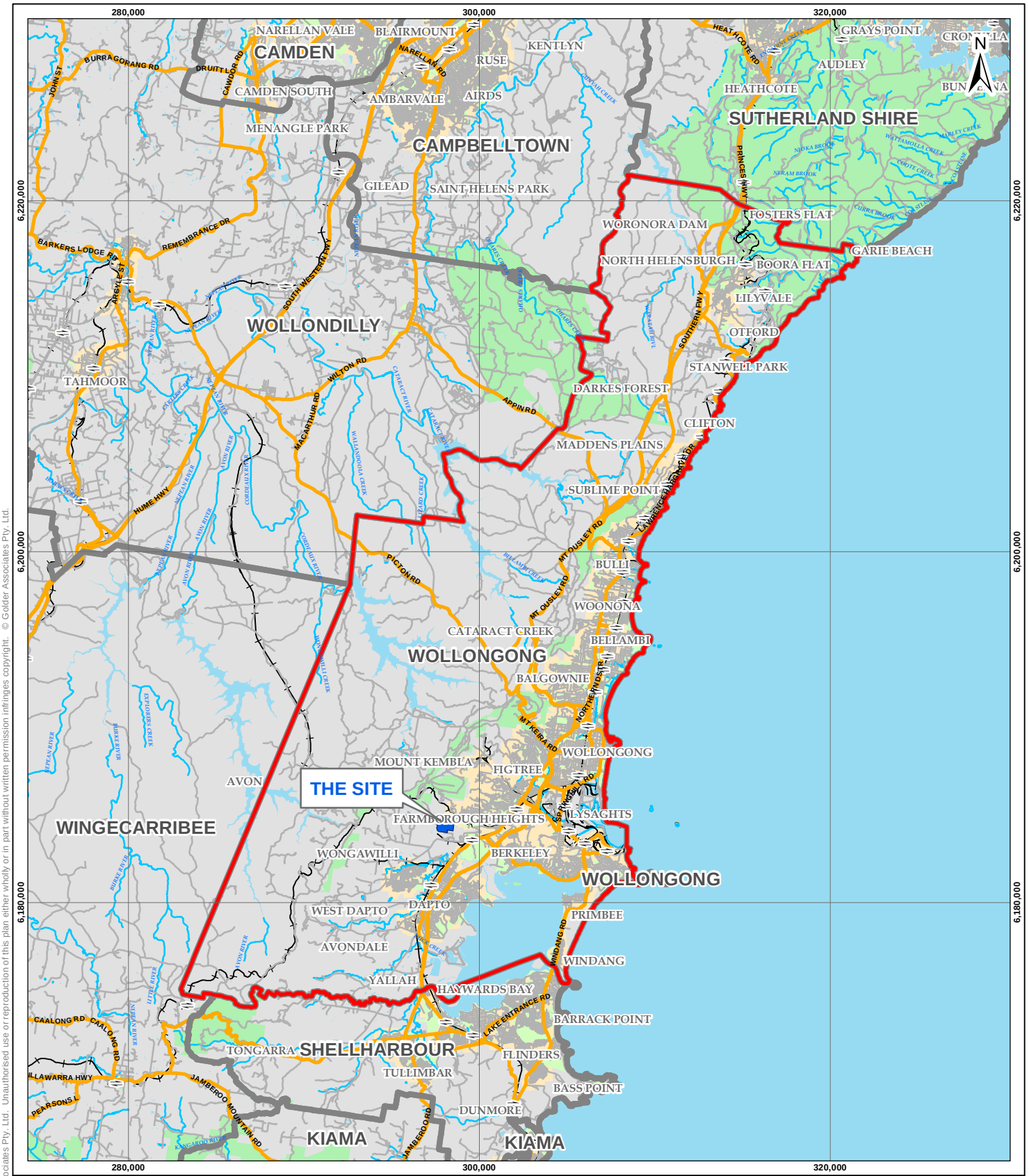
Aspect	Existing	Proposed		
Landfill capacity	Projected to reach capacity in late 2013	Approximately 6 million cu.m of landfill capacity		
Predicted lifespan of Whytes Gully RRP	Projected capacity late 2013	40.5 years resulting in capacity until 2054		
Operations Staging	Projected capacity late 2013	Stage	Years	Year
		1	4.4 yr	2013-2018
		2A	2.4 yr	2018-2020
		2B	15.2 yr	2020-2035
		3	11.3 yr	2035-2046
		4	7.2 yr	2046-2054
Construction timing for each proposed stage of construction.	-	Stage	Capping Construction Period (not continuous)	Liner Construction Period (not continuous)
		1	2016 - 2019	2013 - 2016
		2A	2020 - 2021	2017 – 2018
		2B	2023 - 2036	2019 – 2031
		3	2038 - 2047	2035 – 2041
		4	2048 – 2055	2046 – 2050
Annual tonnage input to landfill	Historically, in excess of 180,000 tpa	Approximately 180,000 tpa		
Site Boundary	65 hectares	65 hectares		
Landfill footprint	20 hectares (approx)	35 hectares (approx)		
Hours of Operation	Weekdays 7:30 to 4:30pm Saturday, Sunday and Public Holidays 8:00am to 4pm	Weekdays 7:30 to 4:30pm Saturday, Sunday and Public Holidays 8:00am to 4pm		
Infrastructure	■ Landfill cell operation and progressive rehabilitation and revegetation ■ Surface Water Drains and Surface Water Ponds ■ Leachate Ponds and Treatment Plant ■ Landfill Gas Extraction ■ ancillary buildings ■ landfill access roads Small Vehicle Transfer Station ■ Recoverables Drop off and Buy Back ■ Materials Recycling Facility ■ Green Waste Processing	■ Landfill cell construction, operation and progressive Rehabilitation and Revegetation ■ Surface Water Drains and Surface Water Ponds ■ Leachate Ponds Landfill Gas Extraction ■ demolition of existing infrastructure ■ construction of temporary and permanent landfill access roads.		

	■ Weighbridge and Old Weighbridge	
Employment (construction and operation)	■ 10 full time staff	■ 10 full time staff ■ 12 construction (capping and liner construction)
Capital Investment Value		80 million

1.2 The Proponent

Established in 1859 Wollongong City Council is responsible for providing services to the residential, commercial and industrial community of approximately 200,000 people, which is the third largest LGA in NSW.

Figure 1.4 displays the extent of Wollongong City Council's LGA, which is bordered by Shellharbour LGA to the South, Sutherland Shire to the North and Wingecarribee Shire to the west.



ENVIRONMENTAL ASSESSMENT

Wollongong City Council

REGIONAL AREA

LEGEND

- Site Location
- Wollongong Local Government Area Boundary
- Local Government Areas

0 1.25 2.5 5 7.5 10 Kilometres

SCALE (at A4) 1:300,000

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: **117625003**
DATE: **22/02/2012**
DRAWN: **AJW/FA**
CHECKED: **JMc**

FIGURE 1.4

Golder Associates

File Location: J:\GIS\Jobs\117625003_Wollongong Council_New Landfill Cell_Whytes Gully\Workspaces\117625003_XYZ_R_F0001_RegionalLocation.mxd

1.3 The Need for the Project

The need for the Project includes:

- Existing landfill airspace at Whytes Gully RRP is projected to expire in late 2013. No further sites within Wollongong LGA are available to accept the Municipal Solid Waste (MSW). The *Local Government Act 1993* (LGA) imposes on councils the responsibility to collect and dispose of waste from domestic premises.
- Providing capacity for landfilling of MSW within Wollongong LGA. While Council is committed to resource recovery targets and the principles of ESD, it is considered there is a strategic need to provide for additional landfill space.
- Contingency to secure Council's future waste disposal options and to complement future alternate resource recovery management options in the Wollongong Region.
- Reduce the waste management footprint and subsequent impact to the environment within Wollongong LGA by extending landfill life at an existing facility. Increasing the landfill life on the existing site would allow increased utilisation of existing waste management infrastructure at the site.
- Securing landfill capacity at Whytes Gully RRP allowing for the consideration and introduction of additional potential resource recovery facilities on the site including future Alternative Waste Treatment (AWT) and/or Materials Recovery Facilities.

The Project is considered to be an important focus area of the "Waste & Resource Recovery Strategy 2012 to 2022" (Waste Strategy) for the Wollongong City Council's LGA, which seeks to increase resource recovery and reduce the amount of waste disposed of to land. While addressing relevant resource recovery and waste minimisation targets of Commonwealth, State and Local legislation and policy, the Waste Strategy recognises that a portion of residual waste would still require disposal to land. Refer to Appendix B of the EA for the Waste Strategy.

Refer to Chapter 4 of the EA, which identifies in more detail of the strategic needs for the Project.

1.4 Assessment Process

This EA has been prepared as a transitional Part 3A project in accordance with Schedule 6A of the EP&A Act. The transitional Part 3A environmental assessment process seeks to ensure that the community is consulted and that all relevant environmental matters, including issues raised by the community, are considered during the development and assessment of the Project.

The EA addresses the 'Director-General's Requirements' (DGRs), which were issued by the Director-General of the NSW Department of Planning and Infrastructure (DoPI) following consultation with government stakeholders to scope the environmental assessment requirements. The EA is set out to address the DGRs including the assessment of the potential key issue impacts of the Project and where applicable identifies mitigation and management strategies to avoid and reduce potential impacts and enhance the benefits of the Project.

The EA will be placed on public exhibition for a minimum of 30 days during which time the community and all other stakeholders may lodge submissions with regard to the Project. Following the public exhibition, all submissions will be forwarded to the Proponent by the DoPI. Following exhibition the Director-General of the DoPI will require the preparation of a submissions report, which may include a revised Statement of Commitments (refer to Chapter 21 of the EA for the draft) in responding to the submissions. An assessment report by the DoPI will then be prepared to assist the Minister for Planning and Infrastructure in determining whether to grant approval to the Project.

1.5 Structure of the Environmental Assessment

This EA is presented in four volumes. Volume One contains the main environmental assessment report, with Volume Two, Volume Three and Volume 4 comprises the appendices, which form the technical basis of the information in Volume One. The mitigation and management measures suggested in the specialist reports have been taken into account in developing the Draft Statement of Commitments for the Project.

The structure of the EA is summarised in Table 1.2: Structure of the Environmental Assessment.

Table 1.2: Structure of the Environmental Assessment

Volume 1 – EA Chapters

Chapter	Description
Chapter 1 – Introduction	Provides an overview of the need and description of the Project. Outlines the purpose of the Environmental Assessment document.
Chapter 2 – Statutory Framework	Provides information on the relevant legislation and environmental planning instruments that apply to the Project.
Chapter 3 – Stakeholder Engagement	Provides an overview of the community consultation and stakeholder engagement processes that have been undertaken for the Project to date.
Chapter 4 – Strategic Need	Provides the strategic context and need including the internal and external drivers for the Project addressing legislative, economic, environmental and social considerations.
Chapter 5 – Project Alternatives	Describes the alternative options to the Project that have been considered.
Chapter 6 – Environmental Setting	Provides an overview of the existing environment of the Project site.
Chapter 7 – Existing Infrastructure and Operations	Provides a history of development on the site and identifies and discusses the existing infrastructure and operations.
Chapter 8 – Project Description	Provides a detailed description of the Project.
Chapter 9 – Environmental Risk Analysis	Details the risk analysis process by which key environmental issues may be identified for assessment.
Chapter 10 – Noise	Assesses the potential impacts of noise during construction and operation of the Project.
Chapter 11 – Greenhouse Gas	Assesses the potential greenhouse gas emission impacts during construction and operation of the Project.
Chapter 12 – Soil and Water	Assesses the potential impacts upon soil and water and the management systems to address these issues.
Chapter 13 – Flora and Fauna	Assesses the potential impacts upon flora and fauna including terrestrial and aquatic as appropriate.
Chapter 14 – Air Quality and Odour	Assesses the potential impacts upon air quality and odour during construction and operation of the Project.
Chapter 15 – Traffic and Transport	Assesses the potential impacts on the transport networks from construction and operational traffic.
Chapter 16 – Heritage	Assesses the potential impacts on indigenous and

Volume 1 – EA Chapters	
Chapter	**Description**
	non indigenous heritage resources.
Chapter 17 – Visual	Assesses the potential visual impacts of the Project upon on the amenity of the surrounding area.
Chapter 18 – Socio-Economic	Assessment of the economic and social impacts of the Project.
Chapter 19 – Hazards and Risk	Assesses the hazards and risk associated with the Project including potential bushfire risks.
Chapter 20 – Rehabilitation and Final Landform	Provides details on the proposed rehabilitation and final landform including how the site would be rehabilitated and integrated with the surrounding environment.
Chapter 21 – Draft Statement of Commitments	Provides a draft Statement of Commitments.
Chapter 22 – Project Justification and Conclusions	Confirms the justification for the Project, considering the project's potential environmental impacts and consistency with the principles of ecologically sustainable development, site suitability and consistency with the EP&A Act.
Limitations	
References	

Volume 2 – Appendices
Appendix A - Director-General's requirements, outlines key issues requiring consideration in the Environmental Assessment
Appendix B – Wollongong City Council Waste and Resource Recovery Strategy 2012 – 2022
Appendix C – Community Engagement and Consultation Materials
Appendix D – Noise Assessment
Appendix E – Greenhouse Gas Assessment
Appendix F – Flora and Fauna Assessment
Appendix G – Soil, Water and Leachate

Volume 3 – Appendices
Appendix H – Air Quality Assessment
Appendix I – Traffic and Transport Assessment
Appendix J – Heritage Assessment
Appendix K – Visual Assessment
Appendix L – Preliminary Hazard Analysis
Appendix M – Bushfire Risk Assessment
Appendix N – Landscape Strategy

Volume 4 – Appendices
Appendix O – Preliminary Design Report
Appendix P – Landfill Environment Management Plan (draft)

1.6 Project Team

Golder Associates has prepared this EA on behalf of Wollongong City Council. A number of other organisations also contributed specialist studies as part of the environmental assessment process, including:

- Consultation – Twyfords Communication
- Air Quality – PAEHolmes
- Traffic and Transport – GTA Consultants
- Flora and Fauna and Heritage – Biosis Research
- Visual and Landscape Strategy – Corkery Consulting

2.0 STATUTORY FRAMEWORK

This chapter outlines the relevant statutory requirements for assessment of the Project, explains the assessment and approval process, and considers the application of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and relevant guidelines, policies, plans and further relevant statutory provisions.

The Director-General's requirements ■ *an assessment of the potential impacts of all stages of the project taking into consideration any relevant guidelines, policies, plans*	**Chapter 2**

2.1 New South Wales Legislation

2.1.1 EP&A Act

Development in New South Wales (NSW) is regulated by the EP&A Act (and the associated EP&A Regulation), which is the primary legislation for establishment of the framework for environmental planning and assessment in NSW.

The objects of the EP&A Act are:

a) *To encourage:*
   - i) *The proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, waters, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment;*
   - ii) *The promotion and co-ordination of the orderly and economic use and development of land;*
   - iii) *The protection, provision and co-ordination of communication and utility services;*
   - iv) *The provision of land for public purposes;*
   - v) *The provision and co-ordination of community services and facilities;*
   - vi) *The protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats;*
   - vii) *Ecologically sustainable development, and*
   - viii) *The provision and maintenance of affordable housing.*

b) *to promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and*

c) *to provide increased opportunity for public involvement and participation in environmental planning and assessment.*

These objects are addressed throughout the EA and in particular in Chapter 22 – Justification in relation to the Project.

2.1.2 Transitional Part 3A Project

Major projects have been assessed under Part 3A of the EP&A Act since 2005. However, NSW Parliament recently enacted the *Environmental Planning and Assessment Amendment (Part 3A) Repeal Act 2011* (The Amendment Act), which repeals Part 3A. This Act commenced on 1 October 2011.

The Amendment Act (and the *Environmental Planning and Assessment Amendment Regulation 2011*) makes provision for transitional arrangements in respect of Part 3A projects through the insertion of Schedule 6A into the EP&A Act. Schedule 6A identifies that Part 3A will continue to apply to "transitional Part 3A projects", being:

- Approved projects (whether approved before or after the repeal of Part 3A);
- Projects for which Director General's environmental assessment Requirements (DGRs) were notified or adopted before the repeal of Part 3A; and
- Projects declared to be transitional Part 3A projects by the Amendment Regulation.

The Project received DGRs on the 11 August 2011 (refer to Appendix A) and is therefore considered to be a "transitional Part 3A project" in accordance with Schedule 6A of the EP&A Act.

Clause 3 of Schedule 6A of the EP&A Act provides the following relevant information on the assessment of "transitional Part 3A projects":

> *(1) Part 3A of this Act (as in force immediately before the repeal of that Part and as modified under this Schedule after that repeal) continues to apply to and in respect of a transitional Part 3A project.*
>
> *(2) For that purpose:*
>
> *(a) any State environmental planning policy or other instrument made under or for the purposes of Part 3A, as in force on the repeal of that Part and as amended after that repeal, continues to apply to and in respect of a transitional Part 3A project, and*
>
> *(b) declarations, orders, directions, determinations or other decisions with respect to a transitional Part 3A project continue to have effect and may continue to be made under Part 3A (including for the purpose of the application or continued application of Part 4 or 5 or other provisions of this Act in relation to the project).*

2.1.3 Environmental Planning Instruments

Within the framework of the EP&A Act, Environmental Planning Instruments (EPIs) are required to be addressed as part of the transitional Part 3A assessment. It is considered the following EPIs are potentially relevant to the Project.

- State Environmental Planning Policies (SEPP)
  - SEPP (Major Development) 2005.
  - SEPP (Infrastructure) 2007.
  - SEPP No. 33 Hazardous and Offensive Development.
  - SEPP No. 44 Koala Habitat Protection.
  - SEPP No. 55 Remediation of Land.
- Local Government legislation
  - *Wollongong Local Environment Plan (West Dapto) 2010*

SEPP (Major Development) 2005

SEPP (Major Development) 2005 identifies development to which the development assessment and approval process under Part 3A of the EP&A Act applies (and transitional Part 3A project as per Schedule 6A of the EP&A Act). Schedule 1, Group 9 (resource and waste related industries) provides that "resource recovery or waste facilities" with a capacity to receive more than 75,000 tonnes per year of putrescibles waste are a class of development to which Part 3A (transitional) applies.

On the 26 July 2010 the Project was declared a project to which Part 3A of the EP&A Act applies. In accordance with Schedule 6A (2)(b) of the EP&A Act (refer to Section 2.1.2), this declaration continues to have effect with respect to transitional Part 3A projects and therefore the Project will continue to be assessed and determined under Part 3A, as in force immediately before its repeal.

SEPP (Infrastructure) 2007

SEPP *(Infrastructure) 2007* (Infrastructure SEPP) was introduced to facilitate the effective delivery of infrastructure across the NSW State by improving regulatory certainty and efficiency through a consistent planning regime for infrastructure and the provision of services across NSW.

Of most relevance to the Project, clause 123 of the Infrastructure SEPP provides for matters of consideration in determining a development application for development for the purpose of the construction, operation or maintenance of a landfill for the disposal of waste.

Specifically Clause 123 of the Infrastructure SEPP identifies the following:

> *(1) In determining a development application for development for the purpose of the construction, operation or maintenance of a landfill for the disposal of waste, including putrescible waste, the consent authority must take the following matters into consideration:*
>
> > *(a) whether there is a suitable level of recovery of waste, such as by using alternative waste treatment or the composting of food and garden waste, so that the amount of waste is minimised before it is placed in the landfill, and*
> >
> > *(b) whether the development:*
> >
> > > *(i) adopts best practice landfill design and operation, and*
> > >
> > > *(ii) reduces the long term impacts of the disposal of waste, such as greenhouse gas emissions or the offsite impact of odours, by maximising landfill gas capture and energy recovery, and*
> >
> > *(c) if the development relates to a new or expanded landfill:*
> >
> > > *(i) whether the land on which the development is located is degraded land such as a disused mine site, and*
> > >
> > > *(ii) whether the development is located so as to avoid land use conflicts, including whether it is consistent with any regional planning strategies or locational principles included in the publication EIS Guideline: Landfilling (Department of Planning, 1996), as in force from time to time, and*
> >
> > *(d) whether transport links to the landfill are optimised to reduce the environmental and social impacts associated with transporting waste to the landfill.*

Refer to Chapter 4 of the EA, which further identifies the review of the Project against clause 123 of the Infrastructure SEPP.

In addition the Infrastructure SEPP repeals *State Environmental Planning Policy 11 – Traffic Generating Development*. In this regard, Clause 104 in conjunction with Schedule 3 of the Infrastructure SEPP identifies what is considered to be traffic generating development requiring consultation with the RTA. Landfill facilities of any size or capacity are identified as a traffic generating activity under Column 1 of Schedule 3 and therefore this provision of the SEPP applies.

SEPP No. 33 Hazardous and Offensive Development

SEPP No. 33 Hazardous and Offensive Development (SEPP 33) aims to ensure that development that is deemed a hazardous or offensive industry is identified and assessed appropriately including identifying appropriate mitigation measures. The draft 2008 guideline "Applying SEPP 33" has been utilised to assist in SEPP 33 application to the Project.

The Project is considered to be a potentially offensive industry as the waste related activities may potentially impact upon the surrounding localities, even after measures are taken to reduce potential impacts. However, in accordance with the guidelines if assessment can demonstrate that the offense can be controlled to a level that is not significant (i.e. in accordance with an Environmental Protection Licence (EPL) issued for the Project under the *Protection of the Environment Operations Act 1997*) then the activity is not considered offensive.

Whytes Gully RRP currently operates in accordance with an EPL, which will require renewal to include the Project. Subject to complying with the new EPL it is considered the Project is not an offensive industry but for the purposes of assessment is considered "potentially offensive".

It is considered the Project is not a "Hazardous industry" as when the measures proposed to reduce impacts of the Project are employed there would not be a significant risk to human health, life or property or the biophysical environment. To confirm this view a Preliminary Hazard Analysis (PHA) has been completed (refer to Appendix L) with further discussion provided in Chapter 19 of the EA).

SEPP 33 requires that potentially hazardous or offensive developments are publicly advertised under the same requirements as for designated developments. Community consultation has been carried out as per these requirements and in accordance with the EP&A Act.

It is considered the Project is not a hazardous or offence industry and is permissible under SEPP 33.

SEPP No. 44 Koala Habitat Protection

Part 2 of *SEPP No.44 Koala Habitat Protection* (SEPP 44) sets out the assessment process for consideration during assessment. No koalas were identified during the fauna surveys and the Whytes Gully RRP site does not contain core Koala habitat. Therefore no further consideration of SEPP 44 is required.

SEPP No. 55 Remediation of Land

SEPP No.55 Remediation of Land (SEPP 55) provides a State wide planning approach to the remediation of contaminated land.

Clause 7 of SEPP 55 states:

> *A consent authority must not consent to the carrying out of any development on land unless:*
>
> *(a) it has considered whether the land is contaminated, and*
>
> *(b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and*
>
> *(c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.*

In accordance with SEPP 55, the consent authority would need to assess the impact of historical operations on the site.

Refer to Chapter 12 for further discussion of contamination and suitability of the Whytes Gully RRP site for the Project.

Wollongong Local Environment Plan (West Dapto) 2010

The site of the Project is zoned as IN2 Light Industrial under the *Wollongong Local Environment Plan (West Dapto) 2010* (LEP). This zoning permits Waste or Resource Management Facilities, which are defined within the LEP and also by Clause 120 of SEPP Infrastructure 2007 as follows:

> ***Waste or resource management facility*** *means a waste or resource transfer station, a resource recovery facility or a waste disposal facility; and;*
>
> ***Waste disposal facility*** *means a facility for the disposal of waste by landfill, incineration or other means, including associated works or activities such as recycling, resource recovery and other resource management activities, energy generation from waste gases, leachate management, odour control and the winning of extractive material to generate a void for disposal of waste or to cover waste after its disposal.*

The Project fits this description and is therefore considered permissible with consent in accordance with the provisions of the LEP and the Infrastructure SEPP.

2.1.4 Further NSW Legislation and Policies

In addition to the EP&A Act, there is further NSW legislation and documentation, which may be relevant to the Project and the preparation of the EA. These are listed in Table 2.1: Further potentially relevant NSW Legislation and Table 2.2 Relevant Strategies, Policies and Guidelines of the Project.

Table 2.1: Further potentially relevant NSW Legislation

Act	Description	Note
Protection of the Environment Operations Act 1997 (POEO Act)	The (POEO Act) relates to pollution management and waste disposal in NSW and establishes requirements for licensing of certain activities that are listed in Schedule 1 of this Act.	An Environmental Protection Licence (EPL) or Variation to the Existing EPL will be required from the Office of Environment and Heritage (OEH) in order for the Project to operate. With Whytes Gully RRP proposed to operate under a single consolidated consent, it may be necessary to vary the EPL for the site. Appropriate consultation with the relevant agency will ensure obligations of the POEO Act are met.
Waste Avoidance and Resource Recovery Act 2001 (WARR Act)	Implemented to encourage efficient use of resources and to reduce environmental harm in accordance with the principles of ecologically sustainable development and to ensure that resource management options are considered against a hierarchy of avoidance of unnecessary resource consumption, resource recovery and disposal to provide for the continual reduction in waste generation. In addition the WARR Act seeks to encourage the avoidance of waste and the reuse and recycling of waste to achieve integrated waste and resource management planning, programs and service delivery on a State-wide basis.	It is considered the Project is consistent with the WARR Act as addressed in Chapter 4 of the EA.

Act	Description	Note
Contaminated Lands Management Act 1997	The *Contaminated Lands Management Act 1997* regulates contaminated sites in NSW.	The Project will be managed in accordance with the *Contaminated Lands Management Act 1997.* This includes consultation with the relevant authorities and management of ground contamination in accordance with this act. Refer to Chapter 12 of the EA for further details.
Roads Act 1993	Pursuant to Section 138 of the *Roads Act 1993*, consent is required to excavate or otherwise disturb the surface of a public and classified road.	The Project does not propose to excavate or otherwise disturb the surface of a public or classified road. However, liaison with the RTA has been completed as part of the EA in accordance with the DGRs for the Project.
Rural Fires Act 1997	The *Rural Fires Act 1997* requires practicable steps to prevent the occurrence and spread of bushfires on the site land.	The Project site is partially located in areas identified as buffer and bushfire prone land and therefore would require consideration under the *Rural Fires Act 1997.* However, transitional Part 3A projects do not require a bushfire safety authority under Section 100B of the *Rural Fires Act 1997.*
Threatened Species Conservation Act 1995	The NSW *Threatened Species Conservation Act 1995* provides for the listing and protection of threatened species, populations, ecological communities, their habitats and critical habitat in NSW.	No additional approval/licence is required during assessment as a transitional Part 3A project.
National Parks and Wildlife Act 1974	The *National Parks and Wildlife Act 1974* (NPW Act), provides regulation for proposed works affecting threatened species, populations and ecological communities or their habitat or critical habitat. Aboriginal or indigenous sites of significance are also protected under the NPW Act.	An aboriginal heritage permit is not required for projects assessed as a transitional Part 3A project.
Heritage Act 1977	The purpose of the *Heritage Act 1977* (Heritage Act) is to protect and conserve non-Aboriginal cultural heritage including heritage items, sites and relics.	No additional approval/licence required during assessment as a transitional Part 3A project.

Act	Description	Note
Native Vegetation Act 2003	The *Native Vegetation Act 2003* (NV Act) provides for the management and protection of native vegetation. The objectives of the NV Act include the management of native vegetation prevention of broad-scale clearing, protection of native vegetation of high conservation value and encouragement of revegetation.	The Project area is zoned IN2 Light Industrial and is therefore exempted from the NV Act under Schedule 1 Part 3 of the NV Act.
Fisheries Management Act 1994	In accordance with Schedule 6 of the *Fisheries Management Act 1994* degradation of native riparian vegetation along NSW water courses is listed as a 'key threatening process' (KTP). KTP's are "threatening processes that, in the opinion of the Fisheries Scientific Committee, adversely affect threatened species populations or ecological communities, or could cause species, populations or ecological communities that are not threatened to become threatened." Where a proposed development has the potential to constitute a KTP, relevant assessments must be undertaken in consultation with relevant government agencies.	A permit under section 201, 205 or 219 of the *Fisheries Management Act 1994* is not required for assessment of transitional Part 3A projects.
Water Management Act 2000	The *Water Management Act 2000* (WMA) is the dominant regulation for management of water resources in NSW. The key object of this Act is to provide for the sustainable and integrated management of the water resources of NSW.	Transitional Part 3A projects are exempt from a water use approval, water management approval and/or a controlled activity approval. However, in accordance with the DGRs, the relevant assessment of water issues is addressed in Chapter 12 of the EA.
Water Act 1912	The Project would involve the installation of bores on the site enabling monitoring of groundwater quality.	Licences as prescribed under Section 112 has been received.

Table 2.2: Relevant Strategies, Policies and Guidelines of the Project

Strategy/Policy/Guideline	Description	Note
NSW Waste Avoidance and Resource Recovery Strategy (WARR Strategy)	Provides the framework for providing for conservation of natural resources and reducing environmental harm from waste management and disposal of solid waste. Includes targets in preventing and avoiding waste, increasing recovery and use of secondary materials, reducing toxicity in products and materials, and reduction litter and illegal dumping. 2014 targets for increases in recycling of municipal waste from baseline 26 percent to 66 percent in 2014, from 28 percent to 63 percent for commercial & industrial waste and from 65 percent to 76 percent for construction and demolition waste.	The Project is consistent with the WARR Strategy in that it delivers improved resource recovery outcomes. Chapter 4 further assesses the Project with regard to the WARR Strategy.
DECC's Guidelines for Solid Waste Landfills	The guidelines focus on the environmental management of landfills, which needs to be considered both 'up front' during the design and planning process and during the life of the landfill. This includes the strategic approach to landfilling when establishing their siting, design, monitoring and management and to consider the benchmark techniques when arriving at their preferred approach to meeting the Environmental Goals.	It is considered the Project is consistent with the aims, objectives and guidance in DECC's Guidelines for Solid Waste Landfills. Chapter 12 of the EA further assesses the Project with regard to these guidelines.
EIS Guideline: Landfilling (Department of Planning, 1996).	The EIS Guideline for Landfilling identifies a number of issues and principles to be considered when preparing an environmental impact statement or EA. This includes site selection procedures consistent with 'locational principles', evaluating of alternative sites and ascertaining the suitability of the proposed location.	It is considered the Project is consistent with principles included in the publication EIS Guideline: Landfilling. Chapter 12 further assesses the Project with regard to these guidelines.
Wollongong City Council Waste & Resource Recovery Strategy: 2012 to 2022 (2011)	The Waste Strategy provides the strategic need that underpins the need for the Project including meeting the waste disposal needs of the Wollongong LGA.	It is considered the Project is consistent with the Waste Strategy and is addressed further in Chapter 4 of the EA.

Strategy/Policy/Guideline	Description	Note
Illawarra Sub-Regional Strategy 2006-31	Applies to the local governments areas of Kiama, Shellharbour and Wollongong. It incorporates specific regional infrastructure requirements identified in the State Government's infrastructure Strategy and is intended to inform infrastructure investment in the region. Waste Management is a key consideration of this strategy.	It is considered the Project is consistent with the Illawarra Sub-Regional Strategy

2.2 Commonwealth Legislation

In addition to NSW legislation, concurrent Commonwealth legislation may apply to assessment of the Project.

2.2.1 Environment Protection and Biodiversity Act 1999

The *Environmental Protection and Biodiversity Act 1999* (EPBC Act) prescribes the Commonwealth's role in environmental assessment, biodiversity conservation and the management of protected areas and species, populations and communities and heritage items.

Assessment and approval under the EPBC Act is required if the Project is:

- An action that has, would have, or is likely to have a significant impact on "matters of National Environmental Significance" (NES matters);
- An action that is likely to have a significant impact on the environment of Commonwealth land;
- An action taken on Commonwealth land that is likely to have a significant impact on the environment anywhere; and
- An action by the Commonwealth that is likely to have a significant impact on the environment anywhere;

NES matters include:

- World heritage values of a declared World Heritage property;
- National heritage values of a listed National Heritage Place;
- Wetlands of International Significance (including Ramsar wetland Sites);
- The Commonwealth marine environment;
- Nuclear actions;
- Listed threatened species and ecological communities, and
- Listed migratory species.

The requirement for a Commonwealth approval is assessed through a referral process by the Proponent where NES matters are potentially impacted upon by the Project. Referral is made to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPAC).

If the Commonwealth Minister for SEWPAC determines that a project is likely to have a significant impact, the Project would be declared a controlled action and approval of the Commonwealth Minister is required.

The assessment of the Project to date has identified it is not likely to have significant impact upon NES matters. A referral of the Project has not been made at the time of preparing the EA.

2.2.2 National Greenhouse and Energy Reporting Act 2007

The Project would need to consider the *National Greenhouse and Energy Reporting Act 2007* (NGER Act), which establishes a mandatory corporate reporting system to report greenhouse gas emissions, reductions, removals and offsets, and energy consumption and production. The NGER Act requires corporations that control facilities emitting approximately 25 tonnes or more of greenhouse gas (CO2 equivalent) per year to register and report their greenhouse gas emissions.

In addition to complying with the requirements of the NGER Act, the package of legislation associated with the *Clean Energy Bill 2011* (assented November 2011) is likely to require further reporting and management measures, which the Project will comply with.

2.3 Environmental Assessment and Approval Process

The steps in the assessment and approval process under Part 3A of the EP&A Act are summarised below. For further information on the process for assessment and approval under Part 3A, refer to the website of the Department of Planning and Infrastructure (www.planning.nsw.gov.au).

Step 1 – Lodgement of application: On 6 July 2011, Wollongong City Council lodged a major project application for the proposed Whytes Gully New Landfill Cell.

Step 2 – Environmental assessment requirements On 11 August 2011, the Director-General of the DoPI issued environmental assessment requirements or DGRs. The DGRs, which are included in Appendix A of the EA, were prepared following consultation with relevant government agencies. The key issues raised in the DGRs, which are required to be assessed in the EA include:

- Waste Management
- Soil, Water and Leachate
- Air Quality and Odour
- Greenhouse Gas
- Biodiversity
- Traffic and Transport
- Noise
- Heritage
- Hazards and Risk
- Visual
- Socio-Economic
- Rehabilitation and Final Landform

The DGRs also specify further requirements including appropriate design, justification and the need for community and stakeholder consultation and the preparation of an environmental risk assessment.

Step 3 – Preparation of Environmental Assessment: The Proponent has prepared this Environmental Assessment in accordance with the DGRs and has been submitted to the DoPI for review prior to public exhibition.

Step 4 – Public exhibition: When the Director-General advised the Proponent that the EA adequately addresses the DGRs, it will be placed on public exhibition for a period of not less than 30 days. During this period, any person (including a public authority) may make written submissions to the Director-General.

Step 5 – Consideration of public submissions: Following public exhibition, the Director-General will consider the submissions received and provide copies of submissions to the Proponent, or a report on the issues raised in the submissions. The Director-General may then require the Proponent to:

- Submit a response to the issues raised in the submissions.
- Prepare a Preferred Project Report that outlines any changes to the project to minimise its environmental impact.
- Prepare a revised Statement of Commitments.

Step 6 – Preparation of Director-General's report: The Director-General will prepare a report on the Project to assist the Minister for Planning's (or delegate) consideration of the application for approval to carry out the Project.

Step 7 – Decision by the Minister for Planning: Following review of the Director-General's report, the Minister for Planning (or delegate) will decide whether or not to approve the Project. The Minister may approve the project with such modifications or on such conditions as the Minister may determine.

2.3.1 Summary of Approvals for Whytes Gully RRP

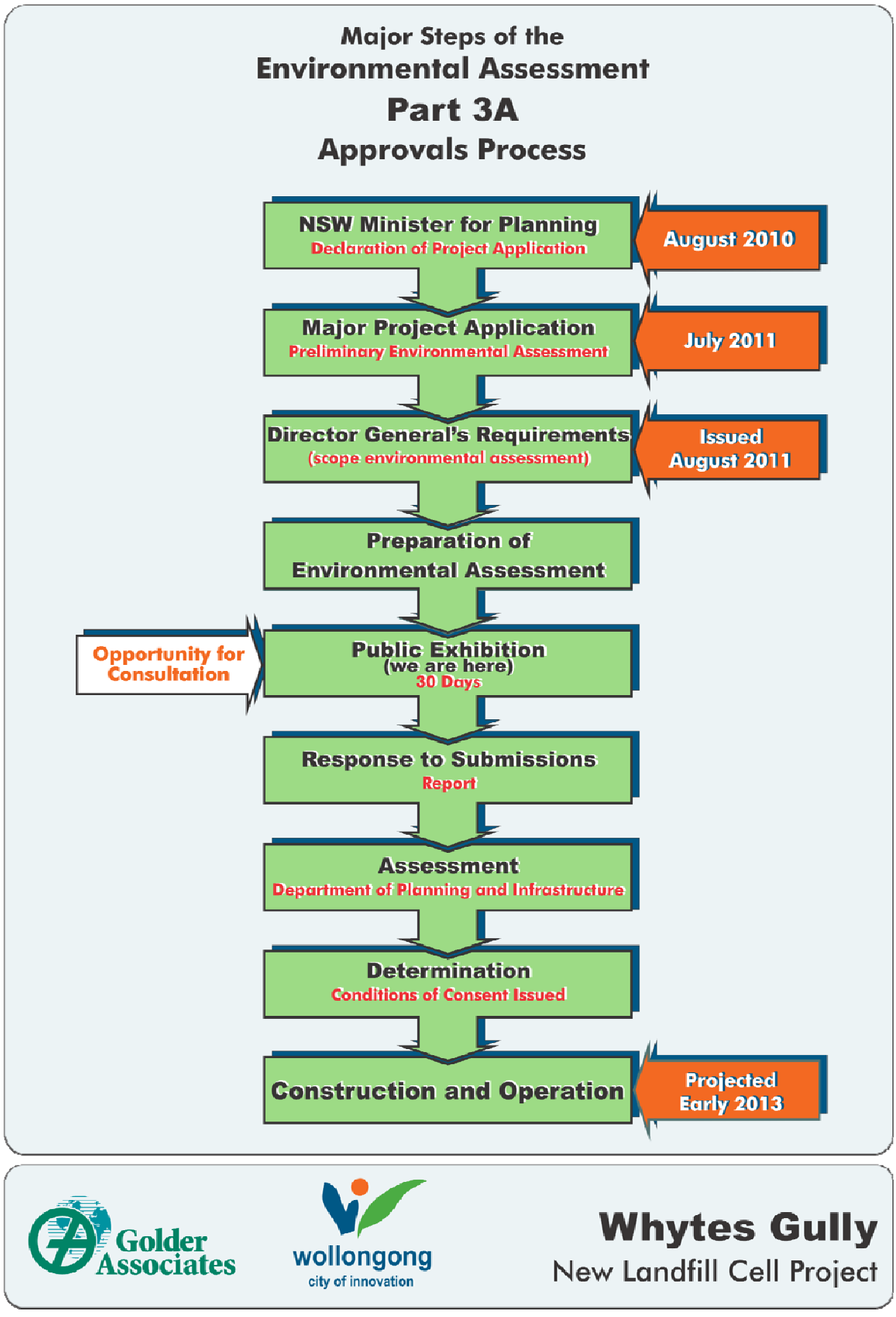
A summary of the known relevant development approvals for the Whytes Gully RRP site is provided in Table 2.3.

If the Project is approved, it is proposed that Wollongong City Council would surrender the existing development consents of relevance to the Project. This would include the development approvals identified in Table 2.3 with the exception of DA-1994/131 and DA-2005/1635 for the MRF, which is not affected by the Project.

Table 2.3: Summary of Approvals

Reference	Site Description	DA Description
DA-1982/459	Western Gully	Lot 2 DP 240557 & PT Por 9 – Waste Disposal Site
DA-1984/228	Western Gully	Develop and Operation of a Waste Disposal Depot (Western Gully)
DA-1992/662	Eastern Gully	Upgrading The Existing Western Gully Landfill & Extending The Land Filling Operation Into the Adjacent Eastern Gully
DA-1994/131	MRF	Construction of a Materials Recycling Facility
DA-1996/8256 DA-1996/6256	SWERF	Solid Waste Energy Recycling Facility
DA-1996/256	Landfill Gas Infrastructure	Landfill Gas infrastructure and associated infrastructure
DA-1999/533	Site access and road realignment	Deviation of Reddalls Road, Kembla Grange
DA-2002/2240	Leachate and Surface Water Ponds	Construction of new leachate and stormwater treatment ponds
DA-2003/532	Leachate Treatment Plant	Construct and operate of the Leachate Treatment Plant
DA-2005/1635	MRF	Extension of the Material Recycling Facility
DA-2006/463	Weighbridge and new site entrance	Weighbridge and new site entrance
DA-2010/1088	Small Vehicle Transfer Station	Small Vehicle Waste Transfer Station within Whytes Gully RRP.

Figure 2.1: Flow Diagram of Approval Process



3.0 STAKEHOLDER ENGAGEMENT

This chapter provides an overview of the stakeholder engagement activities that have been undertaken for the Project prior to, and during the preparation of the EA.

The stakeholder engagement for the Project has been designed to meet both the Project engagement objectives and the DGRs for stakeholder consultation and engagement. Community engagement and consultation materials for the Project that have been made available to the public are provided in Appendix C.

The Director-General's requirements	
■ ***During the preparation of the Environmental Assessment, you should consult with the relevant local, State and Commonwealth Government authorities, service providers, community groups and affected landowners. In particular you must consult with:***	
▪ ***NSW Office of Environment and Heritage;***	**Chapter 3**
▪ ***NSW Office of Water;***	
▪ ***Roads and Traffic Authority***	
The consultation process and the issues raised must be described in the Environmental Assessment.	

3.1 Existing Community Consultation

Consultation for the Project has built upon previous and existing consultation associated with waste management within Wollongong LGA (including consultation associated with preparation of the Waste Strategy and the "Wollongong City Council (2010) Community Survey of Wollongong City Council Services") in addition to existing consultation for Whytes Gully RRP. Previous and ongoing consultation activities associated with Whytes Gully RRP include the:

- Whytes Gully RRP Community Consultative Committee. This committee meets monthly and provides an opportunity for local residents to receive updates regarding the existing Whytes Gully RRP management and identify issues associated with the site's operation.
- Neighbourhood forums, which meet monthly and are community groups independent of Wollongong City Council. Specific neighbourhood forums include:
  - Neighbourhood Forum 6 - Unanderra Area.
  - Neighbourhood Forum 7 - Berkeley Area
  - Neighbourhood Forum 8 - Dapto Area

3.2 Project Engagement

3.2.1 Engagement Strategy

An engagement strategy has been implemented for the Project in August 2011. The purpose of the community engagement strategy was to identify and document roles and responsibilities, the approach to engagement, the objectives of the engagement strategy and the proposed consultation process. In formulating the community engagement strategy for the Project a workshop was held on 16 May 2011.

Engagement Strategy Approach

Wollongong City Council's approach to consultation regarding the Project has been:

- Identify key community stakeholders (including community groups and landowners).
- Early engagement of stakeholders on the assessment process of the Project.
- Engagement with stakeholders in a clear and transparent manner.
- Acknowledge that community stakeholders need to be given the opportunity to understand the Project, the approvals process, and be engaged during preparation of the EA.

Engagement Strategy Objectives

The overall objective of engagement associated with the Project has been to ensure adequate and appropriate community and stakeholder consultation. This includes:

- Enabling community awareness through informing stakeholders about the EA and the assessment process of the Project.
- Providing opportunity for stakeholder input.
- Providing accurate and timely information concerning the Project.
- Informing stakeholders about the key features, related issues and benefits of the Project.
- Identifying and addressing community issues during the preparation of the EA.
- Providing access to a wide range of accessible engagement methods to ensure all stakeholders have had an opportunity to participate in the EA process for the Project.

3.2.2 Community Engagement Identification

Identification of community stakeholders included consideration of individuals or groups who potentially could be impacted by, or have an interest in the Project. These stakeholders include:

- Nearby property owners and lessees;
- Local interest groups, business and potential sensitive receivers (such as schools);
- Those involved in existing consultation for Whytes Gully RRP;
- Local residents;
- The community within Wollongong LGA; and
- The community outside of Wollongong LGA.

3.3 Community Engagement Activities

A variety of community engagement activities have been completed for the Project during preparation of the EA with community engagement and consultation materials for the Project provided in Appendix C of the EA. An overview of these activities is provided in this section.

3.3.1 Communication Channels

The following contact details have been provided on all community information materials associated with the Project since commencement of the Project assessment.

- A toll free 1800 telephone information line was set up to provide a single direct point of contact for the community to provide comment and feedback on the Project.
- A project email address, whytesgully@gmail.com, was set up to provide a single direct point of contact for the community by email.
- A Wollongong City Council postal address was provided for people who preferred to submit feedback by post.

All contact between the Project team and the community and further stakeholders, as well as feedback, submissions and queries, has been collated and reviewed to identify issues to be addressed within the EA as identified within Table 3.1.

3.3.2 Distributed Information Material and Landholder Consultation

Local property owners in the vicinity of Whytes Gully RRP were contacted prior to the EA preparation process to ensure they were aware of the Project and to provide an opportunity for them to identify potential issues that may be addressed within the EA. Local property owners contacted included people who own or lease property adjacent to Whytes Gully RRP and existing members of the Whytes Gully RRP Community Consultative Committee.

Two page newsletters on the Project were letterbox dropped on 12 November and 16 November 2011 (refer to Appendix C), to local residents in the vicinity of the Project including Kembla Grange and Farmborough Heights. In addition this information material was made available to members of the Whytes Gully Community Consultative Committee and the Unanderra, Berkeley and Dapto area neighbourhood forums.

The information letters were supplemented with a flyer providing updated information on the Project including an invitation to the Project's community information sessions. 2000 flyers were distributed to the surrounding area of Whytes Gully RRP including Farmborough Heights and Kembla Grange, and were made available at the Whytes Gully RRP weighbridge and the following locations:

- Thirroul Community Centre.
- Corrimal Community Centre.
- Ribbonwood Centre (Dapto).
- Warrawong Library.
- Helensburgh Library.
- Unanderra Library.

All distributed Information material promoted feedback on issues of concern with regard to the Project.

3.3.3 Media

The Project has utilised the local media to promote engagement and consultation on the Project. Media activities have included:

- A media release announcing the launch of the Project was circulated in June 2011.
- A media release was circulated in November 2011 providing details of the community information sessions.
- Information on the Project has been provided periodically in Wollongong City Council's weekly column in the Illawarra Mercury and the Wollongong Advertiser.
- Advertisements for the community information sessions were placed in the Illawarra Mercury and the Wollongong Advertiser.
- Wollongong City Council's website has been used as a tool for keeping the community informed of the Project including provision of a specific web page on the Project, which was initially provided in July 2011 to inform stakeholders on the lodgement and assessment of the Project. This website has been updated on multiple occasions to inform the community about the EA process, identify methods available to engage on the Project and provision of links to available consultation materials of the Project. An example of the webpage content is provided in Appendix C.

3.3.4 Local Interest Groups

A Wollongong City Council staff member has attended meetings of the following stakeholder groups to provide information on the Project, answer questions, and provide contact details for further information.

- A meeting of the Whytes Gully Community Consultative Committee on 20 November 2011.
- A meeting of the Neighbourhood Forum 6 - Unanderra Area held on 13 October 2011.
- A meeting of the Neighbourhood Forum 7 - Berkeley Area on 20 October 2011.
- A meeting of the Neighbourhood Forum 8 - Dapto Area on 14 November 2011.

All issues raised on the Project have been documented and recorded and addressed as appropriate within the EA.

3.3.5 Community Information Sessions

Two community information sessions were held to provide members of the community the opportunity to view the proposed plans of the Project and discuss the Project with relevant representatives preparing the EA. Three key members of the Project team attended each session with display boards, copies of the Preliminary Environmental Assessment and DGRs provided at these sessions to inform on the Project.

The community information sessions were held on:

- Thursday 24th November 2011 from 6pm to 8pm at the Unanderra Community Centre, on the corner of the Princes Highway and Factory Road, Unanderra.
- Saturday 26th November 2011 from 1pm to 3pm at Glengarry Cottage, Reddalls Road, Kembla Grange.

The community information sessions were promoted within the distributed newsletters and flyers of the Project, discussed at local interest group meetings, advertised in the print media and on local radio, in addition to being identified on Wollongong City Council's website.

Community members who attended the information sessions were encouraged to fill out feedback forms as provided in Appendix C. Notes were also taken of discussions at the information sessions and all feedback was recorded in order to address issues of concern within the EA.

3.4 Regulatory Stakeholder Engagement

In addition to community engagement and consultation, regulatory stakeholders and government agencies have been consulted with regard to the Project. This includes all stakeholders identified within the DGRs for the Project, relevant environmental officers of Wollongong City Council on specific environmental issues (for example traffic, flora and fauna and planning officers), presentations on the Project to Wollongong City Councillors and administrators, in addition to relevant consultation on easements potentially impacted by the Project (including Sydney Water, Endeavour Energy, Telstra and third party operators).

Supplementary consultations with further regulators has also occurred by the authors of technical studies for the EA for the Project and are referred to in their respective technical reports located within the appendices. This includes the statutory consultation processes of the assessment of indigenous heritage impacts of the Project, documented within the relevant chapter and technical study of the EA. Refer to Chapter 16 and Appendix J for further details of heritage consultation.

Regulatory stakeholder consultation has taken the form of phone and email contact in addition to specific meetings to discuss the Project with relevant government agencies as identified within the DGRs and identified government regulatory agency comments on the DGRs (as provided in Appendix A). Specific regulatory consultation identified within the DGRs has included:

- Office of Environment and Heritage - 19 December 2011.
- Roads and Maritime Services (formerly the Roads and Traffic Authority) – 25 January 2012.
- NSW Office of Water – 30 January 2012.

3.5 Identified Community Stakeholder Issues

Through the variety of engagement activities identified within this chapter of the EA, consolidated responses from stakeholders are provided in Table 3.1: Summary of Community Responses on the Project.

To date there has been a general acceptance of the Project by community stakeholders. It has been widely acknowledged that the Project is acceptable as waste is generated within Wollongong LGA, this waste requires some form of landfill activity, and Whytes Gully RRP is widely considered to be the most suitable location for the Project.

Table 3.1: Summary of Community Responses on the Project

Issue	Comment
Air Quality and Odour	■ Infrequent existing odour issues. ■ Concern the Project would increase odour issues.
Noise	■ Concern with sound of reversing beepers of vehicles at the existing Whytes Gully RRP.
Hazards and Risk	■ Concern was raised about potential health impacts from the Whytes Gully RRP on employees and local residents. ■ One community member asked whether there would be any health impacts from chemicals used on site to mitigate odour.
Community Engagement and Consultation	■ Several community members reported that engagement and responsiveness from Wollongong City Council regarding Whytes Gully RRP has improved. ■ Community members identified adequate consultation on the Project.

Issue	Comment
Alternative sites	■ General question on alternative site consideration. ■ Identified as unacceptable to change the site location of landfills within Wollongong LGA.
Landfill Gas	■ Suggested there should be landfill gas extraction at the site.
Leachate Management	■ Concern about leachate management.
Flora and Fauna	■ Concern with removal of vegetation from the area at the north of the site. ■ Concern about feral animals at and near the site.
Visual	■ Concern with visual amenity. Suggestion of buffer of trees/vegetation to screen landfill site.
Traffic	■ Concern with potential increase in traffic.
Strategic Need	■ Concern was raised that the development of West Dapto Release Area would lead to more waste being generated and this may have an impact on the lifetime of the Whytes Gully RRP.
Other issues	■ Concern with airborne litter (but identified as improved (but has improved recently).
	■ Concern with illegal dumping in the vicinity of Whytes Gully RRP.
	■ Concern with fees and charges associated with using Whytes Gully RRP.
	■ Concern that Part 3A projects are considered in isolation to development applications for other development.
	■ Concern with future development in the vicinity of the Project.
	■ Concern with potential impacts upon property values.

3.6 Director Generals Requirements

To date the engagement process for the Project has provided an insight into stakeholder issues and initial feedback on key EA issues. Potential impacts have been identified as a result of this process and are addressed within the EA. Identified community stakeholder issues summarised within Table 3.1 are addressed within the relevant chapters of the EA, in addition to NSW government regulatory agency issues including those provided as comments to the DGRs (refer to Appendix A of the EA).

The principal chapter of the EA addressing each DGR is provided in Table 3.2, which is also considered to address all stakeholder issues identified during engagement and consultation.

Table 3.2: Principal Chapter addressing each DGR

DGRs	Principal Chapter of the EA addressing the DGR
The Environmental Assessment (EA) must include:	
■ *an Executive Summary*	Executive Summary
■ *a detailed description of the Project including the:*	
▪ *Waste strategy that underpins the development of the project;*	Appendix B
▪ *Need for the project, having particular regard to the aims, objectives and guidance in the NSW Waste Avoidance and Resource Recovery Act 2007 and* ▪ *DECC's guidelines for Solid Waste Landfills;*	Chapter 4 Appendix O Appendix P
▪ *A review of the project against clause 123 of the State Environment Planning Policy (Infrastructure) 2007;*	Chapter 4
▪ *Alternatives for the project, including justification for the project on economic, social and environmental grounds;*	Chapter 5 Chapter 22
▪ *Details of any proposed building works, including engineering and/or architectural plans;*	Chapter 8
▪ *Details of the landfill design, leachate and gas management systems;*	Chapter 8 Appendix O
▪ *Various components and stages of the project; and,*	Chapter 8
▪ *The likely inter-relationship between the proposed operations and the existing operations on site including details of existing approvals, management systems and details of past environmental performance.*	Chapter 7 Chapter 8
■ *consideration of whether the development is consistent with the principles included in the publication EIS Guideline: Landfilling (Department of Planning, 1996)*	Chapter 8 Appendix O
■ *a risk assessment of the potential environmental impacts of the project, identifying the key issues for further assessment*	Chapter 9

DGRs	Principal Chapter of the EA addressing the DGR
■ *a detailed assessment of the key issues specified below and any other significant issues identified in the risk assessment (see above), which includes:*	
▪ *a description of the existing environment, using sufficient baseline data;*	Refer to relevant key issue chapter below.
▪ *an assessment of the potential impacts of all stages of the project taking into consideration any relevant guidelines, policies, plans and*	Chapter 2 and relevant key issue chapter.
▪ *a description of the measures that would be implemented to avoid, minimise, mitigate, rehabilitate/remediate, monitor and/or offset the potential impacts of the project, including detailed contingency plans for managing any potentially significant risk to the environment.*	Refer to relevant key issue chapter below.
■ *a statement of commitments, outlining all the proposed environmental management and monitoring measures;*	Chapter 21
■ *a conclusion justifying the project, taking into consideration: the suitability of the sites; the economic, social and environmental impacts of the project as a whole; and whether it is consistent with the objects of the Environmental Planning and Assessment Act 1979, and in particular the principles of ecological sustainable development; and*	Chapter 22
■ *a signed statement from the author of the environmental assessment certifying that the information contained in the report is neither false nor misleading.*	EA Preliminaries
Key Issues	
■ *Waste Management – including:* ▪ *identify, classify and quantify the likely waste streams that would be handled/stored/disposed of at the facility;* ▪ *describe how this waste would be treated, stored, used, disposed and handled on site, and transported to and from the site, and the potential impacts associated with these issues; and* ▪ *any waste recovery methods (including volumes and types of wastes diverted) and monitoring programmes.*	Chapter 8 Appendix P
■ *Soil Water and Leachate – including:* ▪ *The proposed erosion and sediment controls during construction and operation* ▪ *The proposed stormwater management system, including the capacity of onsite detention systems, and measures to treat, reuse or dispose of water;* ▪ *Consideration of potential acid sulfate soils, salinity, soil contamination and flooding impacts of the proposal* ▪ *Potential impacts on watercourses and groundwater; and*	Chapter 12 Appendix G

DGRs	Principal Chapter of the EA addressing the DGR
▪ *The proposed leachate management systems.*	
■ *Air Quality and Odour – including:* ▪ *a quantitative assessment of the potential air quality and odour impacts of the project including cumulative impacts; and* ▪ *A demonstration that the proposal is able to comply with the Protection of the Environment Operations (POEO) Act 1997 and the POEO (Clean Air) Regulation (2002).*	Chapter 14 Appendix H
■ *Greenhouse Gas – Including:* ▪ *a quantitative assessment of the scope 1 and 2 greenhouse gas emissions of the Project, and an assessment of the energy efficiency of the Project in comparison to industry best practice; and* ▪ *a description of the measures that would be implemented to minimise the energy use of the Project including landfill gas capture and electricity generation.*	Chapter 11 Appendix E Chapter 8
■ *Biodiversity – Including:* ▪ *Accurate estimates of any vegetation clearing associated with the Project;* ▪ *A detailed assessment of the potential impacts of the project on any terrestrial and aquatic threatened species or populations and their habitats, endangered ecological communities or groundwater dependent ecosystems;* ▪ *A detailed description of the measures that would be implemented to avoid or mitigate impacts to biodiversity; and* ▪ *An offset strategy to ensure that the project maintains or improves the biodiversity values of the region in the medium to long term (in accordance with NSW and Commonwealth policies).*	Chapter 13 Appendix F
■ *Traffic and Transport – including:* ▪ *details of traffic volumes that are likely to be generated during construction and operation of the project, and an assessment of the impact of this traffic on the safety and efficiency of the surrounding road network; and* ▪ *details of suitable infrastructure required to ameliorate any traffic impacts and safety impacts associated with the project.*	Chapter 15 Appendix I
■ *Noise – including* ▪ *construction, operational and traffic noise.*	Chapter 10 Appendix D

DGRs	Principal Chapter of the EA addressing the DGR
■ *Heritage – including* ▪ *an indigenous and non indigenous heritage assessment.*	Chapter 16 Appendix J
■ *Hazards and Risk – including* ▪ *a Preliminary Hazard Analysis (PHA) of the project, and an assessment of the potential bushfire risks of the project.*	Chapter 19 Appendix L
■ *Visual – including* ▪ *An assessment of the potential visual impacts of the project on the amenity of the surrounding area.*	Chapter 17 Appendix K
■ *Socio-Economic – including* ▪ *a comprehensive assessment of the economic and social impacts of the project, demonstrating that it would have a net benefit for the community, paying particular attention to the potential impacts of the proposal on waste minimisation and resource recovery in the region.*	Chapter 18
■ *Rehabilitation and Final Landform including:* ▪ *A justification of the final landform and details regarding the potential future land uses for the site; and* ▪ *A detailed description of how the site would be progressively rehabilitated and integrated with the final landform.*	Chapter 20 Appendix P
During the preparation of the Environmental Assessment, you should consult with the relevant local, State and Commonwealth Government authorities, service providers, community groups and affected landowners. In particular you must consult with: ■ NSW Office of Environment and Heritage; ■ NSW Office of Water; ■ Roads and Traffic Authority *The consultation process and the issues raised must be described in the Environmental Assessment.*	Chapter 3 Appendix C

3.7 Future and Ongoing Consultation

Wollongong City Council is committed to providing the opportunity for community and stakeholder input during assessment of the Project and, if approved, the construction and operation phases of the Project.

It is understood that the DoPI will provide the following consultation activities during exhibition of the EA:

- The EA will be advertised and placed on public exhibition for 30 days in accordance with the transitional Part 3A project process of the EP&A Act.
- The dates and venues of the public exhibition will be advertised in local media, and will be made available on the Department of Planning and Infrastructures website (http://www.planning.nsw.gov.au).

- During the exhibition period, all stakeholders will be invited to make written submissions to the Department of Planning and Infrastructure in response to the EA for the Project.
- In addition the communication channels identified for the Project within this chapter will remain available throughout the exhibition period.

3.7.1 Stakeholder Engagement on Whytes Gully RRP

Wollongong City Council propose to continue to work closely with all stakeholders to ensure they are well informed about Whytes Gully RRP and the Project assessment and determination in addition to all post-determination stages of development of at the site.

Should the Project be approved, it is proposed that existing and stakeholder engagement activities and tools utilised for the Project EA assessment would continue to be developed and facilitate the engagement process as part of construction and operation management measures of the Project. These may include:

- Ongoing regular consultation through the Community Consultative Committee for Whytes Gully RRP.
- Phone line to communicate issues to Whytes Gully RRP management.
- Complaints management process (refer to Appendix P (draft) Landfill Environmental Management Plan).
- Updates of the Project website.
- Clear signage at construction sites during construction.
- Stakeholder satisfaction surveys and feedback forms (as part of wider Wollongong City Council activity).
- Ongoing use of interactive web-based activities.
- Ongoing review and refinement of construction and operation impact mitigation measures.

4.0 STRATEGIC NEED

Chapter 4 addresses the strategic need for the Project. It presents the existing waste management statistics of Whytes Gully RRP, key internal and external drivers for the Project, including landfill capacity and the legislative and policy drivers at Commonwealth, State and local levels, for waste and resource management within Wollongong LGA.

The Director-General's requirements	
■ *Waste Strategy that underpins the development of the project;*	**Appendix B**
■ *Need for the project having particular regard to the aims, objectives and guidance in the NSW Waste Avoidance and Resource Recovery Strategy 2007 and DECC's Guidelines for Solid Waste Landfills;*	**Chapter 4**
■ *A review of the project against Clause 123 of the State Environmental Planning Policy (Infrastructure) 2007;*	**Chapter 4 (and further relevant chapters).**

4.1 Existing Landfill and Resource Recovery within Wollongong LGA

Wollongong LGA includes two landfills owned and operated by Wollongong City Council, a small non-putrescible landfill at Helensburgh and the existing landfill at Whytes Gully RRP.

Refer to Figure 4.1 for their locations within Wollongong LGA.

4.1.1 Helensburgh Landfill

The unlined landfill at Helensburgh has been accepting waste for over 50 years. This landfill is located at the northern end of Wollongong LGA on the boundary of the Royal National Park and the headwaters of the Hacking River at Nixon Place. Helensburgh landfill has limited capacity and accepts dry domestic waste, builders waste and garden organics only.

4.1.2 Whytes Gully RRP

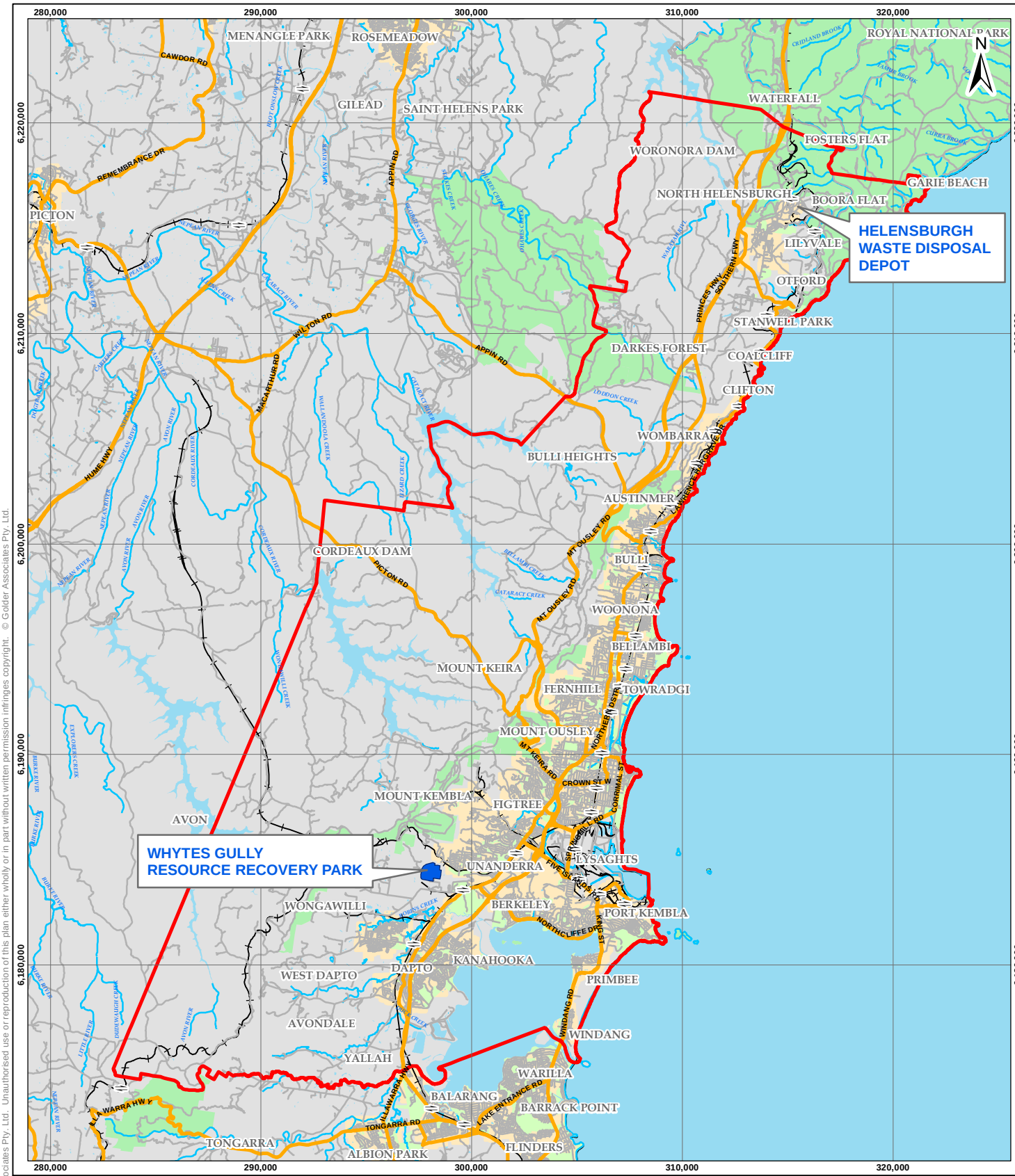
Whytes Gully RRP accepts all of the Municipal Solid Waste (MSW) produced within Wollongong LGA, and a portion of Commercial and Industrial (C&I) waste. Construction and demolition waste is not accepted at Whytes Gully RRP.

In addition to the existing landfill, there is a range of existing facilities and initiatives in place at Whytes Gully RRP designed to recover waste that would otherwise be sent to landfill. Existing facilities and resource recovery activities and initiatives at Whytes Gully RRP include:

- **Small Vehicle Transfer Station**: receives general mixed waste from the public.
- **Green Waste Processing**: collected onsite and removed for composting offsite (this activity is to be relocated offsite in 2012 separate to the Project with only small incidental quantities accepted at the site in the future).
- **Small Vehicles Recyclables Drop Off**: Facilities are provided for receipt of items such as metals, paper, glass, tyres and mattresses, used oil, e-waste and fridges.
- **Recoverables Drop Off and Buy-back** for the drop off and resale of reusable articles.
- **Materials Recycling Facility**: for processing comingled recyclable materials from the kerbside collection service.
- **Weighbridges**: Inbound and outbound to identify waste received at the site.

- **Administration Offices**: located at Glengarry Cottage.
- **Chemical Clean Out Days**: through an arrangement with the OEH, residents are able to dispose of domestic quantities of a range of household chemicals, fluorescent lights, paints, gas bottles, car batteries free of charge.
- **On-Call Annual Clean Up:** contractors recover recyclable material for sorting including e-waste, mattresses and tyres.
- **Fridge Buy Back Scheme:** for second fridges more than 10 years old.

Refer to Chapter 7 of the EA for further details of existing infrastructure at Whytes Gully RRP.



ENVIRONMENTAL ASSESSMENT

Wollongong City Council

REGIONAL LOCATION OF LANDFILLS IN THE LGA

LEGEND

- Site Location
- Wollongong Local Government Area Boundary

0 1 2 4 6 8 Kilometres

SCALE (at A4) 1:250,000

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: 117625003
DATE: 16/01/2012
DRAWN: FA
CHECKED: BJF

FIGURE 4.1

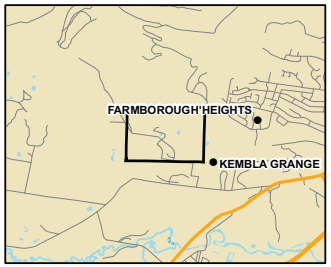
Golder Associates

File Location: J:\GIS\Jobs\117625003_Wollongong Council_New Landfill Cell_Whytes Gully\Workspaces\117625003_113_R_F0001_RegionalLocation.mxd

WHYTES GULLY NEW LANDFILL CELL ENVIRONMENTAL ASSESSMENT

WOLLONGONG CITY COUNCIL

EXISTING SITE LAYOUT



LEGEND

- Site Boundary
- Extent of Waste
- Extent of Landfill Works

NOTES

Extent of waste based on site observations and information provided by Council.

Aerial Ortho-Photograph provided by AAM Pty. Ltd. taken on 16 May 2011, Reference 18763A. Image Georeferenced.

Extend of landfill works as per Golder Design Report.

0 15 30 60 90 120 150 metres

SCALE (at A3) 1:3,800

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: 117625003
DATE: 22/02/2012
DRAWN: FA
CHECKED: JMc

FIGURE 4.2

Golder Associates

File Location: J:\GIS\Jobs\117625003_Wollongong Council_New Landfill Cell_Whytes Gully\Workspaces\117625003_114_R_F0002_General_Site_Details_Rev3.mxd

4.1.3 Existing Waste Management Statistics

Existing Demand

Prior to 2007, weighbridge data indicates that total material accepted at Whytes Gully RRP was consistently above 180,000 tpa and was 225,080 tonnes in 2002 (with no breakdown of this data available for material to landfill/ resource recovery activities).

Total material including cover placed in the landfill) has varied over the past 5 years from around 180,000 tonnes per annum (tpa) to 125,000 tpa in more recent years, as shown in Figure 4.3.

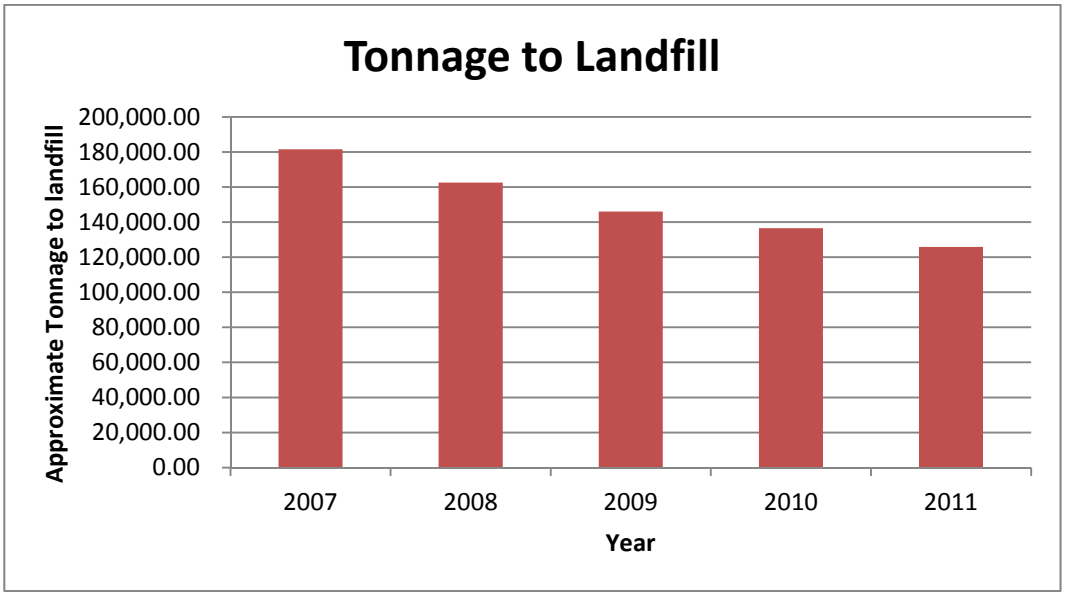


Figure 4.3: Approximate Tonnage to Landfill

The total waste received at Whytes Gully RRP (including waste to the landfill, MRF, green waste processing and other resource recovery but not including cover material) has been approximately 120,000 to 150,000 tpa for the past four years, as shown in Figure 4.4.

Refer to Chapter 7 of the EA for a breakdown of waste flows at Whytes Gully RRP for 2010 -2011.

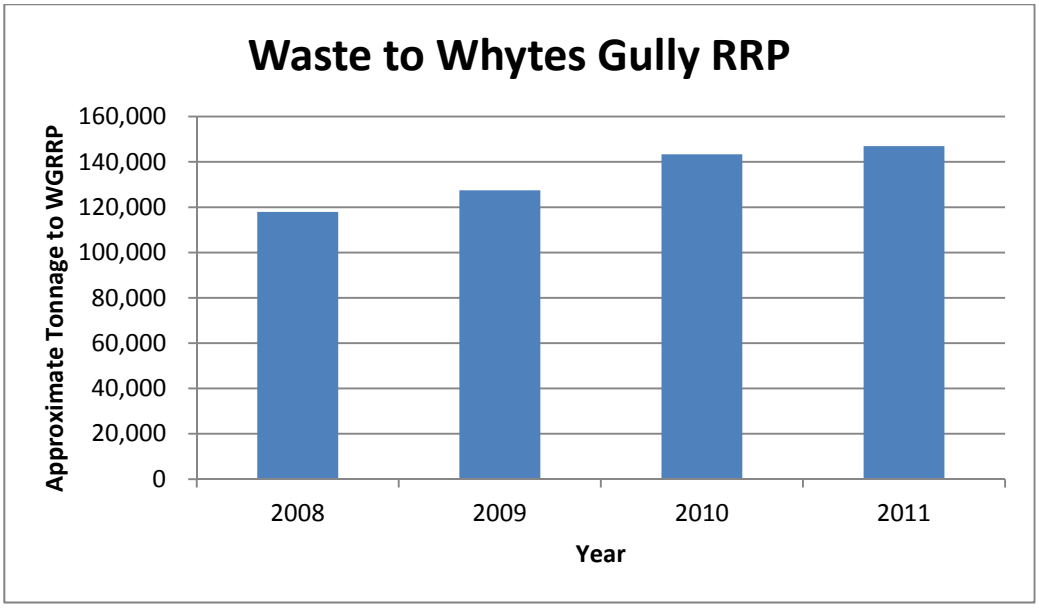


Figure 4.4: Approximate Tonnage of Waste Received at Whytes Gully RRP

Existing Resource Recovery

Wollongong City Council is committed to providing environmentally sound and sustainable waste management solutions that seek to reduce the amount of waste generated and provide for resource recovery to reduce the quantities of waste being disposed to landfill. This commitment is exemplified by initiatives and facilities specifically located at the Whytes Gully RRP site (as identified in Section 4.1.2) and complimentary initiatives and focus areas that are documented within the "Wollongong City Council Waste & Resource Recovery Strategy: 2012 to 2022" (Waste Strategy) provided in Appendix B of the EA. Examples include education programs, collection, advocacy, and enforcement services.

MSW historical and predicted resource recovery rates from 2008-2014 are provided in Figure 4.5, which is adopted from the Waste Strategy.

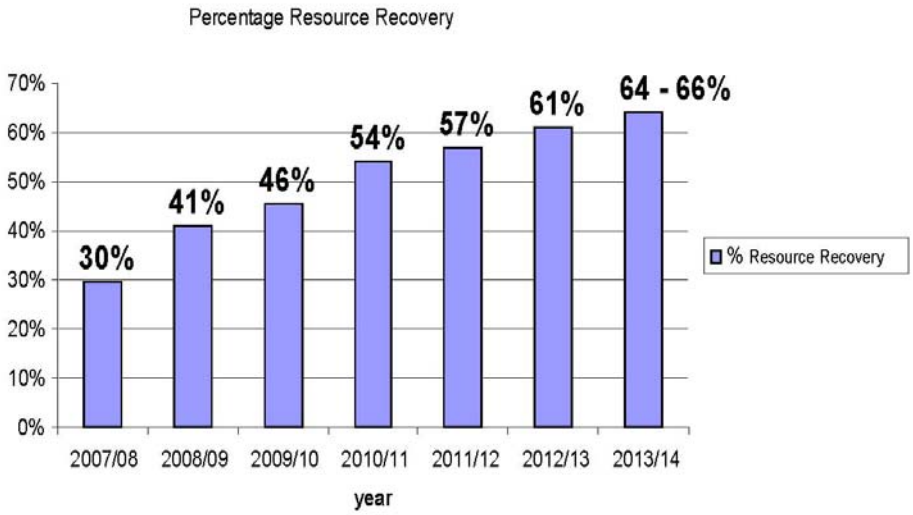


Figure 4.5: MSW Resource Recovery Rates and Projections 2007-2014

(Source: Waste Strategy).

While Wollongong City Council has extensive data available on the generation and diversion of MSW for Whytes Gully RRP (accepting all the MSW within Wollongong LGA), only limited waste management data is available for C&I waste on the site and within Wollongong LGA. This is due to C&I collections being undertaken exclusively by private contractors who transport recyclable C&I material elsewhere. As noted in the Waste Strategy, Wollongong City Council proposes to implement measures to accurately measure and address the C&I waste flow.

4.2 Future Waste and Resource Recovery

4.2.1 Population and Waste Projections

The DoPI has estimated that the population of Wollongong LGA is 201,200 as at 30 June 2011 and based upon past and present population statistics provides projections of Wollongong LGA to increase to 235,800 by 30 June 2036 (refer to Table 4.1). This is an increase of 14.17 percent or approximately 0.7 percent per year.

Table 4.1: Past and Projected Population of Wollongong LGA, 1996-2036

Year	Total population	Growth rate (percent)	Growth Index (2006=100)
Past			
1996	185,300	n/a	94
2001	189,500	0.67	98
2006	194,500	0.50	100
Projected			
2011	201,200	0.67	103
2016	208,300	0.70	107
2021	215,700	0.70	111
2026	223,000	0.67	115
2031	229,700	0.59	118
2036	235,800	0.52	121
Source: past data – Australian Bureau of Statistics. Projections – DoPI.			

As shown in Figure 4.3 total material including cover placed in the existing landfill) has decreased over the past 5 years from around 180,000 tpa to 125,000 tpa in 2011, despite the total waste received at Whytes Gully RRP increasing (Figure 4.4) and total population increasing within Wollongong LGA (approximately 195,000 to 201,200 during this time period: refer to Table 4.1). This result is considered to be attributable to a number of factors including improved landfill management and increased resource recovery.

Notwithstanding the trend of material to landfill decreasing in the last five years, for the purposes of this assessment tonnage to landfill at 180,000 tpa has been adopted. Material placed in the landfill including cover is conservatively projected to increase from 125,000 tpa to 180,000 tpa by 2055 (based on a 0.7 percent increase in airspace demand per year only).

As indicated in Figure 4.3, 180,000 tpa was the maximum tonnage to landfill in the past 5 years. Furthermore historical weighbridge data indicates that prior to 2007 total material accepted at Whytes Gully RRP was consistently above 180,000 tpa including 225,080 tpa in 2002.

Despite data prior to 2007 providing no breakdown of material to landfill and/or resource recovery activities it is considered that Whytes Gully RRP has previously accepted material tonnage to landfill in excess of 180,000 tpa and therefore annual waste accepted to landfill at the site is not proposed to increase from existing operations at Whytes Gully RRP.

4.2.2 Resource Recovery Projections

Figure 4.5 indicates the historical upward trend of resource recovery rates of MSW in Wollongong LGA and at Whytes Gully RRP. The recovery rate of 54 percent in 2010/11 is projected to be around 66 percent by 2014, (which would reach the relevant WARR target as identified in Section 4.4.2). MSW resource recovery projections are based upon a number of factors including internal and external drivers for resource recovery (as identified in Sections 4.3 and 4.4), in addition to potential future resource recovery activities identified

within the Concept Site Masterplan (refer to Section 4.2.3) and further initiatives and activities discussed in the Waste Strategy (Appendix B).

Anecdotally it is considered that any potential increase in waste volume as a result of population growth would likely be offset by existing and future waste minimisation and resource recovery and recycling initiatives, based on existing trends as well as anticipated changes to facilities and services.

4.2.3 Concept Site Masterplan for Whytes Gully RRP

In addition to the existing resource recovery initiatives discussed within this chapter of the EA, a Concept Site Masterplan for Whytes Gully RRP has been completed to identify and plan for potential future resource recovery activities.

The Concept Site Masterplan is considered to be conceptual only with potential new initiatives/activities identified (such as an AWT facility) not being proposed as part of the Project. The Concept Site Masterplan is considered a working document and would be updated at a later date based upon decisions on final resource recovery infrastructure adopted by Wollongong City Council.

The footprint of the Concept Masterplan is provided in Figure 4.6 to give an indication of future potential resource recovery activities for the Whytes Gully RRP site.

LEGEND

- Property boundary
- Landform footprint
- Future road
- Access road
- Proposed small tree and shrub planting on landform
- Proposed screen planting along boundary
- Proposed tree planting on natural ground

Notes:

1. Restricted use areas in accordance with easement agreement.
2. Excavation required to form platform for AWT.
3. Batter area for platform development.
4. Possible future location of MRF, AWT, LFGTE .infrastructure.
5. Area outside heritage curtilage.

ISSUED FOR
PRELIMINARY
NOT FOR CONSTRUCTION

0 20 40 60 80 120 160 240m
1:4000

- BASE DRAWING TAKEN FROM K.F.WILLIAMS AND ASSOCIATES DRG. WHYTES PHOTOGROMETRY AND GROUND SURVEY 20.07.11.dxf DATED 20 JULY 2011
- PLANTING BASED ON DWG BY CORKERY CONSULTING, DATED 28.02.2012, REF. No.LS-001, REV B, FINAL DRAFT

Golder Associates
www.golder.com
GOLDER ASSOCIATES PTY LTD

CLIENT: WOLLONGONG CITY COUNCIL		PROJECT: WHYTES GULLY LANDFILL - NEW CELL DESIGN	
DRAWN: HC	DATE: 02.03.2012	TITLE: CONCEPT SITE MASTER PLAN	
CHECKED: JMc	DATE: 19.03.2012		
SCALE: 1:4,000	A3	PROJECT No: 117625003 / DOC No: 142 / DOC TYPE: R / FIGURE No: F004 / REV No: A	FIGURE 4.6

K:\Des\2011\117625003 WHYTES GULLY\FIGURES\\17625003_142_R_F004_REVA.cdr

Key resource recovery features of the Concept Site Masterplan include:

- Location of Recoverables Drop Off and Buy Back and the Recycling Drop Off at the front of the Whytes Gully RRP site to prevent the public needing to enter and mingle with site operations. These services do not require the public to go over a weighbridge and are free. In addition to this the layout of these facilities is such to encourage separation of waste, reuse and buy back and recycling by directing the public past these facilities first prior to the Small Vehicle Transfer Station.
- Allocation of a footprint for new and/or expanded MRF facility, in addition to construction of an AWT facility or other resource recovery technology. By 2014 Wollongong City Council's Waste Strategy commits Wollongong City Council to reviewing available alternative waste technologies, which may significantly contribute to reduction in waste long term and determining the most appropriate technology proposed to be constructed within the identified footprint area of Figure 4.6.

4.3 Internal Drivers of the Project

4.3.1 Existing Landfill Capacity

The current landfill airspace at Whytes Gully RRP is projected to be at capacity by the end of 2013. This means that Wollongong LGA will have no existing available landfill airspace (other than non-putrescible at Helensburgh) if the Project is not implemented.

Despite actions to reduce the amount of waste generated and the trend of increased diversion rates of waste to landfill, it is recognised in the Waste Strategy by Wollongong City Council that landfill will invariably continue be a part of Council's waste management strategy. This is because no known resource recovery system can achieve a 100 percent landfill diversion performance. Consequently all known resource recovery activities require the disposal of residual material to landfill. It is therefore considered there is a clear strategic need for the Project, which proposes additional landfill capacity to continue to accept waste not available for resource recovery within Wollongong LGA.

Wollongong City Council proposes to provide for additional landfill capacity at Whytes Gully RRP as described in detail in Chapter 8. Alternatives considered for the Project (including design and location) are considered in Chapter 5 of the EA.

4.3.2 Contingency Capacity

In addition to the residual waste to landfill, potential risks and uncertainties associated with resource recovery systems and activities require that adequate landfill space is provided for contingency purposes. These risks and uncertainties include:

- Risk that waste generation will continue to grow each year in spite of new waste avoidance measures;
- Limited availability of alternative suitable sites;
- Consideration of the viability and cost of emerging technologies;
- Potential challenges with the introduction of the new technologies that have not yet been proven on a large scale in the NSW market;
- The scope of increased market demand for recycled, recovered resources; and
- Risks on implementation timing for new technology projects that may have social and environmental impacts.

It is proposed that in addition to providing for existing and future landfill capacity, the proposed new landfill cell at Whytes Gully RRP will offer security by its ability to provide contingency disposal capacity to the Wollongong LGA if and when required.

Proposing to develop a new landfill cell to increase capacity at Whytes Gully RRP is preferable to the establishment of a new landfill, for which there are limited site options. As a relatively low cost landfill solution, annual capacity could be adjusted to meet shortfalls or to complement resource recovery

technology available on the Whytes Gully RRP site or introduced in the future. The proposed new landfill cell would also enable Wollongong City Council to commit tonnage under its control to continue to support investment into alternative technologies.

4.3.3 Wollongong City Council Policy

Wollongong City Council Strategic Directions 2011-2014

Waste management at Wollongong City Council is based on the foundations established in Wollongong City Council's "Strategic Directions 2011-2014". One of the 11 key priorities in the *"Strategic Directions 2011-2014"* is the Waste Strategy as follows:

> *"Changes in government policy and increasing environmental standards mean we need to review our current approach to Waste Management. Our revised strategy will detail a staged approach to develop waste services and waste treatment processes that meet the needs of the community, achieve improved environmental outcomes and control the financial impact of waste management on the community".*

In addition to this key priority, "Strategic Directions 2011-2014" addresses relevant strategic themes and guiding principles as follows:

- *To maximise the Recovery of Resources from Landfill.*
- *To Maximise Landfill Life.*
- *To Protect the Environment.*
- *To provide the services to the community that delivers the required resource recovery and waste management outcomes.*
- *To minimise the cost impost from waste management on the community.*
- *To increase resource recovery and recycling rates.*
- *To maximise the life of the existing landfill.*
- *To minimise climate change impacts.*
- *To meet legislative and regulatory requirements.*

Waste & Resource Recovery Strategy 2012 to 2022

Wollongong City Council's Waste Strategy (Appendix B) underpins the development of the Project. The Waste Strategy explicitly identifies development of the proposed new landfill cell as part of a program to maintain and upgrade waste management facilities within Wollongong LGA. This key focus area is one of several identified within the Waste Strategy to ensure ecologically sustainable waste management, which includes seeking to meet State and Commonwealth objectives and targets for waste management in addition to Wollongong City Council's commitment to its overarching policy document and community expectations for waste management.

Given the current diversion rate of 54 percent of MSW (refer to Section 4.2.2), it is envisaged that improvements within the focus areas within the Waste Strategy (identified below) will enable Wollongong City Council to progress towards the diversion rate objectives and aims of appropriate State and Commonwealth legislation (refer to Section 4.4.1).

Focus areas identified within the Waste Strategy to build upon existing resource recovery include:

- **Planning Controls** to strengthen the "Wollongong Development Control Plan 2009" to promote source separation approaches and to respond to changing waste processing infrastructure.

- **Education programs** will be developed at every level throughout the community to provide information to explain and encourage use of the waste hierarchy and to also train staff and the community in waste minimisation/resource recovery strategies and tools.
- **Services** will be reviewed and enhanced to provide the necessary services that underpin the overall objective including On-Call Domestic Kerbside Cleanup Collection Services.
- **Price controls** particularly for disposal of wastes to continue to encourage and reward source separation of materials and material reuse, including introduction of pricing incentives to support source separation.
- **Facilitation** to encourage the development of industries and markets that will reuse, recycle, recover or reprocess waste materials.
- **Advocacy** will continue to remain high on Wollongong City Council's agenda. Council will continue activity within State and Regional programs as available.
- **Enforcement** will be strengthened by Council through implementing actions in relation to the illegal dumping and littering strategy.
- **Leadership** Council will lead the wider community by practicing the tenets of the waste hierarchy in its own operations, particularly in procurement and reuse of materials.
- **Facilities** Council will continue to provide existing and upgraded facilities to ensure the facilities allow for ease of use and recovery of as much material as feasible prior to landfilling. However, it is also recognised that landfill capacity is a necessary part of sustainable waste management within Wollongong LGA.
- **Finance** Council needs not only to provide price controls but to also to operate its waste business in a manner that is financially viable and sustainable in the long term. Council will review long term financial model for waste services.

4.3.4 Community Expectations

The relevant strategies and guiding principles of Wollongong City Council *"Strategic Directions 2011-2014"* support the high level of importance the community of Wollongong LGA places on waste management. In a recent community survey (2010) completed by Wollongong City Council, the local community identified street cleaning and domestic, recycling and green waste collection as having high community importance. Garbage collection was also identified as having a high satisfaction rating. These findings demonstrate the importance of waste management to the community of Wollongong City Council and the importance of the Project to secure appropriate waste management in the future.

4.4 External Drivers of the Project

4.4.1 Commonwealth Legislative Framework for Waste Management

In November 2009 the Commonwealth (Cth) Environment Protection and Heritage Council introduced the *National Waste Policy: Less Waste, More Resources* (National Waste Policy), which sets a direction for waste management in Australia.

The National Waste Policy sets Australia's waste management and resource recovery direction to 2020, providing an agreed direction and focus that will be implemented by individual jurisdictions in addition to action by the Commonwealth and State and Territory governments. The policy encompasses wastes, including hazardous wastes and substances, in the municipal, commercial and industrial, construction and demolition waste streams and covers liquid, gaseous and solid wastes. The National Waste Policy has the following aims:

- Avoid the generation of waste, reduce the amount of waste (including hazardous waste) for disposal;
- Manage waste as a resource;

- Ensure that waste treatment, disposal, recovery and re-use is undertaken in a safe, scientific and environmentally sound manner, and
- Contribute to the reduction in greenhouse gas emissions, energy conservation and production, water efficiency and the productivity of the land.

The National Waste Policy sets directions in six key areas and identifies a number of strategies across these areas. The six key areas are:

1) **Taking responsibility** Shared responsibility for reducing the environmental, health and safety footprint of products and materials across the manufacture-supply-consumption chain and at end-of-life.
2) **Improving the market** Efficient and effective Australian markets operate for waste and recovered resources, with local technology and innovation being sought after internationally.
3) **Pursuing sustainability** Less waste and improved use of waste to achieve broader environmental, social and economic benefits.
4) **Reducing hazard and risk** Reduction of potentially hazardous content of wastes with consistent, safe and accountable waste recovery, handling and disposal.
5) **Tailoring solutions** Increased capacity in regional, remote and Indigenous communities to manage waste and recover and re-use resources.
6) **Providing the evidence** Access by decision makers to meaningful, accurate and current national waste and resource recovery data and information to measure progress and educate and inform the behaviour and the choices of the community.

The overall objectives of implementing the National Waste Policy are that all wastes are managed consistently with Australia's international obligations, and for the protection of human health and the environment. The policy also seeks to ensure that the risks associated with waste are understood and managed in the future to minimise intergenerational legacy issues.

It is considered the Project is consistent with the aims, directions and objectives of the National Waste Policy. As identified within the Waste Strategy the proposed new landfill cell for Whytes Gully RRP is considered to be part of a tailored waste management strategy for Wollongong LGA, which secures the capacity to manage waste appropriately in an established and suitable location.

4.4.2 New South Wales Framework

In NSW the regulatory and statutory framework for the Project includes legislation, strategies and guidelines relevant to waste. In addition to assessment of the Project in accordance with the EP&A Act, waste management in NSW is primarily regulated under the *Protection of the Environment Operations Act 1997* (including licensing, classifying waste and establishing waste management requirements such as the waste and environment levy) and the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act).

Waste Avoidance and Resource Recovery Act 2001

The WARR Act identifies the NSW Government's strategic direction for waste management promoting waste avoidance and resource recovery. The WARR Act identifies that waste management options are considered against a resource management option hierarchy, which seeks to encourage the most efficient use of resources and to reduce environmental harm in accordance with the principles of ecologically sustainable development (ESD).

The identified hierarchy within the WARR Act is as follows:

1) ***Avoidance*** *including action to reduce the amount of waste generated by households, industry and all levels of government.*

2) ***Resource recovery*** *including reuse, recycling, reprocessing and energy recovery, consistent with the most efficient use of the recovered resources.*

3) ***Disposal*** *including management of all disposal options in the most environmentally responsible manner.*

To address and promote the resource management hierarchy and waste reduction, the "NSW Waste Avoidance and Resource Recovery Strategy 2003" (WARR Strategy 2003) was adopted to provide an implementation framework and introduce targets for resource recovery. In 2007, the strategy was reviewed and updated with the release of "NSW Waste Avoidance and Resource Recovery Strategy 2007" (WARR Strategy 2007). Subsequent Waste Avoidance and Resource Recovery Progress Reports are published every two years with the latest being in 2010. A key finding of the DECCW (2010) "Waste Avoidance and Resource Recovery Strategy Progress Report" identifies that landfill capacity within NSW and metropolitan Sydney is low and needs to be addressed.

Waste Avoidance and Resource Recovery Strategy Targets

The WARR Strategy 2003 (and updates) provides direction on waste reduction and resource recovery in NSW. The key result areas and targets relevant to the Project within the WARR Strategy 2003 and retained in the WARR Strategy 2007 are as follows:

- Increasing recovery and use of secondary materials of municipal waste from 26 percent (in 2000) to 66 percent by 2014;
- Increasing recovery and use of materials from the commercial and industrial waste stream, from 28 percent (in 2000) to 63 percent by 2014; and
- Increase recovery and use of materials from the construction and demolition sector, from 65 percent (in 2000) to 76 percent by 2014. (Commercial quantities of Construction and Demolition (C&D) wastes are not accepted at Whytes Gully RRP and therefore not relevant to the Project assessment).

Refer to Section 4.1 on discussion of relevant Wollongong LGA MSW waste stream recovery and use of secondary materials, which for 2010-11 is 54 percent and is projected to meet the WARR target of 66 percent by 2014.

In addition to the 2014 targets, the WARR Strategy 2007 seeks to:

- Reduce litter and illegal dumping through reduction in total tonnages of illegally dumped material reported by regulatory agencies.

Clause 123 of the State Environmental Planning Policy (Infrastructure) 2007

As identified within the DGRs, a review of the Project against Clause 123 of SEPP Infrastructure 2007 has been completed for the purposes of the EA. While these issues are addressed in relevant sections throughout the EA, refer to Table 4.2 for the principal section of the EA, which addresses each issue.

Table 4.2: Consideration of Clause 123 of SEPP Infrastructure 2007

Clause 123 SEPP Infrastructure 2007	Relevant Chapter/Sections of EA
In determining a development application for development for the purpose of the construction, operation or maintenance of a landfill for the disposal of waste, including putrescible waste, the consent authority must take the following matters into consideration:	
a) whether there is a suitable level of recovery of waste, such as by using alternative waste treatment or the composting of food and garden waste, so that the amount of waste is minimised before it is placed in the landfill, and	Chapter 4 Strategic Need. A variety of existing facilities and resource recovery activities and initiatives operate at Whytes Gully RRP. This has resulted in resource recovery increasing at the site from 30 percent in 2007/2008 to 54 percent in 2010/2011. Resource recovery is projected to be 66 percent by 2014 based upon a range of factors including internal and external drivers, initiatives and activities identified within the Waste Strategy and the Concept Site Masterplan.
b) whether the development: *i) adopts best practice landfill design and operation, and*	Chapter 8 Project Description The Project is considered to adopt best practice landfill design and operation as identified within Chapter 8, the Preliminary Design Report (Appendix O) and draft LEMP (Appendix P) of the EA.
ii) reduces the long term impacts of the disposal of waste, such as greenhouse gas emissions or the offsite impact of odours, by maximising landfill gas capture and energy recovery	Chapter 11 Greenhouse Gas The Project commits to landfill gas capture being implemented at Whytes Gully RRP by 2014, which will reduce the long term impacts of waste disposal. As identified in Chapter 14 of the EA the offsite impact of odours will not exceed existing relevant air and odour criteria. Despite this Wollongong City Council are committed to reducing the potential offsite impact of odours on the surrounding community.
c) if the development relates to a new or expanded landfill: *i) whether the land on which the development is located is degraded land such as a disused mine site, and*	Chapter 12 Soil, Water and Leachate The new landfill cell is to be located on existing waste in the form of a “piggyback” or “overfill” design. Refer to the Preliminary Design Report (Appendix O) for further details.
ii) whether the development is located so as to avoid land use conflicts, including whether it is consistent with any regional planning strategies or locational principles included in the publication EIS Guideline: Landfilling (Department of Planning, 1996), as in force from time to time	Chapter 2 Statutory Framework The Project is to enable the existing activity on the Whytes Gully RRP site to continue. The Project is fully permissible and is consistent with all legislation, guidelines and strategies. The Project is located within the “West Dapto Release Area” and is consistent with all land use and transport studies

Clause 123 SEPP Infrastructure 2007	Relevant Chapter/Sections of EA
	associated with this land release area. Chapter 8 Project Description The Project is considered to be consistent with the Department of Planning 1996 publication "EIS Guideline: Landfilling" including locational principals as identified with consideration of the Project alternatives (refer to Chapter 5 of the EA).
d) whether transport links to the landfill are optimised to reduce the environmental and social impacts associated with transporting waste to the landfill.	Chapter 12 Traffic and Transport The Traffic and Transport assessment findings indicate that the Project will result in a low impact upon existing transport links to the Whytes Gully RRP site during construction and operation and is consistent with all studies associated with the West Dapto Land Release Area including the West Dapto Access Strategy.

4.4.3 Regional Partnerships

Wollongong City Council, together with Shellharbour and Kiama Councils, collaborates as a part of the Southern Councils Group to investigate regional waste options pertaining to the collection and processing/disposal of waste. It has been identified within this group that Wollongong LGA has the size and waste generation rates to operate independently at a regional level and therefore that Wollongong City Council should manage its waste disposal independent of actions taken by both Shellharbour and Kiama Councils.

This agreement is dependent upon Whytes Gully RRP having the capacity to continue operating to service the waste management needs of the Wollongong LGA.

4.4.4 Economic Drivers and Technology

In accordance with the *Protection of the Environment Operations Act 1997,* the NSW Government imposes a levy on all waste received for disposal at licence landfills such as at Whytes Gully RRP. In addition to the NSW State Waste and Environment Levy, the *Local Government Act 1993* allocates councils the responsibility to collect and dispose of waste from domestic premises funded from a separate council levy, normally called the Domestic Waste Management Charge (DWMC), for the collection and disposal of these domestic wastes. Councils must not fund this from general rates revenue (refer to S.504 of the *Local Government Act 1993*). Further economic drivers for waste management and landfills are likely to include obligations associated with the recently adopted Commonwealth *Clean Energy Bill 2011* and carbon farming initiatives associated with this legislation.

For Wollongong City Council the increasing economic cost of placing material in landfill supports consideration of the financial attractiveness of alternative technologies, which could increase the amount of material that could be recovered from the waste stream (ensuring cost savings).

Wollongong City Council seeks to maintain and upgrade existing facilities and technologies to ensure resource recovery is maximised. Technologies either committed to as part of the Project or to be considered at a future date include:

- Augment the existing landfill leachate biological treatment plant required to treat leachate for disposal to the sewer system (part of the Project).
- Relocating the processing of garden organics offsite to reduce potential amenity impacts to the surrounding area (not part of the Project).

- Develop a landfill gas extraction and management system that minimises environmental and safety risks, and addresses climate change and carbon pricing liabilities through flaring and generating green renewable electricity from landfill gas (part of the Project).
- Consideration of on-site soil excavation operations in the development of the AWT platform shown on the Concept Site Masterplan to allow cover materials to be sourced from within the site to avoid significant costs associated with importing soils onto the site (not part of the Project).
- Consideration of development of a new Materials Recycling Facility (MRF) at the Whytes Gully Resource Recovery Park to sort standard recyclables. This facility will replace the current plant that is at the end of its useful life (contract expires in 2014) (not part of the Project).
- Consideration of development of a permanent household hazardous waste drop-off facility to allow Wollongong residents to responsibly dispose of household hazardous materials all year round when needed (not part of the Project).
- Consideration of AWT technologies in the future in accordance with the Waste Strategy (not part of the Project).

4.4.5 Environmental Sustainability

Wollongong City Council recognises environmental sustainability and the potential effects of climate change as a key issue to address to ensure maintaining and enhancing quality for current and future generations. Through its responsibilities to Wollongong LGA and the wider community, Wollongong City Council seeks to provide environmental leadership in managing the impacts of its own activities undertaken on behalf of the community.

Wollongong City Council is committed to minimising climate change impacts (as identified in the Waste Strategy) through the implementation of ESD. The considered impact of the Project upon issues associated with ESD are further discussed in Chapter 22 of the EA.

4.5 Role of Whytes Gully RRP in meeting Strategic Need

The existing Whytes Gully RRP is of critical importance to Wollongong City Council's waste management network, with Whytes Gully RRP accepting all of the MSW generated within Wollongong LGA.

There are a number of drivers for the strategic need and justification for the Project, which are internal and external to Wollongong LGA. The external and internal drivers of the Project address environmental, economic and social considerations, which are framed by legislation, policy and strategy documents at the Commonwealth, NSW State and local council level.

In summary, it is considered there is a demonstrated strategic need for the Project, which is driven externally and internally by Wollongong City Council. To reiterate the key points include:

- Despite increased resource recovery rates there will be a need to secure additional air space to meet long term needs. The proposed new landfill cell would accept inflow of residual materials from the existing and future resource recovery infrastructure either committed to or planned for at the Whytes Gully RRP site.
- Securing of contingency capacity to address potential risks and uncertainties associated with resource recovery activities.
- The Project addresses and is consistent with all local, State and Commonwealth guidelines, policies and legislation including all objectives of the WARR Strategy.
- Whytes Gully RRP seeks to maximise recycling and resource recovery whilst ensuring anything that cannot be recovered or recycled is disposed of responsibly and safely at the landfill on the site, which would be secured through the Project implementation.

- Meeting regional councils and Wollongong LGA community expectation to provide appropriate waste management by Wollongong City Council.
- No other suitable sites to service long term needs of the Wollongong LGA (refer to Chapter 5 of the EA for further analysis of other considered sites).

5.0 PROJECT ALTERNATIVES

This chapter identifies and analyses alternatives considered during development of the Project.

The Director-General's requirements	
■ *Alternatives considered, including a justification for the proposal on economic, social and environmental grounds*	**Chapter 5.0**

5.1 Alternatives to Landfill

As identified in Chapter 4 Strategic Need, existing resource recovery activities currently divert approximately 54 percent of MSW from landfill at Whytes Gully RRP and the Wollongong LGA. With implementation of the Waste Strategy by Wollongong City Council, resource recovery activities and initiatives are assessed as likely to increase to meet the targets identified within the WARR Strategy by 2014.

However, while waste minimisation initiatives and resource recovery facilities are likely to reduce the volume of waste diverted to landfill there is still a need for landfill space. This is recognised in the WARR Strategy targets, which while identifying diversion rates of 66 percent for MSW for 2014, implicitly acknowledge that the remaining 34 percent residual waste is to go to landfill.

To reiterate the point, no known resource recovery system can achieve a 100 percent landfill diversion performance and consequently resource recovery activities still require the disposal of residual material to landfill. Thus there is no feasible alternative to having access to landfill capacity.

5.2 'Do Nothing' Alternative

Existing landfill airspace at Whytes Gully RRP is projected to expire in late 2013. If the "do nothing" option is adopted Wollongong City Council would no longer be able to accept waste. Given Wollongong City Council's responsibilities to Wollongong LGA this is considered to not be acceptable on economic, social and environmental grounds. In addition, the *Local Government Act 1993* gives councils the responsibility to collect and dispose of waste from domestic premises within their LGA. Therefore the 'Do Nothing' alternative is not considered feasible.

5.3 Project Location and Design Alternatives

Having established that the 'Do Nothing' option and alternatives to landfilling are not feasible, alternatives to the location and design to accept waste to landfill are addressed in this section.

5.3.1 Alternative Existing Landfill Sites Outside of Wollongong LGA

To accept the volume of waste proposed to be received as part of the Project, a viable alternative landfill site outside of Wollongong LGA would need to have a considerable capacity. In addition the alternative landfill site (or sites) would likely require consent to permit large quantities of wastes being received from Wollongong LGA.

As identified within the "Public Review Landfill Capacity and Demand" (March 2009) report commissioned by the Department of Planning, there is an annual available capacity constraint for landfill within the Sydney metropolitan and regional areas.[1] This has resulted in the two major putrescibles waste landfill operators in Sydney and Goulburn potentially exceeding their annual waste input caps to accept current waste flows.

Sending all of Wollongong LGAs MSW landfill to facilities such as Woodlawn (located south of Goulburn approximately 130 kilometres from Whytes Gully RRP) or Eastern Creek landfill (approximately 80 kilometres from Whytes Gully RRP) would further exacerbate this waste capacity constraint.

In addition to existing capacity constraints further issues as to why alternative landfill sites outside of Wollongong LGA are not considered favourable to the Project include:

[1] Wright Corporate Strategy Pty Ltd (March 2009) "Public Review Landfill Capacity and Demand" p11

- Significant costs of transporting waste outside of Wollongong LGA. This includes economic, environmental and social costs such as:
  - Increased greenhouse gas generation through increased fuel consumption;
  - Increased vehicle congestion associated with increased vehicle movements within and outside of Wollongong LGA; and,
  - Increased costs associated with purchase and maintenance of transfer and transport infrastructure to transport waste.
- Feasibility of transporting all waste within a suitable timeframe.
- Potential carbon tax, levy and other liabilities managed by a third party.
- Time and cost requirements of the host landfill to gain statutory approvals.
- Potential liability associated with council agreements with private operators outside of Wollongong LGA.
- Imposition of the externalities generated through Wollongong LGA waste generation and management being place upon a further LGA.
- Wollongong City Council would have little control or recourse over landfill practices at third party sites.
- Wollongong City Council would have less long term security (including as contingency considerations) of available landfill capacity, in addition to Council's long term responsibility and liability for waste.

It is considered that the environmental, economic and social cost of transporting waste to alternate landfill sites outside of Wollongong LGA is considered to be high, not in the interest of ratepayers, and do not provide for security and contingency issues associated with managing waste within Wollongong LGA.

Furthermore Wollongong City Council together with Shellharbour and Kiama councils recently collaborated to consider regional assessment of options for MSW. These councils agreed that Wollongong LGA has the potential size, potential capacity and waste generation rates to operate independently at a regional level, with existing landfills within Shellharbour and Kiama not having the capacity to accommodate MSW generated within Wollongong LGA.

The issues identified above demonstrate that use of existing landfills outside of Wollongong LGA do not offer a sustainable waste management solution. This confirms that there is justifiable demand for provision of new landfill capacity within Wollongong LGA.

5.3.2 Alternative New Landfill Sites within Wollongong LGA

The construction and operation of a new landfill site within Wollongong LGA or elsewhere is not considered a favourable alternative to the Project for the following reasons:

- The waste footprint within Wollongong LGA or elsewhere would be increased compared to the Project (the Project overtops the existing waste footprint);
- Resource recovery and associated waste infrastructure would need to be relocated and/or re-established (ponds, treatment plant etc) in proximity to the new landfill site.
- Existing resource recovery activities and infrastructure would be less efficient as residual waste to landfill would require increased transportation costs (environmental, economic and social). The greater distance (such as outside of Wollongong LGA) the greater cost.
- Wollongong LGA is predominantly urban and compatible land use for a new landfill site is heavily constrained.
- A new landfill site would be likely to require Wollongong City Council to purchase additional land at cost to the ratepayers within Wollongong LGA.

- A new landfill site is likely to require more time for design, approval and construction (and subsequent cost) in comparison to providing for new landfill cell within an existing landfill site.

In comparison to the costs associated with the issues identified above, it is considered that a new landfill cell at the existing landfill site of Whytes Gully RRP would present less environmental, social and economic risk than a proposed new landfill site.

Furthermore the time required (design, approve, construct and operate) to accept waste at a proposed new landfill site is likely to be considerably longer than for a new landfill cell at an existing landfill facility. This is an important issue given the limited time available to address the existing landfill capacity constraints at Whytes Gully RRP (end of 2013) and consequently within Wollongong LGA.

5.3.3 Alternative Existing Landfill Sites within Wollongong LGA

As identified within the Waste Strategy (Appendix B) Wollongong City Council operates two existing landfill sites within Wollongong LGA, Whytes Gully RRP and Helensburgh landfill. Refer to Figure 4.1 for their locations within Wollongong LGA.

Helensburgh Landfill

Helensburgh landfill is unlined and has been accepting waste for over 50 years. This landfill is located at the boundary of the Royal National Park and the headwaters of the Hacking River at Nixon Place, Helensburgh. This landfill has limited capacity and currently only accepts dry domestic waste, builders waste and garden organics (i.e. not putrescibles MSW).

Due to Helensburgh landfill having limited capacity and being unlined, and its location, Wollongong City Council is currently investigating potential closure of this landfill in the near future.

As an alternative landfill site to Whytes Gully RRP, Helensburgh landfill is considered unsuitable for the following reasons:

- Unlined landfill in a potential environmentally sensitive area.
- Existing capacity constraint.
- Low design potential to provide for a new landfill cell and capacity.
- Change to waste flow and transport links would be required.
- Location to the north of the Wollongong LGA and not in proximity to large waste generation areas.
- Requirement of additional traffic movements for ingress and egress to the site.
- Stakeholder issues associated with the acceptance of MSW and large increase in waste volume including potential amenity impacts.

For the above reasons it is considered that Helensburgh landfill is unsuitable for increasing landfill capacity to accept MSW and is therefore not a feasible alternative to the Project.

5.3.4 Alternative Landfill Design at Whytes Gully RRP

Having identified that the location of additional landfill airspace at Whytes Gully RRP is preferred to potential alternatives and the only feasible option to Wollongong City Council, the specific design alternatives for the proposed new landfill cell are considered.

Design of the Project has been driven by providing appropriate design including being consistent with NSW Solid Waste Guidelines including the principles provided in the “EIS Guideline: Landfilling” (Department of Planning, 1996) where appropriate, and seeks to balance considerations of environmental, social and economic impacts upon Wollongong City Council and Wollongong LGA.

While this section provides an overview and brief summary of the alternative landfill designs considered as alternatives to the Project, refer to the Preliminary Design Report (Appendix O) for further information on the options considered including justification of the Project design.

Option 1 – Maximise Landfill Airspace within Existing Property Boundary

Option 1 to maximise landfill airspace within existing property boundaries has five sub-options, which provide gross airspace of approximately 6.9 million m^3 (6 million m^3 for option 1E). These options were considered to enable drainage of the wastershed from the northern batters to the surface water management system.

- Option 1A – Preliminary Concept Landform with storage pond.
- Option 1B – Preliminary Concept Landform with drainage through a culvert pipe.
- Option 1C – Preliminary Concept Landform with drainage through pipe installed by Pipe-Jacking.
- Option 1D – Preliminary Concept Landform with detention pond, draining through pipe installed by Directional Drilling.
- Option 1E - Landfill Cutback on East Side to form Open Drainage Channel.

Option 2 – Reduced Landfill Airspace with No Landfilling across Central Ridge

Option 2 has two sub-options that reduce landfill airspace with no landfilling across the central ridge of the site. Option 2 would provide a gross airspace of approximately 6.2 million m^3 of additional landfill capacity, as follows:

- Option 2A – No landfilling across central ridge with Storage Pond at point B.
- Option 2B – No landfilling across central ridge with Culvert Pipe from point B to C.

Option 3 – Reduced Landfill Airspace - Surface Water Drainage Path across Landfill Surface

Option 3 reduces landfill airspace with surface water drainage path across the landfill surface and providing a gross airspace of approximately 5.3 million m^3 of additional landfill capacity. Option 3 has no landfilling across the central ridge, but maintains an existing surface drainage path across new landfill.

Option 4 – Reduced Landfill Airspace - No Landfilling above Existing Landfill Road

Option 4 reduces landfill airspace with no landfilling above the existing landfill road and would provide for approximately 4.5 million m^3 of additional landfill capacity. This option provides for no landfilling across the central ridge. “Piggy-back” fill on the Western Gully landfill would not extend above the existing landfill road with a new surface water drain required to be established on alignment of existing landfill road, draining to the west.

Option 5 – Extend Landfill outside Existing Property Boundaries

Option 5 extends landfill outside existing property boundaries and would extend landform across an identified Endangered Ecological Community (EEC) (refer to Chapter 13) to form a high point on the northern edge of the landform, with perimeter surface drainage to the east and west. This would provide more than 7 million m^3 of additional landfill capacity.

Alternative Design Issues

Each of the alternative designs considered has competing environmental, social and economic considerations, which influence the preferred design outcome. Key issues and considerations include:

- Landfill airspace proposed;
- Potential for environmental impacts including impacts upon amenity and/or EECs;
- Potential for social impacts upon the surrounding area;
- Construction and operational considerations such as a preference for open drainage channels (in lieu of drainage pipes beneath waste, storage ponds, pipe jacking or directional drilling);
- Safety in Design; and
- Property acquisition requirements.

Consideration of the design options against the key issues has identified that Option 1E "Landfill Cutback on East Side" offers the most favourable design option for the Project. Key advantages of this design approach include:

- Large Airspace (approximately 6 million m^3 , ~40 years);
- Low impact upon flora identified as an EEC;
- Open drainage channels; and
- No property acquisition would be required.

The Project footprint for the adopted option is shown in Figure 5.1.

Capacity and Demand for Airspace

As identified in Chapter 4 the approximate tonnage of all material to landfill in 2011 was approximately 125,000 tpa. Allowing for a population growth rate of 0.7 percentage (and conservatively no waste avoidance/resource recovery beyond the existing 54 percent in 2011), the Project proposes to have capacity for up to 180,000 tpa of total material to landfill (including cover) by 2055. While this capacity may be considered conservative, it does allow for some contingency.

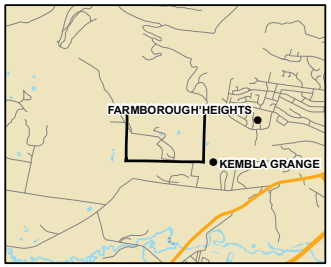
As identified in Section 5.3.1 the "Public Review Landfill Capacity and Demand" report identified there is an annual available capacity constraint for landfills, which has resulted in the two major putrescibles waste landfill operators in Sydney and Goulburn needing to consider breaching their annual waste input caps to accept current waste flows and/or modify their conditions of consent. The Project wishes to avoid exacerbating this potential issue by proposing an annual capacity that allows for contingencies, whilst being driven by strategic drivers identified in Chapter 4 (such as the Waste and Environment levy) to reduce waste to landfill.

File Location: J:\GIS\Jobs\117625003_Wollongong Council_New Landfill Cell_Whytes Gully\Workspaces\117625003_116_R_F0002_ProjectFootprint_Rev1.mxd

WHYTES GULLY NEW LANDFILL CELL ENVIRONMENTAL ASSESSMENT

WOLLONGONG CITY COUNCIL

PROJECT FOOTPRINT



LEGEND

- Contours of Final Landform (5 m interval)
- Site Boundary
- Approximate Extent of Waste
- Extent of Landfill Works
- Indicative New Leachate Pond Footprint
  New Leachate Pond to be established prior to commencement of Stage 4 construction
- Indicative New Surface Water Pond Footprint
  Surface Water Pond to be reduced in size prior to commencement of Stage 4 construction
- Indicative LTP infrastructure will be assessed at the end of 2014.
- Existing Leachate Treatment Plant (LTP) Footprint

NOTES

Extent of waste based on site observations and information provided by Council.

Aerial Ortho-Photograph provided by AAM Pty. Ltd. taken on 16 May 2011, Reference 18763A. Image Georeferenced.

Extent of landfill works as per Golder Design Report.

0 25 50 100 150 metres

SCALE (at A3) 1:3,800

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: 117625003
DATE: 22/02/2012
DRAWN: FA
CHECKED: JMc

FIGURE 5.1

Golder Associates

5.3.5 Future Technology Considerations

Potential for the Project to Impact upon Resource Recovery

As discussed in Chapter 4 (Strategic Need) of the EA, a Concept Site Masterplan has been recently prepared for Whytes Gully RRP, which incorporates the Project in addition to future waste management infrastructure.

The purpose of the Concept Site Masterplan is to allow for the development of Whytes Gully RRP as a sustainable waste management and resource recovery facility. As such, the Concept Site Masterplan identifies dedicated areas within Whytes Gully RRP for future technologies in resource recovery, in addition to the Project and the proposed new landfill cell, in consideration of a coordinated delivery of resource recovery and waste services within Wollongong LGA.

It should be noted the Concept Site Masterplan is not part of the Project, but is provided in the EA to demonstrate potential future resource recovery have been considered in the design and planning of the Project. As shown in Figure 4.6 of the EA this includes potential dedicated areas for a new MRF, expansion of the MRF and construction of an AWT facility or other resource recovery technology.

By 2014 Wollongong City Council's Waste Strategy commits Wollongong City Council to reviewing available alternative waste technologies to determine the most appropriate technology proposed to be constructed within the identified footprint area of the Concept Site Masterplan. Based upon this information it is therefore considered the Project would not "crowd-out" potential resource recovery actions committed to in the future within the Waste Strategy.

While proposing a landfill, the Project seeks to encourage resource recovery through the use of existing resource recovery infrastructure on the site thereby increasing the lifetime of the proposed and existing landfill. It is considered that a design of the Project that largely "piggy-backs" the previous landfill areas would offer the most efficient use of space to maximise the area for existing resource recovery activities and set aside for future resource recovery activities.

6.0 ENVIRONMENTAL SETTING

This chapter of the EA provides an overview of the environmental setting of the Project site. This includes site and surrounding land use, topography, soil and water issues and existing climate. For further information on these and further key issue existing environments refer to the respective chapters of the EA including flora and fauna (Chapter 13) and contamination (Chapter 12).

6.1 Site Locality

Wollongong LGA is located 80 kilometres south of Sydney and covers approximately 714 km^2. Wollongong LGA is bordered by the Royal National Park to the north, Lake Illawarra to the south, the Tasman Sea to the east and the Illawarra escarpment to the west.

Whytes Gully RRP is located approximately 10 km to the south west of the Wollongong CBD and is approximately 65 ha in size. Refer to Figure 1.1 for the Whytes Gully RRP regional context within the Wollongong LGA.

6.2 Surrounding Site Use

Whytes Gully RRP is generally bounded by Reddalls Road to the south and west, rural residential lands to the north, north-east and north-west, and a water treatment plant to the south east. Dapto Creek is located to the west of the site.

The wider area around Whytes Gully RRP includes the Illawarra escarpment to the north and west, and an industrial area lies to the south and south west of the site. The residential suburb of Farmborough Heights is located to the north east over a ridgeline, with the closest residents of this suburb approximately 360 m from Whytes Gully RRP. Two individual residents are within 120 m of the Whytes Gully RRP site boundary.

Whytes Gully RRP is located within the northern area of the West Dapto Release Area. The West Dapto Release Area as identified within the LEP has been planned by Wollongong City Council with input from numerous stakeholders and the community to guide the development of the release area over the next 30 to 40 years. The Project is consistent with West Dapto Release Area's objectives and controls including the LEP and the DCP's "Chapter 16: West Dapto Release Area"

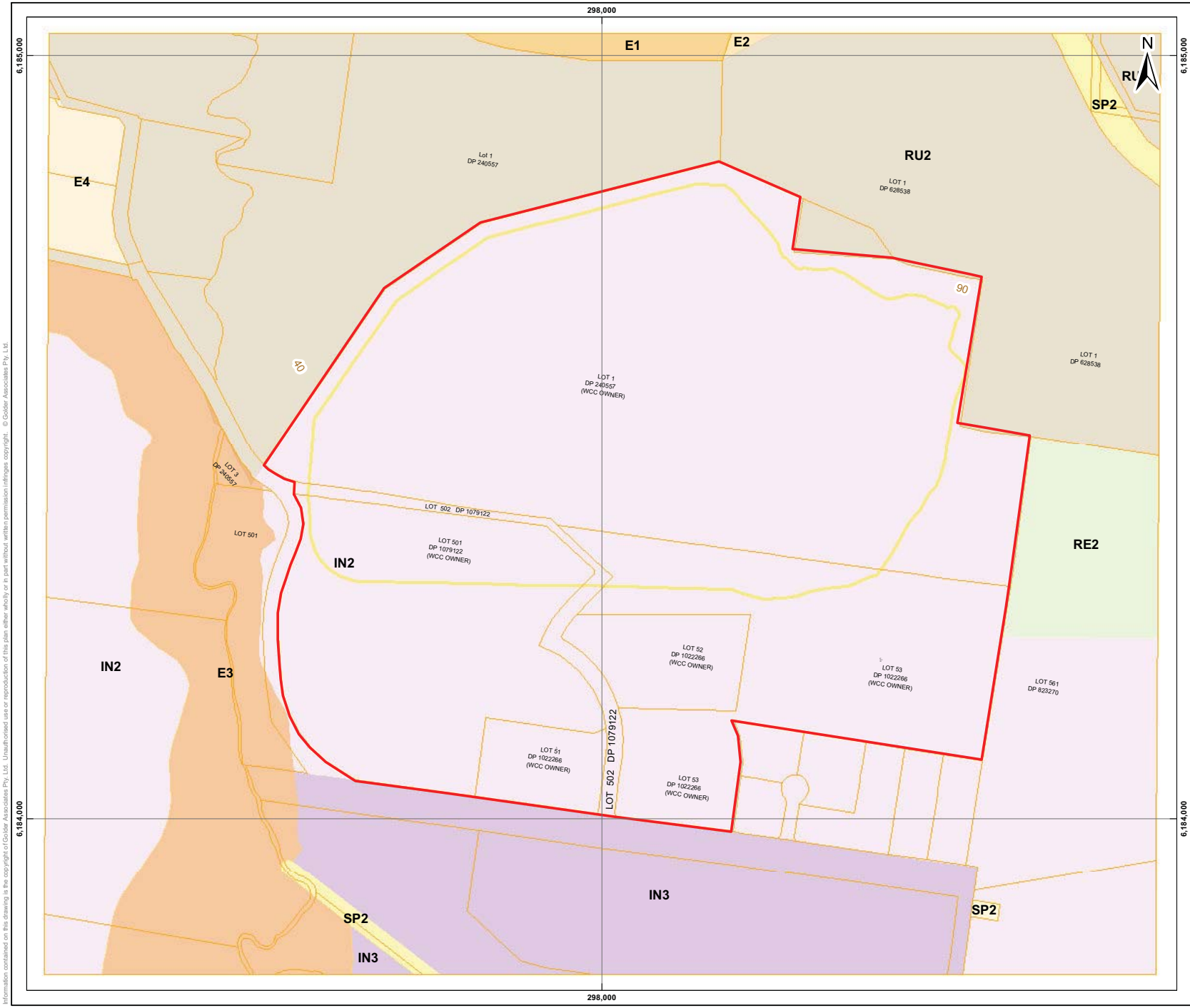
The surrounding land use as per the LEP 2009 and 2010 and the lots and DPs are shown in Figure 6.1.

6.3 Land Ownership and Land Use

The Whytes Gully RRP site is owned by Council and comprises:

- Part Lot 501, DP 1079122;
- Lot 502, DP 1079122;
- Lot 2, DP 240557;
- Lot 51, DP 1022266;
- Lot 52, DP 1022266; and
- Lot 53, DP 1022266.

The Project is defined as a "waste or resource management facility", which is permissible with consent upon land zoned IN2 in accordance with the LEP.



WHYTES GULLY NEW LANDFILL CELL ENVIRONMENTAL ASSESSMENT

WOLLONGONG CITY COUNCIL

PLANNING ZONES

LEGEND

Wollongong City Council LEP 2009, 2010 Zones

- (IN2) Light Industrial
- (IN3) Heavy Industrial
- (RE2) Private Recreation
- (SP2) Infrastructure
- (SP2) Infrastructure Roads and Railways
- (E1) National Parks and Nature reserves
- (E2) Environmental Conservation
- (E3) Environmental Management
- (E4) Environmental Living
- (RU2) Rural Landscape
- (SP2) Infrastructure

- Site Boundary
- Extent of Landfill Works
- Cadastre

NOTES

Zoning data as provided by Council (LEP 2009 and LEP 2010)

0 15 30 60 90 120 150 180 metres

SCALE (at A3) 1:5,000

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: **117625003**
DATE: **26/03/2012**
DRAWN: **FA**
CHECKED: **JMc**

FIGURE 6.1

Golder Associates

File Location: J:\GIS\Jobs\117625003_Wollongong Council_New Landfill Cell_Whytes Gully\Workspaces\117625003_114_R_F0001_PlanningZones_Rev2.mxd

6.4 Topography

The landfill is sited on a south facing slope, which is dominated by an east-west trending ridgeline to the north. The landfill is located in two historical gullies, the western gully and the eastern gully, which correspond to the two landfill developments at the site; the eastern gully landfill and the western gully landfill. The northwest and eastern extents of the landfill are bounded by ridgelines, with a small central north-south trending ridgeline separating the two historical gullies, the upslope portion of which is still visible today. The site rises from RL 15 m at the south west to RL 100 m to the north east. Figure 6.2 presents the existing site contours.

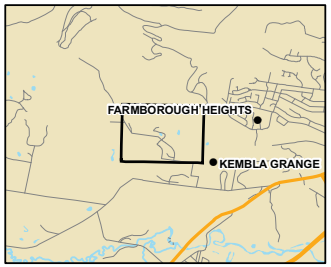
The current surface of the Western Gully landfill is generally sloped at approximately 5H:1V, with indistinct benches at 5 m to 10 m vertical intervals. The landfill surface above RL 80 m has gentler slopes, generally flatter than 10 percent.

The current surface of the eastern gully landfill has an upper platform portion where active landfilling is taking place, as well as a southwest-facing batter portion. The batter portion has an average slope of approximately 4H:1V and is terraced with benches at 2m to 3m vertical intervals, bench widths at 3m to 5m, and slope inclinations of 2H:1V to 3H:1V between benches.

WHYTES GULLY NEW LANDFILL CELL ENVIRONMENTAL ASSESSMENT

WOLLONGONG CITY COUNCIL

EXISTING SITE CONTOURS AND CURRENT MONITORING LOCATIONS



LEGEND

- Existing Monitoring Location
- Site Contours
- Site Boundary
- Approximate Extent Of Waste
- Extent of Landfill Works

NOTES

Extent of waste based on site observations and information provided by Council.

Aerial Ortho-Photograph provided by AAM Pty. Ltd. taken on 16 May 2011, Reference 18763A. Image Georeferenced.

Extent of landfill works as per Golder Design Report.

Site contours based on survey by KFW Williams, dated 20/07/2011

0 12.5 25 50 75 100 125 150 metres

SCALE (at A3) 1:4,000

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: **117625003**
DATE: **12/03/2012**
DRAWN: **FA**
CHECKED: **JMc**

FIGURE 6.2

Golder Associates

File Location: J:\GIS\Jobs\117625003_Wollongong Council_New Landfill Cell_Whytes Gully\Workspaces\117625003_114_R_F0003_Existing_Site_Contours_Rev2.mxd

6.5 Hydrology

The site lies at the foot of Mt Kembla and is located within the catchment of Dapto Creek which discharges to Lake Illawarra via the larger Mullet Creek. The site is approximately one kilometre upstream of Dapto Creek and five kilometres upstream of Lake Illawarra.

There is no major continuous watercourse flowing from the site. Both gully's feed into one minor ephemeral watercourse which discharges under Reddalls Road into Dapto Creek.

Dapto Creek discharges into the much larger Mullet Creek catchment which is approximately 74.5 km^2. Mullet Creek rises at the escarpment at an elevation of about 600m AHD, and flows a distance of about 22 km before reaching the tidal Lake Illawarra. These steep catchment conditions provide for dynamic flooding and geomorphic conditions in the catchment.

The headwaters for the Mullet Creek catchment are mainly forested and much of its catchment is still used for rural activities. However Dapto, Horsley, Brownsville, Kembla Grange and Farmborough Heights represent significant urban use.

The general surface water drainage direction on the site is from the north east towards the south west. The catchment area of the site is approximately 50 ha and extends from a ridge to the north of the site to Reddalls Road to the south. Run-on to the site is minimal due to the site being bounded by ridgelines.

Surface water runoff from covered areas of the western and eastern gully landfills is captured by swales on the landfill surface. The swales divert the runoff towards drains around the perimeter of the landfills and to a central drain between the eastern and western gully landfills. Runoff from the natural slope above the northern edge of the eastern gully landfill (rainforest area) is also directed to the central drain.

Surface water runoff reports to the surface water ponds at the southwest corner of the site before discharge to Dapto Creek.

6.6 Hydrogeology

Regionally the site is located within the southern portion of the Sydney Basin, a geological basin stretching from the Illawarra Plateau in the south to the Lower Hunter Valley region in the north, and incorporating the topographically low Cumberland Basin in the centre. Generally, the dip of the geological formations within the Sydney Basin is from the topographically higher ground in the north and south towards the topographic low ground in the centre of the basin, although this varies locally based on structural features.

The regional hydrogeological setting of the area includes groundwater resources associated principally with the sandstone formations of the Hawkesbury Sandstone, Narrabeen Group, Illawarra Coal Measures and the Shoalhaven Group. Each of these geological groups generally comprise of varying proportions of sandstone, siltstone, claystone, shale and coal. Groundwater resources are generally described as occurring as stacked aquifer systems associated with the sandstone formations, separated by lower permeability strata acting as aquitards. Structural contours presented on the 1:100,000 geological map 'Wollongong-Port Hacking' (Department of Primary Industries, 1985) indicate a local geological dip direction approximately towards the north to northwest in the vicinity of Whytes Gully RRP, which would be expected to influence the regional groundwater flow direction.

Groundwater occurrence at Whytes Gully RRP is generally associated with two shallow systems: groundwater present in the upper weathered and fractured profile of the local bedrock geology, and groundwater present in the unconsolidated deposits that infill the two gullies at the site at the toe of the sloping topography. Water levels measured in wells installed within the shallow weathered bedrock in the sloping northern portion of the site generally range from 5 to 10 metres below ground level (mbgl), whereas water levels in wells installed in both the shallow bedrock and unconsolidated material in the flatter southern portion of the site are shallower, generally in the order of 1 to 3 mbgl. The water level associated with GABH03 is approximately 0.4 m above ground level, indicating local artesian conditions within the shallow bedrock at this location. Hydrogeological conditions at the site are further discussed in Chapter 12, with interpreted groundwater contours presented in Figure 12.2.

6.7 Geology

Based on the 1:100,000 geological map 'Wollongong-Port Hacking' (Department of Primary Industries, 1985) Whytes Gully RRP the southern part of the site is underlain by fluvial sands, silts and clays associated with Dapto Creek. Sandstone of the Budgong Sandstone formation underlies these alluvials. The Budgong Sandstone formation typically composes red, brown and grey lithic sandstone. The northern portion of the site is underlain by interbedded lithic sandstone, coal, carbonaceous claystone, siltstone and claystone of the Pheasants Nest Formation. It appears that the Pheasants Nest formation is mainly encountered on the ridgelines.

The Environmental Impact Statement (EIS) completed for the Western Gully landfill (Scott and Furphy Engineers 1982) indicates that prior to landfilling, volcanic sandstone covered most of the site with a transition to andesitic sandstone with coal seams, carbonaceous shale and mudrock in the higher section (above approximately RL 100 m AHD) and a zone of alluvium, gravels and sands in the lower sections (below approximately RL 30 m AHD). Bedrock is reported to appear at the surface in the upper sections of the site.

The "Whytes Gully Landfill Extension Environmental Impact Statement" undertaken by Maunsell in 1992 (Eastern Gully EIS) notes that a relatively thick layer of colluvium was found along the base of the Eastern Gully. The Golder Associates (2012a) "Whytes Gully New Landfill Cell Geotechnical Investigation Report" (Geotechnical Report) summarises the conditions encountered at the Whytes Gully RRP site as four different geological areas. The geological areas are presented in Figure 6.3.

The geological areas include:

Geological Area 1 – Pheasants Nest Formation: This area is located on the upper slopes across the northern portion of the Project site. The material encountered is generally weathered sandstone that grades into a fresh sandstone at depths typically less than 10 m. The residual soil is generally less than 2 m thick. Siltstone was encountered in zones throughout the sandstone at depths greater than about 15 m (based on the investigation carried out in the Maunsell (1992) "Site Investigations and Geotechnical Assessments for the Phase 2 Development of a Waste Disposal Depot at Whytes Gully, West Dapto". Siltstone was not encountered in the Geotechnical Report investigation.

Geological Area 2 – Budgong Sandstone Formation: This area is located across the southern portion of the Project site. This sandstone generally has weathering profiles that extends to depths up to 15 m. Zones of weathered siltstone, up to approximately 3 m thick are located intermittently throughout this formation.

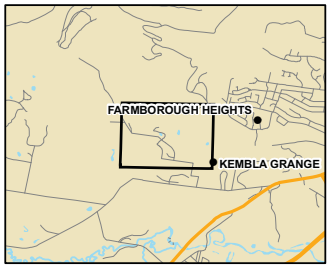
Geological Area 3 – Alluvial Soils: This geological area consists of colluvial / alluvial soil material (silty clay and silt with some sands and sub angular gravels and cobbles) and is located across the middle and south west portion of the site. The thickness of this material varies to a maximum of approximately 11 m. This geological area is expected to be underlain by Budgong Sandstone.

Geological Area 4 – Capping Layer and Landfill: This geological area is located across the northern slope. The capping material consists of generally low to medium plasticity sandy clay and is typically less than 1.5 m thick. Landfill waste is located beneath the capping layer and consists of general waste such as paper, plastic, wood, rubble and other materials. The depth to the base of the general waste fill is not well defined, however, old topographical data (CMA NSW 1979) suggests that the thickness of the fill could be up to 40 m. This geological area is expected to be underlain by the Pheasants Nest Formation.

WHYTES GULLY NEW LANDFILL CELL ENVIRONMENTAL ASSESSMENT

WOLLONGONG CITY COUNCIL

GEOLOGICAL AREAS



LEGEND

- Site Boundary
- Approximate Extent Of Existing Landfill Boundary

Geological Area

- Area 1 - Pheasants Nest Formation
- Area 2 - Budgong Sandstone Formation
- Area 3 - Alluvial Soils
- Area 4 - Capping Layer and Landfill

NOTES

Geological Areas as per the Wollongong - Port Hacking (DPI,1985) Geological Map (1:100,000)

Aerial Ortho-Photograph provided by AAM Pty. Ltd. taken on 16 May 2011, Reference 18763A. Image Georeferenced.

0 15 30 60 90 120 150 metres

SCALE (at A3) 1:4,500

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: **117625003**
DATE: **12/03/2012**
DRAWN: **FA**
CHECKED: **BJF**

FIGURE 6.3

Golder Associates

File Location: J:\GIS\Jobs\117625003_Wollongong Council_New Landfill Cell_Whytes Gully\Workspaces\117625003_114_R_F0004_Rev0_GeologicalAreas.mxd

6.8 Soils

The inferred subsurface stratigraphy generally consists of soil fill materials, landfill waste, colluvial / alluvial soils, residual soils and sandstone and siltstone rock.

The thickness of the soil and fill units varies throughout the site. The depth to sandstone and siltstone rock in the existing natural slope areas is relatively small, typically 3 m or less. Relevant information on soil and fill materials is provided in Table 6.1, with additional detail provided in the Geotechnical Investigation Report (Appendix G1).

Table 6.1: General Description of Soil and Fill Materials

Material	Description
Fill – general	Fill was encountered in zones of the proposed Cell 1 to 4 area at the southern edge of the proposed landfill (refer Drawing D004). This area is also referred to as the new cell floor area. This fill had variable thickness and comprised clayey soils with sands. Observation indicates that thickness may be up to 5m in the vicinity of the existing landfill access road and recycling area.
Fill – existing landfill cap	Fill in the existing landfill cap comprises mixed soils (clays/sands) with pockets of gravels, slag and coal-wash. Thickness generally ranges from 0.5m to 2.0m.
Existing Landfill Waste	Landfill Waste is present beneath the existing landfill cap material in both the Eastern and Western Gully landfills. Maximum thickness is approximately 50 m in the Eastern Gully Landfill and 35 m in the Western Gully Landfill. Refer to Section 2.6 for additional information.
Colluvial and Alluvial soils	These soils comprise mostly silty clay and clay with zones of sands and gravels and traces of cobbles. Soils within 2 m to 3 m of the surface are soft to firm in parts and strength improves with depth. Clear distinction between the Colluvial soils on the lower slopes and the Alluvial soils at the base of the slopes is not generally possible. The maximum combined thickness of colluvial/alluvial soils within the proposed landfill footprint is approximately 16 m. Additional discussion is provided below.
Residual soil	Residual soil is mostly clay with varying quantities of gravel, silt and sand. The clay is medium plasticity and generally stiff to very stiff with zones of medium dense to dense sand. The maximum thickness of this material in natural areas of the site is approximately 2m. Additional discussion is provided below.

6.9 Climate

Climate data for the site has been collated from a number of Bureau of Meteorology's (BoM) weather stations as no nearby weather station has a continuous long term record of weather data and variability in rainfall patterns in particular is known in the area. The weather stations in closest proximity to the site are summarised in the Table 6.2.

Table 6.2: Weather Stations

Station	BoM Reference	Approximate Distance to Site (km)	Station Open	Data selected
Albion Park (Wollongong Airport)	068241	10	1999 to present	Temperature, solar exposure, wind speed, humidity
Dapto West (Stane Dykes)	068023	5	1898 to 1987	Rainfall
Berkeley (Northcliffe Drive)	068110	4	1963 to present	Rainfall
Sydney Airport	066037	67	1974 to present	Mean Daily Evaporation

Mean monthly rainfall, temperature, evaporation, wind speed and humidity are presented in Table 6.3.

Table 6.3: Monthly Climate Statistics (BOM, 2011)

Statistic Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Rainfall (mm)[1]	100.6	133.2	140.1	112.9	85.7	106	54.5	66.2	58.2	93	96.5	76.8	1125.4
Mean Rainfall (mm)[2]	123.5	130.2	140.9	106.7	101.7	101.3	78.6	70.9	59.6	85.8	92.3	97.6	1192.4
Mean Rainfall (mm)[3]	116.1	157.5	183.7	92.9	89.0	140.3	62.6	87.7	55.0	108.0	94.3	90.4	1278.6
Mean max temperature (°C)[4]	26.8	26.3	25.2	23.1	20.3	18.2	17.5	18.9	21.4	22.7	23.7	25.5	22.5
Mean max temperature (°C)[3]	24.1	24.4	24.1	22.4	19.4	17.5	16.7	17.3	19.2	20.7	22.4	23.4	21.0
Mean min temperature (°C) [4]	16.7	17.2	15.3	11.9	8.6	6.9	6.2	6.4	8.4	10.7	13.3	15.0	11.4
Mean min temperature (°C)[3]	18.4	18.7	18.0	15.7	12.7	10.9	9.8	10.3	11.8	13.7	15.3	17.1	14.4
Mean daily evaporation (mm) [5]	7.2	6.4	5.4	4.2	2.9	2.5	2.7	3.7	4.9	5.8	6.5	7.4	5.0
Mean daily solar exposure (MJ/m^2) [4]	22.7	20.0	17.4	13.9	10.4	8.7	9.8	13.3	17.0	19.8	21.1	23.0	16.4
Mean 9am wind speed (km/hr) [4]	11.6	9.8	8.1	10.7	12.4	13.6	14.4	15.0	15.3	14.4	12.9	12.7	12.6
Mean 9am wind speed (km/hr) [3]	17.4	16.1	14.7	14.7	16.7	17.4	17.7	18.5	18.7	19.7	19.5	18.1	17.4
Mean 3pm wind speed (km/hr) [4]	21.6	20.0	18.9	17.7	17.1	17.6	18.1	21.8	22.6	20.9	20.9	21.5	19.9
Mean 3pm wind speed (km/hr) [3]	24.4	23.7	22.9	22.8	21.9	22.0	24.6	25.4	27.1	26.3	26.5	25.5	24.4
Mean 9am relative humidity (percent)[4]	68	74	76	68	69	73	68	61	57	58	67	66	67
Mean 3pm humidity (percent)[4]	63	67	64	61	58	57	54	49	53	58	63	61	59

[1] Mean data for Dapto West (Stane Dykes) weather station, (068023)

[2] Mean data for Berkeley (Northcliffe Drive) weather station, (068110)

[3] Mean data for Port Kembla (Signal Station) weather station, (068053), data from 1950 to 1976 and from 1957 to 1976 for wind speed

[4]Mean data for Albion Park (Wollongong Airport) weather station, (068241)

[5] Mean data for Sydney Airport weather station (066037), data from 1974 to 2010.

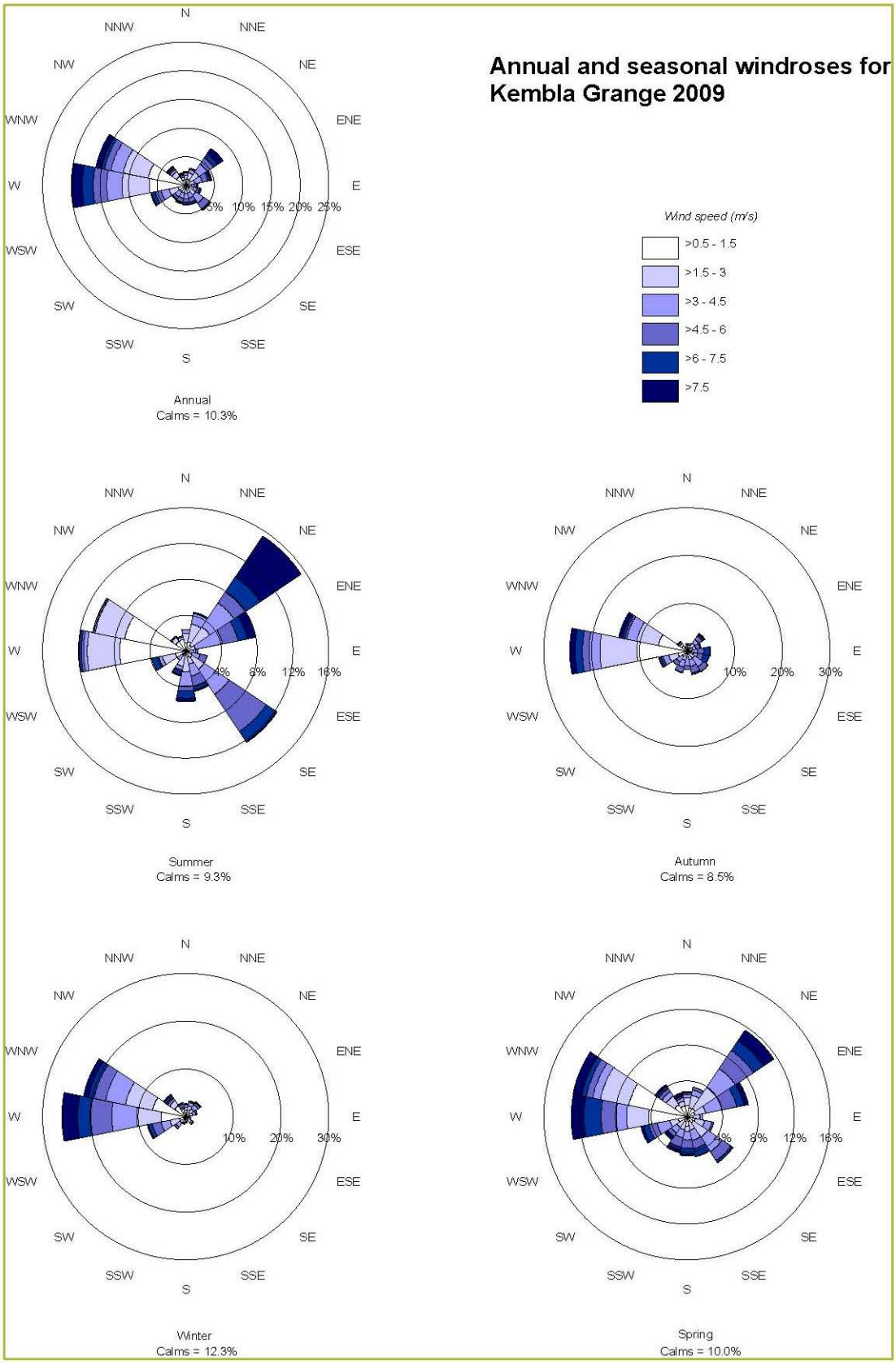
For the Dapto West (Stane Dykes) weather station, which is the station in operation for the longest period, the average annual rainfall is 1192.4 mm. The rainfall distribution throughout the year is higher for summer, with winter and spring months experiencing on average the driest weather.

Annual and seasonal wind roses for the Kembla Grange weather station are shown in the Figure 6.4.

Wind directions at the site are seasonal and are dominated by strong westerly winds during the winter months. North-easterly winds dominate during the remainder of the year.

For climate data used for technical models for key issue assessment of the Project, refer to the relevant chapters and appendices of the EA including Air (Chapter 14), Noise (Chapter 10) and Bushfire Report (Appendix M).

Figure 6.4: Annual and seasonal Wind Roses for Kembla Grange 2009



7.0 EXISTING INFRASTRUCTURE AND OPERATIONS

This section provides a summary of the existing infrastructure and operations of Whytes Gully RRP including the history of development, details of existing approvals, description of existing infrastructure and easements in addition to existing environmental management and monitoring procedures are outlined and discussed.

The Director-General's requirements ■ ***The likely inter-relationship between the proposed operations and the existing operations on site including details of existing approvals, management systems and details of past environmental performance.***	***Chapter 7 (and Chapter 8).***

7.1 History of Development

A history of infrastructure and operations development at Whytes Gully RRP is provided in this section incorporating development approval history.

All locations referred to in this section are shown in Figure 4.2 – Site Layout.

The Whytes Gully RRP was established in 1984 at a site known as Whyte's farm. As identified within "Environmental Impact Statement – Proposed Waste Disposal Depot at Reddalls Road West Dapto" prepared by Scott and Furphy in 1982 (Western Gully EIS), the site is defined by two gullies known as the western and eastern gullies separated by a central north-south trending ridgeline. Whyte's farm initially comprised an area of 35.6 ha of mostly cleared, improved grazing land owned by Mr Whyte for a period of approximately 40 years prior to the sites development as a landfill.

An area of land to the south of Whyte's farm adjacent to the eastern gully was also purchased by Wollongong City Council to accommodate the Whytes Gully RRP development as a landfill. A stockyard remains near the central western boundary of the site which is remnant from this prior use.

7.1.1 Western Gully

Development consent for landfilling in the Western Gully was granted in 1984, in accordance with the Western Gully EIS. Landfilling commenced in the Western Gully in 1984.

Site Preparation - We understand that colluvium and residual soil were stripped from the natural slopes during preparation works prior to landfill being placed in the area. From discussions with Council staff involved in this stripping operation it appears that the natural slopes are likely to have been almost completely stripped to rockhead, but that colluvium and residual soil were not removed to full depth at the base of the natural slopes.

Lining - The Western Gully Landfill is unlined.

Leachate Collection –Collection of leachate was originally through a central 100 mm diameter perforated pipe located at the base of the landfill. From discussions with Council staff we understand that this pipe did not have filter protection and became non-functional early on during the filling process. These discussions also indicate that an alternate leachate collection system was constructed where leachate collection horizons were established successively at approximate 5 m vertical intervals within the landfill mass comprising a network of finger drains. At the low point on each horizon, flows in the finger drains enter a shallow 300 mm concrete or HDPE pipe and are conveyed to the base of the landfill batter. At the toe of the landfill batter the shallow 300 mm pipe extends through the landfill bund wall to the current leachate collection pit near the current landfill access road, from where it is transferred to the leachate collection ponds.

Irrigation of leachate is also understood to have historically been undertaken on the Western Gully landfill but has not been practiced in recent years.

Volume - The Western Gully landfill received approximately 980,000 cubic meters (cu.m.) of waste during its 9.5 year life from 1984 to 1993 (Western Gully EIS).

Filling - Landfilling commenced following the construction of a large soil bund wall at the toe of the landfill with a height of 5 m and a crest elevation of RL 35 m. The bund wall extends from one side of the Western Gully to the other. After site preparation, waste was subsequently placed in the gully behind the bund wall. Once waste was placed to the height of the bund wall, a second, smaller, bund wall was placed to a height of approximately 37.5 m AHD. Waste was then placed to the crest level of the second bund wall. This filling technique of bund construction followed by waste filling was continued throughout the life of the landfill with each bund wall being approximately 2.5 m high. The maximum waste thickness is approximately 30 m.

Bund wall and cover material was won from site preparation works prior to filling of each lift. The external bund wall surfaces were subsequently vegetated following completion of each lift.

Capping – the Western Gully Landfill is covered with a varying depth of cover materials comprising generally low to medium plasticity sandy clay ranging in thickness from 0.3 m to 2.5 m (Geotechnical Report).

Profile - The profile of the landfill batter comprises an average surface slope of approximately 20 percent with indistinct benches at approximate 5 m to 10 m vertical intervals. The landfill surface above RL 80 m has gentler slopes, generally flatter than 10 percent.

Footprint – The approximate footprint of the Western Gully landfill is 10 ha.

Landfill Gas – Approximately 40 vertical landfill gas extraction wells were previously installed and operated in all areas of the Western Gully Landfill. These gas wells were abandoned in approximately 2005.

7.1.2 Eastern Gully

Development consent for landfilling in the Eastern Gully was granted in 1993 in accordance with the Eastern Gully EIS.

Site Preparation - As with the Western Gully we understand that colluvium and residual soil were stripped from the natural slopes during preparation works prior to landfill being placed in the area. From discussions with Council Staff involved in this stripping operation it appears that the natural slopes are likely to have been almost completely stripped to rockhead, but that colluvium and residual soil were not removed to full depth at the base of the natural slopes.

Leachate Barrier - The Eastern Gully landfill was constructed as a lined landfill, with the barrier component of the lining system comprising a high density polyethylene (HDPE) geomembrane liner (2 mm thickness). The HDPE geomembrane liner has a textured surface in sloped areas to enhance landfill stability.

The HDPE geomembrane liner is underlain by a groundwater drainage layer comprising an approximate 500 mm thick fine gravel layer that is intended to collect any groundwater seepage from natural materials below the liner. This layer incorporates a 100 mm diameter collection pipe that drains by gravity to a surface water pond at the toe of the Eastern Gully landfill. Sampling shows that water collected in the groundwater system may be impacted by leachate. We understand that when high water levels develop in the surface water pond, it is pumped to the leachate management system.

Leachate Collection - The HDPE geomembrane liner is overlain by a blanket leachate drainage layer comprising an approximate 300 mm thick clean sand layer. This layer incorporates two 300 mm diameter leachate collection pipes that drain by gravity to the toe of the landfill – one pipe drains Stage 1 and the other pipe drains Stage 2 (refer below for stage description). Collected leachate is transferred to leachate ponds.

Filling - has been undertaken in four stages. Stage 1 commenced in 1993 and was located in the upper portion of the Eastern Gully. Stage 2, located on the lower section of the Eastern Gully commenced in 2001. Stages 1 and 2 together received approximately 1,250,000 cu.m. of waste to the year 2004. Stage 3 is located over the Stage 1 and Stage 2 filling area and had an estimated 610,000 cu.m. capacity over a five year period (2004 to 2009). Stage 4, located in the upper portion of the gully over Stage 3 and Stage 1 is currently underway and has an estimated 750,000 cu.m. capacity over a four year period (2009 to 2013) with

completion of filling expected in 2013 (Forbes Rigby, 2001 and WCC Drawing No. 1475, 2004, Survey Drawings KFW dated December 2000, December 2001, June 2004 and December 2009 drawing numbers 2982, 3156, 3705, 4600 respectively).

Capping - Capping materials encountered had a variable composition of materials throughout the existing cap. The thickness of the capping observed by Golder (Geotechnical Investigation Report, refer Appendix O) ranged from 0.1 m (GAHA04) to 0.6 m (GAHA01) across the Eastern Gully landfill.

Profile - The current landfill batter has an average slope of approximately 25 percent and is terraced with benches at 2m to 3m vertical intervals, bench widths at 3m to 5m, and slope inclinations of 2H:1V to 3H:1V between benches.

Footprint – The approximate footprint of the Eastern Gully landfill is 9.5 ha.

Landfill Gas – Approximately 30 vertical landfill gas extraction wells were previously installed and operated in the Eastern Gully Landfill, primarily in the Stage 3 portion. These gas wells were abandoned in approximately 2005.

Refer to the draft Landfill Environmental Management Plan (LEMP) (Appendix P) for further detail on the Western Gully and Eastern Gully landfill.

7.1.3 Site Access

Access to the Whytes Gully RRP has changed several times during its operation based on changes to the alignment of Reddalls Road and changes to the site access point. Prior to site development, Reddalls Road turned to the north west to the east side of Glengarry Cottage. A section of the road was realigned around the time of commencement of landfilling such that the road continued westward to the south of Glengarry Cottage and then turning north between the current Materials Recycling Facility (MRF) location and Glengarry Cottage. The site entrance was then located at the old weighbridge.

At the time of commencement of the Eastern Gully landfill it was recognised that the location of Reddalls Road presented difficulties for the long term development of the landfill and for local residents who had to pass through the facility to access the local road network. To address these issues Reddalls Road was deviated to the south west in 2001 after preparation of the “Review of Environmental Factors for Proposed Deviation of Reddalls Road, Kembla Grange” in 2001.

In 2007 the current entrance and weighbridge was approved and located to the west of the existing MRF and east of the Leachate Treatment Plant.

The old weighbridge is located on the main site access road near the oil recycling area and the intersection with old Reddalls Road. This facility consists of the pitless weighbridge (approximately 16 m by 5 m), a concreted traffic island (approximately 50 m in length) and a weighbridge office. Reinforced concrete slabs associated with the discussed weighbridge are 100 mm thick (underneath the weighbridge) and 200 mm thick on either end of the weighbridge with footings up to 800 mm thick. Vehicles currently accessing the landfill and the materials drop off areas pass by the disused weighbridge. This weighbridge and foundations would be demolished during construction of the Project.

The existing landfill access road is a two-lane, paved road extending approximately 1.7 km from the existing weighbridge at approximate elevation RL 20 m to the northern edge of the Eastern Gully landfill at approximate elevation RL 75 m. The road traverses existing Western Gully waste for a distance of approximately 250 m at approximate elevation RL 65 m. Access tracks suitable for 4WD vehicles extend from the landfill toe up the central ridge to the landfill access road and up the eastern ridge.

7.1.4 Solid Waste to Energy Recycling Facility

The site contained a Solid Waste to Energy Recycling Facility (SWERF) (approved in 2000), which operated in test phase from 2000 until April 2004. The large building which housed this facility remains at Whytes Gully RRP (refer to Figure 4.2). The system was operated by Brightstar Environmental, a subsidiary of Energy Developments Limited. The former SWERF building now houses the Small Vehicle Transfer Station.

7.1.5 Landfill Gas to Energy Facility

A landfill gas extraction system and energy turbine was previously operated at the site in 2000 and decommissioned in April 2004. The system was operated by Brightstar Environmental, a subsidiary of Energy Developments Limited. Only the subsurface infrastructure for this system remains with gas manifolds still visible on the Western Gully landfill.

7.1.6 Leachate and Surface Water Ponds

Three ponds originally constructed for the Western Gully landfill are located at the toe of the landfill (refer Figure 4.2). The ponds comprise two stormwater ponds with a capacity of 3,000 cu.m and 4,200 cu.m, respectively and a former leachate pond with a capacity of 8,000 cu.m. These three ponds are currently used for temporary surface water storage. A fourth surface water pond, located at the toe of the Eastern Gully landfill, collects surface water and groundwater from the groundwater under drain system of the Eastern Gully landfill. As identified in Chapter 12 of the EA, water collected in the under drain system was sampled and found to be impacted by leachate. These ponds would be decommissioned as part of the construction of the Project.

Approval to relocate leachate and surface water ponds was granted in 2003 (Approval reference D2240/02). These new ponds comprise a series of leachate (Primary and Secondary) and wetland ponds (Surface Water Reed Beds 1 and 2) and a Surface Water Polishing Pond (Refer to Figure 4.2).

7.1.7 Leachate Treatment Plant

Approval was received in 2003 to construct and operate a leachate treatment plant. The purpose of the leachate treatment plant is to treat leachate prior to discharge to sewer to meet Sydney Water criteria. This includes potentially reducing the ammonia levels and other analytes in leachate to below Sydney Water Trade Waste discharge criteria suitable for discharge to sewer. Monitoring and discharge criteria for the leachate treatment plant are outlined in the trade waste agreement 11205.

The LTP is fed from the primary leachate pond, the lower of the two leachate ponds located north of the surface water ponds. The LTP is a Sequencing Batch Reactor (SBR) process, which operates in a four phase cycle. A simplified diagram and description of the SBR cycle follows:

Fill

Feeder pumps fill the SBR from the leachate ponds and are controlled by a cycle timer and a level override switch.

React (aerobic)

The SBR is aerated to oxidise the ammonia. The SBR is pH and dissolved oxygen controlled and dosed with liquid caustic soda to control pH.

Settle (anoxic)

After aeration biomass settles at the bottom of the SBR tank and the waste sludge is removed.

Decant

After approximately an hour of settlement, supernatant from the SBR is decanted into an effluent balancing tank. Treated effluent is pumped to the Sydney Water sewer.

Refer to the LEMP (Appendix P) for the design of the LTP.

7.1.8 Materials Recycling Facility

A MRF is located in the south of Whytes Gully RRP near the site entrance (Refer Figure 4.2). The MRF is operated by Thiess Services Pty Ltd and owned by Wollongong City Council. Extension of the MRF was approved in January 2006 (DA-2005/1635).

7.2 Current Operations

7.2.1 Hours of Operation

Table 7.1 provides the existing hours of operation for Whytes Gully RRP. These are not proposed to be altered as part of the Project.

Table 7.1: Existing Hours of Operation

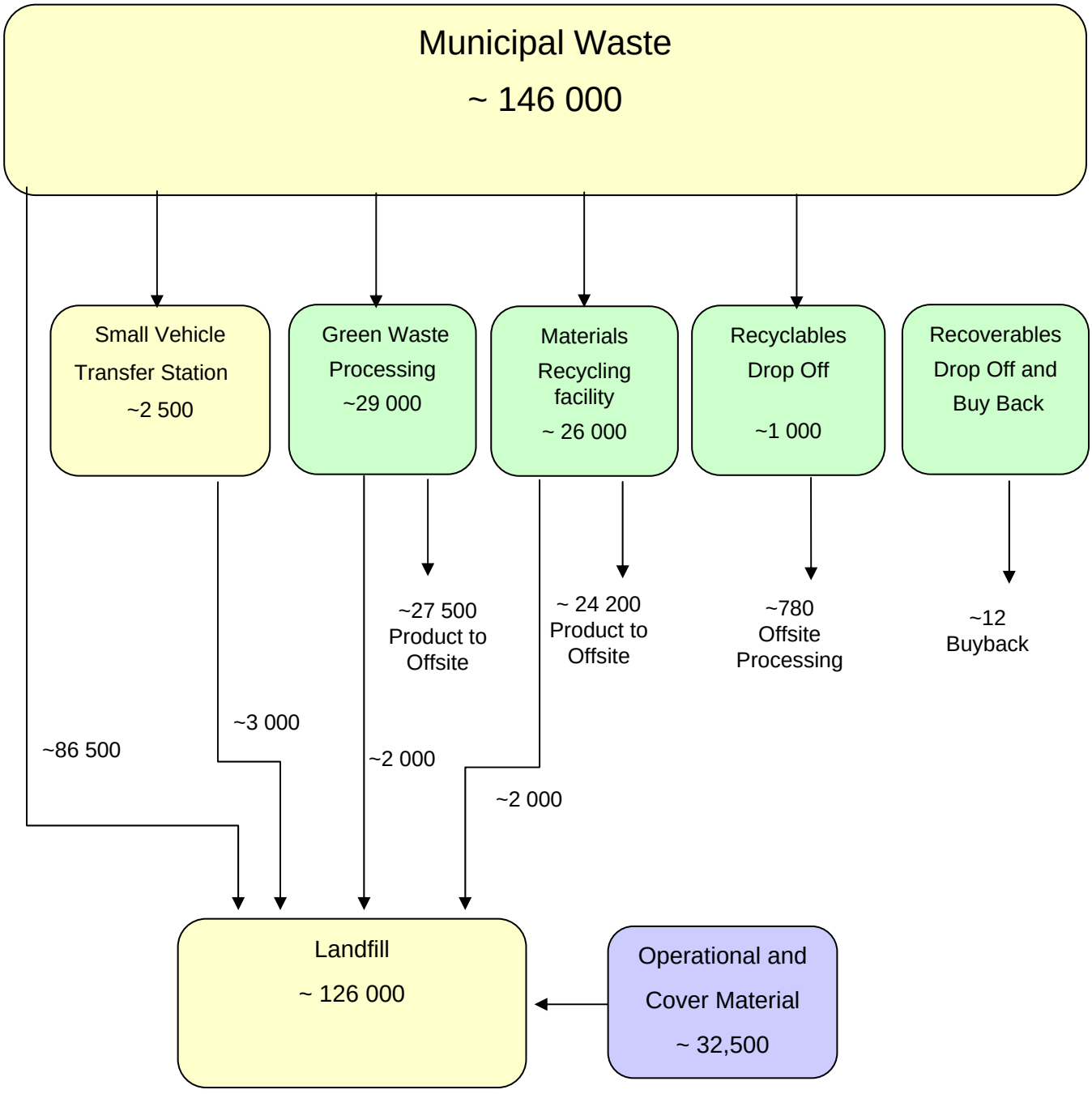
Activity	*Day*	*Time*
Operation	*Monday – Friday*	*7:30am to 4:30pm*
	Saturday, Sunday and Public Holidays	*8:00am to 4:00pm*

7.2.2 Waste Type and Material Flows

Waste accepted at Whytes Gully RRP includes putrescible solid waste that originates from domestic waste collection and commercial waste drop off as well as drop off of waste on site by private customers. Wastes not accepted for landfilling include builders waste, asbestos waste and recyclable waste.

Figure 7.1 outlines approximate existing material flows at the Whytes Gully RRP. It is based on weighbridge data received from Wollongong City Council for 28 August 2010 to 28 August 2011 and 1 September 2011 to 29 November 2011 in addition to discussions with K Packer of Wollongong City Council. The type of waste accepted at the Whytes Gully RRP site is not proposed to be altered as part of the Project.

Figure 7.1: Waste Flows (tpa)



7.2.3 Landfilling

Current filling operations at Whytes Gully RRP are located on the platform of the Eastern Gully landfill. The Eastern Gully landfill has been gradually filled to its current filling level of approximately RL 87.5 m AHD as indicated in the most recent site survey dated 06 June 2011 (Ref. KF110290 SV01). The final fill level of the Eastern Gully landfill is RL 105 m AHD. The tipping currently occurs in the Eastern Gully landfill as shown on Figure 4.2 and in general accordance with the site filling plan. Waste is generally placed in 3 m high runs of waste, each run having a width between 15 m and 20 m. Waste is delivered to the active tip face by garbage collection vehicles, then spread by a Caterpillar 950H front end loader (static weight of 18.4 t) and compacted in layers with a maximum height of 500 mm using a Caterpillar 836H (static weight of 55.6 t). The waste is compacted using no less than five passes of the compactor.

Landfill lids are used as temporary daily covers along with soil, while imported soil is used as intermediate cover. The amount of cover used at the site during 2010 / 2011 was approximately 32,500 t (refer Figure 7.1).

Since 2007, the amount of landfilled waste has reduced from approximately 180,000 tpa in 2007 to approximately 126,000 tpa in 2011.

Plate 1: Whytes Gully Landfill Tip Face

7.2.4 Small Vehicle Transfer Station

The Small Vehicle Transfer Station is currently located in the former SWERF building located to the south west of the toe of the Eastern Gully landfill. Waste dropped off at the transfer station is inspected and then loaded into bins, which are transported by a hook lift truck to the tipping face. Recyclables or unacceptable waste is removed by Whytes Gully RRP staff at the transfer station for appropriate management.

All small vehicle are directed to the Small Vehicle Transfer Station, while all other waste including large commercial loads is directed to the tip face. The amount of waste dropped off at the Small Vehicle Transfer Station was approximately 2,500 tonnes during the 2010/2011 year (refer Figure 7.1).

7.2.5 Green Waste Processing

The green waste from kerbside collection and drop-off is processed in the dedicated area at the south of the Western Gully landfill (refer to Figure 6.2). The green waste is shredded on a regular basis and subsequently exported from site for reuse. Green waste processing is undertaken under contract by Soilco Pty Ltd under Environment Protection Licence 13171.

During the year from 28 August 2010 to 28 August 2011, approximately 29,000 tonnes of green waste were delivered to site, while approximately 100 tonnes of mulch (free to the public) and approximately 28,500 tonnes of green waste were exported from site (refer Figure 7.1).

Green waste processing is to be relocated offsite in March 2012 to Soilco's offsite facility with all green waste going directly to this offsite location.

Plate 2: Green Waste Processing Area

7.2.6 Small Vehicle Recyclables Drop Off

Small Vehicle Recyclables Drop off is located at the toe of the Western Gully landfill and is shown on Figure 4.2.

Resource Recovery at Whytes Gully RRP includes the following recyclable materials:

- Comingled recyclables (Glass bottles, paper and cardboard);
- Mobile phones;
- Car batteries;
- Scrap metal (including white goods, steel, brass, aluminium, copper);
- Gas bottles and fire extinguishers;
- Fluorescent lights and CFL's;
- Waste oil (motor oil, transmission oil, gear oil, kerosene and Diesel, no cooking oil or petrol are accepted);
- Green Waste;
- E-Waste; Computers and Televisions;
- Mattresses; and
- Tyres.

Comingled recyclables dropped off at the Small Vehicle Transfer Station are transported to the MRF. Waste oil is transported to the Oil Recycling Area adjacent to the old weighbridge. All other recyclables are collected by subcontractors and exported offsite for recycling on a regular basis.

The amount of waste dropped off at the Small Vehicles Recyclables Drop Off was approximately 1,000 t. Approximately 78 t went off site.

Plate 3: Small Vehicles transfer station Recyclables Drop Off

7.2.7 Recoverables Drop Off and Buy Back (Revolve)

The Recoverables Drop Off and Buy Back (Revolve)is located to the north of the old SWERF building. Customers can drop off reusable items at the Revolve Centre, where they are sold back to the public. From 28 August 2010 to 28 August 2011, 12 tonnes of reusable materials were sold at the Revolve Centre.

7.2.8 Leachate Ponds

Whytes Gully RRP includes two lined leachate ponds (primary and secondary leachate pond) located at the toe of the Western Gully landfill. The ponds are lined with 1.5 mm HDPE geomembrane liner and have a capacity to store 18,000 cu.m leachate and a 300 mm freeboard. Both ponds contain surface aerators located on pontoons. The primary leachate pond contains an axial mixer. The design of the ponds is provided in the draft LEMP (Appendix P). Further detail relating to the leachate ponds is outlined in Chapter 12.

Plate 4: Primary Leachate Ponds

7.2.9 Leachate Treatment Plant

Leachate is collected from the Eastern Gully landfill and Western Gully landfill and is piped to the primary leachate pond. In the primary leachate pond, the leachate is mixed and aerated and transferred to either the leachate treatment plant or, depending on plant capacity, to the secondary leachate pond. The Leachate Treatment Plant is a biological treatment process using sequencing batch reactor technology, with the capacity to treat up to 250 kL per day.

Treated leachate is discharged to sewer under a Trade Waste Agreement with Sydney Water or returned to the secondary leachate pond .

Plate 5: Leachate Treatment Plant

7.2.10 Surface Water Drainage Lines and Ponds

Surface water runoff from the Western Gully and Eastern Gully landfills is captured by swale drains on the landfill surface. The swale drains divert the runoff towards drains around the perimeter of the landfills and a central drain located between the Eastern Gully and Western Gully landfills. Runoff from the natural slope above the northern edge of the Eastern Gully landfill is also directed to the central drain. Runoff from the western ridge is directed offsite and discharges to Dapto Creek via a culvert under Reddalls Road.

All surface water flows are directed into the surface water treatment system, which comprises a series of surface water ponds approved in 2003. The system is located in the south west corner of the site and comprises two reed beds (Reed Beds 1 2) and an upper and lower surface water polishing pond. The total capacity of the surface water treatment system is 40,000 cu.m. The design of the ponds is provided in the draft LEMP (Appendix P). Discharge from the ponds is to Dapto Creek.

Further detail relating to the surface water ponds is outlined in Chapter 12.

Plate 6: Surface Water Ponds

7.2.11 Amenities Buildings

An amenities building for Whytes Gully RRP staff is located near the toe of the Eastern Gully landfill. The building contains toilets, three showers, kitchen, lunchroom, laundry, change rooms, an electrical distribution board and a carport. A car park for staff is located outside this building. The building is currently used by site staff and is proposed to be demolished during construction of the Project.

7.2.12 Glengarry Cottage

Glengarry Cottage is located in the south western part of the Whytes Gully RRP site to the south of the former SWERF building. The Cottage including the surrounding curtilage is listed as a local heritage item under the LEP.

Glengarry Cottage is the last of the Veteran's Land Grants homes at Kembla Grange and currently houses administrative offices for Whytes Gully RRP. It is considered the Project would have negligible impact upon Glengarry Cottage and its curtilage.

7.2.13 Materials Recycling Facility

The MRF receives comingled recyclables from kerbside collection and the small vehicle drop off at the Whytes Gully RRP site. The amount of material received at the facility in 2010 / 2011 was approximately 26,000 t (refer Figure 7.1).

The MRF produces recycled mixed paper, polyethylene terephthalate, HDPE, mixed plastic, steel (from cans), aluminium (from cans) and glass (amber, clear, green and fines). In 2011, approximately 50 percent (by weight) of the MRF product consisted of mixed paper, approximately 26 percent (by weight) consisted of glass, and approximately 7 percent (by weight) of the material output was waste returned to landfill. All other products amounted to approximately 17 percent by weight.

7.2.14 Weighbridge

The weighbridge (refer to Figure 4.2), is a self indicating Mettler Toledo 7560 with a maximum capacity of 60 tonnes and eight load cells mounted in pairs. The weighbridge consists of identical weighbridges for incoming and outgoing vehicles. Associated with the weighbridge is the following infrastructure:

- Concrete ramps for vehicle access to the weighbridge;
- Roof to protect the weighbridge and customers from rain;
- Weighbridge office including amenities for staff; and
- CCTV cameras, which relay footage of vehicles at the weighbridge to the operator.

The weighbridge is certified by the National Measurement Institute (NMI) under certification number 6/10B/46C. The weighbridge would be retained for future operations at Whytes Gully RRP. The design of the weighbridge and entrance road is located in the LEMP (Appendix P).

Plate 7: Weighbridge

7.2.15 Services and Easements

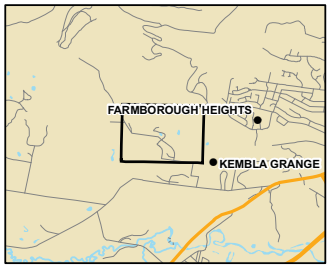
The location of services and easements on the Whytes Gully RRP site are shown on Figure 7.2. These are summarised as follows:

- An easement for the 132 kV overhead power transmission line which runs east to west across the site, situated south of the Eastern Gully landfill and north of Reddalls Road.
- Power lines as well as a Telstra line run along Old Reddalls Road.
- Power supply and easement for the LTP runs from Old Reddalls Road near Glengarry Cottage along the northern edge of the MRF property.
- A private power line easement exists in the northern part of the site and crosses the Western Gully landfill. It is understood this line is de energised and due for decommissioning.
- Municipal water supply is provided to amenities buildings via an underground water pipe running from Reddalls Road across the Lot 53 DP 1022266 to Glengarry Cottage. A sewer connection runs between the leachate treatment plant and sewer along Reddalls Road.
- A 70 mm high density polyethylene (HDPE) sewer line conveying sewer from the LTP and site amenities to the main sewer line on Reddalls Road.

WHYTES GULLY NEW LANDFILL CELL ENVIRONMENTAL ASSESSMENT

WOLLONGONG CITY COUNCIL

DEVELOPMENT CONSTRAINTS



LEGEND

- Site Boundary
- Cadastre
- Easement
- Flood Planning Area (West Dapto LEP)
- Interpreted Flood Planning Area (50 cm Freeboard)
- Heritage
- Aboriginal Archaeological Sites (12/01/2012)
- AHIMS Results in Study Area (12/01/2012)
- Extent of Landfill Works

NOTES

Historic locations digitised by Golder from reports supplied by Wollongong City Council

Aerial Ortho-Photograph provided by AAM Pty. Ltd. taken on 16 May 2011, Reference 18763A. Image Georeferenced.

Site contours based on survey by KFW Williams, dated 20/07/2011

0 12.5 25 50 75 100 125 150 metres

SCALE (at A3) 1:4,000

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: **117625003**
DATE: **26/03/2012**
DRAWN: **FA**
CHECKED: **JMc**

FIGURE 7.2

Golder Associates

File Location: J:\GIS\Jobs\117625003_Wollongong Council_New Landfill Cell_Whytes Gully\Workspaces\117625003_115_R_F0001_DevelopmentConstraints_Rev_1.mxd

7.3 Environmental Management

Environmental management procedures are outlined in detail in the draft LEMP (Appendix P) and are summarised here to address the DGRs for the Project. The environmental management of the Whytes Gully RRP site is outlined in the LEMP initially prepared by Maunsell in 1992.

7.3.1 Waste Receipt

Waste is received, identified and weighed at the weighbridge. The type and amount of waste is recorded and entered in a database. Signs at the weighbridge indicate the wastes accepted at the Whytes Gully RRP site. Customers dropping off loads or partial loads of unacceptable waste are rejected and the customer is informed of the appropriate location for receipt of such wastes. The customer is directed to the appropriate location for waste drop off.

Waste dropped off at the small vehicle transfer station, the small vehicle recyclables drop off area and the green waste area is screened by Wollongong City Council staff or contractors and unacceptable waste is diverted elsewhere.

7.3.2 Water Quality Management and Monitoring

Surface Water Management

The following surface water categories have been defined for the Whytes Gully Resource Recovery Park;

- "clean" stormwater: Runoff from areas of the site where soil and vegetation have not been disturbed is considered to be 'clean'.
- "dirty" stormwater: Runoff from areas of the site where soils have been disturbed and are likely to generate sediment are considered to the "dirty", including areas of intermediate cover or areas of final capping that have not yet been vegetated; and
- leachate water: comprises runoff from areas of waste or daily cover material as well as leachate generated by the landfill.

Control and Management of "Clean" Stormwater

"Clean" stormwater is currently not managed separately from "dirty" stormwater. Runoff from the western ridge is diverted offsite via a culvert under Reddalls Road to Dapto Creek. Runoff entering the Western Gully landfill from the western ridge area also combines with the "dirty" stormwater system.

Runoff from the woodland to east of the Eastern Gully landfill area either combines with the "dirty" stormwater system or is diverted around the Eastern Gully landfill in a diversion drain, which subsequently discharges into the "dirty" stormwater system.

Runoff from the ridge to the north of the Western Gully landfill currently discharges through the central drain between the Eastern and the Western Gully landfill and combines with the "dirty" stormwater flow.

Control and Management of "Dirty" Stormwater

Surface water, which falls on disturbed areas of the Eastern Gully landfill (including intermediate cover and unvegetated final capping and some stockpiles) is diverted away from active landfilling areas and is generally directed along the eastern and western edges of the Eastern Gully Landfill through a series of grassed swales.

The swales from the eastern and western gullies ultimately discharge into the surface water management system. The reed bed system comprises two surface water reed beds and a surface water polishing pond.

The discharge channel to Dapto Creek is monitored on an annual basis and during overflows.

Erosion and Sedimentation Control

Erosion and sedimentation control measures employed at the site incorporate the following:

- Reducing the area of exposed soil including recently constructed sections of the landfill;
- Diverting clean run on away from disturbed areas;
- Reducing the length and steepness of slopes;
- Rehabilitating capped areas in the timely manner;
- Applying sediment control measures to intercept and retain sediment on site (e.g. drains and sedimentation ponds);
- An inspection maintenance and cleaning program for control structures to maintain capacity and integrity; and
- Using designated access roads and paths.

Control and Management of Leachate Water

Surface water which falls within an active cell, whether it be covered with daily cover or exposed waste, is considered leachate and is directed to the 'dirty' stormwater control system from where it is diverted to the leachate treatment plant.

Leachate is collected from the Eastern Gully and Western Gully landfills at collection points at each landfill toe. The collected leachate is piped to the leachate ponds (Primary and Secondary Leachate Pond) from where the leachate is pumped to the onsite leachate treatment plant. The ponds and leachate treatment plant are monitored daily.

Discharge from the treatment plant is monitored in general accordance with the trade waste agreement.

7.3.3 Air Quality Management

Odour

Odour management at the site comprises the following management procedures:

- Good covering procedures to keep the amount of exposed waste to a minimum.
- Fast identification and attention to odorous waste loads.

Dust

The management strategy for dust control at the Whytes Gully Resource Recovery Park comprises:

- Unsealed trafficable areas and stockpiles are watered on a regular basis.
- Internal roads are sealed to within approximately 100 m of the tip face with the exception of the Small Vehicles Recyclables Drop Off area, which is covered by gravel. The access road to the tip face is covered with breckets (a gravelly slag product).
- Plant operating at the tip face is not entering other areas of the landfill to prevent access roads from becoming impacted by dirt.
- Site roads are frequently cleaned with a water cart if found to be impacted by dirt.
- Revegetate capped areas as soon as possible after forming.
- Revegetate stockpiles that are not used for some time.
- Reduce vehicular speeds on site to reduce dust.

- Mechanical plant and equipment are properly serviced and maintained in an efficient operating condition.
- Restricting the size of disturbed areas as much as practicable.
- Temporarily suspending operations under extreme wind speed conditions.
- Plant and equipment are fitted with appropriate pollution control devices.

Currently no landfill gas collection system exists at the site and landfill gas is allowed to vent through the landfill surface. Wollongong City Council currently conducts monthly surface landfill gas monitoring on the surface of landfilled areas as well as building accumulation in site buildings as outlined in Section 7.4.5.

7.3.4 Litter

Generation of litter at Whytes Gully RRP is primarily through wind movement of waste, which has not yet been covered. As identified in the 2009 / 2010 Annual Environmental Monitoring Report wind-blown litter through high winds has previously been identified as an issue on the site. To reduce the generation of litter, current management measures include:

- A litter fence is located at the perimeter of the landfill around the northern, eastern and western side of the active filling area.
- Local litter fences are used immediately around the tip face.
- Load covering signs are located along the site access road.
- Covering the tip face at the end of each working day with landfill lids and/or daily cover.
- Applying Intermediate cover to areas exposed for more than 90 days.
- Inspection and clearing of the litter fence, perimeter fence and surrounding areas is undertaken on a weekly basis.
- Consideration of tip face orientation in high winds.
- Fences are repaired or replaced as required.

7.3.5 Noise

Noise management at the site comprises the following management procedures:

- Mechanical plant and equipment are maintained regularly.
- All contractors onsite make a commitment to minimise the levels of noise from their activities.
- The operating hours of the landfill are limited in accordance with approved times (refer to Table 7.1).

7.4 Environmental Monitoring

Ongoing environmental monitoring at the site included for the 2010 / 2011 monitoring round:

- Landfill Gas Monitoring (Surface and Building Accumulation Monitoring);
- Surface Water Monitoring (1 location); and
- Groundwater Monitoring (12 locations).

The current monitoring locations are shown in Figure 6.2.

Further detail on current environmental monitoring undertaken at Whytes Gully RRP is in the draft LEMP (Appendix P).

7.4.1 Monitoring Locations

7.4.1.1 Water Monitoring Network

Council is currently monitoring a network comprising groundwater wells MW1, MW3, MW4, MW5, MW6, MW1A, MW2A, MW3A, MW4A, MW5A, MW6A and MW7A, the stormwater discharge point adjacent to Reddalls Road and the primary leachate dam overflow. All these groundwater monitoring wells are located downgradient of the site.

This monitoring system is in excess of the monitoring system prescribed by the EPL 5862, which prescribes monitoring of MW1, MW3, the stormwater discharge point adjacent to Reddalls Road and the primary leachate dam overflow. The monitoring frequency for the groundwater monitoring wells is quarterly, while the stormwater discharge point is monitored annual and during overflow events. The leachate overflow location is monitored during overflow events.

The current monitoring network is proposed to be supplemented with additional wells and also additional surface water monitoring locations along Dapto Creek. The monitoring system has been installed and is currently being monitored to gather baseline water quality data. Further information relating to the proposed monitoring network can be found in the LEMP (Appendix P) as well as in the Hydrogeological Investigation Report (refer to Appendix G).

7.4.2 Groundwater Monitoring Program

The EPL prescribes that all groundwater quality monitoring locations outlined above are monitored at the frequency and for the analytes outlined in Table 7.2.

Table 7.2: Goundwater Monitoring Program

Pollutant	Units of measure	Frequency	Sampling Method
Ammonia	milligrams per litre	Quarterly	Grab sample
Biochemical oxygen demand (BOD)	milligrams per litre	Quarterly	Grab sample
Conductivity	millisiemens per centimetre	Quarterly	Grab sample
Total Kjeldahl Nitrogen	milligrams per litre	Quarterly	Grab sample
Total suspended solids	milligrams per litre	Quarterly	Grab sample
pH	pH	Quarterly	Grab sample

Wollongong City Council has generally analysed all samples taken for additional analytes including:

- Alkalinity;
- Selected cations and anions;
- Total dissolved solids (TDS);
- Total organic carbon (TOC);
- Nitrate and nitrite; and
- Metals (aluminium, arsenic, barium, cadmium, total chromium, cobalt, copper, manganese, mercury and zinc).

Wollongong City Council omitted analysis of BOD and conductivity in 2011.

7.4.3 Surface Water Monitoring Program

Surface water monitoring location 1 is the surface water discharge point to Dapto Creek near the western boundary of the MRF and is monitored at the frequency and for the analytes outlined in Table 7.3.

Table 7.3: Surface Water Monitoring Program for Location 1

Pollutant	Units of measure	Frequency	Sampling Method
Alkalinity (as calcium carbonate)	mg/L	Annually and whenever overflow occurs	Grab sample
Ammonia	mg/L	"	Grab sample
Calcium	mg/L	"	Grab sample
Chloride	mg/L	"	Grab sample
Conductivity	mg/L	"	Grab sample
Dissolved Oxygen	mg/L	"	Grab sample
Filterable iron	mg/L	"	Grab sample
Fluoride	mg/L	"	Grab sample
Magnesium	mg/L	"	Grab sample
Nitrate	mg/L	"	Grab sample
Potassium	mg/L	"	Grab sample
Sodium	mg/L	"	Grab sample
Sulfate	mg/L	"	Grab sample
Temperature	degrees Celsius	"	In situ
Total Phenolics	mg/L	"	Grab sample
Total organic carbon	mg/L	"	Grab sample
Total suspended solids	mg/L	"	Grab sample
pH	pH	"	Grab sample

Pollutant	Units of measure	Frequency	Sampling Method
Biochemical Oxygen Demand	mg/L	"	Grab sample

7.4.4 Leachate Monitoring

The Sydney Water Trade Waste Agreement (TWA) number 11205 specifies substances and daily masses as well as maximum daily volumes that Wollongong City Council is allowed to discharge to sewer, from the Leachate Treatment Plant. The TWA also specifies sampling and reporting requirements. Monitoring is undertaken in general accordance with this agreement.

Analytical monitoring is also required during overflow events in accordance with the EPL. There have been no overflows at the leachate dam since September 2010, therefore there has not been a requirement to monitor this.

7.4.5 Landfill Gas Monitoring

The table below summarises the landfill gas monitoring currently undertaken at Whytes Gully RRP. No subsurface landfill gas monitoring is currently undertaken at the site.

Table 7.4: Surface Gas Monitoring Locations

EPA ID no.	Parameter	Description of location	Frequency
3	Methane v/v	Areas where intermediate or final cover has been placed	Quarterly. Monthly if an initial survey indicates significant gas.
4	Methane v/v	Inside all buildings within 250 m of deposited wastes	Quarterly. Monthly if an initial survey indicates significant gas.

It is proposed to install a network of landfill gas wells and undertake subsurface landfill gas monitoring. Further information relating to the proposed monitoring network is located in the LEMP (Appendix P) and Chapter 11 of the EA on Greenhouse Gas.

7.5 Details of Past Environmental Performance

7.5.1 Previous Investigations

WCC (1991)

In an investigation undertaken by Wollongong City Council in 1991, *Investigation of Central Ridge – Whytes Gully Waste Disposal Area* (P Tobin, Council of the City of Wollongong, pers. comm., 20 March 1991), four boreholes were installed along the central ridgeline between the eastern and western gullies, and one was installed within the eastern gully. The purpose of the boreholes was to investigate the availability of ripped rock from this ridgeline to substitute as cover materials on the Western Gully landfill. A groundwater sample was collected from open borehole number 5, located in the eastern gully, due to "odorous groundwater" being noted. The water level in the borehole was consistent with the water level in the nearby pond.

Results indicated a pH of 5.96, conductivity of 1648 µS/cm, BOD of 44 mg/L and TKN of 0.11 mg/L, suggesting that the water quality reflected leachate impact which was presumed to be flowing east from the Western Gully landfill along the bedding plane and fracture zone of the sandstone. The odour in the bore was noted at RL 21 m which occurred at the top of a highly fractured sandstone layer.

It is noted that leachate irrigation was occurring in the Eastern Gully landfill at the time, and as such subsurface infiltration and migration of irrigated leachate could have resulted in the degraded water quality reported for borehole 5.

Maunsell (1992)

A combined geotechnical and environmental investigation was performed by Maunsell in 1992, *"Site Investigations and Geotechnical Assessments for the Phase 2 Development of a Waste Disposal Depot at Whytes Gully, West Dapto" ,* to assess the suitability of the Eastern Gully for development of a landfill cell. The investigation comprised of 13 boreholes and 18 test pits, with 10 of the boreholes completed as piezometers. In conjunction with the drilling program, eight falling head tests and 22 packer tests were performed to assess rock mass permeability, and groundwater samples were collected from most boreholes for chemical analysis.

Groundwater samples were also collected from selected boreholes (during drilling) and from selected wells following well installation, and analysed for a range of general water quality and leachate indicator parameters. There was evidence of leachate impact in groundwater samples in the form of elevated biochemical oxygen demand (BOD), chemical oxygen demand (COD), total organic carbon (TOC), alkalinity, and total kjeldahl nitrogen (TKN) concentrations in certain wells, particularly B5, D1 and D2 located close to the filled western gully. Lesser concentrations of these analytes were also reported for the other investigation locations. It is possible that the groundwater quality impacts reflect a combination of leachate irrigation effects in the eastern gully, and potentially a degree of leachate infiltration to groundwater from the filled Western Gully.

7.5.2 Annual Environmental Monitoring Reports

Reports prior to 2009 / 2010 are not summarised here.

2009 / 2010:

The 2009 / 2010 Annual Environmental Monitoring Report (AEMR) (GHD July 2010) covers the period from 29 May 2009 to 28 May 2010. A summary of the findings of this report is presented below.

The monitoring undertaken during this period found that groundwater appeared to be not impacted by leachate in the wells monitored.

Stormwater discharged from the site was found to comply with the conditions outlined in the EPL. However, the stormwater was found to have elevated concentrations of ions / anions, indicating impact by either groundwater or activities on site.

Surface concentrations of landfill gas on the surface of landfilled waste were found to exceed the threshold limits for further investigations as specified in EPA 1996 in a number of locations. While the GHD 2010 AEMR considered that the concentrations encountered did not represent a significant hazard to receptors, it was considered that landfill gas emissions contribute to odour emissions from the site.

Odour emissions were identified to be an issue at the site, particularly originating from the kerbside collection green waste processing. It is noted that Wollongong City Council was pursuing relocation of the kerbside collection garden waste drop off, processing and treatment to an indoor facility.

One round of groundwater monitoring was missed, landfill gas was not monitored on a monthly basis as required by the guidelines and stormwater discharged from the site was not monitored for temperature on two occasions and iron on one occasion. Groundwater monitoring was undertaken at five locations additional to the locations specified in the EPL.

2010 / 2011:

The most recent 2010 / 2011 AEMR, Annual Environmental Monitoring Report (Waste Gully Waste Disposal Facility – Annual Report) was prepared by Wollongong City Council and covers the period from 01 June 2010 – 31 May 2011. A summary of the findings of the report is presented below.

The 2010 / 2011 AEMR states that groundwater monitoring did not indicate impact of leachate on groundwater. The AEMR further indicates four surface water overflow events during the reporting period. The AEMR further indicates compliance with surface water criteria for suspended solids, while one elevated value for ammonia was recorded on 21 March 2011.

Monthly landfill gas surface monitoring indicated elevated concentrations of methane in areas on the surface of landfilled waste above the criteria of 500 ppm methane specified by OEH (NSW EPA 1996). Monitoring in site buildings did not indicate accumulation of landfill gas in buildings.

Complaints received were related to odour, which is assumed to mainly emanate from the kerbside collection green waste processing on site. It is noted that this facility will be relocated to an indoor facility in March 2012.

7.5.3 Leachate Management System

Golder has reviewed the leachate management reports prepared by URS Australia Pty Ltd on the operation of the LTP and Leachate ponds for the period between October 2010 and January 2012. It is noted that recent major upgrades (not part of the Project) have been undertaken at the leachate treatment system.

The URS reports are weekly observation reports on the wastewater properties in the leachate ponds and in the balance tank of the LTP, leachate ponds levels as well as the discharge figures to sewer and general operation.

The discharge rate to the sewer fluctuated throughout this reporting period, mainly as a way of controlling leachate pond levels and ammonia concentration to sewer. The flow rates ranged between 80 and 220 kL/day compared to Sydney Water Discharge Criteria of 250 kL/day.

Ammonia discharge criteria were met within the balance tank for the majority of the reporting period with the exception of marginal exceedences of 109, 116, 113, 105 mg/L on 18th July 2011, 1st August, 3rd August 2011 and 15th August 2011. Suspended solids discharge results in the balance tank were reported less than 220 mg/L and well below the allowable 600 mg/L, with the exception of one result of 1040 mg/L occurring on the 30th May 2011.

During the reporting period the level in the Primary Leachate Pond ranged between 1.45 and 2.70 m below the spillway with an average level of 2.21 m and the level in the Secondary Pond ranged between 1.30 and 3.64 m below the spillway an average level of 2.82. The maximum depth below the spillway is 4 m. There were no leachate overflows during the reporting period.

7.5.4 Non-compliances

OEH notes general compliance with licence conditions, with the exception of non-compliances recorded in 1999, 2000 and 2008. No compliance data from the Protection of the Environment Operations (PoEO) public register is available for the monitoring periods ending in May 2009 and May 2010. The non-compliances since 1999 are listed in Table 7.5.

Table 7.5: List of non-compliances with the site licence

Licence Condition number	Type of non-compliance	No. of incidents
L1.3	Following heavy periods of rain, there were overflows of leachate to the stormwater dam in June 2007, November 2007, December 2007 & February 2008.	4
L3.3	The total suspended solid (TSS) discharged from the site to the stream was 180 mg/L on 7/12/2007 & exceeded the 50 mg/L limit. Caused by earthworks on the premises being washed away during rainfall event.	1
M2.1	The concentrations of total organic carbon and fluoride were not tested in one sample of stormwater discharging from the site as not enough sample was available to undertake the tests.	1
M2.1	Storm water discharged from site was not tested for alkalinity and temperature	0

Licence Condition number	Type of non-compliance	No. of incidents
-	Leachate overflowed under continuous wet weather conditions in February and March 2001. NOTE: Licensee indicated that this was a breach of L3.4 & L3.5 however these don't appear on licence	0
L3.5	Leachate overflow, under condition of dry weather occurred on 9 December 1999	0
L3.5	Leachate overflow under conditions of dry weather on 22 March 2000	0

8.0 PROJECT DESCRIPTION

This Chapter provides detailed information about the design and operation of the Project and in particular the proposed new landfill cell from design through to final closure. The Project description chapter refers to the Golder Associates (Golder 2012d) "Whytes Gully New Landfill Cell: Preliminary Design report" (Preliminary Design Report) (Appendix O) and the Golder Associates (Golder 2012g) "Landfill Environmental Management Plan" (Draft LEMP) (Appendix P).

The Director-General's requirements	
■ ***The Environmental Assessment (EA) must include: a detailed description of the Project including the:***	
▪ ***Details of any proposed building works, including engineering and/or architectural plans;***	**Chapter 8**
▪ ***Details of the landfill design, leachate and gas management systems;***	**Chapter 8**
▪ ***Various components and stages of the project;***	**Chapter 8**
▪ ***The likely inter-relationship between the proposed operations and the existing operations on site including details of existing approvals, management systems and details of past environmental performance.***	**Chapter 8 (Chapter 7)**
▪ ***Identify classify and quantify the likely waste streams that would be handled/stored/disposed of at the facility***	**Chapter 7 (existing)**
▪ ***A description of the measures that would be implemented to minimise the energy use of the Project including landfill gas capture and electricity generation.***	**Chapter 8**

8.1 Current and Future Waste Tonnages

8.1.1 Current Tonnages

The total waste received at the Whytes Gully RRP (including waste to landfill, MRF, green waste processing and other resource recovery) has ranged between 120,000 and 150,000 tpa over the past 5 years. The waste flows across Whytes Gully RRP for 2010 / 2011 are presented in Chapter 7.

The total material to landfill (including cover material to landfill) has reduced from 180,000 tpa to 125,000 tpa over the past 5 years. This reduction is largely due to Wollongong City Council reducing the amount of cover material during this time. Table 8.1 presents the total material to landfill for the past 5 years.

Table 8.1: Total Material to Landfill

Year	Total Material to Landfill (tonnes)	Total Waste to Landfill (tonnes)	Total Cover to Landfill (tonnes)
2007	181,600	96,200	85,400
2008	162,600	97,800	64,900
2009	146,100	95,200	50,900
2010	136,600	100,100	36,600
2011	125,900	93,300	32,600

8.1.2 Future Tonnages

The Project does not seek to increase the volume of material accepted at Whytes Gully RRP. As discussed in Chapter 4 the Project has been prepared assuming 180,000 tpa to landfill equating to 140,000 cu.m per annum airspace (assuming 30 percent by weight cover material and typical soil and waste densities). This equates to the highest tonnage received at the landfill in the past 5 years.

The value of 180,000 tpa to landfill is further justified by projecting values for the most recent year (2011) to the end of the Project based on likely population increase. It should be noted that this is a conservative estimate of future waste generation as it does not account for future increases in resource recovery or the use of alternative waste treatment technologies. Specifically, the population within the Wollongong LGA is predicted to increase at a rate of around 0.07 percent per annum (Department of Planning (2009) "New South Wales Statistical Local Area Population Projections, 2006-2036"*)* over the coming years resulting in increased waste generation. Based on an annual increase of 0.07 percent alone the material to landfill including cover would increase from 125,000 to 180,000 tonnes per annum by 2055.

In parallel with the increase in waste generation due to population, the Waste Strategy (refer Appendix B) outlines measures to increase waste minimisation and resource recovery and recycling and thereby divert waste from landfill. The Waste Strategy plans for diversion of MSW from landfill to increase from current (2011) 54 percent to 66 percent by 2014 and as identified in the Waste Strategy to 75 percent by 2035. This diversion would likely result in reduced volume of material received at the Whytes Gully RRP and would also likely result in increase in waste flow to resource recovery and recycling facilities located onsite and elsewhere within Wollongong LGA. By 2014 the Waste Strategy also commits Wollongong City Council to reviewing alternative waste technologies, which would be expected to significantly contribute to reduction in waste to landfill in the long term.

Anecdotally it is considered that increase in waste volume as a result of population growth would likely be offset by waste minimisation and resource recovery and recycling initiatives. This assumption is made based on existing trends as well as anticipated changes to facilities and services outlined in the Waste Strategy and the Concept Site Masterplan.

8.2 Type of Waste to be Landfilled

The following materials would continue to be accepted at the site in accordance with the Whytes Gully RRP site Environment Protection Licence (EPL 5862):

- General Solid Waste (non-putrescible)
- General Solid Waste (putrescible)

It is noted that Whytes Gully RRP is also permitted to accept asbestos waste in accordance with its EPL. However the site has never received asbestos waste and acceptance of this waste is not proposed as part of the Project.

8.3 Overview of Preliminary Design

The preliminary design and calculations, design approach, environmental rationale, drawings and technical specifications are presented in Appendix O. The following sections provide an overview of the Preliminary Design.

8.3.1 Project Elements

The Project would consist of the following key components:

- New landfill cell construction (Stage 1, 2A, 2B, 3 and 4);
- New landfill cell operation (Stage 1, 2A, 2B, 3 and 4);
- Progressive landfill rehabilitation and revegetation of the finished landform;
- Surface Water Drains and Surface Water Ponds;

- Leachate Ponds;
- Landfill Gas Extraction; and
- Ancillary – demolition of existing buildings, construction of temporary and permanent roads.

A Project Footprint Plan is provided in Figure 5.1.

8.3.2 Regulatory Requirements

The new landfill cell of the Project has been designed in general accordance with the NSW EPA's *Environmental Guidelines: Solid Waste Landfills 1996* (Landfill Guidelines) and incorporates measures to reflect "best practice landfill design and operation" as suggested by Clause 123 of the Infrastructure SEPP 2007. For design aspects where Golder considers that the 1996 Landfill Guidelines do not reflect best practise, the Victoria EPA document *Best Practice Environmental Management: Siting, Design, Operation and Rehabilitation of Landfills 2010* (herein referred to as the Victorian BPEM) has been used as a guiding document as it is considered to be the most recent Australian regulatory landfill design and operation guideline that adopts current generally accepted international best practices.

An assessment of the design of the Project against the Landfill Guidelines benchmark techniques is located within the Cover Statement of the Draft LEMP (refer to Appendix P). Generally, all benchmark techniques are met or exceeded or alternatives are proposed.

Design of surface water management elements has been developed in relation to the NSW Department of Environment & Climate Change guidelines *Managing Urban Stormwater, Soils and Construction – Volume 2B Waste Landfills 2008* (Landfills Blue Book).

The Project is consistent with the principles included in the publication "EIS Guideline: Landfilling" (Department of Planning), 1996.

If the Project is approved, it is proposed that Wollongong City Council would surrender existing development consents (as identified in Chapter 7 of the EA) of relevance to the Project site. This does not include the existing development consent for the MRF, which is not affected by the Project.

8.3.3 International Peer Review

The proposed design of the Project new landfill cell has been subject to an international peer review by Dr. J.P. Giroud. Dr.Giroud's relevant qualifications are summarised in the biography presented below.

An assessment of the preliminary design by Dr. Giroud is included in the Preliminary Design Report (Appendix O).

> Dr. J.P. Giroud is certainly one of the engineers who had the deepest influence on modern landfill design. Dr. Giroud, considered the "father of geosynthetic liner systems" by *Waste Age* magazine, has developed many of the methods used for the design of geosynthetic liner systems for landfills such as: method for the determination of the rate of leakage through liners, stability analysis of liner systems on slopes, liner anchor trench design, leachate collection system design, leakage detection system design, design of liner systems over weak foundations, design of geotextile filters, and evaluation of geomembrane liner uplift by wind. He received the International Geosynthetics Society Award for the design method he developed for the evaluation of leakage through liners; this method has now been incorporated in the HELP model for landfill design of the U.S. Environmental Protection Agency (USEPA). The design methods developed by Dr. Giroud for liners have been published in more than 60 papers and are used worldwide.
>
> Dr. Giroud has extensive experience in landfill design and construction. He has designed, or conducted a performance analysis for more than 100 liner systems. He has participated in the design of several major landfills and low-level radioactive waste disposal facilities the United States, Canada, and France. He has participated in performance analyses and forensic analyses of 15 landfills in the United States, Portugal and Columbia. Dr. Giroud is also recognized for his pioneering work in construction quality assurance of liner systems.

Dr Giroud has received numerous professional awards. In 1994, the International Geosynthetics Society named its highest award "The Giroud Lecture", "in recognition of the invaluable contributions of Dr. J.P. Giroud to the technical advancement of the geosynthetics discipline". In 2002, he became Honorary Member of the IGS with the citation "Dr. Giroud is truly the father of the IGS and the geosynthetics discipline". In 2005, Dr. Giroud has been awarded the status of "hero" of the Geo-Institute of the American Society of Civil Engineers (ASCE). In 2007, Dr. Giroud has been appointed Doctor Honoris Causa of the Technical University of Bucharest, Romania. In 2008, Dr. Giroud presented the Terzaghi Lecture, the highest award bestowed on a geotechnical engineer by the ASCE. In 2009, Dr. Giroud has been elected to the US National Academy of Engineering. In 2010, Dr. Giroud was appointed Chevalier in the Order of the Légion d'Honneur by the French President.

8.3.4 Landform

The final landform is discussed in the Preliminary Design Report (Appendix O) and Chapter 20 of the EA. The proposed final landform for the Project is shown in Figure 20.1 and has a final elevation of RL 111 m AHD at its highest point and the southern toe of the landform has a minimum elevation of RL 19 m AHD. The eastern, northern and western batters of the landform tie into ridges of the natural landform. The principal south-facing batters of the landform are proposed to be at a slope of 4H:1V towards the landform toe and will be intersected by five metre wide benches every ten vertical metres. This will result in an average landform slope of approximately 4.5H:1V. This landform provides a total airspace of approximately 6 million cum and approximately 40 years of life based on 140,000 cu.m. per annum airspace consumption.

The landform design allows for permanent access around the site perimeter and to the landform summit for maintenance, inspection and bushfire protection.

8.3.5 Footprint

The landfill would be developed by constructing the new landfill cell to the south of the existing waste footprint and then filling the new cell and overfilling (i.e. piggy backing) the existing waste. The existing waste footprint would also be extended over previously non-landfilled areas of the Whytes Gully RRP site to the west and across the central ridge. The landform incorporates setbacks from site property boundaries sufficient to establish perimeter access tracks, surface water drainage paths, and environmental monitoring locations. The overall area of the footprint of the landfill is approximately 35 ha. The landfill footprint is presented on Figure 5.1.

8.3.6 Landfill Cell Staging

The proposed landfill would be constructed in stages (Stage 1, Stage 2A, Stage 2B, Stage 3, Stage 4) and Cells 1, 2, 2A, 2B, 3, 4, 4A and Piggy Back 1, 2A, 2B, 3 to enable the gradual development of the landfill site, which would be beneficial in reducing the active footprint of the landfill and consequently reducing potential impacts upon the environment and allowing progressive rehabilitation throughout the life of the proposed landfill. The stages of the development are presented in Figure 8.1. Table 8.2 outlines the approximate airspace, life and timeline for the development of each stage of the Project's new landfill cell.

Table 8.2: Approximate Stage Volumes and Timelines of the Project New Landfill Cell

Stage	Area (m^2)	Airspace (cum)	Life of Cell (Years)	Operation Period	Proposed Capping Construction Period *	Proposed Liner Construction Period *
1	82,000	912,000	4.4	2013 - 2018	2016 - 2019	2013 - 2016
2A	22,500	343,000	2.4	2018 - 2020	2020 - 2021	2017 – 2018
2B	81,200	2,134,000	15.2	2020 - 2035	2023 - 2036	2019 – 2031
3	67,200	1,589,000	11.3	2035 - 2046	2038 - 2047	2035 – 2041
4	69,000	1,007,000	7.2	2046 - 2054	2048 - 2055	2046 – 2050
TOTAL	**321,900**	**5,985,000**	**40.5**			

* Not continuous during period

The overall staging sequence is summarised as follows:

- Stage 1 covers the Eastern Gully landfill, a section of the Western Gully landfill and a non-landfilled area at the foot of the Eastern Gully landfill that is occupied by roads and stormwater infrastructure.

  In order to divert stormwater from the northern side of the Eastern Gully landfill to the southern side, waste will have to be removed from the eastern most portion of the Eastern Gully landfill. This waste (approximately 300,000 cu.m.) would be placed in Stage 1 of the newly constructed landfill.

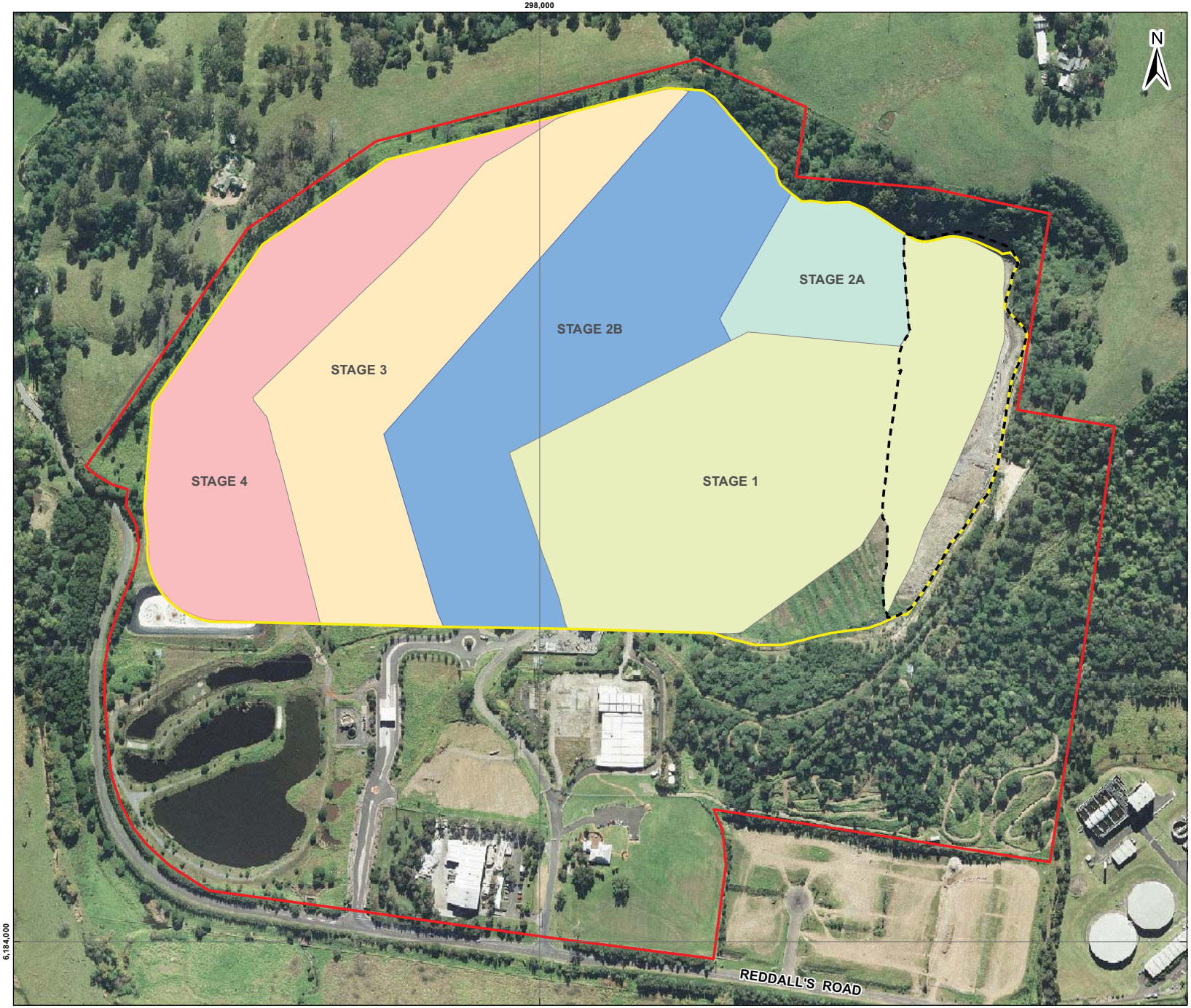
- Stage 2 covers part of the Western Gully landfill, a non-landfilled area at the toe of the Western Gully landfill that is occupied by roads and stormwater infrastructure and a non-landfilled ridge line between the eastern and western gully landfills.

- Stage 3 covers part of the Western Gully landfill and a non-landfilled area at the toe of the Western Gully that is occupied by roads, the green waste process area and stockpiling areas.

- Stage 4 covers an area to the west of the Western Gully landfill that has previously not been landfilled as well a non-landfilled area at the toe of the Western Gully landfill that is currently occupied by roads and the Primary and Secondary Leachate Ponds.

While one stage is providing for waste filling, the liner for the succeeding stage is proposed to be constructed. In addition, finalising of stages would be capped and rehabilitated whilst waste is being landfilled in subsequent cell.

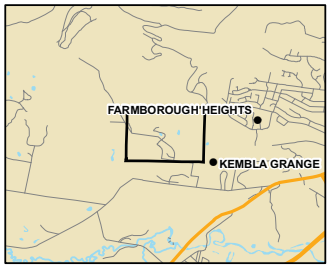
Further detail on Staging including temporary access roads is located in the Draft LEMP (refer to Appendix P).



WHYTES GULLY NEW LANDFILL CELL ENVIRONMENTAL ASSESSMENT

WOLLONGONG CITY COUNCIL

PROJECT STAGING



LEGEND

- Site Boundary
- Extent of Landfill Works
- Proposed Area of Waste Cut
- Stage1
- Stage2a
- Stage2b
- Stage3
- Stage4

NOTES

Extent of waste based on site observations and information provided by Council.

Aerial Ortho-Photograph provided by AAM Pty. Ltd. taken on 16 May 2011, Reference 18763A. Image Georeferenced.

Extent of landfill works as per Golder Design Report.

0 25 50 100 150 metres

SCALE (at A3) 1:3,800

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: 117625003
DATE: 26/03/2012
DRAWN: FA
CHECKED: JMc

FIGURE 8.1

Golder Associates

File Location: J:\GIS\Jobs\117625003_Wollongong Council_New Landfill Cell_Whytes Gully\Workspaces\117625003_116_R_F0001_ProjectStaging_Rev1.mxd

8.3.7 Easements

The location of easements and other development constraints on the site are shown on Figure 7.2. These are summarised as follows:

- An easement for the 132 kV overhead power transmission line which runs east to west across the site, situated south of the Eastern Gully landfill and north of Reddalls Road.
- Power lines as well as a Telstra line run along Old Reddalls Road.
- Power supply easement for the leachate treatment plant runs along the northern edge of the MRF boundary.
- A private power line easement exists in the northern part of the site and crosses the Western Gully landfill. It is understood this line is de-energised and due for decommissioning.
- A sewer line exists between the leachate treatment plant and Reddalls Road.

Endeavour Energy power lines along Reddalls Road are within an existing easement. Wollongong City Council have commenced liaison with Endeavour Energy for the relocation of these powers line to a new alignment along Reddalls Road with relinquishment of the existing easement.

Telstra lines along Reddalls Road are not within an Easement. Wollongong City Council has commenced liaison with Telstra for the relocation of the Telstra line to a new alignment along Reddalls Road.

Wollongong City Council has commenced liaison with the owner of the private power line easement. This line is understood to be currently de-energised with no plans for future use and the network of this line is to be decommissioned. As such there is no need to relocate these power lines as they can be removed. The owner of the identified private powerline are in the preliminary stage of determining the scope of work for the removal of the network and Wollongong City Council would work with the private line owner to ensure appropriate removal.

All other easements would not be impacted by the Project.

Wollongong City Council would work with relevant parties to ensure affected easements are relocated and/or decommissioned prior to operation of the Project.

8.3.8 Landfill Environmental Protection Measures

The overall approach of the Project to landfill environmental protection measures is outlined in Table 8.3. These measures are described in following sections of this chapter of the EA.

Table 8.3: Environmental Protection Measures incorporated into Landfill Design

System	Protection Measure	Function
Cell Base	Barrier	■ Limit infiltration of leachate through the cell base
	Leachate collection system.	■ Remove leachate from above the base liner and thereby limit the potential for contaminant migration through the base liner
Piggy Back Liner	Gas collection system	■ Remove landfill gas from beneath the piggyback liner
	Barrier	■ Limit infiltration of leachate from new waste into existing waste
	leachate collection system	■ Remove leachate from above the piggyback liner and thereby limit the potential for contaminant migration through to existing waste
Cell Capping	gas collection system	■ Remove landfill gas from beneath the cap
	barrier	■ Limit infiltration of water and oxygen into the cell and contain waste
	subsurface drainage system	■ Drain infiltrating rainwater from above the barrier liner
	vegetation growth medium	■ Support vegetation growth to limit erosion from the cap and to provide visual amenity; provide sufficient thickness to reduce potential for human contact with cell materials
Surface Water	cap drainage	■ Collect and convey runoff from rainfall on the cell
	perimeter drain	■ Collect and control runoff from cap drainage and from upslope of the cell

A construction quality assurance (CQA) system will be in place for cell construction because the performance of these environmental protection measures, particularly the cell liner, piggy back liner and cap barrier, is known to be highly dependent on the quality of their construction.

8.3.9 Design Issues

Key design issues considered include slope stability, settlement, piggy back liner performance, landfill gas collection, leachate generation and management, surface water management, and staging feasibility. Detailed discussion is provided within the Preliminary Design Report (refer to Appendix O).

8.4 Cell Design

8.4.1 Cells 1, 2, 3 and 4 Base Elevation

The cell design includes a minimum separation distance of 2 m between the current ground water level and the base of the waste. Filling to establish base grades for the cell liner is therefore required because the current groundwater level is approximately 1 m below ground level in some areas. The groundwater level will be verified for detailed design from analysis of data currently being collected from data loggers installed in the proposed new landfill cell footprint area, as discussed in Chapter 12.

8.4.2 Perimeter Bund and Internal Bunds

The new landfill cell design includes a perimeter bund. The perimeter bund provides a physical boundary for the limit of placement of waste within the cell and also provides a termination point for both the base liner system and the barrier layer in the capping system. The perimeter bund will be constructed of clay rich soil.

Internal bunds between cells and sub-cells would be constructed to provide a physical barrier to waste, leachate, and surface water movement during sequential excavation, lining, and filling.

8.4.3 Leachate Barrier and Leachate Collection System

The primary purpose of the leachate barrier is to provide a continuous barrier to limit contaminant migration from the cell. The new cell base liner has a secondary purpose to limit contact between cell materials and groundwater during potential (unanticipated) rising groundwater conditions, although Project construction is generally anticipated to result in falling groundwater levels beneath the liner.

Three distinct types of ground conditions can be identified for proposed new landfill areas of the Project:

1) Non-landfilled areas primarily occupied by infrastructure such as roads, soil fill placement, and ponds,. (south of existing landfill Footprint) and would include Cells 1 to 4.

2) Non-landfilled areas that have remained largely undisturbed (Western Ridge and Central Ridge) including Cells 2A, 2B and 4A.

3) The Eastern Gully and Western Gully landfill (Existing Waste) including Piggy Back 1, 2A, 2B, 3.

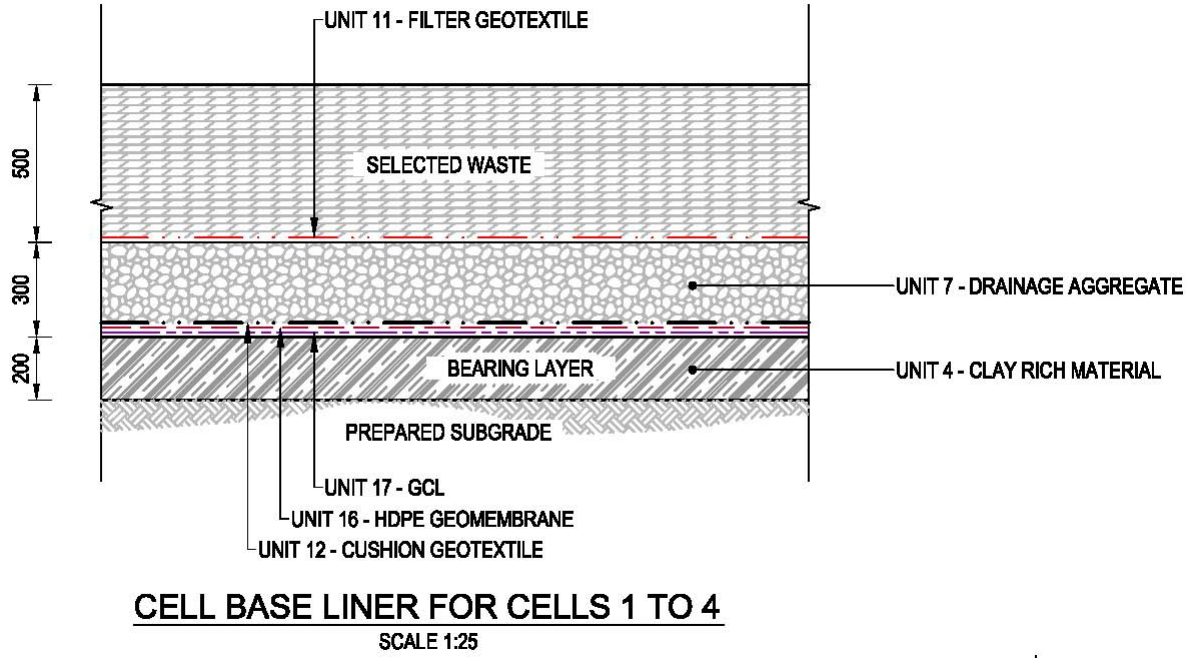
The type of liner varies depending on the ground conditions as follows. The profiles for each liner type are presented following.

Cell Base Liner for Cells 1 to 4

The leachate barrier and leachate collection system for the proposed new landfill cell floor comprises from bottom to top:

- 200 mm bearing layer (clay rich soil);
- Geosynthetic clay liner (GCL);
- 1.5 mm high density polyethylene (HDPE) textured geomembrane liner;
- Cushion geotextile; and
- 300 mm drainage aggregate and filter geotextile for leachate collection with periodic pipes.

Figure 8.2: New Cell Liner Cells 1 to 4

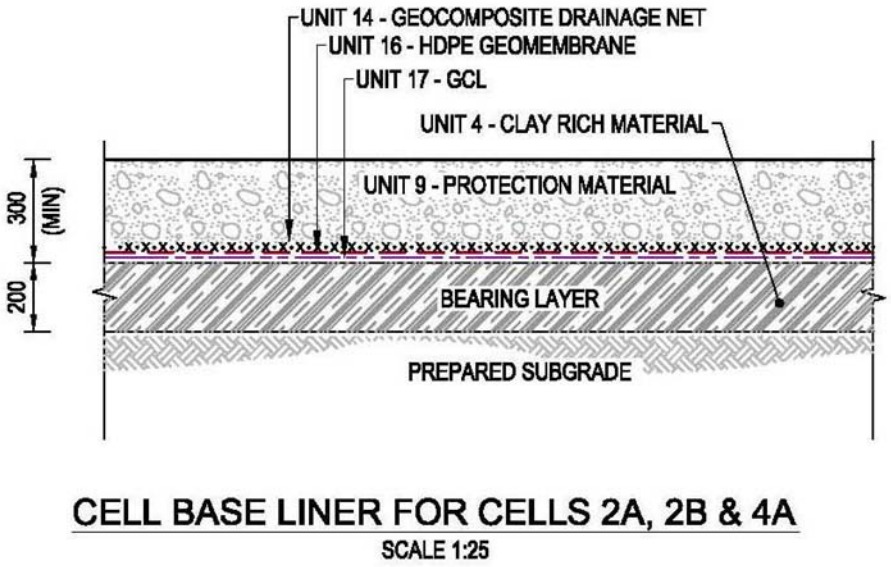


Cell Base Liner for Cells 2A, 2B and 4A

The leachate barrier and leachate collection system for these cells comprises:

- 200 mm bearing layer (clay rich soil);
- GCL;
- 2.0 mm high density polyethylene (HDPE) textured geomembrane liner;
- Leachate collection layer (geocomposite drainage net) with filter geotextiles and periodic pipes; and
- 300 mm protection soil layer.

Figure 8.3: New Cell Liner for Cells 2A, 2B and 4

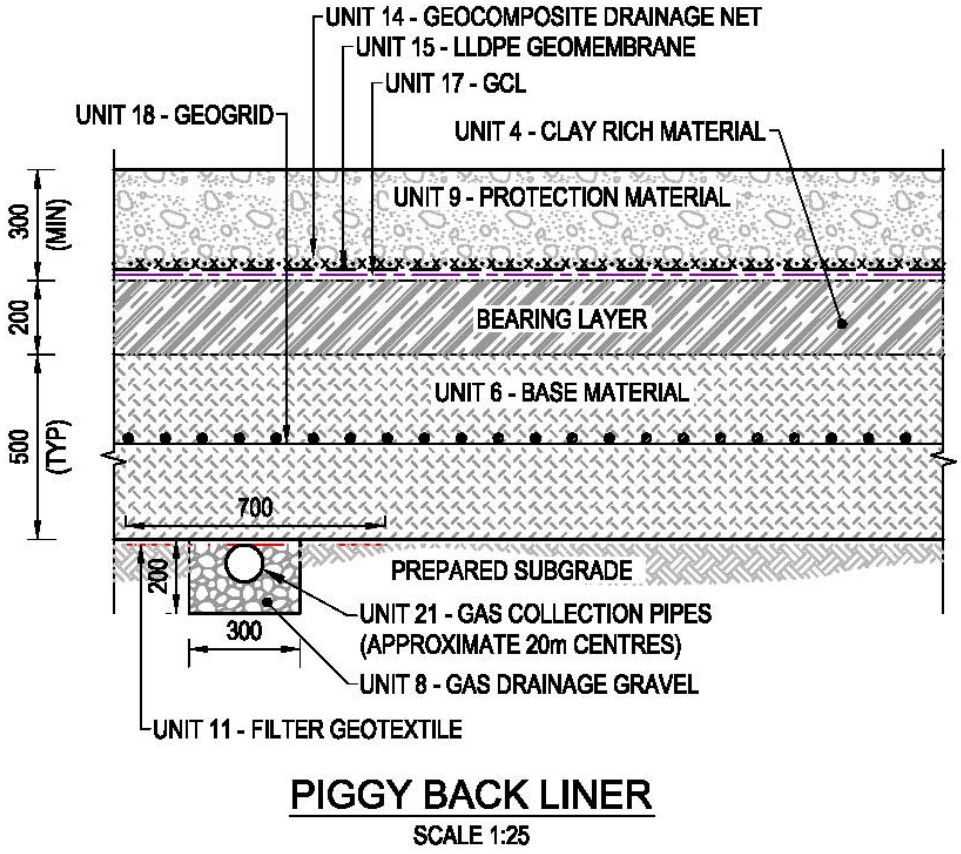


Piggy Back Liner for Existing Waste for Piggyback 1, 2A, 2B, 3

The leachate barrier and leachate collection system for the “piggyback” comprises from bottom to top:

- Gas drainage trenches with perforated gas collection pipes;
- Reinforcement layer consisting of 500 mm of base material soil and a geogrid;
- 200 mm bearing layer (clay rich soil);
- GCL;
- 1.5 mm linear low density polyethylene (LLDPE) textured geomembrane liner;
- Leachate collection layer (geocomposite drainage net) with filter geotextiles and periodic pipes; and
- 300 mm protection soil layer.

Figure 8.4: Piggy Back Liner



8.4.4 Leachate Collection System

The primary purpose of the leachate collection system is to remove leachate from above the liner and thereby limit the potential for contaminant migration through the liner.

The leachate collection system in all new liner areas comprises a continuous blanket collection layer, either geocomposite drain or aggregate layer, with a network of leachate collection pipes. The collection pipes are positioned to provide an approximate 50 m (maximum) flow distance from point of entry into the blanket to the nearest pipe and to maintain positive drainage after long-term landfill settlement. The system is sized to provide for long-term clogging resistance and for pipe clean out access points.

The base of Cells 1 to 4 are graded to drain to the south, with a leachate collection sump positioned in a southern corner of each cell. Leachate will drain to the leachate collection sump via gravity. Leachate from the piggy back cells and Cells 2A and 2B and 4A would also drain to one of these four sumps. The sumps are essentially depressions that are filled with drainage aggregate. Each sump drains via gravity to a leachate sump riser outside the perimeter bund. Each leachate sump riser is subsequently drained via gravity through a new leachate drainage pipe to a single external leachate pumping pit for pumping to the leachate ponds. For the first stages of the Project, the existing leachate well near the leachate ponds will be the pumping location; while in subsequent stages a new pumping pit will be constructed near the south west corner of the landform. From this point leachate is pumped to the appropriate storage pond.

A number of leachate drainage lines from the existing landfilled areas will also be connected into the new system. These lines comprise the following:

- Two existing leachate drainage lines from the Eastern Gully;

- The existing shallow leachate drainage line from the Western Gully (to be replaced prior to Project construction);
- A new leachate drainage line proposed for the Western Gully prior to the Project construction; and
- The existing groundwater underdrain line beneath the Eastern Gully liner which is likely impacted by leachate.

An important feature of the system is that leachate will be collected and removed from the landfill via gravity flow. No internal pumping wells with leachate risers through the waste mass will be constructed. This approach generally provides a passive, high-reliability, system. Although pumping would be required to deliver the collected leachate to the leachate ponds (as is the current approach), this would occur from a single point external to the landfill that is relatively easy to access and maintain.

8.4.5 Surface Water Management

The design for each component of the stormwater management system is discussed in Chapter 12 and details and calculations can be found in the Surface Water Assessment Report (Appendix G). In summary, three main types of stormwater would be generated by the Project :

- Clean stormwater runoff from undisturbed and rehabilitated / revegetated areas of the site;
- Potentially sediment-laden stormwater runoff from disturbed areas of the site; and
- Leachate that has come into contact with waste (including surface water from daily cover).

The surface water management controls would be progressively developed as the landfilling areas are developed. A drainage philosophy has been designed based on the construction staging of the proposed new landfill cell and offsite discharge constraints. The following summarises the staged approach.

Stage 1 and Stage 2A:

The drainage philosophy up to the completion of Stage 2A is to discharge the whole 50 ha catchment to the existing sediment pond. Forbes Rigby Pty Ltd (2002), “Whytes Gully Landfill Leachate Management Study” and RIENCO Consulting (2008), “Whytes Gully Landfill Surface Water and Leachate Management Plan 2008” reports suggest and Golder have verified that there is sufficient capacity in the existing surface water management system for the whole 50 ha catchment.

A minor existing discharge offsite from the western ridge would be maintained.

Stage 2B:

After completion of Stage 2B the Eastern Gully would become fully capped and therefore surface runoff would become ‘clean’ runoff. During Stage 2B a new ‘clean’ drain can be constructed to bypass the sediment pond and discharge directly to the Dapto creek outfall. This drain would be constructed between the existing leachate treatment plant and the surface water ponds. On completion of stage 2B, approximately 24 ha will discharge directly to Dapto Creek and 26 ha to the existing sediment pond.

Stage 3:

On completion of Stage 3, approximately 30 ha will be discharged directly to Dapto Creek and 20 ha to the existing sediment pond. Due to the extent of the Stage 4 works the existing leachate ponds will require relocating towards the end of Stage 3. At this stage it is proposed that the leachate pond is relocated to the footprint of the two reed bed ponds and downsize the existing surface water pond. The downsizing of the surface water pond at this stage is possible due to approximately 60 percent of the original 50 ha catchment now discharging directly to the Dapto Creek outfall.

Stage 4:

The downsized surface water pond is designed for a 20 ha catchment. The clean 30 ha catchment would discharge unrestricted to the Dapto Creek outfall. The surface water pond would be made up of sediment pond and onsite surface water detention pond. The outflow from the pond to the Dapto Creek outfall would be restricted to meet discharge constraints and the resultant attenuated runoff detained within the surface water pond.

Cap Drainage and Perimeter Drain

Benching and drop structures would be implemented and constructed into the formation of the landfill cells to reduce the runoff velocities and prevent scouring and sediment migration on the landfill cap. The design of the landform will include positive grades in all areas, batters (4H:1V), cell top (5 percent), and bench (3 to 5 percent cross fall), to collect and convey runoff generated from rainfall on the cell.

The cell design includes a perimeter drainage swale, which serves to collect and convey runoff water from cap drainage.

8.4.6 Leachate Management

Leachate is deemed to include all water that has come into contact with waste. A range of appropriate measures would be implemented to minimise, contain, collect and dispose of leachate generated during landfilling at the site. All practicable measures would be undertaken to reduce the volume of leachate generated at the Whytes Gully RRP site, including:

- Diverting upstream, clean stormwater runoff around the landfilling operation, where possible;
- Staging the landfilling operation, to minimise the active footprint of the landfill;
- Minimising exposed areas at the active landfilling area by regular covering of the landfilled waste;
- Grading filled areas to direct surface water runoff away from the active waste landfilling area;
- Applying intermediate cover on all areas of the landfill that are left inactive for periods greater than 90 days; and
- Progressive capping and rehabilitation of landfilled areas.

Water balance modelling was undertaken to assess the quantity of leachate that may be generated by both the existing and proposed new landfilled waste. Methodology and results of the water balance modelling are presented in Chapter 12 and Appendix G5.

The modelled leachate volumes (based on average monthly rainfall) indicate that throughout Stages 1-3, the maximum leachate requiring storage (4,100 kL/month) occurs during the second year of the project (month 24) and the maximum cumulative volume of leachate requiring storage (6 413 kL) occurs during the third year of the project (month 27). With a capacity of approximately 18 000 kL, the existing leachate ponds are therefore expected to have sufficient capacity to store leachate generated during Stages 1-3 under average rainfall conditions.

It is proposed to retain the existing leachate ponds (described in Chapter 7) in place until the end of Stage 3 (end of 2046). During 2045 a proposed new leachate pond would be constructed to the south of the existing leachate ponds in the approximate location shown on Figure 5.1. The existing leachate ponds would be decommissioned as part of the construction of the Stage 4 liner.

The water balance model for the site would be reviewed prior to construction of the new leachate pond and calibrated with actual site data. The new leachate pond would be a composite lined pond.

8.4.7 Leachate Treatment and Discharge

Liaison with Sydney Water has indicated that although the West Dapto Release Area may result in sewer upgrades, there are current no identified plans or approvals and therefore the Project must be designed for the current trade waste discharge limit to sewer of 250 kL/day.

The leachate treatment system at the site currently incorporates aeration and biological treatment with the Primary and Secondary Leachate Ponds and subsequent treatment in the leachate treatment plant using sequencing batch reactor technology.

A review of the recent performance of the existing site Leachate treatment system (refer to Chapter 7 of the EA) indicates that the leachate treatment has consistently been meeting Sydney Water Industrial Trade Waste Criteria since recent upgrades were completed.

Water Balance Modelling has been undertaken for the Project. Methodology and Results are presented in Chapter 12 and Appendix G5 of the EA.

It is proposed to retain the existing leachate treatment system in place until the end of the first year of Stage 1 (end of 2014) of the Project.

During the first year of the Project it is proposed there would be significant works undertaken at the Whytes Gully RRP site including operational changes that are expected to significantly impact and reduce the leachate generation rates. These include capping and reprofiling the existing Eastern Gully landfill batter (considered to be a significant source of infiltration and stormwater contribution to the leachate collected at the site) in addition to capping of the current landfilling area and commencement of the Piggy Back Liner in Stage 1.

Additionally, Sydney Water may in this time develop firm upgrade plans for the sewer along Reddalls Road and consider an increased discharge limit to sewer for the Project site.

Wollongong City Council would log and review the resultant leachate generation volumes and rainfall amounts during 2014 and reassess the water balance model assumptions for infiltration rates and continue to liaise with Sydney Water on timing for sewer capacity upgrade and quantify and assess the need to upgrade the leachate treatment plant.

The following contingency actions for leachate storage and/or treatment are considered feasible, and could be implemented in a short period of time at the Project site if necessary:

- Discharge to sewer directly from the leachate storage ponds during periods of low ammonia concentrations to increase leachate storage capacity (this approach is known to be acceptable to Sydney Water and has been implemented successfully in the past year) .
- Leachate reinjection over short-term into new waste proposed for the new cell through surface application across the daily cover area (10 000 m^2);
- Trucking of leachate to sewage treatment plant for disposal;
- ‘Package’ plants: proprietary package treatment plants are available that can be mobilised to the Whytes Gully RRP site should increased leachate treatment capabilities be temporarily required;
- Until the end of Stage 1 store excess leachate in the former surface water pond at the toe of the Western Gully, or construct a new leachate overflow storage pond in the Cell 2 or Cell 3 area;
- Upgrade the existing leachate treatment plant to increase volume throughput and/or efficiency of treatment process/new technologies; and
- Construct a cover over the existing leachate ponds to reduce the effects of direct rainfall.

In addition prior to commencement of the Project Wollongong City Council would:

- 'Drain', treat and dispose of accumulated leachate from the Western Gully landfill via replacement of the existing shallow leachate drainage line in the Western Gully and construction of a proposed new leachate drainage line in the Western Gully.

8.4.8 Landfill Gas Management

Modelling of Landfill Gas (LFG) emissions undertaken in accordance with the *National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for the estimation of greenhouse gas emissions from facilities in Australia*, Department of Climate Change and Energy Efficiency, July 2011, predicts a significant volume of LFG generation from within both the existing landfill and the proposed new landfill cell as a result of the Project. Modelling methodology and results are presented in Chapter 11 and Appendix E of the EA based on 50 percent capture flaring and LFG combustion, which are considered feasible at the Whytes Gully RRP site.

The existing landfill is estimated to run out of air space during late 2013 and as such the construction of the Project is required to commence early 2013 (pending EA approval). Therefore, the management of LFG within the existing landfill waste is required prior to the construction of proposed new landfill cells in late 2013. Wollongong City Council plan to implement landfill gas extraction at the site according to the following phased approach:

- Phase 1: Revitalise existing LFG collection system on Western Gully, install additional vertical gas wells and commission a flare – mid 2012.
- Phase 2: Install vertical gas wells within the Eastern Gully and prepare for construction of piggyback liner – by mid 2013.
- Phase 3: Collection of LFG from new landfill cells including the installation of sacrificial horizontal gas wells (initially) followed by vertical gas wells – from 2014/2015.

The design of the piggyback lining system will accommodate the continuing operation of vertical gas wells in the existing waste that will be installed in Phase 1 and Phase 2, with potential design features described in the Preliminary Design Report (Appendix O). It is noted, however, that the need to continue extraction from these wells would depend on the quantum of future gas generation expected at the time of piggy back lining construction, and there would be less need to preserve Phase 1 (Western Gully) wells due to the advanced age of the existing waste at the time of piggy back lining. The design of the piggyback lining system will also include gas collection vents beneath the lining to reduce the risk of increased lateral gas migration developing after lining construction.

8.5 Construction of the Project

8.5.1 Construction Activities

Construction methods would be determined at the time of construction (in accordance with the Project approval conditions). All construction would be carried out in accordance with a Construction Quality Assurance plan and would comprise the general steps:

- Site Preparation;
- Cell Preparation;
- Liner and leachate collection system construction;
- Landfilling and cover; and
- Final Capping and Rehabilitation.

The construction activities differ depending on the presence of ground condition types 1 through to 3 as follows.

Eastern Gully landfill:

- Stripping of vegetation where present;
- Smoothing of abrupt changes in grade by cutting and filling existing bunds on the landfill batter (no importation of fill);
- Compaction and proof rolling of subgrade; and
- Placement of 'piggy-back' lining system including landfill gas under drainage layer (geonet) and leachate collection layer (geonet)

Western Gully landfill:

- Stripping of vegetation;
- Smoothing of abrupt changes in grade by cutting and filling (no importation of fill);
- Compaction and proof rolling of subgrade; and
- Placement of 'piggy-back' lining system including landfill gas under drainage layer (geonet) and leachate collection layer (geonet).

Non-landfilled areas that have remained largely undisturbed:

- Stripping of vegetation;
- Excavation and profiling of up to 5 m of soil and rock and stockpiling for re-use as cover material;
- Compaction and proof rolling of subgrade;
- Placement of composite liner system for non landfilled areas including leachate collection system;

Non-landfilled areas occupied by infrastructure such as roads, ponds, etc.:

- Stripping of vegetation;
- Removal of road surfaces and subgrades;
- Removal of lining systems of ponds and removal of sludge from ponds;
- Smoothing of abrupt changes in grade by cutting and filling;
- Compaction and proof rolling of subgrade;
- Placement of lining system for New Cell area including leachate collection system.

In order to divert stormwater from the northern side of the landfill to the southern side, waste will have to be removed from the eastern most portion of the Eastern Gully landfill. This waste will be placed in Stage 1 of the newly constructed landfill.

It is proposed that while one cell is being filled with waste, the liner for the succeeding cell is being constructed. In addition finalised cells would be capped and rehabilitated whilst waste is being landfilled in subsequently proposed cells. Further details on Staging are provided within the Draft LEMP (Appendix P).

8.5.2 Capping

The primary purpose of the capping system barrier is to provide a continuous barrier over the waste to limit rainwater infiltration into the cell, thus reducing the potential for leachate generation. The capping system barrier would also serve to limit infiltration of oxygen (atmospheric oxygen and oxygen-enriched rainwater) into the proposed cell, thus reducing the reactivity and flammability potential of the waste.

The subsurface drainage system is designed to remove infiltrating rainwater from above the capping system barrier and thereby limit the potential for water infiltration into the waste. A secondary benefit of this system is that removal of infiltrating rainwater from above the capping system barrier increases the slope stability of the capping system on the cell batters through reduction in down slope seepage forces.

Vegetation growth is proposed to support the capping to:

- Limit erosion from the cell landform; and
- Provide suitable visual amenity.

The vegetation medium also serves a secondary purpose by providing a layer with substantial thickness that would reduce the potential for inadvertent human contact with emplaced cell materials. Further, the combination of vegetation growth, layer thickness, and capillary break achieved at the interface with the subsurface drainage layer, would enhance removal of infiltrating rainwater by plant evapotranspiration, thus reducing leachate generation potential within the proposed new landfill cell.

The site would be capped progressively as each stage reaches final levels. The capping system is shown on Figure 20.2 and is proposed to comprise (from top to bottom):

- 500 mm to 1 m revegetation layer, specifically designed to encourage growth of the selected plant species.
- Geocomposite drainage system with filter geotextiles and periodic drainage collection pipes.
- 1.0 mm thick Linear Low Density Polyethylene (LLDPE) geomembrane liner.
- 200 mm clay rich bearing layer.
- 500 mm intermediate cover remaining from the landfill operation.
- Landfill gas drainage trenches with perforated gas collection pipes.

Once final capping of an area has been completed, the area would be revegetated with shallow rooted native grasses and shrubs and small tress that are of local provenance in accordance with the Landscape Strategy (Appendix N).

The capping system designs are outlined in detail in the Preliminary Design Report (refer to Appendix O).

8.5.3 Construction Quality Assurance

A Construction Quality Assurance (CQA) system would be in place for cell construction because the performance of these environmental protection systems, particularly the base liner, piggy back liner and cap barrier, is strongly dependent on the quality of their construction. Detailed CQA requirements are embedded in the Technical Specification of the Preliminary Design Report (Appendix O). The CQA system comprises a combination of approval and documentation requirements for the cell construction contractor, inspection by the construction Superintendent (to be appointed by Wollongong City Council) and independent material testing (audit testing).

8.5.4 Material Quantities

Approximate volume of cut and fill, intermediate cover and capping materials for the Project are identified in Table 8.4.

Table 8.4: Volume of Cut and Fill, Cover and Capping

	Cut (cu.m)	Fill (cu.m.) [1]	Intermediate Cover (cu.m)	Capping (cu.m.) [2]
Stage 1	60,400	98,000	26,000	61,000
Stage 2A	74,000	19,000	4,900	12,000
Stage 2B	25,000	95,000	23,000	54,000
Stage 3	29,000	76,000	23,000	53,000
Stage 4	172,000	44,000	28,000	66,000
Total	**288 400**	**332,000**	**104,900**	**246,000**

Notes: 1. quantity includes material for subgrade, bunds, bearing layers, base layer and protection layer.
2. quantity based on a 500 mm thick revegetation layer.

8.5.5 Construction Equipment

An indicative list of key construction equipment that would be used at for the Project is summarised in Table 8.5.

Table 8.5: Construction Equipment

Activity	Equipment
Excavation and new cell construction	Excavator Bulldozer Roller Truck and Dog Water Truck
Waste relocation (during Stage 1)	Dump trucks
	Excavator/loader

8.5.6 Other Landfill Facilities

Indicative temporary and permanent internal access roads of Whytes Gully RRP would be constructed throughout the life of the Project. The existing weighbridge will be used throughout the life of the Project.

The existing amenities for Wollongong City Council staff are currently located within the footprint of Stage 1 (refer Figure 5.1) and would be demolished as part of the Project. Wollongong City Council would propose to use the amenities located within the former SWERF building before commencement of construction. No new buildings are required for the Project.

8.5.7 Construction Environmental Management

Prior to construction a Construction Environmental Management Plan (CEMP) would be prepared. All construction works would be undertaken in accordance with the construction environmental controls presented within the EA and include consideration of relevant conditions of the Project determination.

8.5.8 Construction Hours

Construction activities of the Project are proposed to be limited to the standard hours of 07:00 to 16:00 Monday to Friday and 08:00 to 13:00 on Saturdays with no work on Sundays and public holidays. However, relevant guidelines also state that the following activities have justification to be undertaken outside of standard hours as required:

- The delivery of oversized plant or structure;
- Emergency work; and
- Works for which it can be demonstrated that there is a need to operate outside the recommended standard hours.

Wollongong City Council would endeavour to work within the standard hours of construction.

8.5.9 Construction Workforce

It is anticipated that the average construction workforce for the Project would be approximately 6 workers for capping and 6 for cell preparation activities.

8.5.10 Eastern Gully Landfill Waste Cutback

In order to achieve gravity drainage of surface water around the perimeter of the final landform, the eastern batter of the landfill will be excavated (cutback) and the waste material excavated would be relocated to Stage 1 of the proposed landfill (refer Chapter 5 for alternative footprint options assessed). Approximately 300,000 m^3 of existing waste material would be relocated. The cutback is over an area of approximately 40,000 m^2.

The waste excavation and relocation work would likely require equipment as follows in addition to other Project construction equipment and the normal landfill operational equipment:

- Two 25 tonne excavators to excavate the waste material and load it onto dump trucks. The excavators would also trim the batters to the design grade and place intermediate cover on the areas where excavation is complete to reduce potential environmental impacts of the Project.
- Three 30 tonne articulated dump trucks to haul the waste material excavated to the operating landfill face.
- One litre water truck to undertake dust suppression works at the excavation area and on site roads and cool down any hot material excavated from the new landfill cell to prevent fire on exposure to air.
- Additional landfill compaction equipment may be required at the proposed Stage 1 of the new landfill cell to spread & compact relocated waste at the operating tip face.

Environmental Management for Waste Relocation

The excavation and relocation work for waste relocation during Stage 1 of the proposed new landfill cell is to be undertaken in a staged manner over a period of approximately twelve months. The works need to be staged to manage potential environmental impacts. In addition to landfilling environmental controls identified within the Draft LEMP, the following environmental controls would be put in place for the Eastern Gully Landfill Waste Cutback:

- Odour would be minimised by keeping the exposed area of waste under excavation to approximately 2,500 m^2 or 6 percent of the total area and capping excavation areas with clean soil prior to commencing the next excavation stage.
- Intermediate capping (approx 300 mm thick) would be placed over the excavated surface at the end of an excavation stage prior to commencing the next excavation stage. This capping would reduce odour and the generation of leachate.

- Leachate would be controlled at each excavation stage by constructing a leachate sump at a low point in the excavation floor. Leachate sumps may also be needed in local areas at the base of the excavation batter if perched leachate is encountered. The leachate collected at sumps would be pumped to the existing landfill leachate system.
- Test pitting would occur in advance of each excavation stage. The test pits would identify any high temperature waste with the potential to ignite on exposure to air. Prior to the main excavation, this material would be excavated and transported to a clay pad area where it would be watered down to cool the waste material prior to draining and placing it into the proposed new landfill cell at the tipping face.
- Landfill gas emissions would be monitored during the works in the waste excavation areas. If elevated readings are obtained work methods would be reviewed and changed as necessary.
- Bunds would be constructed at the top of batters prior to batter excavation to stop clean surface runoff water running down excavation batters and onto the excavation floor and becoming impacted by the waste.
- If buried hazardous wastes are encountered during the process of excavating waste material work would stop until the nature of the hazardous materials and extent can be identified.
- If areas of soil are encountered during excavation of the waste material this material would be stockpiled on the landfill separately for re-use as landfill daily cover material in the operating landfill area. Similarly, soil used as temporary excavation capping would also be scraped back and stockpiled for re-use as daily cover material.
- Upstream catchment drainage channels would remain blocked until the entire batter cutback is complete. This method ensures major overland flows would not disrupt the batter excavation works.
- An activity specific work plan would be developed for waste excavation and relocation as part of the CEMP.

8.6 Operation of the Project

8.6.1 Landfilling

Landfilling of solid waste for the Project comprises:

- Dumping of waste in the active filling area and placement of waste in layers.
- Compaction of waste using a Compactor and a Loader to assist spreading the waste.
- Placement of landfill lids and/or daily cover (150 mm) over exposed waste at the end of each working day.
- Removal of landfill lids prior to recommencement of filling in an area and/or removal or puncturing of daily cover prior to placement of waste.
- Placement of intermediate cover (300 mm) on finalised lifts and batters. Intermediate cover would be applied over landfilled surfaces in areas that are not going to be used for more than the next 90 days. Intermediate cover areas would be revegetated with grasses.
- Stripping of intermediate cover prior to placement of the subsequent layer of waste and reuse of the intermediate cover for future lifts.
- The intermediate cover over the final landfill lift would remain in place to form part of the landfill capping layer subgrade.

- While one cell is being filled with waste, the liner for the succeeding cell would be constructed. In addition finalised cells would be capped and rehabilitated whilst waste is being landfilled in subsequently staged cells. Further staging details are provided within the Draft LEMP (Appendix P).

8.6.2 Operational Hours

Table 8.6 provides the existing hours of operation f or Whytes Gully RRP. These are not proposed to be altered as part of the Project.

Table 8.6: Hours of Operation

Activity	*Day*	*Time*
Operation	*Monday – Friday*	*7:30am to 4:30pm*
	Saturday, Sunday and Public Holidays	*8:00am to 4:00pm*

8.6.3 Operational Equipment

The following Table presents the equipment to be used during operation of the landfill.

Table 8.7: Operational Equipment

Activity	Key Equipment
Placement and compaction of waste	Front end loader
	Compactor, vibratory
	Excavator
Placement of cover	Bulldozer
	Truck and Dog
	Roller
	Loader
Removal of cover	Excavator/loader

It is noted that the above equipment would be maintained offsite of Whytes Gully RRP.

8.6.4 Roles and Responsibilities

Waste management facilities require adequate staffing levels to ensure that all tasks are completed in compliance with the management procedures. This would be 10 full time staff during operation of the Project and 5 on weekends. Clear definition of staff function, roles and responsibilities is necessary to ensure this. Proposed operational key staff and their roles and responsibilities at Whytes Gully RRP are identified within the draft LEMP (refer to Appendix P).

8.6.5 Environmental Management during Operation

The waste streams of the Project would be similar to the waste streams currently received at the Whytes Gully RRP site, which are shown in Figure 7.1, with the exception of green waste which would no longer be received at the site.

A detailed description of how waste would be received, treated, stored, used and disposed at the site is outlined in the LEMP (Appendix P), with a summary of current practices provided in Chapter 7 of the EA.

Recycling at the Whytes Gully RRP site currently comprises separation of recyclable waste loads at the weighbridge and the Small Vehicle Transfer Station and collection of recyclable materials at the Small Vehicle Recyclables Drop Off Area. Recyclable materials are transported either to the MRF, where they are processed or transported off site for processing. Detailed measures and management practices for recycling and to ensure high recovery rates at the site are outlined in the LEMP.

8.6.6 LEMP

A draft LEMP has been developed for the Project in accordance with the NSW EPA "Environmental Guidelines: Solid Waste Landfills" (1996). The objective of the LEMP would be to ensure that a high level of environmental performance is maintained throughout the life of Whytes Gully RRP. The draft LEMP and the identified management strategies outlined therein would be finalised in accordance with the Project approval conditions and would be review on an annual basis or where significant changes to site operation are proposed. The final LEMP would contain:

- Statutory and other legal requirements.
- Project Site descriptions, layout, regional geology, hydrogeology, physical setting.
- The proposed landfill facility design, objectives and operational framework.
- Key environmental, operational and rehabilitation issues.
- Management measures.
- Environmental management responsibilities and training.
- Monitoring and reporting provisions.

Detailed management measures are presented in relevant chapters throughout the EA and in the Draft LEMP in Appendix P.

9.0 ENVIRONMENTAL RISK ANALYSIS

This chapter details the environmental risk analysis process for the Project. It considers the significance of the potential environmental impacts, the effectiveness of the proposed management and mitigation measures and any residual impacts likely to remain after the application of these measures.

The Director-General's requirements	**Chapter 9**
■ ***The Environmental Assessment (EA) must include: a risk assessment of the potential environmental impacts of the project, identifying the key issues for further assessment***	

9.1 Role of Environmental Risk Analysis

The Director-General of the Department of Planning and Infrastructure requires the Proponent to prepare an environmental risk analysis to identify potential environmental impacts associated with the construction and operation of the Project. The Director-General also requires that where additional key environmental impacts are identified through the environmental risk analysis, an appropriately detailed impact assessment of this additional key environmental impact must also be included in the EA.

The environmental risk analysis process began at the Project Application and Preliminary Environmental Assessment (PEA) phase, and was further developed in the preparation of the EA. The risk analysis process was used to scope the environmental investigations and guide project design.

The environmental risk analysis enables the EA to:

- Target those environmental issues identified as key issues in the PEA. This includes consideration of the significance of the potential environmental impacts and the effectiveness of the proposed management measures in minimising degradation or deterioration of the biophysical, economic or social environment.
- Identify those potential environmental impacts that are not key issues, including those that would be expected to respond well to appropriate mitigation measures and management.
- Identify residual environmental impacts likely to remain after the application of the mitigation measures. Where significant residual impacts remain, this may require greater commitment to management strategies to mitigate the effect or, in some instances, appropriate modifications to the design of the Project.

9.2 Identification of Key Issues

The PEA identified the key issues for the Project, which are subsequently adopted as the basis for the key issues identified in the DGRs for the Project.

The DGRs have identified the following key environmental issues for consideration and assessment within the EA:

- Waste Management
- Soil, Water and Leachate
- Air Quality
- Greenhouse Gas
- Flora and Fauna
- Traffic and Transport

- Noise
- Heritage (Indigenous and non-indigenous)
- Hazards and Risks
- Visual
- Socio-Economic
- Rehabilitation and Final Landform

9.3 Risk Analysis Methodology

The environmental risk analysis was undertaken in accordance with the principles of the *Australian and New Zealand standard AS/NZS 4360:2004 – Risk Management*. The analysis involved:

- Ranking the risk of each identified potential impact by identifying the consequences of the impact and the likelihood of each impact occurring.

9.3.1 Evaluating Consequences

The first steps involved an identification of the consequence levels should a particular impact occur. Definitions of the consequence levels used are provided in Table 9.1.

Table 9.1: Risk Analysis - Definition of Consequences

Consequence level	Definition
Catastrophic	■ Would cause long-term and irreversible impacts. ■ Would result in a major prosecution under relevant environmental legislation.
Major	■ Would cause medium-term, potentially irreversible impacts. ■ Would result in a fine or equivalent under relevant environmental legislation.
Moderate	■ Would result in medium-term, reversible impacts.
Minor	■ Would result in short-term, reversible impacts.
Insignificant	■ Would result in minor, negligible impacts.

9.3.2 Evaluating Likelihood

The next step involves a definition of the likelihood by considering the frequency of activities that may cause an impact and the probability of the impact occurring during that activity. The level of likelihood has been classed as:

- Very likely – the event is almost certain to occur in the course of normal or abnormal operating circumstances.
- Likely – the event is likely to occur in the course of normal operations.
- Possible – the event may occur in course of normal operations.
- Unlikely – the event is unlikely to occur in the course of normal or abnormal operating circumstances.
- Very unlikely – the event may occur in exceptional circumstance only.

9.3.3 Risk Assessment Matrix and Rating

The risk rating has then been determined by combining the consequence and likelihood according to the matrix in Table 9.2.

Table 9.2: Risk Assessment Matrix

		Likelihood				
		Very likely	**Likely**	**Possible**	**Unlikely**	**Very unlikely**
Consequence	**Catastrophic**	25	20	15	10	5
	Major	20	16	12	8	4
	Moderate	15	12	9	6	3
	Minor	10	8	6	4	2
	Insignificant	5	4	3	2	1

Risk rating scores have been determined for each combination of consequence and likelihood as shown in Table 9.3.

Table 9.3: Risk Rating

Risk rating score	Risk category	General description
12 – 25	High	Detailed assessment and planning are necessary to develop appropriate measures to mitigate and manage the potential impacts.
4 – 10	Medium	Potential impacts can be mitigated through the application of relatively standard environmental management measures.
1 – 3	Low	Potential impacts either require no specific management measures or are mitigated adequately through other working controls (such as detailed design requirements, normal working practice, quality and safety controls).

The potential effectiveness of the proposed mitigation measures have been assessed and the degree of effectiveness of the mitigation measures are classed as:

- Very effective – the measure would decrease the risk rating score by 12 points – for example, from 20 (high) to 8 (medium).
- Effective – the measure would decrease the risk rating score by 7 points – for example, from 12 (high) to 5 (medium).
- Partly effective – the measure would decrease the risk rating score by 3 points – for example, from 6 (medium) to 3 (low).
- Not effective – the measure would not change the risk rating.

9.4 Environmental Risk Analysis

Using the above risk framework an environmental risk analysis has been undertaken for the Project based on investigations and assessment of the environmental issues during the preparation of the EA and considers the input from various government agencies and other stakeholders during the consultation process.

Each environmental issue is assessed in detail in the relative chapters of the EA including potential impacts and benefits and consideration of proposed mitigation and management measures. Mitigation and management is detailed in full in the (draft) Statement of Commitments (Chapter 21 of the EA).

The results of the environmental risk assessment are presented in Table 9.4.

Table 9.4: Environmental Risk Assessment Results

Aspects	Potential impact example	Overall Consequence	Overall Likelihood	Risk Rating	Proposed Mitigation Measures	Effectiveness	Effectiveness factor	Residual risk rating
Groundwater	Leachate contamination as a result of the Project	Major	Possible	12 High	Chapter 12	Effective	7	5 Medium
Soils and surface water	Clean and dirty water (sediment-laden) and leachate leaving the site, and impacting downstream environments	Major	Possible	12 High	Chapter 12	Effective	7	5 Medium
Greenhouse gas	Emissions from fuel use in construction, and from plant in operation. Landfill gas emissions to the atmosphere`	Minor	Likely	8 Medium	Chapter 11	Partly Effective	3	5 Medium
Flora and Fauna	Impacts on threatened or vulnerable species or their habitats	Minor	Likely	8 Medium	Chapter 13	Partly Effective	3	5 Medium
Air Quality and Odour	Dust during construction and operation affecting amenity of the surrounding area. Odour from operation activities affecting surrounding land users.	Minor	Likely	8 Medium	Chapter 14	Partly Effective	3	5 Medium
Noise	Construction and operational noise form machinery and plant..	Minor	Likely	8 Medium	Chapter 10	Partly Effective	3	5 Medium
Hazards and risks	Breakdowns in operational procedures may give rise to hazards	Minor	Possible	6 Medium	Chapter 19 and LEMP	Partly Effective	3	3 Low

Aspects	Potential impact example	Overall Consequence	Overall Likelihood	Risk Rating	Proposed Mitigation Measures	Effectiveness	Effectiveness factor	Residual risk rating
Socio-Economic	Impacts to equality and access to waste disposal facilities for the community. Reduction in incentive to minimise waste through the availability of additional landfill space.	Minor	Possible	6 Medium	Chapter 18	Partly Effective	3	3 Low
Indigenous heritage	Disturbance of Indigenous heritage items during construction	Major	Unlikely	8 Medium	Chapter 16	Effective	7	1 Low
Non-Indigenous heritage	Disturbance of European heritage items during construction	Major	Unlikely	8 Medium	Chapter 16	Effective	7	1 Low
Bushfire hazard	Increasing bushfire hazard to operations and personnel at the site	Moderate	Possible	9 Medium	Chapter 19	Effective	7	1 Low
Traffic	Increased traffic on the roads leading to the Whytes Gully RRP	Minor	Unlikely	4 Medium	Chapter 15	Partly Effective	3	1 Low
Waste management	Integrity of waste management processes, and the potential for harmful adverse impacts on the surrounding area as a result of waste handling and transport	Moderate	Possible	9 Medium	LEMP	Effective	7	2 Low
Visual	Unacceptable visual impacts due to changes in the landscape as a result of new landfill cell	Moderate	Possible	9 Medium	Chapter 17	Effective	7	2 Low
Rehabilitation and final landform	Lack of an implementable acceptable rehabilitation plan following closure of the landfill	Major	Unlikely	8 Medium	Chapter 20	Partly Effective	7	1 Low

9.5 Environmental Risk Analysis Findings

The environmental risk assessment has identified that no aspects of the Project present a high level of residual risk. There are six aspects of the proposal which present a medium level of residual risk:

- Noise.
- Greenhouse Gas.
- Soil and water.
- Flora and Fauna.
- Air Quality.

The residual risk rating of 'medium' suggests that the residual risk can be managed through the application of environmental management measures. These are detailed within the relevant EA chapters 10-14, and in Chapter 21 Draft Statement of Commitments.

The remaining environmental risks identified below have been assessed as having a low level of residual risk once mitigation measures have been applied. Taking into account these environmental risks, the residual risk is of a nature that it can be managed through detailed design controls, conditions of consent, and normal working practices.

- Traffic and Transport.
- Heritage.
- Visual Impacts.
- Socio-Economic Impacts.
- Hazards and Risks (including Bushfire).
- Rehabilitation and final landform.

10.0 NOISE

This chapter of the EA provides an assessment of noise based upon Golder Associates "Whytes Gully New Landfill Cell Noise Impact Assessment" (2012) (Noise Assessment) provided in Appendix D to identify and assess the noise impacts of the Project.

The Director-General's requirements	
■ **Noise including:** ▪ **an assessment of construction, operational and traffic noise.**	**Chapter 10**

In accordance with the DGRs the Noise Assessment has been undertaken to assess construction, operation and traffic noise of the Project and includes the following methodology:

- Identification of the spatial area and noise sensitive receivers for the noise assessment based upon site plans, aerial photographs and the site survey;
- Background unattended noise monitoring for a period of nine days (15 to 24 November 2011) at three locations and attended noise monitoring at the same three locations and a further two locations (24 November 2011);
- Processing of the background noise monitoring to identify operational and construction performance criteria for the Project in accordance with applicable policy;
- Assessment of potential construction, operation and traffic noise impacts including:
  - Noise modelling to predict potential noise impacts of the Project at sensitive receivers;
  - Assessment of predicted noise impacts against the identified performance criteria for the Project utilising relevant guidelines including the "Interim Construction Noise Guideline" (DECC 2009), (ICNG), Industrial Noise Policy (DECC 2000) (INP) and the NSW Road Noise Policy (DECCW 2011)[2] (RNP); and
- Discussion of noise mitigation measures to reduce potential noise impacts of the Project.

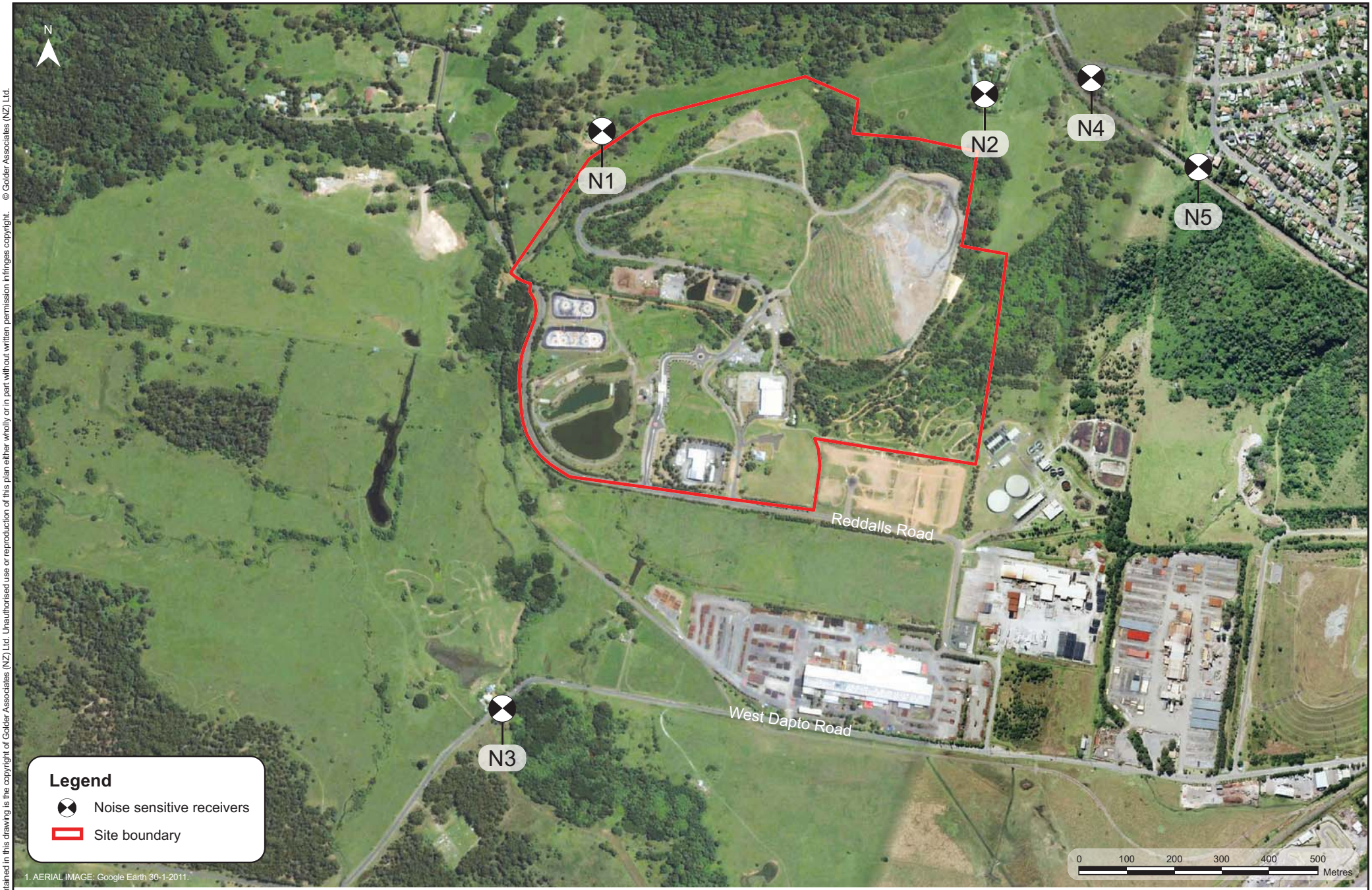
10.1 Existing Environment

10.1.1 Noise Sensitive Receivers

The nearest residential receivers to Whytes Gully RRP have been identified based upon aerial photos and site visits and are considered to be the most likely noise sensitive receivers to be impacted by the Project based on the attenuation of noise at this location. The noise sensitive receivers are shown in Figure 10.1 and are identified as follows:

- N1 – Residence NW of Whytes Gully RRP;
- N2 – Residence NE of Whytes Gully RRP;
- N3 – Residence SW of Whytes Gully RRP;
- N4 – Residence NE of Whytes Gully RRP; and
- N5 – Closest Resident at Farmborough Heights.

[2] As identified by the OEH, the NSW Road Noise Policy (DECCW 2011) supersedes the Environmental Criteria for Road Traffic Noise (identified within the Project DGRs) from July 1 2011. http://www.environment.nsw.gov.au/noise/traffic.htm



Golder Associates

Source: Noise Assessment Report, Appendix D

TITLE NOISE SENSITIVE RECEIVERS

MARCH 2012

PROJECT 117625003

10.1

S:\Graphics\Projects-numbered\2011\11782x\12xxx\1178212_216_GAP_Whytes Gulley\Mar12

10.1.2 Background Noise Monitoring Results

Unattended noise monitoring (NM1 – NM3) and attended noise monitoring (NM1, NM2, NM3, NM4 and NM5) was undertaken in proximity to the noise sensitive receivers of Whytes Gully RRP to identify the background noise levels and sources of background noise. Noise monitoring locations are shown in Figure 10.2. The noise levels, measured over 15 minute periods at each location are shown in Table 10.1.

Table 10.1: Attended Background Noise Levels
(Source: Noise Assessment Appendix D)

Location	Measured L_{Aeq}	Measured L_{A90}	Observed Noise Sources
NM1	43	38	Bird song, distant noise from Whytes Gully RRP.
NM2	49	45	Bird song, distant noise from metal yard and Whytes Gully RRP.
NM3	58	55	Noise from metal yard and Whytes Gully RRP.
NM4	65	46	Road traffic only.
NM5	51	45	Bird song, distant noise from metal yard and Whytes Gully RRP.

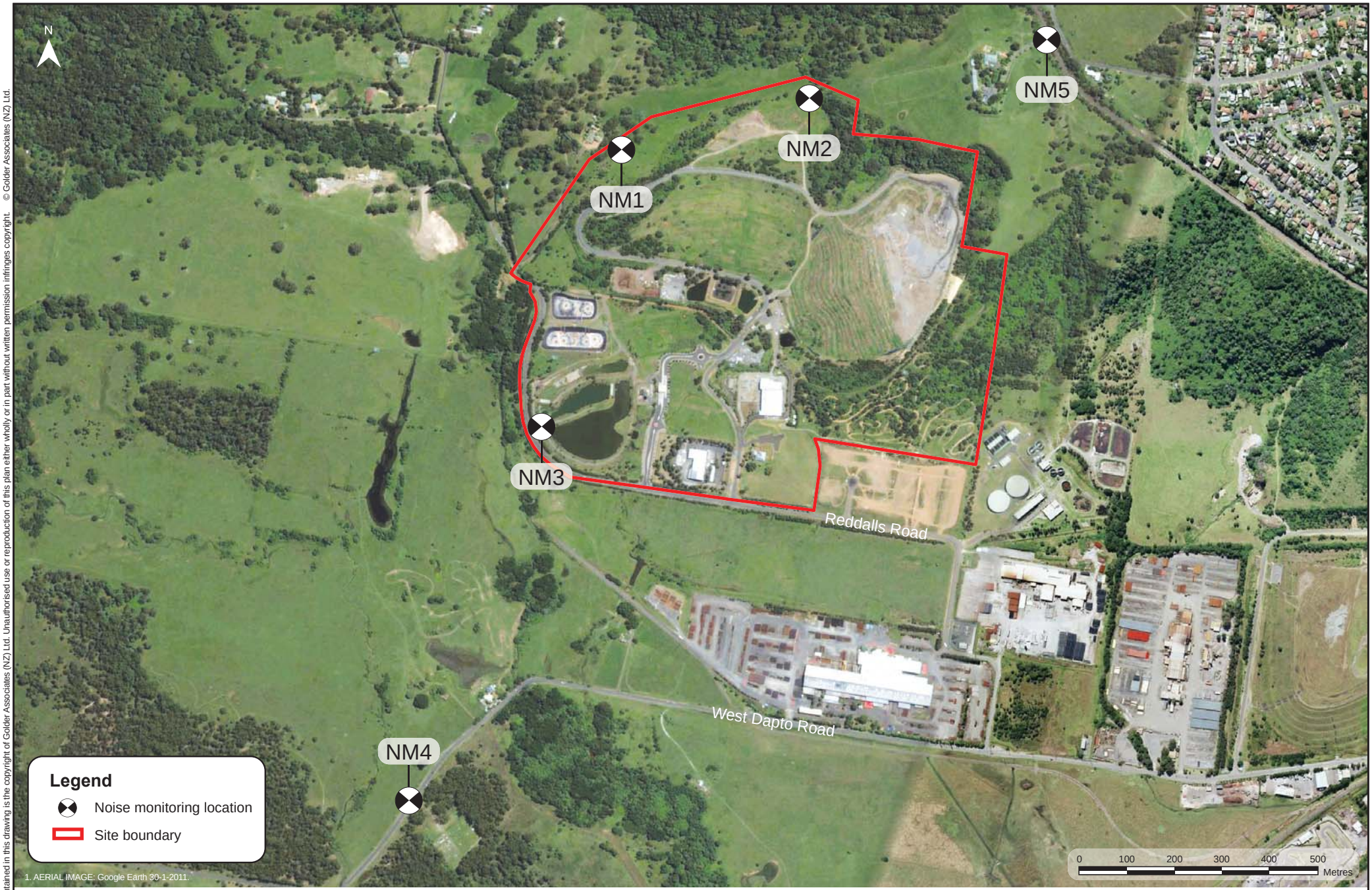
10.2 Noise Criteria

10.2.1 Processing Background Noise Monitoring

The measured L_{A90} data was processed in accordance with the requirements of the INP. This document sets out a method of determining a 'rating background level' (RBL) on which to base intrusiveness criteria. The method accounts for the variation of background noise levels by nominating a reference level that is exceeded for at least 90 percent of a measured time period.

Recorded surface wind speed, wind direction, temperature and relative humidity data from the Bureau of Meteorology Albion Park station recorded over 30 minute periods from 15 to 24 November 2011 was used to eliminate any weather affected noise data from the measured background noise levels.

An 'assessment background level' (ABL) is determined from the tenth percentile L_{A90} result for each identified period (day, evening or night), for each day of measurement. This corresponds to the 15 minute L_{A90} result that was exceeded by 90 percent of the measured L_{A90} levels in each period (the ABL is therefore roughly equivalent to the noise level exceeded for 99 percent of the measurement period). The 'rating background level' (RBL) for each day, evening or night period is determined as the median of the ABLs over all measurement days.



Golder Associates

TITLE | NOISE MONITORING LOCATIONS ATTENDED AND UNATTENDED

MARCH 2012

PROJECT | :117625003

10.2

S:\Graphics\Projects-numbered\2011\11782x\12xxx\1178212_216_GAP_Whytes Gulley\Mar12

The calculated ABL and RBL values based on the unattended noise logging at sites N1, N2 and N3 are presented in Table 10.2.

Table 10.2: ABL and RBL Values derived from the Unattended Noise Monitoring Data
(Source: Noise Assessment Appendix D)

Location	Day (07:00 – 18:00)	Evening (18:00 – 22:00)	Night (22:00 – 07:00)
	L_{A90}	L_{A90}	L_{A90}
NM1			
ABL range	32.4 – 38.8	30.1 – 32.8	26.2 – 31.7
Median of ABLs	34.1	31.9	29.5
RBL	**34**	32	30
NM2			
ABL range	30.0 – 37.8	28.9 – 31.6	23.9 – 30.7
Median of ABLs	32.9	30.1	27.2
RBL	**33**	30	30
NM3			
ABL range	36.1 – 44.3	37.7 – 49.8	35.2 – 41.3
Median of ABLs	39.4	44.5	36.3
RBL	**39**	45	36

Note: Numbers in **bold** font are the daytime RBLs to be used in the assessment.

Based upon the L_{A90} attended noise values at sites N4 and N5 it is considered the RBL values for NM2 (shown in Table 10.2) can conservatively representative the general background noise levels at these locations.

10.2.2 Construction Noise

Construction activities of the Project are proposed to be limited to the standard hours of 07:00 to 18:00 Monday to Friday and 08:00 to 13:00 on Saturdays with no work on Sundays and public holidays. However, in accordance with the ICNG the following activities may be undertaken outside of standard hours:

- The delivery of oversized plant or structure;
- Emergency work; and
- Works for which it can be demonstrated that there is a need to operate outside the recommended standard hours.

The 'noise affected' management level represents the identified point at which there may be community reaction to noise. Where the noise affected management level is exceeded, all feasible and reasonable work practises to minimise noise should be applied and all potentially impacted residences should be informed of the nature of the works, expected noise levels, duration of the works and a method of contact.

As identified within the ICNG, the noise affected management level is the background noise level (refer to Table 10.2 for RBLs) plus 10 dB(A) during standard hours and plus 5 dB(A) outside of standard hours. The ICNC also identifies a 'highly noise affected' management level of 75 dB(A), which represents the point above which there may be strong community reaction to noise.

Table 10.3 identifies the construction noise criteria as calculated from the RBL and the ICNG.

Table 10.3: Construction Noise Criteria
(Source: Noise Assessment Appendix D)

Time Period	RBL			Noise Affected Construction Noise Criteria, LAeq, 15 min			Highly Noise Affected Construction Noise Criteria, LAeq, 15 min		
	NM1	NM2	NM3	NM1	NM2	NM3	NM1	NM2	NM3
Monday to Friday (07:00 – 18:00) and 08:00 to 13:00 on Saturdays	34	33	39	**44**	**43**	**49**	75	75	75
Outside recommended standard hours	30	30	36	35	35	41			

Note: Numbers in **bold** font are the daytime noise construction criteria to be used in the assessment.

10.2.3 Operational Noise

The INP assessment procedure for industrial noise sources has two components:

- Controlling potential intrusive noise impacts in the short-term for residences; and
- Maintaining noise level amenity for particular land uses, including residences and other specified activities.

Intrusive Criteria

The "intrusiveness" criterion requires that the $L_{Aeq,15min}$ noise level from an industrial noise source should not exceed the existing Rating Background Level (RBL) for that period by more than 5 dB(A). These criteria apply to $L_{Aeq,15min}$ noise levels measured under specific meteorological conditions, determined as outlined in the INP including no precipitation and wind speeds <5 m/s). Refer to the Noise Assessment (Appendix D) for further details.

Amenity Criteria

The "amenity" criterion applies to the $L_{Aeq, period}$ noise level due to all industrial sources affecting a location. It sets an upper limit to the total noise level (L_{Aeq}) in an area from all industrial noise (existing and future). The criterion depends on the time of the day, area classifications and the relationship of the total measured L_{Aeq} (and contribution from existing industrial noise) to determine the acceptable noise level for the Project.

With reference to the INP 'Noise Amenity Area' classification, it is considered the affected area would be classified as "Urban/Industrial Interface" (which can only be used for existing situations i.e. existing Whytes Gully RRP). The acceptable amenity levels (L_{Aeq}) which apply over the whole day, evening and night period for the proposed development are, therefore, as follows:

- Day (07.00 to 18.00) 65dB L_{Aeq};
- Evening (18.00 to 22.00) 55dB L_{Aeq}; and
- Night (22.00 to 07.00) 50dB L_{Aeq}.

The existing hours of operation for Whytes Gully RRP are not proposed to change as follows:

- 7:30 to 4:30 Mon- Fri
- 8:00 to 4:00 Sat, Sun and Public Holidays

Project Specific Noise Levels

In accordance with the INP, the Project specific noise levels are the most stringent of the intrusive or amenity criteria. As identified in Table 10.4 the most stringent are the intrusive criteria. These have been utilised for the purposes of assessment of noise that would be generated during operation of the Project.

Table 10.4: Operational Noise Criteria - Intrusive and Amenity
(Source: Noise Assessment Appendix D)

Time Period	RBL (from Table 10.2)			Intrusive Criteria, $L_{Aeq,\ 15\ min}$			Amenity Criteria, $L_{Aeq,\ period}$		
	NM1	NM2	NM3	NM1	NM2	NM3	NM1	NM2	NM3
Day (07:00 – 18:00)	34	33	39	**39**	**38**	**44**	65	65	65

Notes: The **Bold** text represents the most stringent criterion, which has been adopted for the purpose of this assessment.

10.2.4 Traffic Noise

While the NSW DECC's "Environmental Criteria for Road Traffic Noise" (ECRTN) has been identified in the Project DGRs, the RNP has superseded this guideline as of 1 July 2011 for "transitional Part 3A" projects.[3]

The RNP criteria apply to new local road corridors or road redevelopments or when there is a land use development with the potential to generate additional traffic on local, sub-arterial or arterial roads. While the Project would not create new local road corridors or propose to redevelop local roads it may create additional traffic during construction. Therefore the following assessment criteria apply where traffic noise is measured for assessment in front of a building façade during peak hour.

- Day (07:00-22:00) - 55 dB $L_{Aeq,\ 15\ hr}$ (Peak Hour); and
- Night (22:00-07:00) - 50 dB $L_{Aeq,\ 9\ hr}$ (Peak Hour).

10.3 Impact Assessment

10.3.1 Noise Modelling of the Project

As identified within Chapter 8 of the EA, the Project would involve construction and lining of the proposed new cell and associated infrastructure, deposition and compaction of waste, placement of intermediate cover, removal of intermediate cover, capping and landscaping. The new landfill cell is proposed to be constructed in five stages (refer to Figure 10.2) with construction and operation of the proposed stages to predominantly occur concurrently utilising similar equipment including excavator/loader, roller, bulldozer and truck and dog.

The major activities associated with the construction and operational phases of the Project would involve the use of powered plant and equipment summarised as follows:

- Construction of new cells and other infrastructure;
- Deposition and compaction of waste – transportation and deposition of waste, and compaction;
- Placement and removal of daily and intermediate cover; and
- Capping.

The proposed new landfill cell is to be constructed and filled in five stages as outlined in Table 10.5. As identified within Chapter 8 of the EA, the Project proposes to construct and operate and cap stages of the new landfill cell simultaneously at times. This includes potential overlap of construction associated with liner construction and capping with operations.

[3] http://www.environment.nsw.gov.au/noise/traffic.htm

Table 10.5: Construction and Operations Staging
(Source: Noise Assessment Appendix D)

Stage	Proposed Liner Construction Period (*)	Proposed Capping Construction Period (*)	Operation Period
1	2013 - 2016	2016 - 2019	2013 - 2018
2A	2017 – 2018	2020 - 2021	2018 - 2020
2B	2019 – 2031	2023 - 2036	2020 - 2035
3	2035 – 2041	2038 - 2047	2035 - 2046
4	2046 – 2050	2048 - 2055	2046 - 2054

*** Not continuous during this period**

Based upon the staging, ten modelling scenarios have been developed to evaluate the potential noise effects of each proposed stage with all equipment modelled to the north and south of each stage at the closest point to the nearest receiver.

It is considered the modelling completed within the Noise Assessment is conservative and accounts for potential worst case scenarios in which all plant and equipment are operating (including cell construction, operation and capping of cell) in close proximity to one or more receivers and assumed to operate concurrently and continuously.

Noise modelling of the Project has been completed in compliance with all applicable guidelines and policies utilising CadnaA environmental noise prediction model (Version 4.2), which is internationally certified for the calculation of noise attenuation through the built and natural environment (*ISO 9613 Acoustics – Attenuation of Sound during Propagation Outdoors*). The model utilises a range of inputs including meteorological conditions, contour data developed by Golder for each construction/operational stage in addition to Golder and industry noise inventory data supplemented with reference to *Australian Standard AS 2436:2010 – "Guide to noise and vibration control on construction, demolition and maintenance sites.*

Meteorological data obtained from the local Bureau of Meteorology station indicate wind and temperature inversions are within the default meteorological data set of the CadnaA model.

Refer to the Noise Assessment (Appendix D) for the full details of the noise emission inventory, meteorological conditions and further detail on the methodology associated with the noise assessment model for the Project.

10.3.2 Construction Noise

The construction noise levels predicted during the five stages of the Project when equipment is in the northern part of each Stage is presented in Table 6. These noise levels take into account site layout, ground and atmospheric absorption and implementation of plant and equipment with appropriate silencers and broadband reversing alarms.

Table 10.6: Predicted Noise Levels - Plant and Equipment located in the Northern Part of Each Stage (Source: Noise Assessment Appendix D)

Receivers	Construction Noise Criteria[1]	Stage 1	Stage 2A	Stage 2B	Stage 3	Stage4
N1	44	18	24	29	32	38
N2	43	36	31	36	32	39
N3	49	22	28	28	25	24
N4	43	22	17	21	20	30
N5	43	14	14	15	12	23

Notes: Construction Noise Criteria: RBL + 10 dB(A). Exceedances of the Construction Noise Criteria are highlighted in **BOLD**.

Refer to the Noise Assessment (Appendix D), for the results of the predicted noise levels for plant and equipment located within the southern part of each stage, which are generally less than the northern part of each stage and are in compliance with all relevant criteria.

Compliance with the construction noise criteria is predicted during all stages of the Project at all receivers.

10.3.3 Construction Traffic

Additional construction vehicles movements would be generated during construction of the Project. With reference to the Traffic and Transport Assessment (Appendix I), it is anticipated that up to eight additional construction vehicle movements are expected during each peak hour during simultaneous liner and capping construction. In addition 12 additional staff movements associated with construction activities are anticipated with all vehicles assumed to travel during the AM and PM peak periods.

The RNP criteria apply to new roads or road redevelopments or when there is a land use development with the potential to generate additional traffic on local, sub-arterial or arterial roads and identify a daytime criterion of $L_{Aeq,15}$ 55 dB. However, as identified in Table 10.1, the closest attended noise monitoring to roads accessing the Whytes Gully RRP site (NM3) identifies an existing daytime road traffic noise level of $L_{Aeq,}$ 58 dB(A). This indicates the existing noise levels may be at, or exceeding, the NSW RNP criterion and there would therefore be no material benefit to nearby receivers if the proposed road traffic movements were required to comply with the criterion.

Golder considers that a more appropriate assessment methodology would be to determine the potential changes in road traffic noise levels resulting from the proposed construction activities and to consider what, if any, effects might be generated.

Based on the data, the predicted increase in traffic noise emissions at Reddalls Road would be 1-2 dB(A), no more than 1 dB(A) at West Dapto Road and with no increase on the Princes Highway. Taking into consideration there are no residential receivers along this section of Reddalls Road and that the noise levels at West Dapto Road would increase at most 1 dB(A) it is considered there would be negligible adverse impacts from increased traffic noise as a result of the Project.

Refer to the Noise Assessment (Appendix D), for more details of the predicted traffic noise emissions as a result of the Project.

10.3.4 Operational Noise

The plant and equipment utilised during operation of the Project would be similar to construction plant and equipment. Refer to the Noise Assessment (Appendix D) for specific operational noise emission inventory data.

Table 10.7 provides the predicted operational noise levels during the five stages of the Project at the closest receivers to the Project, taking into account site layout, distance separation, screening from existing topography, ground and atmospheric absorption and implementation of plant and equipment with appropriate silencers and broadband reversing alarms.

Table 10.7: Predicted Noise Levels – Plant and Equipment Located within the Northern Part of Site for each Stage
(Source: Noise Assessment Appendix D)

Receivers	Intrusive Criteria ($L_{Aeq,15min}$)	Amenity Criteria	Stage 1	Stage 2A	Stage 2B	Stage 3	Stage 4
N1	39	65	29	25	36	**41**	**54**
N2	38	65	**43**	**45**	**44**	**43**	36
N3	44	65	25	24	29	27	27
N4	38	65	29	30	35	34	28
N5	38	65	23	27	31	30	19

Notes: Exceedances of the Criteria are highlighted in **BOLD.**

Refer to the Noise Assessment (Appendix D), which also shows the predicted operational noise levels of plant and equipment located in the southern part of each stage of the Whytes Gully RRP, (which similar to construction are less than the northern area of the site with no exceedances identified from the modelling).

As indicated in Table 10.7, noise from the operational activities is predicted to comply with both the amenity and intrusive criteria at all of the residential receivers during all the operation phases with the exception of exceedance of the intrusive criteria during Stages 1, 2A, 2B and 3 at N2 and Stage 4 at N1 when the plant and equipment is operating within the northern part of the site. Whilst a worst case noise level of up to 45 dB(A) is predicted at N2, when compared against the daytime attended background noise levels (refer to Table 10.1) the measured L_{Aeq} of NM2 was 49 dB(A). Thus the predicted noise levels at NM2 are unlikely to be notable as they are at least 4 dB(A) below the attended background noise levels, which included the noise effects of the existing landfill activities at Whytes Gully RRP which are currently in a similar proximity to N2 as that modelled. A worst case noise level of up to 54 dB(A) is predicted at N1 during Stage 4 when the plant and equipment is operating at the northern part of the site.

Section 10 of the INP specifically sets out a process for existing industrial premises that are looking to "upgrade or expand" such as Whytes Gully RRP and the Project. It is considered implementation of the Project would include this process including consideration of feasible and reasonable noise mitigation strategies and potential consultation with the affected landholder in accordance with Section 8 of the INP and as identified in the Project's statement of commitments (refer to Chapter 21).

As discussed in the Traffic Report of the EA (refer Appendix I of the EA) and Chapter 15 of the EA, the Project does not propose to increase the annual volume of material received at the Whytes Gully RRP site and existing operational traffic movements would also not change as a result of the Project,

10.3.5 Cumulative Impact

As discussed in Section 10.3.1, construction and operational activities of the Project would predominantly be undertaken concurrently and the Project has been conservatively modelled to assess the cumulative effects of construction and operational activities by assuming all plant and equipment would operate simultaneously and continuously. For the purposes of the cumulative impacts modelled during Stage 1 of the Project, simultaneous waste relocation activity has been included.

This modelling of cumulative impacts is considered to be conservative given that each stage is large and the plant and equipment utilised during construction and operation would likely be moved around different parts of the site with the noise levels received offsite likely to vary considerably.

Because construction and operational activities would be taking place concurrently, it is considered appropriate to evaluate the cumulative noise levels against the construction noise criteria, given that construction and operation would predominantly occur simultaneously.

Table 10.8 sets out the cumulative noise levels predicted for the five stages at the closest receivers to the Project. Table 10.8 assumes all plant and equipment are located at the northern part of each stage.

Table 10.8: Predicted Noise Levels - Plant and Equipment located within the Northern Part of Each Stage
(Source: Noise Assessment Appendix D)

Receivers	Construction (Cumulative) Noise Criteria[1]	Stage 1	Stage 2A	Stage 2B	Stage 3	Stage 4
N1	44	23	25	33	37	**54**
N2	43	43	**45**	**45**	43	41
N3	49	26	30	32	30	29
N4	43	28	29	35	34	32
N5	43	23	25	32	30	25

Notes: Construction Noise Criteria: RBL + 10 dB(A). Exceedances of the Construction Noise Criteria are highlighted in **BOLD**.

Exceedances of the construction (cumulative) noise criteria are predicted during stages 2A and 2B at N2 and during Stage 4 at N1. As discussed in Section 10.3.5, these modelled exceedances are considered minor at N2. Appropriate and feasible mitigation measures introduced to reduce operational noise impacts during Stage 4 of N1 are likely to result in a reduction of cumulative noise impacts of the Project.

10.4 Mitigation and Management Measures

All modelled scenarios were below the adopted Project criteria with the exception of the following:

- Operational activities during the worst case modelled scenario where all operational equipment is continuous and in the northern part of the established noise criteria for stages 1 to 3 of receiver N2 and Stage 3 and 4 at N1.
- The cumulative effects of noise from the worst case scenario where concurrent and continuous construction and operation activities are modelled with all construction and operation equipment in the northern part of Stages 2A and 2B at receiver N2 and in the northern part of Stage 4 at receiver N1.

It is considered that for the purposes of assessment the modelling is precautionary and represents conservative worst case scenarios. Furthermore if exceedences do occur, due to the conservative nature of the modelling, they would likely be short term and temporary given the size of the site and the likelihood of all plant and equipment operating in close proximity to each other concurrently and continuously and at the respective northern area of each relevant stage.

It should further be noted that receivers N1 and N2 are currently exposed to noise associated with the existing Whytes Gully RRP and it is considered the Project would not materially alter the existing acoustic amenity of the surrounding receivers when compared to the historic landfill activities. However, mitigation measures would be proposed to limit noise impacts of the Project in accordance with relevant policies.

The ICNG provides a summary of potential noise mitigation measures, which would be adopted for the Project. These include:

- All mobile equipment should be selected to minimise noise emissions. Equipment should be fitted with appropriate silencers and be in good working order.

- To reduce the annoyance associated with reversing alarms, broadband reversing alarms would be used for all site equipment.
- Construction activities would be limited to the recommended construction hours where feasible and reasonable.

In accordance with the INP best management practice would be utilised to manage and control noise impacts of the Project at the source. In addition consultation with the nearby affected residential receivers is proposed to assist in reducing uncertainty, misconceptions and adverse reaction to noise. In this regard the following mitigation and management measures are proposed:

- Ongoing contact with residents who may be affected by cumulative and operational noise exceedances and communicate details of the construction and operational program on a regular basis;
- Provide a community liaison phone number and permanent site contact so that noise complaints can be received and address in a timely manner; and
- Respond to any noise complaints, in a timely manner with monitoring undertaken and reported as appropriate.

11.0 GREENHOUSE GAS

This chapter provides a summary of the finding of the Golder Associates (January 2012) "Greenhouse Gas Emissions Assessment" (GHG Assessment) to address the DGR's. The GHG Assessment is provided in Appendix E of the EA.

The Director-General's requirements	
■ ***Greenhouse Gas – Including:*** ▪ ***a quantitative assessment of the scope 1 and 2 greenhouse gas emissions of the project, and an assessment of the energy efficiency of the project in comparison to industry best practice***	**Chapter 11**

11.1 GHG Assessment Methodology

The following regulatory guidance was used in the preparation of the emissions assessment:

- *National Greenhouse and Energy Reporting (Measurement) Determination 2008 as amended*;
- *National Greenhouse and Energy Reporting (Measurement) Technical Guidelines 2011* (NGER Guidelines);
- NGER Solid Waste Calculator Version 1.6;
- National Greenhouse Accounts Factors by Department of Climate Change and Energy Efficiency - July 2011 (NGA Factors); and
- Department of Energy, Utilities and Sustainability (2005) "Guidelines for Energy Savings Action Plans".

To appropriately address the DGRs and provide a quantitative assessment of Scope 1 (emissions that arise from direct sources within the assessment boundary such as emissions from waste, fuel and energy use) and Scope 2 (emissions that arise from an activity outside the assessment boundary including from the consumption of electricity produced such as electricity produced at a power station) the follow methodology has been employed in the GHG Assessment, which is based upon the regulatory guidance above.

11.1.1 Assessment boundary

The assessment boundary is confined to:

- Emissions resulting from the direct construction of the Project including fuel and electricity emissions from plant and fixed sources;
- Emissions resulting from the operation of the Project including emissions from:
  - Waste only;
  - Electricity usage from site office and leachate treatment plant; and
  - Fuel usage from plant and generators.
- Emissions that occur following the cessation of the Project including emissions from:
  - Waste; and
  - Electricity emissions from leachate treatment.

Other emissions not included in this assessment are emissions associated with the delivery of the waste to the Project.

Greenhouse Gases Assessed

The greenhouse gases considered in this assessment are:

- Methane;
- Carbon Dioxide; and
- Nitrous Oxide.

Depending on the specific activity, only some of these greenhouse gases are required to be assessed. For example, only methane is considered for emissions from landfill as carbon dioxide is considered to be biogenic and would have been emitted regardless.

11.1.2 Waste Data

The NGER Solid Waste Emissions Calculator (Version 1.6) is a default Method 1 emissions calculator was used to estimate methane generated from waste disposal. Methane generation is estimated using waste stream data for the site and the Tier 2 First Order Decay (FOD) Model provided in the IPCC Guidelines for National Greenhouse Gas Inventories.

Waste Tonnages

Waste tonnages inputs are required for the NGER model in order to estimate the emissions arising from waste over time. Waste tonnage data adopted for this assessment was based on the average annual weighbridge data for the previous three years (2009 to 2011). These three years of data are considered to provide an appropriate average of tonnages accepted and cover material used.

Waste Stream Designation

The NGER Solid Waste Emissions Calculator incorporates default waste composition percentages for the Municipal (MSW), Commercial & Industrial (C&I) and Construction & Demolition (C&D) waste stream categories, as outlined in the NGER (measurement) Technical Guidelines 2010, Section 5.11. As the Project only accepts MSW and C&I waste, the waste data was evaluated to estimate the average accepted percentage of MSW and C&I waste accepted for use in the modelling.

Waste stream data adopted for this assessment was based on the average annual weighbridge data for the previous three years (2009 to 2011) provided by Council.

Waste Mix Types

Default NGER waste mix percentages for both MSW and C&I were adopted for this assessment.

11.1.3 Fuel and Electricity Emissions

The emission factors used to calculate both fuel and electricity emissions from on site activities were adopted from NGER Technical Guidelines (2011). Fuel and electricity emissions for the site are associated with all plant and fixed equipment used in addition to peripheral activities including commercial site office and weighbridge.

11.1.4 Landfill Gas Emissions

A consideration of emissions associated with the combustion of LFG collected has been assessed for the Project. The gases assessed are nitrous oxide and methane as described in Table 2.3.2A (NGER 2011 Technical Guidelines).

A collection efficiency of 50 percent has been adopted for this assessment. This value is considered to be acceptable (and conservative) amongst current landfill operators where landfill cells are engineered and landfill gas management is undertaken by a competent contractor.

11.2 Potential Impacts

11.2.1 Emission Assessment Results

Landfill Methane Emissions

The estimated methane emissions from the waste deposited within the proposed new cell are detailed in Figure 11.1. This also estimates the emissions associated from each stage of the Project. Emissions are predicted to peak at the cessation of filling in 2053 at approximately 105 $ktCO_2e$. This is following a deduction of 10 percent from methane oxidation.

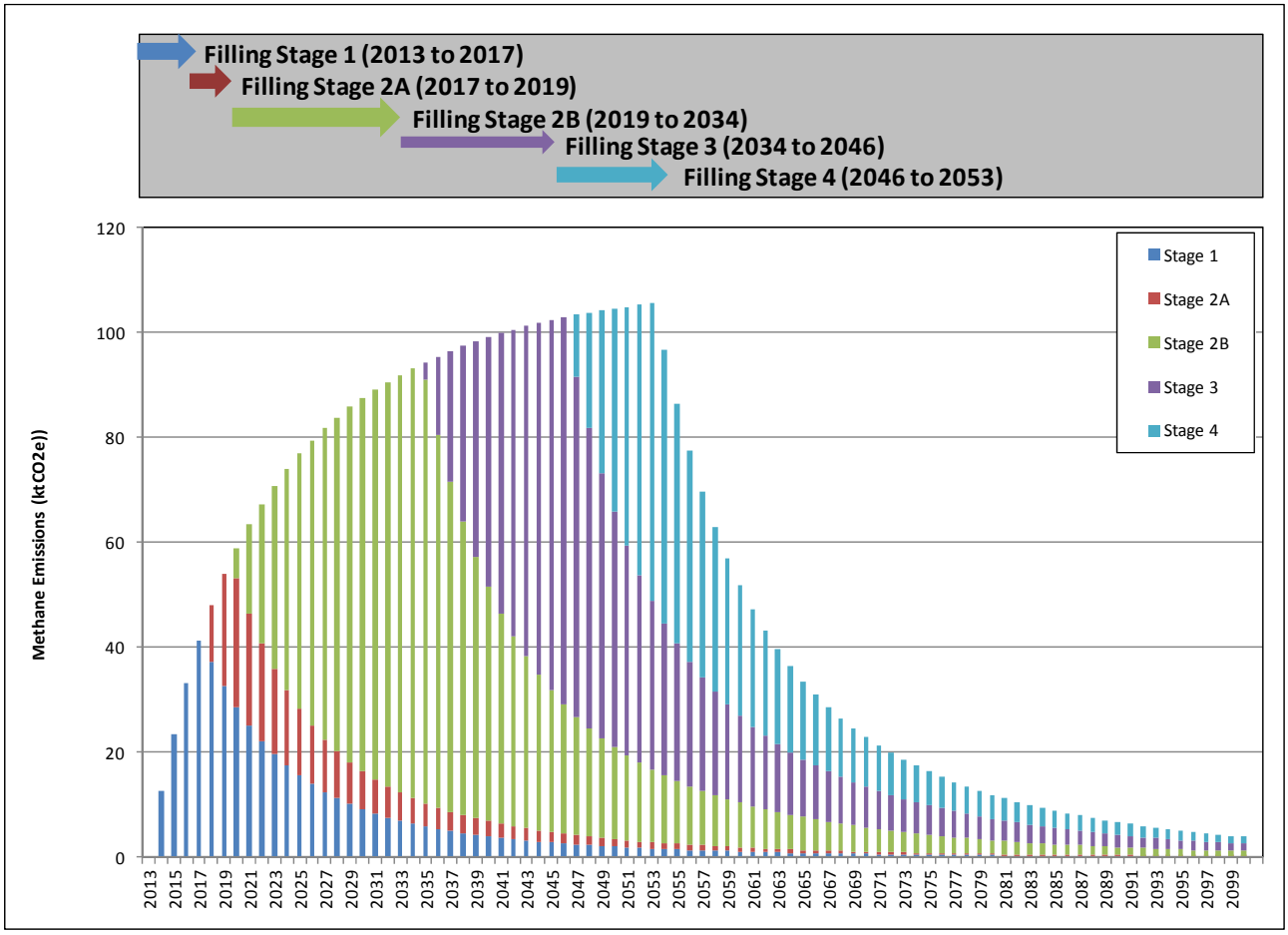


Figure 11.1: Methane Emissions from Waste

(Source GHG Assessment AppendixE)

Table 11.1 provides a summary of estimated annual emissions from landfill for the Project.

Table 11.1: Estimated Annual Landfill Emissions
(Source GHG Assessment Appendix E)

Year Ending	Methane Generated ($ktCO_2e$)	Emissions - Post CH_4 Oxidation ($ktCO_2e$)
2013	0	0
2014	14.04	12 635
2015	26.20	23.58
2053 (peak)	117.37	105.63

Fuel and Electricity Emissions

Fuel emissions assessed are for diesel fuel only and have been estimated as the fuel usage information provided by Wollongong City Council was considered unusually low. Therefore a conservative estimate is provided. Usage data were based on the typical fuel consumptions of the plant proposed for both the operation and construction of the Project. The operational emissions were based on a 6 day per week, 10 hours per day operation and included a compactor, an excavator, a front end loader, a haulage truck and one generator.

Fuel usage during the construction phases would not be continuous as construction of the liner would only be required prior to placement of the waste within the cells. Therefore the annual fuel usage has been estimated for the entire Project (assumed to be a total of 5 years) and averaged for the operational life of the Project (assumed as 40 years) to obtain an annual fuel emission. Plant utilised include a roller, an excavator, a dozer and includes provisions for a further 2 excavators and 3 trucks for the relocation of waste from the existing eastern gully landfill.

Table 11.2 details the fuel related emission estimates for the Project:

Table 11.2: Annual Emissions Associated with Fuel Combustion
(Source GHG Assessment Appendix E)

Source	Annual Quantity (kL)	Energy Content Factor (GJ/kL)	Energy Content (GJ)	Emission Factor[(1)] kg CO_{2-e}/GJ	Emission (tCO_2-e)
Operational Consumption					
Fuel Data - Diesel	334	38.6	12,892	CO_2 – 69.2	892
				CH_4 – 0.1	1
				N_2O – 0.2	3.0
Total					***896***
Construction Consumption					
Fuel Data - Diesel	167	38.6	6,450	CO_2 – 69.2	446
				CH_4 – 0.1	1.0
				N_2O – 0.2	1.0
Total					***448***

1. Emission Factors taken from the NGA Factors Workbook 2010

The operational electricity usage for the site has been estimated at 1,036 MWh per year. This was estimated through electricity invoices provided by Wollongong City Council for three quarters with the last quarter being averaged from the first three and conservatively doubling the electricity consumption of the leachate treatment plant to account for leachate treatment plant upgrades.

The electricity consumption as a result of the construction phase of the Project has been estimated at 5 percent of the normal annual operational usage. This figure is similar to the fuel usage estimation. Table 11.3 provides a summary of the estimated electricity related emissions for the site.

Table 11.3: Annual Emissions Associated with Electricity Consumption

Source	Annual Quantity	Emission Factor[(1)]	Emission (tCO_{2-e})
Operational Consumption	1,036,000 kWh	0.89 kg CO_2/kWh	922
Construction Consumption	103,600 kWh	0.89 kg CO_2/kWh	92
Annual Total			**1,014**

1. Emission Factors taken from the NGA Factors July 2011

Emissions Associated with the Combustion of Landfill Gas

The emissions associated with the combustion of landfill gas have been estimated based on a 50 percent gas capture efficiency during the operation of a LFG gas management system involving either flaring or electricity generation. Table 11.4 below summarises the estimated annual emissions associated with the combustion of LFG.

Table 11.4: Annual Emissions Associated with the Combustion of LFG
(Source GHG Assessment Appendix E)

Year	Quantity of CH_4 Collected (m^3)	N_2O Emissions (tCO_2e)	CH_4 Emissions (tCO_2e)	Total Combustion Emissions (tCO_2e)
2013	0	0	0	0
2014	981,120	1.1	177	178.1
2015	1,830,840	2.1	331	333.1
2053 (closure)	8,216,880	9.3	1,487	1,496.3

Preliminary modelling (refer to Figure 11.2 and Table 11.5) indicates that LFG production would support flaring or electricity generation. Assuming a 50 percent capture efficiency methane emissions would be reduced in 2014 from 12,635 tCO_2e to 6,318 tCO_2e and during peak LFG generation (2053) from 105,632 tCO_2e to 52,816 tCO_2e.

The preliminary modelling indicates that feasible landfill gas capture of the Project would commence 1 to 2 years (2014/2015) after operation of the Project, with modelling indicating that methane would not be generated during the first year of operation (2013). In addition due to the height of the waste mass, it is not operationally feasible to collect the gas prior to this time. However, infrastructure to capture LFG is proposed to be installed during construction of the Project and on a progressive basis (refer to Chapter 8 of the EA) to ensure that energy use of the Project is reduced where feasible.

While gas collection efficiencies modelled for the Project have been estimated at 50 percent, if practices such as sacrificial horizontal gas collection are utilised, higher gas capture efficiencies could be achieved, which could further reduce GHG emissions beyond that modelled for the Project.

Table 11.5: Estimated Annual Landfill Emissions Following Combustion @ 50 percent Capture

Year Ending	Methane Emissions (tCO_2e)	Residual Emissions - Post CH_4 Oxidation (tCO_2e)
2013	0	0
2014	12,635	6,318
2015	23,583	11,792
2053 (peak)	105,632	52,816

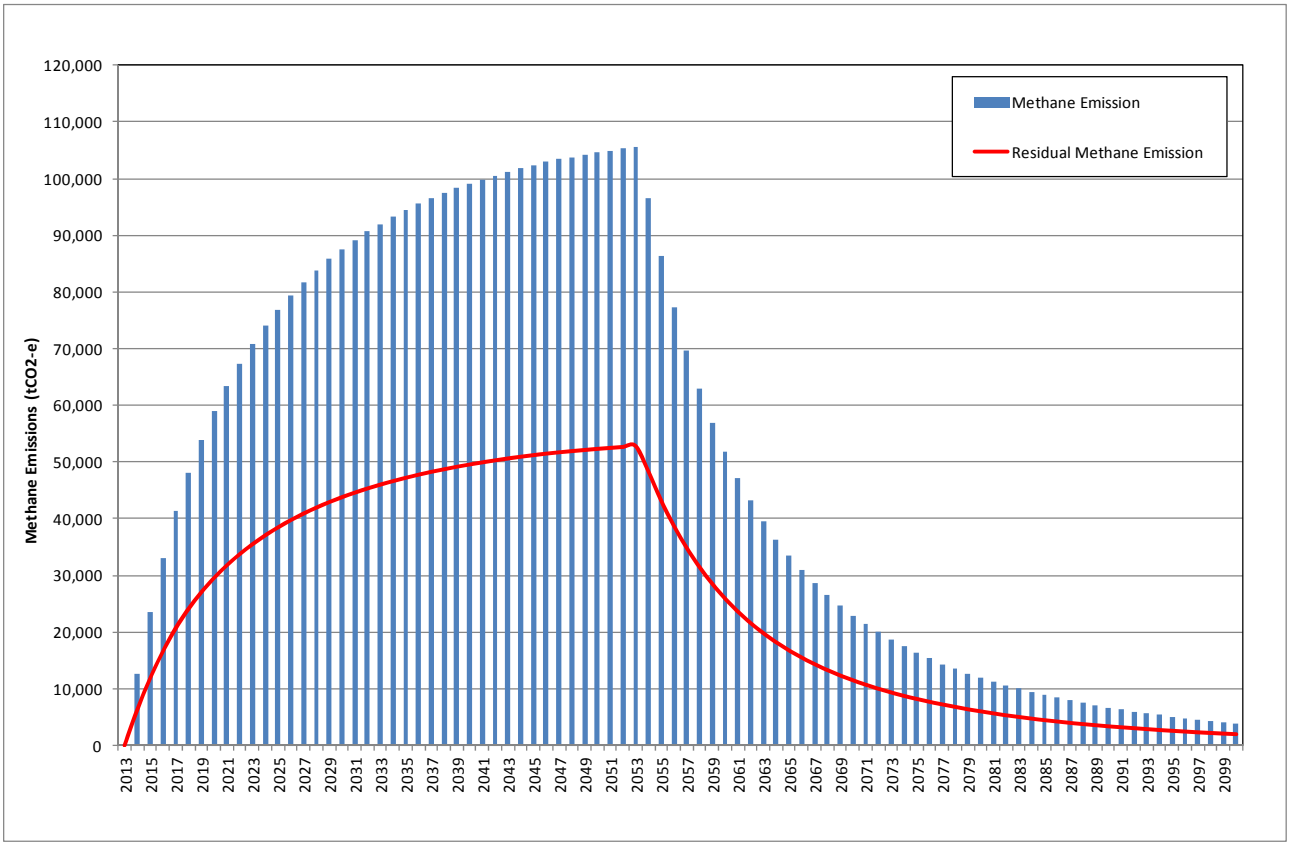


Figure 11.2: Residual Methane Emissions Following Capture and Combustion

11.2.2 Annual Net Estimated Emissions

Table 11.6 summarises the estimated net annual emissions for the Project. It has been estimated that no landfill gas would be generated from the waste deposited in the first year of the Project. However, from 2014, emissions would be mitigated assuming 50 percent capture efficiencies can be achieved.

Table 11.6: Estimated Project Annual Net Emissions (tCO_2e)

Activity	2013	2014	2015	2053 (Peak)
Landfill Emissions Post Oxidation (Scope 1)	0	6,318	11,792	52,816
Fuel Emissions – Operational (Scope 1)	896	896	896	896
Fuel Emissions – Construction (Scope 1)	448	448	448	448
Electricity Emissions – Operational (Scope 2)	922	922	922	922
Electricity Emissions – Construction (Scope 2)	92	92	92	92
Combustion Emissions (Scope 1)	0	178	333	1496
Total Emissions	**2,358**	**8,854**	**14,483**	**56,670**

11.2.3 Project Impacts

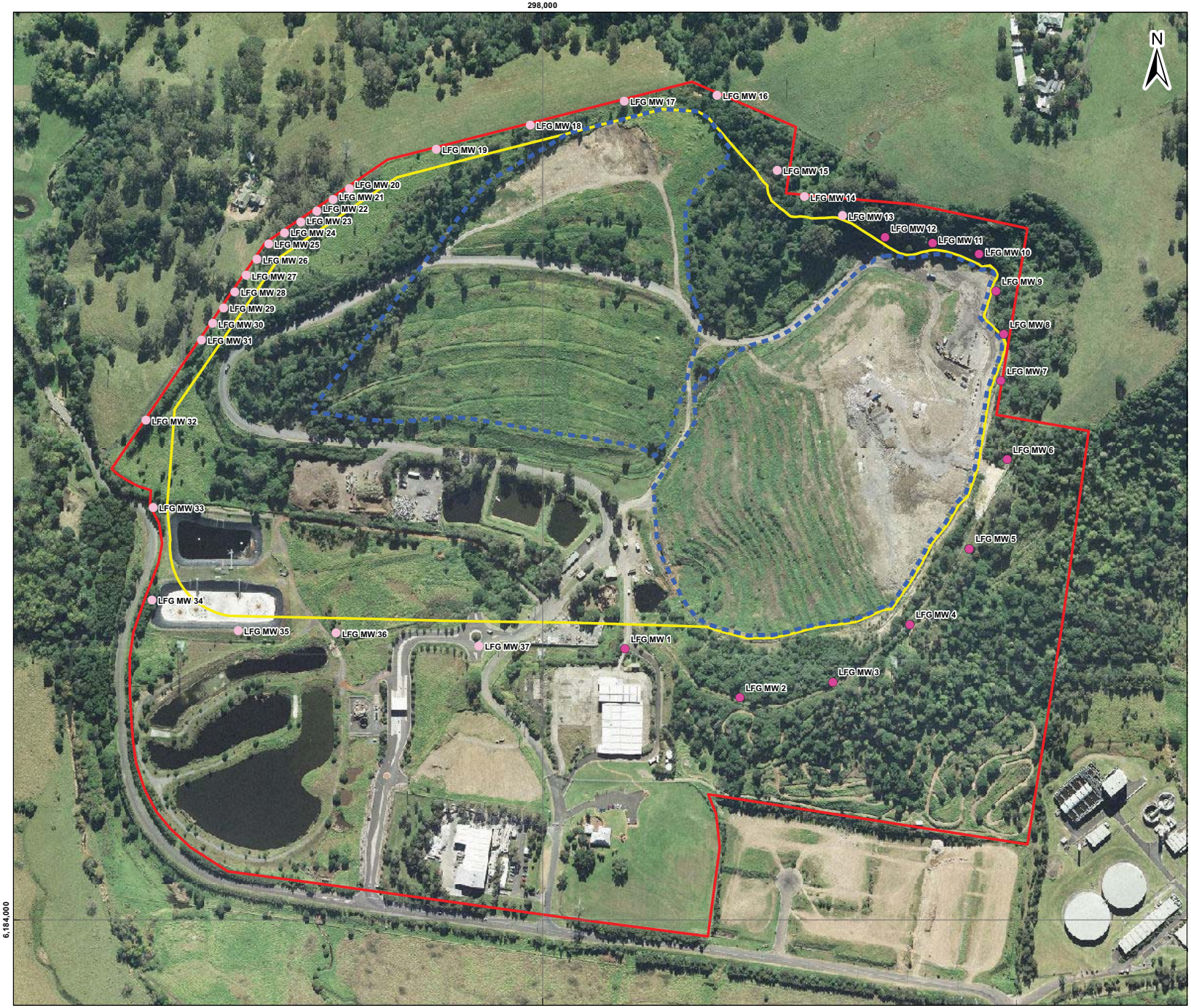
Estimates of Australia's greenhouse gas emissions are produced by the Australian Department of Climate Change and Energy Efficiency (Department of Climate Change and Energy Efficiency (2009) “State and Territory Greenhouse Gas Inventories 2009”). NSW emissions in 2009 (the latest year of data available) were 161 million tonnesCO2e. Therefore by conservatively calculating the estimated peak Project annual net emissions of the Project (in 2053) against the NSW emissions in 2009, it can be seen that the Project would generate less than 0.03 percent of the state’s total emissions.

11.3 Landfill Gas Monitoring

In addition to the surface and building accumulation monitoring currently undertaken at the site described in Chapter 7. Wollongong City Council would install a subsurface landfill gas monitoring network. The installation of the landfill gas monitoring bores would be staged, with the first stage of development concentrating on areas where landfilling of waste currently occurs and where the largest risk to residents may exist. Refer Figure 11.3 for Subsurface Landfill Gas Monitoring Locations.

Wells to be installed initially are located along the eastern boundary of the landfill LFGMW01 through to LFGMW12). The monitoring system would be expanded as the active tipping face moves towards the west. However, installation along the north western boundary of the site will be a priority as this is the area closest to the nearest residence (LFGMW20 through to LFGMW31).

Refer to the draft LEMP (Appendix P) for further details.

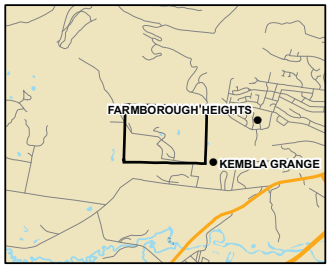


File Location: J:\GIS\Jobs\117625003_Wollongong Council_New Landfill Cell_Whytes Gully\Workspaces\117625003_120_R_F0006_Proposed_LFG_MonitoringLocations_Rev0.mxd

WHYTES GULLY NEW LANDFILL CELL ENVIRONMENTAL ASSESSMENT

WOLLONGONG CITY COUNCIL

PROPOSED LANDFILL GAS MONITORING LOCATIONS



LEGEND

- Proposed Landfill Gas Monitoring Wells (Stage 1)
- Proposed Landfill Gas Monitoring Wells (Future Stages)
- Site Boundary
- Approximate Extent Of Waste
- Extent of Landfill Works

NOTES

Extent of waste based on site observations and information provided by Council.

Aerial Ortho-Photograph provided by AAM Pty. Ltd. taken on 16 May 2011, Reference 18763A. Image Georeferenced.

Extent of landfill works as per Golder Design Report.

0 25 50 100 150 metres

SCALE (at A3) 1:4,000

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: 117625003
DATE: 6/03/2012
DRAWN: FA`
CHECKED: JMc

FIGURE 11.3

Golder Associates

11.4 Energy Efficiency Mitigation Measures

As identified by OEH since 1990 emissions generated from waste have decreased by a quarter as increased waste associated with growing populations and industrial production have been offset by higher recycling rates and methane recovery at landfills (Source NSW OEH http://www.environment.nsw.gov.au/climatechange/emissionsoverview.htm accessed March 2012).

A decrease in emissions from existing landfill activities per annum is also likely to occur as a result of the Project, given that Chapter 4 of the EA identifies efficient waste management practises, increased resource recovery and recycling initiatives proposed for the Project (and within Wollongong LGA) are projected to result in the total material (including cover) placed in the Project landfill to be less per year than the existing Whytes Gully RRP site despite population and total waste increase projections.

Furthermore as discussed in the previous section and shown in Figure 11.2, capture and combustion of landfill gas (through a LFG gas management system committed to as part of the Project) would greatly reduce the methane emissions as a result of the Project.

As part of their commitment to reducing the energy use of the Project and the Whytes Gully RRP site, Wollongong City Council is currently implementing studies to examine the feasibility of gas utilisation as a result of the Project and identifying suitable procurement models for the capture of landfill gas. During the construction of the Project, it is proposed that infrastructure to capture LFG be installed on a progressive basis.

Further energy efficiency measures proposed as a result of the Project would include the adoption of energy efficient plant and construction techniques to reduce the quantity of fuel emissions. This may include measures such as operating plant from side to side rather than up and down slopes and maintaining efficient maintenance of plant and equipment. In order to monitor the effectiveness of the energy efficiency of the Project including the identified mitigation measures, an Energy Savings Action Plan for the Project would be completed in accordance with the “Guidelines for Energy Savings Action Plans (DEUS 2005).

12.0 SOIL AND WATER

This chapter provides detailed information about the design and operation of the Project with respect to soil, surface water, groundwater and leachate. The soil and water chapter makes reference to the following documents provided in the Appendices of the EA:

- Golder Associates (2012a) "Whytes Gully New Landfill Cell, Geotechnical Investigation Report " (Geotechnical Investigation) (Appendix G1)
- Golder Associates (2012e) "Whytes Gully New Landfill Cell, Preliminary Environmental Site Assessment" (PESA) (Appendix G2)
- Golder Associates (2012c) "Whytes Gully New Landfill Cell, Hydrogeological Investigation Report" (Hydrogeological Investigation) and Golder Associates (2012r) "Hydrogeological Investigation Addendum" (Addendum) (Appendix G3)
- Golder Associates (2012l) "Whytes Gully New Landfill Cell: Surface Water Assessment" (Surface Water Assessment) (Appendix G4)
- Golder Associates (2012j) "Leachate Treatment Plant Operation Review" (Leachate Assessment) (Appendix G5)

The Director-General's requirements	
■ ***Soil, Water and Leachate including:***	
▪ ***The proposed erosion and sediment controls during construction and operation***	***Chapter 12***
▪ ***The proposed stormwater management system, including the capacity of onsite detention systems, and measures to treat, reuse or dispose of water;***	
▪ ***Consideration of potential acid sulfate soils, salinity, soil contamination and flooding impacts of the proposal***	
▪ ***Potential impacts on watercourses and groundwater; and***	
▪ ***The proposed leachate management systems.***	

12.1 Soil

Three investigations were undertaken for the Project associated with soils and their management:

- Geotechnical Investigation;
- Hydrogeological Investigation and Addendum; and
- PESA.

The following is a summary and discussion of the key findings of these investigations.

12.1.1 Existing Environment

Geology

A summary of the Geology at the site in presented in Chapter 6.

Soils

The site is located close to the Illawarra escarpment and is predominantly cleared with small patches of vegetation. The 1:100 000 Soil Landscape Series Sheet 9029-9129, Wollongong-Port Hacking (Soil Conservation Service of NSW, 1990) indicates that the soil on the site is primarily of the Gwynneville residual soil landscape group with some pockets of Hawkesbury colluvial soil located along the upper slopes at the north of the site and Fairy Meadow soil (of swamp origins) located at the southwest and southeast boundaries of the site.

A review of the Western Gully EIS (Scott and Furphy 1982) indicates that:

- The steeper sloping sections of the site are overlain by a variable thickness of colluvium (fine sand and silt) and residual soil (silty to sandy clays of medium to high plasticity), broadly corresponding with the Hawkesbury and Gwynneville soil landscape groups described in Table 12.1, respectively. It is understood that the colluvium underlying the landfill has been removed.
- The gullies generally feature 0.2-0.4 m of topsoil, 0.4-0.8 m of clayey silt and 2-3 m of silty to sandy clay; and
- The lower sections of the site feature a zone of alluvium, gravels and sands which corresponds to the Fairy Meadow soil landscape group described in Table 12.1.

A description of each of the soil landscape groups is included in Table 12.1.

Table 12.1: Description of Soil Landscape Groups – Whytes Gully

Soil Landscape Group	Origin	Description		
		Landscape	Soil	Limitations
Gwynneville	Residual	Footslopes of the Illawarra Escarpment and isolated rises of the Wollongong Plain, local relief 10-70 m, slopes 3-25%, broad to moderately (250-850 m) rounded ridges and gently inclined slopes, structural benches and occasional rock outcrops and extensively cleared tall open-forest and open-forest.	Shallow (50-100 cm) Brown Podzolic Soils and Xanthozems on upper slopes, Lithosols on simple slopes and shallow (<50 cm) Brown Earths on midslopes and lower slopes.	Extreme erosion hazard, steep slopes, mass movement hazard, local flooding, reactive subsoil and impermeable, low wet bearing strength clay subsoil.
Hawkesbury	Colluvial	Rugged, rolling to very steep hills on Hawkesbury Sandstone, local relief 100-200 m, slopes >25%, surface rock >50%, narrow crests and ridges, narrow incised valleys, steep sideslopes with narrow rocky benches, broken scarps and boulders, mostly uncleared eucalypt woodland, open-forest (dry sclerophyll forest) and tall open-forest (wet sclerophyll forest).	Shallow (<50 cm) discontinuous Lithosols/Siliceous Sands associated with rock outcrop, Earthy Sand, Yellow Earth and locally deep sands on inside of benches and along joints and fractures, localised Yellow and Red Podzolic Soil associated with shale lenses, Siliceous Sand on narrow valley flats.	Extreme erosion hazard, mass movement (rock fall) hazard, steep slopes, shallow, stony, highly permeable soil, very low soil fertility.
Fairy Meadow	Swamp	Alluvial plains, floodplains, valley flats and terraces below the Illawarra escarpment, almost completely cleared low forest and woodland.	Friable Alluvial Soil and Siliceous Sand on the upper floodplains with dark brown sand and heavy clays on lower alluvial flats, Prairie Soil and Yellow Podzolic Soil.	Flood hazard, low wet bearing strength, highly permeable soil, high seasonal water tables.

12.1.2 Soils Impact Assessment

Acid Sulfate Soils

A search of Acid Sulfate Soil (ASS) for the Whytes Gully RRP site was carried out through a review of the website maintained by the Australian Soil Resource Information Service (ASRIS). According to the ASRIS, there is a low probability (type B4) of occurrence of acid sulfate soil related to the site. A copy of the acid sulfate soil search results is provided in the PESA (Appendix G2).

Impacts from ASS, if present at the site, include oxidation of ASS leading to generation of sulphuric acid leaching into surface water.

Prior to construction of the Project commencing, a Construction Environmental Management Plan (CEMP) would be prepared. For the event of discovery of ASS, the procedures would be implemented to mitigate potential impacts on the environment. These procedures would be documented in the CEMP and may include:

- Disposed of ASS at an appropriately a licensed landfill. ASS disposed to landfill must be treated prior to disposal in accordance with procedures outlined in the *Acid Sulphate Soil Manual, Acid Sulfate Soil Management Advisory Committee, 1998*.
- If storage of the ASS is required, excavated material shall be temporarily stockpiled in a pond within a bunded area to collect drainage and a thin layer of lime added to the base and cover of the stockpile.
- All procedures shall ensure the ASS do not oxidise.

Soil Contamination

The existing potential for contamination associated with the Whytes Gully RRP site has been assessed in the PESA (Appendix G2). Based on the desktop investigation performed the following statements are made:

- It is understood that historical use of the site has largely been rural prior to the commencement of landfill operations;
- Landfilling operations in the Western Gully Cell commenced in 1984 and landfilling operations in the Eastern Gully commenced in 1993;
- The construction of landfill associated infrastructure and amenities including surface water and leachate ponds, the MRF and the SWERF also occurred during the period from 1985 to 2001;
- WorkCover NSW holds three Dangerous Goods Licences for the site. Based on site observations and information provided by Wollongong City Council, the dangerous goods are understood to no longer present on site, with the exception of sodium hydroxide stored as part of the LTP; and
- Whytes Gully RRP operates under an existing Environment Protection Licence (EPL) (EPL No. 5862). Non-compliances between 2001 and 2008 have been recorded involving leachate overflow into the stormwater dam and incomplete analytical programs.

Based on the Whytes Gully RRP site history and existing site conditions, landfilling is considered a likely potential source of contamination.

Golder has undertaken limited sampling, field screening and laboratory analysis of:

- sediments from two surface water ponds;
- surface soils from the area adjacent to the old stockyard; and
- surface soils from the area of the old farm house and backfilled surface water ponds.

No contaminants above the selected criteria for commercial / industrial landuse have been encountered in the samples analysed (refer Appendix G2).

In the event of discovery of previously unidentified area(s) of potentially contaminated material, procedures would be implemented to mitigate potential impacts on the environment. These procedures would be documented in the CEMP and may include the following:

- If required, OEH would be promptly notified of any suspected potentially contaminated ground that is exposed during construction activities;
- Advice would be immediately sought from a suitably qualified and experienced contaminated site consultant;
- Any suspected contaminated materials excavated during site works would be stockpiled on a sealed surface or on plastic sheeting. The stockpile would also be covered to prevent wind or rain removing any of the material. The stockpile would not be placed in the vicinity of sensitive environmental receivers such as vegetated areas. A spoon drain would be excavated on the downgradient side of the stockpile and any run-off would be appropriately treated prior to release;
- Stockpiles would be adequately secured to prevent unauthorised access;
- Stockpiled material would be sampled for testing. Reuse or disposal options would be based on the results of laboratory analysis in accordance with relevant legislation;
- All confirmed contaminated material would be excavated and disposed of off-site in a suitably licensed facility in accordance with OEH regulations;
- Any workers who come in contact with suspected contaminated material would report the exposure and take appropriate precautions in terms of the project's adopted OH&S;
- Any contaminated waste identified or generated during the works would only be disposed of in accordance with OEH guidelines.
- If necessary, a Remedial Action Plan would be prepared and implemented in accordance with OEH

Soil Erosion

Erosion is most likely to occur during major rainfall events and heavy wind. There is the potential for erosion of soils during construction and operation, particularly upon removal of top soil and during the excavation works that would be required for the preparation for cell construction. Any erosion would potentially be accentuated via the movement of construction machinery, vehicles and personnel and would also be further exacerbated by rain. There is also the potential for aeolian (wind) erosion to occur from any unsecured stockpiles of materials or spoil, as well as any exposed ground during construction, and/or during operation.

The CEMP would contain a range of appropriate erosion and sediment control measures that would be required for implementation, monitoring and maintenance during the construction of the Project.

Construction

An Erosion and Sedimentation Control Plan would be developed as part of the CEMP in general accordance with the following erosion and sedimentation control principles:

- Construction of earth bunds and diversion drains upslope and around the perimeter of construction areas where surface disturbance occurs, to prevent clean surface water entering these areas.
- Erection of silt fences or straw bales at strategic locations (i.e. around stockpiles) to prevent the migration of fires.
- Construction of temporary sediment retention ponds.
- Installation of water recycling equipment for dust suppression as needed.
- Reducing the surface area disturbed by construction activities at any one time.

- Regular inspection and maintenance of sediment and erosion control structures.
- Protecting and retaining vegetation and surface cover where possible.
- Placement of an erosion protection barrier (e.g. grassing) at the completion of works.
- Using designated access roads and paths where possible.
- Removing soil adhering to the wheels and undercarriage of trucks (e.g. by wheel wash) prior to departure from the Project site.
- Limit both the size of any stockpile footprints and the time between excavation and removal off-site of materials.
- Do not place stockpiles within 30 m of any watercourse.
- Stabilise all disturbed areas as soon as practicable. Temporary vegetative destabilisation techniques must be applied to any disturbed soil to prevent areas remaining bare for more than 28 days.
- Stabilise all temporary and permanent drainage immediately.
- Maintain all sediments and erosion control measures in effective condition until the works are completed and the site is stabilised.
- Release “Dirty” Stormwater, captured and stored by sediment and erosion control measures or site works, after treatment and testing to confirm compliance with relevant criteria.

Operation

Proposed erosion and sediment control measures that would be applied during operation of the Project are outlined in the draft LEMP (Appendix P).

Erosion control works are required for all works where the possibility for soil erosion exists and are used to control and minimise erosion and sedimentation. Erosion control measures employed at the site incorporate the following:

- reducing the area of exposed soil including recently constructed sections of the landfill;
- retain existing vegetation onsite as long as possible;
- diverting clean run on away from disturbed areas;
- reducing the length and steepness of slopes;
- rehabilitating capped areas in the timely manner;
- applying sediment control measures to intercept and retain sediment on site (eg drains and sedimentation ponds);
- an inspection maintenance and cleaning program for sediment control structures to maintain capacity and integrity;
- wheel wash facilities would be at site egress points, to prevent the tracking of mud or loose sediment off site;
- using designated access roads and paths where possible;
- Inspection monitoring and maintenance of sediment control structures; and
- Surface water monitoring in the sedimentation ponds and Dapto Creek.

Salinity

The NSW Natural Resources Atlas sourcing information from the Salinity Hazard Map of NSW (DIPNR, unknown date) does not indicate a soil salinity hazard at the site. A copy of the salinity search results is provided in the PESA (Appendix G2).

12.1.3 Mitigation and Management of Soil Impacts

The following mitigation and management measures, as indicated above, would be adopted for soil:

- For the event of discovery of ASS, procedures would developed to mitigate potential impacts on the environment. These procedures would be documented in the CEMP.
- For the event of discovery of potential soil contamination, procedures would developed to mitigate potential impacts on the environment. These procedures would be documented in the CEMP.
- The CEMP would contain an Erosion and Sedimentation Control Plan and would include a range of appropriate erosion and sediment control measures that would be required for implementation, monitoring and maintenance during the construction of the Project.
- The Draft LEMP outlines erosion and sediment control measures to be applied during operation of the Project .

12.2 Groundwater

The Hydrogeological Investigation and Addendum have been completed for the Project to:

- Establish the hydrogeological conditions across the Whytes Gully RRP site;
- Establish the groundwater quality across the site;
- Determine potential impact on groundwater from the Project; and
- Identify a monitoring program and compliance with appropriate guidelines (where appropriate) to ensure hydrogeological issues are considered and incorporated into the design of the Project.

The Hydrogeological Investigation and Addendum are presented in Appendix G3 and G2. The following is a summary and discussion of the key findings of these investigations.

12.2.1 Existing Groundwater Environment

The existing regional and local hydrogeological setting is presented in Chapter 7.

12.2.2 Groundwater Impact Assessment

Summary of Investigations

A review of prior investigations of the Whytes Gully RRP site has been completed including:

- Golder Associates (March 1981), “Preliminary Geotechnical Investigation of Possible Waste Disposal Depot at Whytes Gully, Reddalls Road, West Dapto”
- Wollongong City Council (R Britten, pers. comm. July 1991), “Geotechnical Assessment – Proposed Extension to Whytes Gully Waste Disposal Depot”
- Maunsell (September 1992) “Site Investigations and Geotechnical Assessments for the Phase Two Development of a Waste Disposal Depot at Whytes Gully, West Dapto”; and
- Wollongong City Council Materials Testing Laboratory (June 2003), “Geotechnical borehole reports W8683-87, W8726 & W8689-91”.

Based upon the review of prior investigation, the following field investigations were undertaken to address identified data gaps and to confirm and expand on the characterisation of the two groundwater systems

considered to be most relevant to the Whytes Gully RRP site development. These investigations are summarised as:

- **July and August 2011**
  - Installation of 13 monitoring wells (GMW101 to GMW111 including two shallow and deep paired wells) for the future groundwater monitoring network, in addition to seven monitoring wells in the new landfill cell footprint to provide information on foundation conditions (GABH01 to GABH06 including one shallow and deep pair;
  - Hydraulic testing (slug tests) of two alluvial (GMW108S and GMW109S) and six shallow rock monitoring wells (GABH02, GABH05, GMW104, GMW105, GMW108D and GMW109D); and
  - Water level measurement and sampling of 20 new monitoring wells and one existing well (MW6) for groundwater quality analysis.
- **December 2011**
  - Installation of five monitoring wells for further site characterisation of the site (GABH01, GABH202, GABH205 to GABH207); and
  - Water level measurement and sampling of the five new monitoring wells for groundwater quality analysis.

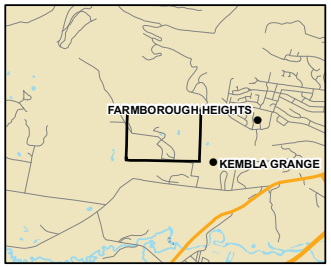
Investigation Locations are shown on Figure 12.1. Methods, borelogs, well construction details and rationale are presented in the Hydrogeological Investigation (Appendix G3).

File Location: J:\GIS\Jobs\117625003_Wollongong Council_New Landfill Cell_Whytes Gully\Workspaces\117625003_120_R_F0012_CurrentInvestigationLocations_Rev1.mxd

WHYTES GULLY NEW LANDFILL CELL ENVIRONMENTAL ASSESSMENT

WOLLONGONG CITY COUNCIL

INVESTIGATION LOCATIONS



LEGEND

- Contamination Investigation Location
- New Cell Floor Investigation Location and Monitoring Well
- Ground Water Monitoring Well
- Exisiting Capping Hand Auger Location
- Exisiting Capping Test Pit Location
- Borrow Pit Test Pit Hand Auger Investigation Location
- Site Boundary
- Approximate Extent Of Waste
- Extent of Landfill Works

NOTES

Extent of waste based on site observations and information provided by Council.

Aerial Ortho-Photograph provided by AAM Pty. Ltd. taken on 16 May 2011, Reference 18763A. Image Georeferenced.

Extent of landfill works as per Golder Design Report.

Investigation locations surveyed by KFW Williams.

0 25 50 100 150 metres

SCALE (at A3) 1:3,600

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: 117625003
DATE: 22/02/2012
DRAWN: FA
CHECKED: BJF

FIGURE 12.1

Golder Associates

Subsurface Lithology

Existing subsurface lithology and summary of water bearing units encountered are summarised in Chapter 7 of the EA.

Groundwater Depth and Flow Direction

Groundwater occurrence at the Whytes Gully RRP is generally associated with two shallow systems: groundwater present in the upper weathered and fractured profile of the local bedrock geology, and groundwater present in the colluvium/alluvium deposits that infill the two gullies at the site at the toe of the sloping topography.

Water levels measured in wells installed within the shallow weathered bedrock in the sloping northern portion of the site generally range from 5 to 10 metres below ground level (mbgl), whereas water levels in wells installed in both the shallow bedrock and unconsolidated material in the flatter southern portion of the site are shallower, generally on the order of 1 to 3 mbgl.

A potentiometric map was produced based on the measured groundwater elevations (Figure 12.2). The piezometric contour interval is 10 m from 80 m AHD to 20 m AHD (i.e. in the steeper topography in the northern portion of the site), and then changes to 1 m contour intervals below 20 m AHD. The potentiometric analysis indicates that groundwater flow generally conforms to local topography, with a flow direction predominantly towards the southwest. The hydraulic gradient is steeper on the slopes and becomes flatter to the south west in the alluvial plains. The hydraulic gradient on the slopes is relatively steep and generally ranges from 0.10 to 0.15 m/m. The hydraulic gradient rapidly decreases by approximately an order of magnitude in the alluvial plain to between 0.010 and 0.015 m/m.

As the majority of monitoring wells were screened within the shallow weathered/ fractured rock horizon, the piezometric contours reflect the shallow rock water bearing zone. Separate contours have not been prepared for the wells completed in the alluvium as they were installed on a linear transect along a common groundwater flow path. However the alluvial water levels were compared to the shallow rock water levels to draw conclusions regarding groundwater flow in the alluvium.

Water level measurements at paired well locations (GMW108, GMW109 and GABH06) confirmed an upward hydraulic gradient between the shallow rock horizon and the overlying alluvial/ residual soil. The average upward gradient was greatest at GABH06 (0.15 m/m), which is located closest to the steeply sloping portion of the site, and reduced with distance from the escarpment (0.08 m/m at GMW108, and 0.02 m/m at GMW109). This is attributed to the influence of the hydraulic head from the elevated northern portion of the site, and the relatively low permeability (silt/ clay) of the overlying residual and alluvial soils. It is inferred that the shallow weathered rock water bearing zone is semi-confined where it occurs beneath alluvial deposits, with a degree of hydraulic connectivity to the overlying soils.

Given the consistency of alluvial water levels relative to underlying shallow rock water levels at the paired wells and the thickening of the alluvial/colluvial deposits towards the southwest, the groundwater flow direction in the alluvial material was inferred to be towards the southwest consistent with the shallow rock water bearing zone. This is supported by the decreasing water level trend between locations GABH06S, GMW108S and GMW109S, located on what is inferred to be a common groundwater flow path.

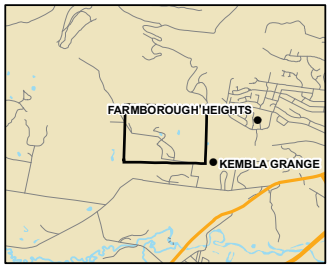
It is noted that due to a lack of groundwater monitoring data within the filled gullies, professional judgement has been applied to adjust the linear interpolation of water level data from wells on the site boundary to reflect the expected influence of the original topography (i.e. gullies and central ridgeline) on the piezometric surface. Prior to landfilling, the central ridgeline would have been expected to provide a local groundwater divide with respect to shallow groundwater flow in the eastern and western gullies. The actual piezometric surface beneath the current cell footprints may vary slightly from that presented in Figure 12.2.

File Location: J:\GIS\Jobs\117625003_Wollongong Council_New Landfill Cell_Whytes Gully\Workspaces\117625003_120_R_F0002_GW Contours_Rev1.mxd

WHYTES GULLY NEW LANDFILL CELL
ENVIRONMENTAL ASSESSMENT

WOLLONGONG CITY COUNCIL

GROUNDWATER CONTOURS



LEGEND

- Groundwater Level (mAHD) - August 2011
- Groundwater Contours
- Site Boundary
- Approximate Extent Of Waste
- Extent of Landfill Works

Note: groundwater elevation contours have been estimated by linear interpolation between well locations, with minor adjustments based on professional judgement. Actual groundwater elevations in areas of limited data coverage (e.g. within the existing cells) may differ to an unknown extent from the estimated contour locations presented.

NOTES

Extent of waste based on site observations and information provided by Council.

Aerial Ortho-Photograph provided by AAM Pty. Ltd. taken on 16 May 2011, Reference 18763A. Image Georeferenced.

Extent of landfill works as per Golder Design Report.

0 25 50 100 150 metres

SCALE (at A3) 1:4,000

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: 117625003
DATE: 22/02/2012
DRAWN: RB/FA
CHECKED: LBJ

FIGURE 12.2

Golder Associates

Hydraulic Conductivity

Hydraulic testing of wells completed within both the shallow weathered bedrock and in the unconsolidated deposits indicate hydraulic conductivity values in the order of 10^{-5} to 10^{-6} m/s, which is consistent with the range of published values for the lithologies encountered.

Assessment Criteria for Groundwater Quality

The Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000), "Australian and New Zealand Guidelines for Fresh and Marine Water Quality" (ANZECC 2000) were adopted as the groundwater quality assessment criteria for the Project site. Table 12.2 provides a summary of the adopted criteria for the analytical suite.

Table 12.2: ANZECC Criteria for Groundwater Samples
(Source: Hydrogeological Investigation)

Group	Analytes	95% Protection of Species Fresh Water (µg/L)
Metals & Metalloids [1]	Aluminium [2]	55
	Arsenic	13 [3]
	Cadmium	0.2
	Chromium VI	1.0 [4]
	Copper	1.4
	Lead	3.4
	Mercury (inorganic)	0.6
	Nickel	11
	Silver	0.05
	Zinc	8.0 [4]
Non-Metallic Inorganics	Ammonia	900 [4,5]

[1] Trigger values for metals apply to bioavailable (soluble) fraction of total concentrations (filtered samples).

[2] Criterion only applies for pH>6.5

[3] Criterion is for Arsenic V, this is the more conservative of the Arsenic trigger values. Where this is exceeded the criterion of 24 µg/L for Arsenic III should be considered when interpreting the results.

[4] Figure may not protect key test species from chronic toxicity (this refers to experimental chronic figures or geometric mean for species) – check Section 8.3.7 of ANZECC 2000 guidelines for spread of data and its significance.

[5] Ammonia trigger value corresponds to a water pH of 8.0, and must be adjusted when different pH values are recorded.

Analytical Results

Groundwater quality at the Whytes Gully RRP site differs slightly between wells installed upgradient and cross-gradient from the existing landfill cells, which exhibit limited (if any) influence from landfill leachate and those installed downgradient from the existing landfill cells and related infrastructure that exhibit a degree of impact from landfill leachate. Whilst the concentrations of most leachate indicator parameters are relatively low in the groundwater samples, most were still below the relevant assessment criteria. Where available, there is an increasing concentration trend between the upgradient and downgradient wells, as summarised in Table 12.3. These concentrations would propose to be monitored to assess their persistence and whether they represent a potential risk to downgradient groundwater receptors.

Table 12.3: Summary of Leachate Indicator Parameters by Water Type (average concentrations). Source: Hydrogeological Investigation.

Analyte	Units	Shallow Rock		Alluvium	Surface Water	Leachate [3]
		UG [1]	DG [2]			
pH	-log{H}	5.7	6.7	6.6	7.3	8.1
ORP	mV	82	145	31	209	-33
EC	µS/cm	1440	3860	3223	463	22,700
DO	mg/L	3.1	2.4	2.9	7.5	2.4
Total Alkalinity (as CaCO3)	mg/L	232	524	490	135	7060
Ammonia as N	mg/L	0.03	0.03	1.63	0.28	0.69
TKN as N	mg/L	0.2	0.41	1.03	2.65	17.7
TOC	mg/L	8.7	2.5	9.0	12	1780
BOD	mg/L	<2	<2	<2	3.7	1430

1. UG = upgradient wells
2. DG = downgradient wells
3. Leachate data from pond influent sample collected in December 2011

Groundwater Separation

The depth to water table was evaluated in more detail in the proposed new cell footprint area to the east of the leachate ponds to support cell design considerations. Although various approaches can be adopted with respect to minimising risk of groundwater contamination from landfill leachate, it is generally accepted that greater separation distances result in reduced risk. As discussed in Chapter 8 of the EA, based on EPA Victoria's "Best Practice Environmental Management – Siting, Design, Operation and Rehabilitation of Landfills (Publication 788.1, dated September 2010)" (BPEM) guidance, the preliminary design has been developed to maintain a 2 m vertical separation distance between waste and the groundwater table.

Pressure transducers have been installed in two monitoring wells screened close to or across the water table within the proposed new cell footprint and would continue to be monitored to collect data for detailed design of the Project.

Groundwater Beneficial Uses

A review of registered bores within approximately 2 km of the Whytes Gully RRP site indicates limited water supply development. All of the bores are located either up- or cross-hydraulic gradient from the site, accessing both shallow and deep groundwater resources. However there is very limited groundwater supply development downgradient from the site (which is consistent with the limited land development to the immediate south of the Project site).

Whilst the fractured rock aquifer could potentially support domestic water supply, the water quality is marginal based on electrical conductivity (EC) values and the anticipated yield would be relatively low based on the permeability values indicated by hydraulic testing. The alluvial groundwater and underlying weathered

sandstone aquifer resource is also considered to be of poor quality and low yielding with regard to potential beneficial uses. The relative value of the shallow fractured rock aquifer for potable water supply, and the likelihood for substantial water supply development in the foreseeable future, is considered to be low (especially given the moratorium on new entitlements under the Greater Metropolitan Region Water Sharing Plan).

Given its proximity to the Whytes Gully RRP site, Dapto Creek is likely to be the most relevant environmental value downgradient, which may receive baseflow from groundwater in the alluvial deposits. A combined surface water and groundwater monitoring program would propose to assess impacts upon Dapto Creek.

Groundwater Dependent Ecosystems

GDEs are ecosystems that are wholly or partially dependent on groundwater for their biodiversity and natural ecological processes. The following actions have been undertaken to assess the potential presence of high-value GDEs in the vicinity of the Project site:

- Review of the locations of identified high-value GDEs presented in the recently commenced macro Water Sharing Plan (WSP) for the Greater Metropolitan Region (NOW, July 2011);
- A direct enquiry with NOW regarding their draft state wide GDE catalogue; and
- Review of the results of the Flora and Fauna Assessment (Appendix F).

Information provided by the NOW indicates there are no known high-value GDEs within at least 10 km of the Project site. Consistent with this information the Flora and Fauna Assessment (Appendix F) identifies that no known GDEs are present within or in the vicinity of the Whytes Gully RRP site.

Liner

The primary groundwater management control for the Whytes Gully New Landfill Cell would be the construction of a liner.

As discussed in Chapter 8, landfilling of new waste for the New Landfill Cell project will occur in both: (i) areas underlain by existing waste and (ii) areas of natural ground.

The natural ground and existing waste will be lined with a single composite lining system, as per best practice design, as described in Chapter 8.

Construction of a piggy back lining system in both the Eastern Gully and Western Gully areas is considered prudent for the project based on the existing landfill conditions (Refer Chapter 7) and the environmental factors outlined below.

Leachate generated within new waste placed above the existing landfill areas is generally expected to migrate vertically downward by gravity. In the case that no piggy back lining is constructed then leachate from new waste would eventually report to the base of the existing landfill with the following potential consequences:

- Western Gully Landfill – leachate reporting to the base of the existing landfill could potentially cause an impact to groundwater due to the lack of a base lining system in the Western Gully Landfill.
- Eastern Gully Landfill - leachate reporting to the base of the existing landfill could potentially cause an impact to groundwater due to the uncertain current performance of the existing Eastern Gully leachate barrier. Further, even without the performance uncertainty, the existing Eastern Gully leachate barrier is classified as a ‘single geomembrane liner’ and does not meet the current best practice design standards of “single composite liner” .

Liner Installation

Potential impacts to groundwater may arise from leachate infiltration through a landfill's liner material, primarily where the liner has not been installed appropriately, or has since become compromised in some way (ie liner defects). There is potential, albeit limited, for defects to occur during the construction of the landfill liner, resulting in potential leaks to the groundwater.

A Construction Quality Assurance (CQA) system would be in place for cell construction because the performance of these environmental protection systems, particularly the base liner, piggy back liner and cap barrier, is strongly dependent on the quality of their construction. Detailed CQA requirements are embedded in the Technical Specification of the Design Report (Appendix O). The CQA system comprises a combination of approval and documentation requirements for the cell construction contractor, inspection by the construction Superintendent (to be appointed by Wollongong City Council) and independent material testing (audit testing).

Summary

Potential for leachate infiltration to groundwater from the landfill would be controlled by the permeability of the liner. Appropriate design and installation of liner and leachate collection systems would serve to mitigate the potential for leachate generated by the Project to impact groundwater.

The hydrogeological setting (upward hydraulic gradient, relatively low permeability formations, limited water supply development and no high-value GDEs in the vicinity of the site) is conducive to land use for landfilling operations, and would appear to represent a relatively low risk in the event of a leachate release to groundwater. The clayey nature of the shallow alluvial/ colluvial soils would promote attenuation of leachate constituents in the event of a release, and would likely limit the migration potential of leachate constituents in groundwater.

12.2.3 Mitigation and Management Measures

A number of design features and management measures would be used to mitigate the potential for leachate generated by the waste of the Project to impact upon groundwater.

Prior to Construction

- Ongoing monitoring of groundwater quality at the site. Including monitoring contaminant concentrations in downstream wells during future monitoring events to assess their persistence, and whether they represent a potential risk to downgradient groundwater receptors.
- Ongoing monitoring of groundwater levels at the site is continued to establish long-term values.
- Ongoing monitoring of groundwater levels in the Cells 1,2,3 and 4 footprint prior to construction.

Construction

- Ongoing monitoring of groundwater quality at the site. Including monitoring contaminant concentrations in downstream wells during future monitoring events to assess their persistence, and whether they represent a potential risk to downgradient groundwater receptors.
- Ongoing monitoring of groundwater levels at the site is continued to establish long-term values.
- Implementation of a Construction Quality Assurance Program. The Construction Quality Assurance Plan is presented in Appendix O.

Operation

During the operational phase of the Project a number of engineering measures and management strategies would be used to mitigate impacts to groundwater as follows.

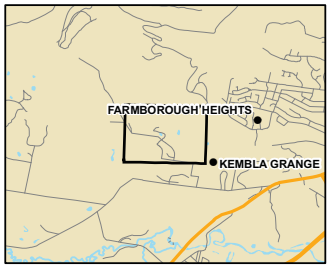
- *Leachate Barrier System.* The primary management system to protect groundwater quality is the lining system of the landfill. The design of the lining system is discussed in Chapter 8 and Appendix O.
- *Leachate Collection System*. The leachate collection system is design to collect and convey leachate generated from the waste and prevent leachate from ponding on the liner, thus assisting in preventing the migration of leachate to the environment.
- *Leachate Pond.* The existing ponds are lined with a HDPE Liner. Future ponds would be lined with a composite liner to assist in preventing migration of leachate to the environment. Monitoring of liner integrity during construction is discussed in the Draft LEMP and Appendix O.
- *Leachate Treatment Plant.* The existing leachate treatment plant is bunded and any future upgrades to the leachate treatment plant would also be bunded. Redundancy is built into the controls and equipment for prevention of overflow.
- *Groundwater and Leachate Monitoring.* A network of groundwater bores would be used to monitoring groundwater quality and trends at the Project Site. This would include a regular programme of groundwater sampling and assessment as detailed in the Draft LEMP (Appendix P). Refer Figure 12.3 for groundwater monitoring locations.
- *Groundwater Assessment Program.* Groundwater would be monitored and background concentrations would be established for all analytes. If a significant change in concentration for any of the indicator parameters is detected over two consecutive monitoring periods, then the affected groundwater monitoring bores would be resampled and assessed and OEH notified (if required) as per the procedure outlined in the Draft LEMP. Following this a groundwater assessment plan may be developed as outlined in the Draft LEMP.
- *Groundwater Contamination Remediation Plan.* The need to develop a Groundwater Contamination Remediation Plan would flow from the Groundwater Assessment Program. Should groundwater monitoring indicate contamination of groundwater, the extent of such contamination would be delineated and contingency groundwater remediation measures would be put in place. The assessment program would define the nature and general extent of contamination. A remediation plan would utilise the information obtained in the assessment program. The general steps on developing a Groundwater Contamination Remediation Plan are outlined in the Draft LEMP.

Post Closure. Post Closure groundwater monitoring and management is described in Chapter 20 of the EA.

WHYTES GULLY NEW LANDFILL CELL ENVIRONMENTAL ASSESSMENT

WOLLONGONG CITY COUNCIL

PROPOSED WATER MONITORING LOCATIONS



LEGEND

- Proposed Ground Water Monitoring Locations
- Existing Monitoring Location
- Approximate Extent Of Waste
- Extent of Landfill Works
- Site Boundary

NOTES

Extent of waste based on site observations and information provided by Council.

Aerial Ortho-Photograph provided by AAM Pty. Ltd. taken on 16 May 2011, Reference 18763A. Image Georeferenced.

Extent of landfill works as per Golder Design Report.

Investigation locations surveyed by KFW Williams.

0 25 50 100 150 metres

SCALE (at A3) 1:4,000

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: 117625003
DATE: 26/03/2012
DRAWN: FA`
CHECKED: JMc

FIGURE 12.3

Golder Associates

File Location: J:\GIS\Jobs\117625003_Wollongong Council_New Landfill Cell_Whytes Gully\Workspaces\117625003_120_R_F0004_ProposedWaterMonitoringLocations_Rev3.mxd

12.3 Surface Water

Surface Water Assessment has been undertaken for the site and is included as Appendix G4. This section summarises this assessment.

12.3.1 Existing Surface Water Environment

The existing regional, local and site catchments are described in Chapter 6. Existing Surface Water Infrastructure and Stormwater Management is described in Chapter 7.

12.3.2 Surface Water Impact Assessment

Water Use

A search of the NOW data base and Wollongong City Council's internal data base indicates no known uses of Dapto and Mullet Creek downstream of the Project site.

Surface Water Flows

An increase in the impermeable surface area or runoff characteristics of the catchment can increase runoff flows when compared with undeveloped catchments. Generally, runoff could enter the downstream waterways in a shorter period of time as a result of the proposal, thus contributing to increased peak flows. Modification of the flow regime could subsequently influence bed and bank stability, downstream flood levels and biological components of the creek.

There is no streamflow information available for Dapto Creek or Mullet Creek. The NSW Office of Water was consulted regarding streamflows along Dapto Creek but no information was available.

Environmental flows of Dapto and Mullet Creek are not expected to be impacted by the Project. There is no significant increase in the proposed area of impervious surfaces at the site (i.e. paving of limited road areas), rather vegetative cover and grassed drains would be implemented, which is a similar condition to the existing disturbed site. Therefore, watershed characteristics for the Project would be similar to the existing conditions.

Site Opportunities and Constraints

The opportunity to harvest water from the site is modest. The proposed surface water management system would involve control of surface runoff from operational areas of the site as required in accordance with the NSW Department of Housing's Managing Urban Stormwater: Soils and Construction (2004) to be referred to as the "Blue Book' hereon. Water capture would be given priority for operational use for dust suppression and compaction.

Surface Water Quality

Local water quality

Surface Water samples were collected by Wollongong City Council during December 2011 along Dapto Creek. The results of recent surface water sampling from Dapto Creek, and from collected leachate, have been included in a Piper plot for reference in the Hydrogeological Investigation (Appendix G3). In general, the Piper plot indicates relatively similar water types between the upgradient, downgradient and Dapto creek water samples, and a leachate signature that is relatively distinct from the water samples. Hence, any leachate influence on surface water quality is inferred to be limited.

As part of their commitment to the Project, Wollongong City Council would continue to collect samples in Dapto Creek as outlined in the Draft LEMP in order to confirm surface water quality characteristics around the site.

Site Surface Water Quality

The Project site has an Environmental Protection Licence (EPL) (licence number 5862). With regards to surface water management the licence provides the following management criteria:

- pH for a 100 percentile concentration limit is pH 6.5-8.5;
- Total Suspended Solids (TSS) for a 100 percentile concentration limit 50 mg/l;
- Drainage from areas not subject to waste disposal activities must be directed away from the existing leachate collection pond(s);
- Disturbed areas must be provided with separate water quality controls for the treatment of runoff containing suspended or turbid pollutants; and
- The licensee must maintain a leachate management system to collect and direct all leachate to a point for treatment and disposal to sewer.

Surface water quality monitoring has been undertaken annually and during overflow at the discharge point from the surface water pond for pH, ammonia, TSS and temperature as a minimum.

The GHD (2010) "2009 / 2010 Annual Environmental Monitoring Report" (AEMR) covers the period from 29 May 2009 to 28 May 2010. The stormwater was reported to have elevated concentrations of ions / anions.

The Wollongong City Council (2011) "2010 / 2011 AEMR Waste Gully Waste Disposal Facility – Annual Report" covers the period from 01 June 2010 – 31 May 2011. The report indicates four surface water overflow events were monitored during the reporting period. The report further indicates compliance with surface water discharge criteria for suspended solids, while one elevated value for ammonia of 3.86 mg/L was detected on 21 March 2011.

Wollongong City Council would continue to monitor surface water at the Whytes Gully RRP site and the outflow in accordance with the EPL requirements.

Surface Water Controls

Potential Impacts of the Project on water quality include:

- Increased suspended sediment load to the creek. Runoff containing sediments and other pollutants could enter downstream watercourses, adversely impacting on both water quality and the aquatic flora and fauna within these systems.
- Leachate contamination of surface water.
- Spillage or uncontrolled releases of pollutants such as fuel and oils could provide a source of pollutants.

The surface water management and maintenance controls proposed for the Whytes Gully New Landfill Cell would provide a high level of impact mitigation and are outlined below.

Construction

A Surface Water Management Plan would be developed as part of the CEMP in general accordance with the following control principles:

- Bund fuels, oils, paints, and other chemicals onsite in accordance with relevant guidelines.
- Remove accidental spills of soil or other materials.
- A monitoring program shall be conducted during construction to monitor compliance with the CEMP.

Operation

The design of the drainage system for the Project site would incorporate measures and controls to mitigate impacts. The proposed surface water management for the Project site is shown in the Design Report (Appendix O) and described in Chapter 8. Surface Water assessment including design and calculations is presented in Appendix G4.

Surface Water Management Principles

Water at the site can be divided into three categories, Clean, Dirty and Leachate. These are defined in Table 12.4 along with their treatment requirements.

Table 12.4: Water Types

Name	Description	Treatment requirements
Clean	Runoff from: • undisturbed areas; • disturbed areas after full revegetation; or • landfilled areas after final capping and full revegetation	No treatment requirements. Discharge directly to creek Note: From the Landfill Blue Book Page 28 - Sediment basins are usually only required for the first two years after the rehabilitation of disturbed areas.
Dirty	Runoff from: • disturbed areas (ie. cleared or construction) • landfilled areas with final capping prior to full revegetation • landfilled areas with temporary capping (ie interim cover 300 mm) .	Potentially sediment laden. Route to sedimentation ponds. Discharge to creek after sediment removal (would require periodic demonstration that water is not significantly impacted by landfill constituents)
Leachate Type 2	• Water recovered from leachate collection systems. • Runoff that has come in direct contact with waste • Runoff from daily cover (ie 150 mm cover) • Runoff that is otherwise known to be impacted	Collect , store, and treat to required sewer discharge standard

The following key principles have been used as the basis for the design of the surface water management controls.

- Diversion of clean drainage directly into Dapto Creek. Runoff from areas that are unaffected by the development would be allowed to discharge directly from the site to Dapto Creek as happens currently. Runoff from fully rehabilitated areas after two years of rehabilitation would also be allowed to discharge directly to Dapto Creek.
- Runoff from areas that are likely to generate sediment such as the new cell construction areas and stockpile areas would be directed into the Surface Water Ponds .
- Reduce the volume of runoff to Surface Water Ponds by reducing the contributing catchment area at any particular time.
- Keep sources of different water quality types separate from each other.

- Construction of a perimeter bund and drain around the entire active landfill area to prevent surface water from entering the landfill area;
- Construction of a diversion drain around the entire landfill area to collect all runoff from disturbed areas (but outside exposed/uncapped active waste cell area(s)) which would drain to the sedimentation basin to the north east of the landfill footprint.
- The existing surface water ponds would be used for Stages 1 to 3 of the development.
- The Surface Water ponds would be downsized for Stage 4 onwards, as Stage 1 to 3 would be rehabilitated and runoff would be directed offsite to Dapto Creek.
- Re-use 'dirty' water for dust suppression.

The surface water management controls would be progressively developed as the landfilling areas are developed. The Design Report (refer Appendix O) presents the proposed surface water management throughout the stages of the Project. These stages of stormwater management system development are described in Chapter 8.

Drainage Channels

Key Design Criteria adopted for the drainage channels is as follows, in accordance with Wollongong City Council's Development Control Plan (DCP), E14 Storm Water Management (2009).

- Drainage channels designed for 10yr Average Recurrence Interval (ARI), 2 hour duration for a **minor storm event**. Rainfall intensity: 47.2 mm/hr.
- Drainage modelled for a 100yr ARI, 2 hour duration to ascertain a controlled flood path for a **major storm event**. Rainfall intensity: 73 mm/hr.
- Manning's roughness coefficient (n) value of 0.08 for catchment run-off, assuming the final stage vegetation cover is light brush and small trees (ARR 2007).
- Manning's roughness coefficient (n) value of 0.033 for drains, assuming normal grass coverage (AR&R 2007).

The size of the drainage channels have been designed for the completed final stage in terms of catchment and final flows. A consistent drainage channel size has been adopted for each of the east and west drainage channels. Table 12.5 summarises the design of the drainage channels.

Table 12.5: Drains Sizes
(Source: Surface Water Assessment- Appendix G4)

Network	Batter Slope (1:X)		Base Width (m)	Channel width (m)	Depth (m)	Cover Type	Manning (n)
	Left	Right					
East	4	1	0	5	1	Grass	0.033
West	2	2	1	5	1	Grass	0.033

The drainage network has been modelled in accordance with the DCP design requirements for a peak flow in a 100 yr ARI.

Drop Structures and Benches

The benches have been designed to convey up to a 10 yr ARI storm event in accordance with DCP requirements. Due to the nature of the site and its sensitivity to erosion the capacity of the bench would also be sufficient for up to the 100 yr ARI i.e. designed to convey up to a 100 yr ARI peak storm event.

The drop structures would be trapezoidal in cross section with a 1 m base width and a top width ranging between 2.7 m and 3.5 m. The depth of the structure would range between 300 mm to 400 mm. Like the bench construction the drop structure would be designed for up to a 10 yr ARI in accordance with the DCP and have sufficient capacity for up to a 100 yr ARI i.e. designed to convey up to a 100 yr ARI peak storm event

Sedimentation Basin

The Sediment pond has been designed for the completion of Stage 4 of the Project. It has been assumed that the existing sediment ponds would be used between stages 1 and 3. The design requirements for the sedimentation pond would be in accordance with the "Blue Book". These are as follows:

- Pond capacity would be designed for a Type D sediment soil; and
- 5 day, 90th percentile rainfall depth.

From Stage 4 onwards it is proposed that all dirty water runoff (approximately 20 ha maximum catchment) is transferred directly to the existing polishing pond which would be reconfigured for the final stage works to act as both sediment pond and Onsite Detention (OSD) to form a combined Surface Water Management Pond (SWMP)..

Table 12.6: Sediment Dam Design
(Source: Surface Water Assessment)

Settlement Zone (m^3)	**7660**
Sediment storage (m^3)	3830
Total Storage (m^3)	**11490**

Onsite Detention

The OSD refers to the storage volume required to restrict flows to a Permissible Site Discharge (PSD) so as not to adversely affect the downstream catchment under a nominated ARI. To ascertain the OSD required for the site the DCP has been consulted regarding standard calculations for PSD and Site Storage Requirements (SSR).

A PSD is a flow rate calculation that is required to ascertain the pre-development discharge off site. The flow rate is then used as a restriction for the post development discharge so the existing hydrological regime downstream to the site is unchanged.

- PSD_5 calculated for a 5 yr ARI event, 2 hour duration peak flow to size onsite detention to the first stage control.
- PSD_{100} calculated for a 100 yr ARI event, 2hour duration peak flow to size Onsite detention to the second stage control.
- A 20 percent impervious area has been used for the pre-development site when calculating PSD. The 20 percent has been based on a Public Recreation Area land use noted in the DCP. This is considered high and therefore a conservative assessment.

A SSR is a storage volume required upstream to the outfall to attenuate the PSD set at the outfall. This volume is the minimum storage requirement.

- The SSR has been calculated for PSD's associated with the peak flow duration in 5 yr ARI and 100 yr ARI:

Surface Water Pond

The sediment and OSD ponds would be combined to form a SWMP. The ponds would be combined as there is sufficient capacity within the existing polishing pond for this to be efficiently constructed.

The philosophy of the SWMP would be to construct the sediment pond as a wet pond with a concrete culvert overflow to Dapto Creek. The invert level of the overflow would be set above the sediment pond level.

Above the sediment pond the detention basin would be constructed to a level sufficient to contain up to a 100 yr ARI peak flow event.

Through modelling the network design for the completion of Stage 4, the storage volume was calculated to be greater than the SSR whilst satisfying PSD requirements at the Dapto Creek outfall, thus satisfying the Council's DCP design requirements for both PSD and SSR.

Table 12.7 summarises the total volume requirements for the pond.

Table 12.7: Surface Water Pond Summary
(Source: Surface Water Assessment)

	ARI	
	5 yr – 2 hr duration	**100 yr – 2 hr duration**
Sediment pond volume (m^3)	11491	
OSD storage Volume (m^3)	7855	15452
Total Pond Volume (m^3)	19350	26950

Water Sensitive Urban Design

Water Sensitive Urban Drainage (WSUD) principles would be adopted in the design criteria for the control and treatment of drainage runoff.

WSUD is a management approach for water cycles in an urban development to minimise environment degradation and improve the aesthetic appeal.

Features of WSUD adopted at the site include:

- Grassed drains for surface water treatment by impeding the conveyance of flows;
- Vegetative areas for aesthetics;
- Sedimentation Basin for surface water treatment; and
- Onsite Surface Water Detention for the restriction of flows to mimic that of the pre-development natural catchment so as not to disturb the downstream hydrological regime.

Water Quality Monitoring

Monitoring of surface water and leachate is to be carried out at the Project site as detailed in the Surface Water Monitoring Programme and the Leachate Monitoring Programme (refer Draft LEMP Appendix P). Refer Figure 12.4 for surface water monitoring locations.

Monitoring would help to ensure there are no measurable effects on surface water resulting from the landfilling activities.

Maintenance

Inspection monitoring and maintenance of sediment and surface water control structures would be undertaken in accordance with the Draft LEMP (Appendix P).

12.3.3 Mitigation Measures

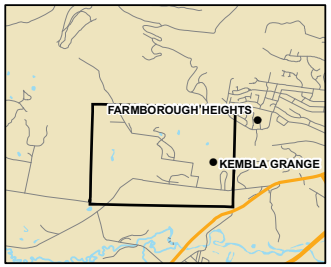
A number of design features and management measures would be used to mitigate the potential for runoff from the Project site to impact upon surface water.

- a Surface Water Management Plan would be developed as part of the CEMP
- a monitoring program shall be conducted during the construction period to monitor compliance with the CEMP.
- collect samples in Dapto Creek in order to confirm surface water quality characteristics around the site prior to construction, during construction and during operation.
- continue to monitor surface water at the Whytes Gully RRP outflow during operation
- construction, management and maintenance of Surface Water Controls including diversion drains and surface water ponds.

WHYTES GULLY NEW LANDFILL CELL ENVIRONMENTAL ASSESSMENT

WOLLONGONG CITY COUNCIL

PROPOSED SURFACE WATER MONITORING LOCATIONS



LEGEND

- Existing Monitoring Well Location
- Surface Water Monitoring Locations
- Site Boundary
- Approximate Extent Of Waste
- Extent of Landfill Works

NOTES

Aerial Photography Copyright NearMap Pty Ltd.
Image dated 2011.11.27.
Sourced with permission from Nearmap on 2011.11.16.
Image Georeferenced by Golder and intended for indicative purposes only.
More information can be found here:
http://www.nearmap.com/

Extent of waste based on site observations and information provided by Council.

Extent of landfill works as per Golder Design Report.

0 50 100 200 300 metres

SCALE (at A3) 1:7,000

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: **117625003**
DATE: **26/03/2012**
DRAWN: **FA**
CHECKED: **JMc**

FIGURE 12.4

Golder Associates

File Location: J:\GIS\Jobs\117625003_Wollongong Council_New Landfill Cell_Whytes Gully\Workspaces\117625003_120_R_F0005_ProposedSurfaceWaterMonitoringLocations_Rev2.mxd

12.4 Flood

12.4.1 Existing Environment

The site is located to the north of the Mullet Creek floodplain. The location of the site in context to the Mullet Creek floodplain is presented in Figure 6.1. To the southwest of the site lies Dapto Creek.

The Whytes Gully site lies upstream of the Mullet Creek floodplain and the majority of the site exists above the flood planning area, as defined in the LEP.

The Mullet Creek floodplain is broad and flat and is hydrodynamically influenced by the Illawarra Railway and Lake Illawarra. Dapto Creek is a minor tributary of the Mullet Creek floodplain of moderate slope, 10 percent below the escarpment, with a contributing catchment of only 280 ha.

The current flood study for Mullet Creek is presented in the WBM BMT (2010) “Mullet and Brooks Creek Flood Study”. There is currently no flood study of Dapto Creek.

Current Flood Affectation

Figure 12.5 presents the flood planning area for Mullet Creek floodplain, as defined in the LEP (Reference No. 8450_URB_CL1_010_020_20100301.pdf) with respect to the relevant site boundaries and proposed development area. Wollongong City Council have also provided indicative 5 y and 100 y flood levels for Mullet Creek. A freeboard of 0.5 m has been added to the 100 y flood levels.

The Flood Planning Area ranges from 15.8 m AHD to 15.5 m AHD along the southwest boundary of the Project site. The Flood Planning Level is less than the crown of Reddalls Road.

The southern portion of the Whytes Gully RRP site is designated as being flood affected due to the culvert on the Reddalls Road being overtopped during the 100 y storm event. This is currently the main surface water discharge location. The affected lots due to this behaviour include:

- Lot 50, DP 1022266
- Lot 51, DP 1022266

Currently Lot 50, DP 1022266 is occupied by several surface water treatment ponds. The bund level (at minimum) of the Surface Water Polishing Pond is 15.8 m AHD. The bund level of the Surface Water Reed Ponds are 16.3 m AHD and 16.6 m AHD respectively. There are two leachate treatment ponds in the north of Lot 50. The bund level of the primary leachate pond is 20.6 m AHD (at minimum) and the bund level of the secondary leachate pond is 24.3 m AHD (at minimum).

The flood planning area is based on the WBM BMT (2010) “Mullet and Brooks Creek Flood Study”. The FPL in the south west of the Project site, can be inferred, conservatively, based on the available study results to be 17.14 m AHD (100 y flood level of 16.64 m AHD + 0.5 m freeboard). An interpreted extent of the flood planning area (FPA) including freeboard is presented in Figure 12.5.

12.4.2 Impact Assessment

The Project would include reconfiguration of the leachate ponds in Lot 50, DP 1022266 as well as reconfiguration of the surface water treatment ponds in the south of Lot 50. The proposed leachate treatment pond lies above the FPL, therefore reconfiguration would not affect flood level or flood behaviour. The footprint of the surface water treatment ponds lie within the FPA (or the interpreted extent including freeboard). However, the proposed configuration would be such so as to maintain existing floodplain storage at this location. Accordingly the Project would not affect flood levels or flood behaviour.

The Project does not include alteration to existing land-use with respect to Lot 51, DP 1022266 and therefore would not affect flood levels or flood behaviour with respect to Lot 51.

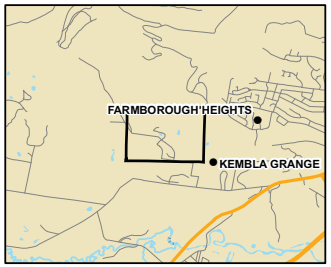
12.4.3 Mitigation Measures

The project does not alter the existing flood storage. Accordingly the Project would not affect flood levels or flood behaviour.

WHYTES GULLY NEW LANDFILL CELL ENVIRONMENTAL ASSESSMENT

WOLLONGONG CITY COUNCIL

EXTENT OF FLOODING



LEGEND

- Site Boundary
- Mullet Creek Flood Planning Area (West Dapto LEP)
- Mullet Creek Interpreted Flood Planning Area (50 cm Freeboard)
- Site Contours
- Extent of Landfill Works

NOTES

Flood area estimated based on flood levels in West Dapto LEP.

Aerial Ortho-Photograph provided by AAM Pty. Ltd. taken on 16 May 2011, Reference 18763A. Image Georeferenced.

Extent of landfill works as per Golder Design Report.

Site contours based on survey by KFW Williams, dated 20/07/2011

0 25 50 100 150 metres

SCALE (at A3) 1:3,800

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: 117625003
DATE: 26/03/2012
DRAWN: FA
CHECKED: JMc

FIGURE 12.5

Golder Associates

File Location: J:\GIS\Jobs\117625003_Wollongong Council_New Landfill Cell_Whytes Gully\Workspaces\117625003_120_R_F0003_Extent_of_Flooding_Rev1.mxd

12.5 Leachate

12.5.1 Existing

Existing leachate controls and infrastructure are described in Chapter 7.

12.5.2 Leachate Impact Assessment

Leachate would be generated by the landfill and, if released to the environment (surface water or groundwater), could impact on water quality through:

- Input of nutrients at elevated levels;
- Rapid growth of weeds, supported by the high nutrient levels;
- Death of aquatic organisms within the creek such as fish and macro-invertebrates;
- Lower dissolved oxygen levels; and
- Odour emissions.

Segregation of Leachate

In addition to the measures described in Section 12.3, to maintain leachate segregation from Surface Water:

- While waste is being placed in a cell, all runoff that has been in contact with wastes would be treated as leachate;
- Progressively filled areas would be covered with daily cover (150 mm minimum) to minimise contact between surface waters and waste, and therefore minimise the generation of leachate. Nevertheless, water collected within these exposed/uncapped active waste cell areas would be designated as “leachate”;
- The total area of exposed and/or uncapped active waste cell areas would be reduces and bunded (diversion drains) to prevent run-off entering these areas; and
- Leachate would be collected and directed to the leachate ponds then leachate treatment plant then ultimately discharged to sewer.

Measures to protect groundwater from leachate include separation, leachate barrier and collection system and are discussed in Section 12.3

Leachate Generation

In addition to the measures described in Section 12.3, the following is proposed to reduce leachate generation as part of the Project:

- Eliminate surface water cross connections;
- Reprofiling and capping the existing Eastern Gully landfill batter (considered to be a significant source of infiltration and stormwater contribution to the leachate collected at the site); and
- Capping of the current landfilling area.

Leachate Ponds

Water balance modelling has been undertaken to assess the quantity of leachate that may be generated by both the existing and proposed new landfilled waste. Methodology and results of the water balance modelling are presented in Chapter 12 and Appendix G.

The modelled leachate volumes (based on average monthly rainfall) indicate that throughout Stages 1-3, the maximum leachate requiring storage (4 100 kL/month) occurs during the second year of the project (month

24) and the maximum cumulative volume of leachate requiring storage (6 413 kL) occurs during the third year of the project (month 27). With a capacity of approximately 18 000 kL, the existing leachate ponds are therefore expected to have sufficient capacity to store leachate generated during Stages 1-3 under average rainfall conditions. A summary of modelled volumes is presented in Table 8.

Table 12.8: Modelled Volumes of Leachate Collection (Average Monthly Rainfall)
(Source: Leachate Assessment Report)

Stage	Leachate Collection (kL/month)		Leachate Requiring Storage (kL/month)*		Cumulative Leachate Storage Required (kL)	
	Minimum	Maximum	Minimum	Maximum	Maximum	At end of Stage
1-3	1 000	10 200	0	4100	6413	0
4	6 00	4 600	0	0	0	0

Notes:

* After the consideration of rainfall, evaporation and discharge to sewer

It is proposed to retain the existing leachate ponds (described in Chapter 7) in place until the end of Stage 3 (end of 2046). During 2045 a proposed new leachate pond would be constructed to the south of the existing leachate ponds in the approximate location shown on Figure 5.1. The existing leachate ponds would be decommissioned as part of the construction of the Stage 4 liner. The new leachate pond would be lined using a single composite liner or other system assessed to be suitable at the time.

The modelled leachate volumes (based on average monthly rainfall) indicate that the combined effect of discharge to sewer and evaporation is expected to exceed the volume of generated leachate such that the cumulative volume of leachate requiring storage at the end of Stage 4 is zero. A new leachate pond with nominally equivalent surface area and capacity as one of the existing ponds can thus be expected to provide ample storage for leachate generated during Stage 4 under average rainfall conditions.

As recommended in EPA Victoria's *Best Practice Environmental Management – Siting, Design, Operation and Rehabilitation of Landfills* (Publication 788.1, dated September 2010) (BPEM), the 90th Percentile rainfall data is adopted for two consecutive years as a sensitivity analysis to ensure the system has sufficient capacity over the operational life of the landfill.

The predicted monthly leachate generation volumes (based on 90th percentile monthly rainfall) are summarised in Table 9 below. The first two years were selected for this analysis as this is the period which results in the highest volume of cumulative leachate storage required.

Table 12.9: Modelled Volumes of Leachate Collection (90th Percentile Rainfall)
(Source: Leachate Assessment Report)

Years	Leachate Collection (kL/month)		Volume of Leachate Requiring Storage (kL/month)*		Cumulative Leachate Storage Required (kL)	
	Minimum	Maximum	Minimum	Maximum	Maximum	At end of Year
1	2100	17600	0	12500	18000	1500
2	2300	20300	0	15200	15000	4400

Notes:

* After the consideration of rainfall, evaporation and discharge to sewer

The modelled leachate volumes (based on 90th percentile monthly rainfall) indicate that within the 2-year period, the maximum leachate requiring storage (15 200 kL/month) occurs during the second year of the project (month 15) and the maximum cumulative volume of leachate requiring storage (18 000 kL) occurs

during the third month of the project (month 3). With a capacity of approximately 18 000 kL, the existing leachate ponds are therefore expected to have sufficient capacity to store leachate generated during two consecutive wet years.

Leachate Treatment and Disposal

Liaison with Sydney Water has indicated that although the West Dapto Release Area may result in sewer upgrades, there are current no identified plans or approvals and therefore the Project must be designed for the current trade waste discharge limit to sewer of 250 kL/day.

The leachate treatment system at the Whytes Gully RRP site currently incorporates aeration and biological treatment with the Primary and Secondary Leachate Ponds and subsequent treatment in the leachate treatment plant using sequencing batch reactor technology. A review of the recent performance of the existing site Leachate treatment system (Refer Chapter 7) indicates that the leachate treatment has generally consistently been meeting Sydney Water Industrial Trade Waste Criteria and EPL license requirements since recent upgrades were completed. It is proposed to retain the existing leachate treatment system in place .

Evaluation of Future Leachate Generation

During the first year of the Project it is proposed there would be significant works undertaken at the Whytes Gully RRP site, including operational changes, which are expected to significantly impact and reduce the current leachate generation rates. These include capping the Eastern Gully landfill platform, reprofiling the existing Eastern Gully landfill batter (considered to be a significant source of infiltration and stormwater contribution to the leachate collected at the site), in addition to capping of the current landfilling area and commencement of the Piggy Back Liner.

Additionally, Sydney Water may in this time develop firm upgrade plans for the sewer along Reddalls Road and consider an increased discharge limit to sewer for the Project site.

Wollongong City Council would log and review the resultant leachate generation volumes and rainfall amounts during 2014 and reassess the water balance model assumptions for infiltration rates and continue to liaise with Sydney Water on timing for sewer capacity upgrade and quantify and assess the need to upgrade the leachate treatment system.

Contingency Actions

The following contingency actions for leachate storage and/or treatment are considered feasible, and could be implemented in a short period of time at the Project site if necessary:

- Discharge to sewer directly from the leachate storage ponds during periods of low ammonia concentrations to increase leachate storage capacity (this approach is known to be acceptable to Sydney Water and has been implemented successfully in the past year) .
- Leachate reinjection over short-term into new waste proposed for the new cell through surface application across the daily cover area (10 000 m^2);
- Trucking of leachate to sewage treatment plant for disposal;
- ‘Package’ plants: proprietary package treatment plants are available that can be mobilised to the Whytes Gully RRP site should increased leachate treatment capabilities be temporarily required;
- Until the end of Stage 1 store excess leachate in the former surface water pond at the toe of the Western Gully, or construct a new leachate overflow storage pond in the Cell 2 or Cell 3 area;
- Upgrade the existing leachate treatment plant to increase volume throughput and/or efficiency of treatment process/new technologies; and
- Construct a cover over the existing leachate ponds to reduce the effects of direct rainfall.

In addition prior to commencement of the Project Wollongong City Council would:

- 'Drain', treat and dispose of accumulated leachate from the Western Gully landfill via replacement of the existing shallow leachate drainage line in the Western Gully and construction of a proposed new leachate drainage line in the Western Gully.

12.5.3 Mitigation Measures

Mitigation measures proposed to reduce the impact of leachate include:

- Segregation of leachate from surface water and groundwater;
- Maintain pond levels with adequate freeboard to minimise the potential for overflow;
- Continue to monitor leachate discharge to sewer in accordance with Trade Waste Agreement.

13.0 FLORA AND FAUNA

Chapter 13 of the EA assesses the potential biodiversity impacts of the Project including the existing conservation significance of terrestrial and aquatic flora and fauna at Whytes Gully RRP, the potential impacts of the Project upon threatened species, populations or ecological communities that occur, or have the potential to occur and proposes mitigation and management measures as required to ensure the Project maintains or improves the biodiversity values of the region.

The Director-General's requirements	
■ ***Biodiversity – Including:***	**Chapter 13, Appendix F**
▪ ***Accurate estimates of any vegetation clearing associated with the Project;***	**13.2**
▪ ***A detailed assessment of the potential impacts of the project on any terrestrial and aquatic threatened species or populations and their habitats, endangered ecological communities or groundwater dependent ecosystems;***	**13.1 13.2**
▪ ***A detailed description of the measures that would be implemented to avoid or mitigate impacts to biodiversity; and***	**13.3**
▪ ***An offset strategy to ensure that the project maintains or improves the biodiversity values of the region in the medium to long term (in accordance with NSW and Commonwealth policies).***	**13.2 13.3**

A terrestrial and aquatic flora and fauna impact assessment of the Project has been undertaken by Biosis Research (2012) "Whytes Gully New Landfill Cell Terrestrial and Aquatic Flora and Fauna Assessment" (Flora and Fauna Assessment) and is provided in full in Appendix F and summarised in this chapter.

The Flora and Fauna Assessment has been undertaken in accordance with the requirements of the *Environmental Planning and Assessment Act 1979* (EP&A Act), *Threatened Species Conservation Act 1995* (TSC Act) and the *Fisheries Management Act 1994* (FM Act).

13.1 Existing Environment

Consisting predominantly of previous landfill area and associated infrastructure, the majority of Whytes Gully RRP supports exotic grassland with patches of regrowth scrub and woodland/open forest. This vegetation is generally in poor condition with weeds throughout the understorey.

An area of forest and subtropical rainforest in the north east of the Project area is in better condition, with all native vegetation layers intact.

Aquatic habitats across Whytes Gully RRP include a number of surface water ponds, consisting of three large interconnected ponds, five small dams and several other additional water bodies associated with the operations of the site. These provide habitat of varying condition for a range of fauna species.

13.1.1 Background Review and Consultation

The Flora and Fauna Assessment first conducted a relevant background review of Whytes Gully RRP including a literature review and database search of the locality. This review included identification of threatened species, populations and communities within a 10 kilometre radius of Whytes Gully RRP as identified within the NSW National Parks and Wildlife Service (NPWS) Atlas of NSW Wildlife. Fish records were obtained from the Department of Primary Industries (DPI) protected species records viewer.

Threatened species, populations and communities listed in the EPBC Act and predicted to occur within a 10 kilometres radius of the Whytes Gully RRP site were obtained from the SEWPAC Protected Matters Search Tool.

Key specific literature reviewed included:

- The Draft Illawarra Biodiversity Strategy 2010 (the Strategy) (WCC *et al* 2010a; WCC *et al* 2010b);
- The *Native Vegetation of the Illawarra Escarpment and Coastal Plain* (NPWS 2002); and,
- *Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. Version 1.0*. (SCIVI) by Tozer *et al* (2006).

In addition flora and fauna specialists of Wollongong City Council (the Proponent) and the Office of Environment and Heritage were consulted prior to field surveys of Whytes Gully RRP being completed.

13.1.2 Field Surveys

Terrestrial and aquatic ecological surveys of Whytes Gully RRP were undertaken between 1 June 2010 and 10 January 2012 in varying weather conditions. This included initial site inspections and follow up diurnal and nocturnal targeted surveys.

Flora Surveys

The general flora survey conducted at Whytes Gully RRP applied the following methods:

- Determination of the vegetation communities present and comparison to those mapped as occurring within relevant vegetation mapping;
- The boundary between varying vegetation communities observed in the field was walked and tracked using a hand held GPS unit;
- An assessment of each vegetation community was conducted including a species inventory, abundance and description of the vegetation structure;
- Random meanders were conducted through Whytes Gully RRP to opportunistically search for threatened species, assess potential habitat for threatened species and determine changes in vegetation community;
- The general condition of the vegetation was assessed based on disturbance history, the degree of infestation by exotic species and vegetation structure; and,
- An assessment of the likelihood for threatened species to occur within Whytes Gully RRP was conducted.

As a result of the field surveys five vegetation communities were identified within Whytes Gully RRP, of which one, the lowland Dry Subtropical Rainforest corresponds with the TSC Act listed Illawarra Subtropical Rainforest (ISTR) endangered ecological community (EEC). In addition vegetation mapping indicated an Illawarra Lowland Grassy Woodland EEC may be located on the site, but during field survey work, no such EEC was identified.

- Targeted flora surveys were conducted on 19 July 2011 to map the boundaries of the ISTR in addition to identifying three threatened species considered potentially likely to occur at Whytes Gully RRP based on previous records. The three threatened flora species that had targeted surveys were:
- *Cynanchum elegans* White-flowered Wax Plant;
- *Daphnandra sp. 'Illawarra'* Illawarra Socketwood; and,
- *Syzygium paniculatum* Magenta Lilly Pilly.

However no record of these species was recorded at Whytes Gully RRP and therefore the Flora and Fauna Assessment concluded there is a low likelihood of these threatened flora species occurring at Whytes Gully RRP.

The area of ISTR within the Whytes Gully RRP site is approximately 0.56 hectares. The area of ISTR mapped by NPWS (2002b) within the Locality (10 kilometres radius) is approximately 194.025 hectares.

The boundary of the ISTR is provided in Figure 13.1.

Figure 13.1: Vegetation and aquatic mapping of Whytes Gully RRP
(Source: Flora and Fauna Assessment, Appendix F)

Fauna Surveys

Prior to diurnal and nocturnal or targeted surveys being undertaken, a habitat based assessment of Whytes Gully RRP was undertaken by three zoologists. The objective of this assessment was to identify the range of species and fauna habitats potentially within the site, with a particular emphasis on threatened and migratory species likely to occur.

Fauna habitats were assessed by examining the following characteristics of Whytes Gully RRP:

- Structure and floristics of the canopy;
- Understorey and ground cover vegetation;
- Abundance and size range of hollows and fissures in trees;
- Structure and composition of the litter layer;
- Disturbances, including weed invasion, clearing, rubbish or fire;
- Potential foraging, nesting or roosting resources; and,
- Connectivity to off-site habitats.

Other features considered in the fauna habitat assessment included; habitat corridors and vegetation communities present.

Four major fauna habitats were identified:

- Aquatic Environments – including the three surface water ponds located in the south-western section of the site, ephemeral drainage lines, decommissioned ponds and various other water bodies (including the Primary and Secondary Leachate Ponds);
- Open Forest/Woodland – highly disturbed habitat;
- Closed Forest – encompassing the ISTR located in the north-eastern section of Whytes Gully RRP; and
- Cleared and Disturbed – including the operational areas of the Whytes Gully RRP, easements, cleared Exotic Grasslands and Acacia Scrub.

Diurnal and nocturnal field surveys were then designed accordingly including:

- Diurnal survey techniques comprising:
  - Two 30 minute dawn bird surveys and one 30 minute dusk bird survey were undertaken by two zoologists at 3 locations including the surface water reed beds 1 and 2 located in the south-west of Whytes Gully RRP, the closed forest habitat in the north and the open forest/woodland habitat located in the south-east of the site. Birds were recognised by calls, flight patterns and plumage;
  - Direct sightings and observations of other signs and traces such as tracks and scats and aural recognition of calls;
  - Active searches for reptiles, amphibians and small mammals by turning logs, rocks and other debris for native fauna in locations of preferential habitat such the closed forest, open forest/woodland and around aquatic environments of the site; and,
  - Assessments of other microhabitats as hollows, culverts and artificial habitat features.

- Nocturnal survey techniques included:
  - Four ultrasonic bat detectors (Anabat) being deployed across Whytes Gully RRP for three consecutive nights and positioned in potential microbat flyways or foraging areas;
  - Nocturnal call playback conducted over two nights for the Barking Owl *Ninox connivens*, Powerful Owl *Ninox strenua* and Masked Owl *Tyto novaehollandiae*.
  - Spotlighting conducted on foot by two zoologists throughout the Whytes Gully RRP site; and,
  - Two motion-activated cameras deployed at Whytes Gully RRP for two nights.

As a result of the diurnal nocturnal and aquatic surveys, two threatened species, the Grey-headed Flying-fox and Southern Myotis (probable detection) were recorded within Whytes Gully RRP and an assessment for each species was completed in accordance with Appendix 3 of the *Draft Guidelines for Threatened Species Assessment (DEC & DPI 2005)* and the *EPBC Act Policy Statement 1.1* (DEWHA 2009a) (only for Grey-headed Flying-fox, which is listed as vulnerable under the EPBC Act).

Seven further threatened species were predicted to occur at Whytes Gully RRP based on preferred habitats and the proximity of previous records and after assessment for each species (in accordance with Appendix 3 of the *Draft Guidelines for Threatened Species Assessment (DEC & DPI 2005)* and the *EPBC Act Policy Statement 1.1* (DEWHA 2009a)) two of these species required further targeted surveys.

While considered unlikely to occur at Whytes Gully RRP, utilising the precautionary approach targeted surveys were completed for the Green and Golden Bell Frog (GGBF) and Australian Painted Snipe (APS), which were surveyed in accordance with relevant state and Commonwealth guidelines specific to the field survey of threatened frog and bird species in proposed development areas. These guidelines require at least four separate surveys at Whytes Gully RRP in summer months (completed November 2011 to January 2012), which have failed to detect either species.

Two additional targeted field surveys for the GGBF and APS were planned during the January/February season to confirm the results to date. However during this time conditions have not been suitable and no further surveys have been undertaken. Despite this in accordance with guidelines four separate targeted surveys completed have not identified the GGBF or APS and therefore the Project is assessed as unlikely to have a significant impact upon either species.

Aquatic Surveys

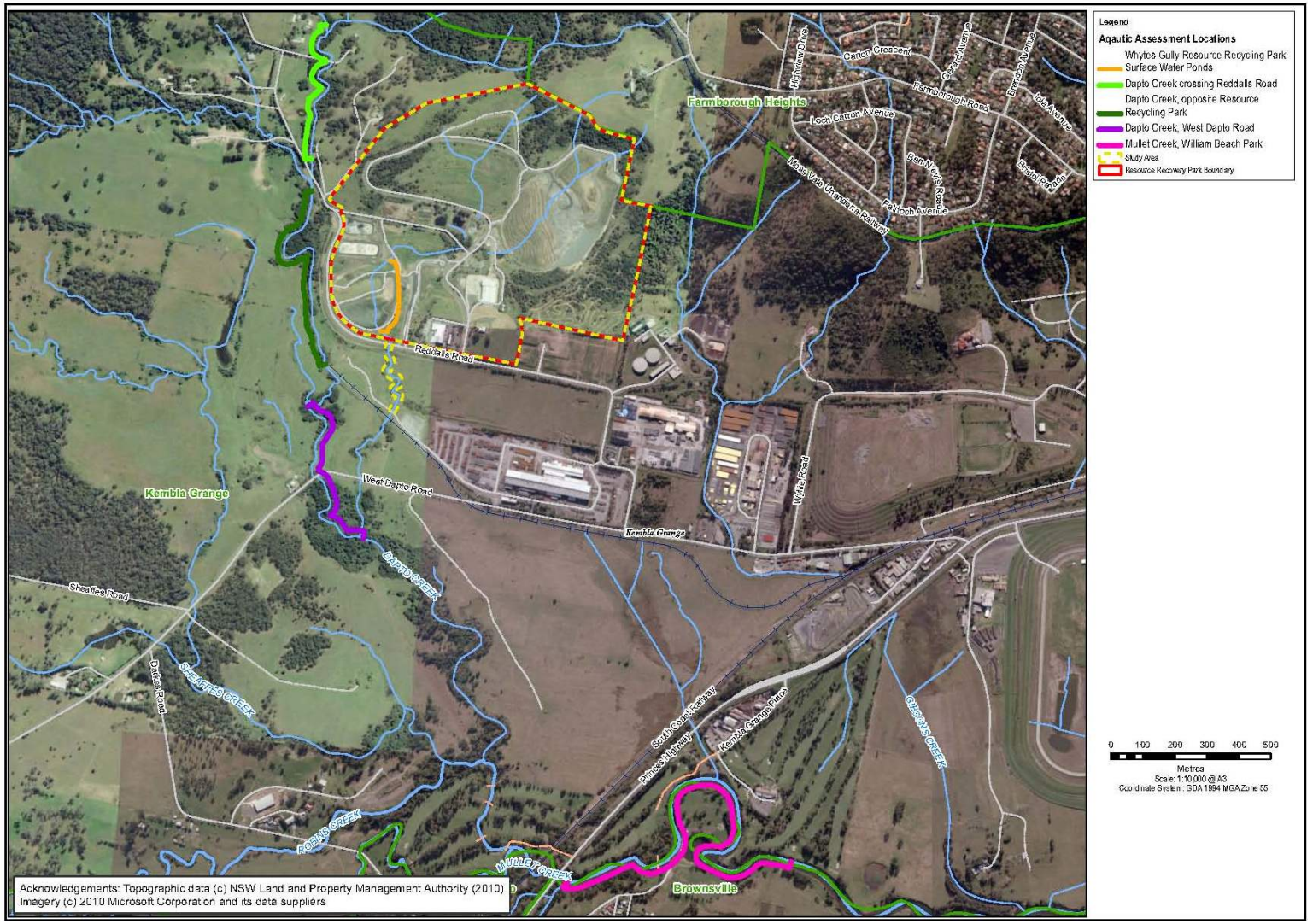
A survey of aquatic habitats at Whytes Gully RRP was undertaken on the 5 September 2011 using a combination of habitat-based assessment and water quality sampling. Aquatic survey effort was most rigorous within areas identified as most likely to contain habitat for threatened species. Further survey effort was conducted outside of Whytes Gully RRP to determine whether sufficient barriers to fish movement were present downstream of the site.

A total of five sites were focused on during assessment undertaken for the aquatic field surveys. This includes an artificial wetland consisting of surface water ponds, several smaller ponds (four being decommissioned), water bodies associated with the operations of the site including two leachate dams and Dapto Creek to the immediate west boundary of Whytes Gully RRP Site, flowing south parallel to Reddalls Road. Refer to Figure 13.2 for the specific location of these aquatic surveys.

Generally the aquatic habitat within Whytes Gully RRP is identified as man-made, designed to filter sediment laden stormwater from disturbed areas prior to release into Dapto Creek. Thus the surveyed ponds are subject to levels of pollution from runoff. The ponds have not been created as fauna habitat, and as such many of the essential fauna habitat components, such as significant areas of dense vegetation and floating aquatic vegetation, are not located within the survey areas.

No aquatic flora species listed under the FM Act and/or EPBC Act have been identified in relation to Whytes Gully RRP. Furthermore there are no known threatened aquatic flora populations or aquatic EECs listed under the FM Act, TSC Act or EPBC Act, or within the Wollongong LGA.

Figure 13.2: Aquatic Habitat Assessment Locations
(Source: Flora and Fauna Assessment, Appendix F)



A total of four aquatic fauna species listed under the FM and/or EPBC Acts, or their habitats are identified to potentially occur in the Wollongong LGA. These are:

- (Australian Grayling *Prototractes maraena*;
- Murray Cod *Maccullochella peelii*;
- Trout Cod *Maccullochella macquariensis*; and
- Macquarie Perch *Macquaria australasica*).

The likelihood of occurrence of these four species within Whytes Gully RRP, Dapto Creek or upstream of Mullet Creek are considered to be low, based on previous records, absence of suitable habitats and existing in-stream barriers.

Existing in-stream barriers to fish movement include exposed banks, dams, extensive dry areas and artificial weirs outside of the Project area within Dapto Creek and Mullet Creek, which provide no opportunities for fish to utilise habitats within the upper reaches of Dapto Creek. The availability of potential habitat was also identified to be in poor condition due to shallowness, dis-connectivity, low flow rates and prevalence of exotic weed species. No Groundwater Dependent Ecosystems (GDEs) occur within Whytes Gully RRP.

There is sparse vegetation consisting of few trees and no shrub layer within the riparian zone associated with the surface water pond located at Whytes Gully RRP. Exotic grasses dominate the banks of the wetland assessed to providing some stability against erosion.

Offsite of Whytes Gully RRP riparian vegetation exists around Dapto Creek (predominantly at Reddalls Road crossing outside of Whytes Gully RRP with the riparian zone highly disturbed around Mullet Creek.

Summary of Field Surveys

All field surveys undertaken for the Project are summarised in Table 13.1.

It is considered the field survey timing provides a spectrum of flora and fauna species and assessment of the ecological processes that occur in Whytes Gully RRP with the aid of desktop assessments and background research. However, it is also recognised that field survey conditions may impact upon findings with respect to seasonal and timing differences. These limitations have been addressed by identifying potential habitats for flora and fauna species and assessing the likelihood for these species to occur within the site and locality based on previous records, the type and condition of habitats present, the land use throughout the Project area and the landscape context at the locality scale.

Table 13.1: Field Survey Dates for flora and fauna at Whytes Gully RRP

Survey Type	Date
Initial terrestrial ecology site inspection	1 June 2011
Diurnal fauna surveys	7 June & 10 June 2011
Nocturnal fauna surveys	7 June & 10 June 2011
Flora survey	10 June 2011
Targeted flora survey	19 July 2011
Aquatic survey	5 September 2011
Targeted Fauna Survey Round 1	2 November 2011
Targeted Fauna Survey Round 2	14 November 2011
Targeted Fauna Survey Round 3	28 November 2011
Targeted Fauna Survey Round 4	10 January 2012

13.2 Potential Impacts of the Project

13.2.1 Flora

The potential impacts of the Project with regards to flora include:

- Potential clearing of native vegetation;
- Additional impacts to retained native vegetation, including edge effects leading to potential increased weed invasion;
- Trimming of the lower branches of native trees (to a height of 2 metres) retained on site for the purposes of bushfire protection;
- Potential drying of the soil along the top edge of the drain and a localised effect on native vegetation caused by drainage works within the edge of the ISTR;
- Reduced area of habitat for native vegetation; and,
- Indirect impacts to vegetation resulting from the construction phase of the Project.

As identified in Section 13.1 Whytes Gully RRP predominantly consists of exotic grassland over previous landfill area, with patches of regrowth scrub and woodland/open forest. This vegetation is generally in poor condition with weeds throughout the understorey. The Project proposes to remove approximately 25.56 hectares (ha) of this non-native or disturbed vegetation. In addition to this vegetation there is a further area of approximately 0.49 ha on the site which contains the EEC listed ISTR, which is in good condition.

Of the 0.49 ha area of ISTR mapped within Whytes Gully RRP approximately 0.01 ha is proposed to be removed by the Project. This area of proposed vegetation removal is identified as impacted by weed invasion caused by previous clearing and soil disturbance at the edge of the community.

The area of ISTR mapped by NPWS (2002b) within the Locality (10 kilometres radius around Whytes Gully RRP) is 194.025 ha, and therefore the amount of ISTR removal would represent approximately 1.8 percent of the ISTR mapped within Whytes Gully RRP and 0.05 percent of the ISTR mapped within the locality.

Given the limited area of disturbance anticipated as a result of the Project, it is considered removal of the proposed ISTR vegetation that has been affected by weed invasion would not significantly affect the biodiversity values of the Whytes Gully RRP site. Furthermore through the implementation of mitigation measures identified in Section 13.3, particularly weed control and revegetation works, it is considered the biodiversity values of the region would be improved and no biodiversity offset is required for the Project.

Potential impacts of the Project not only include direct removal of vegetation along the south-east edge of the ISTR community, but indirect impacts, which may exacerbate weed invasion on the edge of this community. To address this issue weed control measures are proposed to mitigate potential weed invasion of the remaining ISTR, thereby maintaining and improving the condition of the remaining ISTR community.

It is considered that in the medium to long term affective weed management of the remaining ISTR community at Whytes Gully RRP has the potential to maintain or increase the biodiversity values of the site and the region.

Drainage works proposed within the south east edge of the ISTR has the potential to affect the soil hydrology of the area by causing drying along the top edge of the drain. As a certain level of soil moisture is required to support the flora species that comprise this community this has the potential to impact upon the habitat of the ISTR. However, the ISTR vegetation proposed to be retained is up slope of proposed drainage works and therefore potential impacts of drainage works are likely to be localised. Installation of sediment and erosion control measures are proposed to further mitigate potential impacts of drainage works up the ISTR community as identified in Section 13.3.

13.2.2 Fauna

Potential impacts of the Project with regards to fauna include:

- Reduction in foraging habitat for microchiropteran bat species;
- Reduction in foraging habitat for the Grey-headed Flying-fox;
- Reduction in foraging habitat for native birds, mammals and reptiles in the open forest/woodland and closed forest habitats;
- Removal of understory flora including woody weeds such as Lantana, which provides important foraging and sheltering habitat for small native birds;
- Removal of woody debris, logs and/or grass thickets, which provide sheltering habitat for reptiles and small mammals;
- Removal of potential foraging and dispersal habitat for the GGBF and APS;
- Removal of sub-optimal habitat for the for the GGBF and APS;
- Modification to foraging and drinking habitats for native fauna over the surface water reed beds 1 and 2 and the surface water polishing pond; and
- Potential changes in flow received to the drainage line running from Whytes Gully RRP into Dapto Creek, which may impact on downstream habitats used by native fauna.

Assessments of significance in accordance with relevant legislation (including EPBC Act Policy Statement 1.1 (DEWHA 2009a) and Appendix 3 of the *Draft Guidelines for Threatened Species Assessment* (DEC & DPI 2005) have been conducted for the following fauna species:

- Hollow-dependent microbats, including:
  - Yellow-bellied Sheathtail-bat;
  - Eastern Freetail Bat;
  - Eastern False Pipistrelle; and
  - Greater Broad-nosed Bat
  - Eastern Bentwing-bat;
  - Southern Myotis;
- Green and Golden Bell Frog;
- Australian Painted Snipe; and
- Grey-headed Flying-fox.

Each assessments of significance for the identified species above has concluded that providing recommended avoidance and mitigation measures are adhered to (refer to Section 13.3), the Project is considered unlikely to have a significant impact on identified threatened species, populations and/or existing habitat at Whytes Gully RRP and will not reduce the long-term viability, accelerate or place at risk of extension, or adversely affect critical habitat of these species.

Refer to Appendix 3 of the Flora and Fauna Assessment (Appendix F) for full details of each species relevant assessment of significance.

13.2.3 Aquatic

The potential impacts of the Project with regards to aquatic ecology include the consideration of up to three Key Threatening Processes (KTPs) listed under Schedule 6 of the FM Act and one listed under Schedule 3 of the TSC Act.

A summary of the consideration of the KTPs which may potentially relate to the Project are as follows:

- Degradation of native riparian vegetation along NSW waterways (FM Act).
  - The Project would involve the modification of the existing surface water ponds within Whytes Gully RRP with limited native vegetation fringes of the surface water ponds being removed during the construction phase. However, it is proposed to reinstate native vegetation along the banks of the ponds following the re-structuring of the surface water ponds in accordance with the appropriate riparian buffer width as per *Wollongong (West Dapto) LEP 2010* and "Wollongong Development Control Plan" 2009, utilising the methodology identified within the Riparian Corridor Management Study (RCMS). The vegetation buffer is proposed to be constructed to an average width of 5 metres where possible to improve the existing aquatic habitats. As this revegetation occurs, the quality of native riparian vegetation would not be degraded at the Whytes Gully RRP site as a result of the Project.
  - As assessed within the Flora and Fauna Assessment (Appendix F), off-site riparian buffer distances are proposed to be maintained from nearby waterways in accordance with relevant legislation and the RCMS. As all construction works are to be undertaken within the Whytes Gully RRP these buffer distances should be maintained without any difficulty.
- Removal of large woody debris from NSW rivers and streams (FM Act). The surface water ponds to be modified currently do not have large canopy trees surrounding the ponds. No large woody debris have been observed within the ponds and given the lack of surrounding canopy this habitat feature is unlikely to be present within the surface water ponds to be re-structured. As these habitat features are absent from the site it is considered this KTP is not triggered.
- Instream structures and other mechanisms that alter natural flow (FM Act). The Project would involve modifying the current lay-out of the surface water ponds receiving water run-off from across the Whytes Gully RRP, but no instream structures are proposed to be installed. While the Project would temporarily alter the current natural flow of water that exits Whytes Gully RRP, this change is temporary and as a result the natural flow of the waterway would not be permanently altered and is considered an acceptable potential impact.
- Alteration to the natural flow regime (TSC Act). The Project would involve modifying the current lay-out of the surface water ponds receiving water run-off from across Whytes Gully RRP. However, this alteration to the current flow of water across the site would be temporary with the surface water ponds being re-structured with similar capacity to continue in their function as settling ponds for surface water run-off. The natural flow should not be permanently disrupted as a result of the proposal and is considered acceptable.

A full assessment of all KTPs is included within the Flora and Fauna Assessment (Appendix F).

13.3 Mitigation Measures

In order to avoid, mitigate and manage potential impacts of the Project upon flora and fauna the following mitigation measures are proposed.

- Clearing for the purposes of bushfire protection be restricted to non-native vegetation communities (Acacia Scrub/Exotic, Closed Exotic Grassland, Planted). In accordance with the Bushfire Assessment, clearing or trimming of the ISTR is proposed to be avoided.
- Removal of native vegetation communities and fauna habitats during construction and operation of the Project be avoided and minimised where possible.
- Undertake additional targeted surveys for the Green and Golden Bell Frog in the peak breeding season (as available) to confirm results of targeted surveys undertaken in November/December 2011and early January 2012.
- Removal of waterbodies and associated vegetation should be undertaken over the spring or summer months when fauna species are most active. This allows fauna to retreat to surrounding habitats such as Dapto Creek and farm dams.
- Undertake protection of all retained trees. Tree protection measures such as temporary fencing would be implemented for any trees potentially indirectly impacted by the Project.
- Install protective fencing around all retained native vegetation. This is particularly important for areas of ISTR EEC where there is a risk of indirect impact.
- Installation of sediment and erosion controls as required including for potential indirect impacts to the ISTR EEC.
- Ensure machinery parking, equipment or materials storage compounds, temporary stockpiling of excavated material and work areas are well outside sensitive natural features including retained native vegetation, wetlands and drainage line.
- Logs removed with any vegetation removal would be relocated into areas of retained vegetation, in a sensitive manner, for the purpose of providing fauna habitat.
- A weed control program would be undertaken. Bush regeneration techniques conducted by a suitably qualified contractor would be implemented as this approach would lead to an improvement in the condition of native vegetation communities, reduce the requirement for weed control in the long term, reduce the risk of over clearing impacting fauna habitats, reduce potential harm to the ISTR EEC and in the medium to long term improve condition of this EEC.
- Undertake revegetation of cleared and disturbed areas using a range of native species of local provenance for the purpose of managing weeds, controlling soil erosion, and maintaining fauna habitat.
- Maintain suitable buffer distances from nearby waterways. These buffer distances are recommended based on the stream orders of waterways and the subsequent categories identified within the “Wollongong City Council Development Control Plan 2009”. As all construction works are to be undertaken within the Whytes Gully Resource Recovery Park boundary, these buffer distances should be maintained without any difficulty.
- Following the re-shaping and modification of existing surface water ponds, landscaping would be undertaken to enhance existing riparian zone vegetation associated at the ponds to provide in accordance with appropriate riparian buffer widths. The vegetation buffer is proposed to be constructed to an average width of 5 metres where possible to improve the existing aquatic habitats.
- The current water quality monitoring program is proposed to be extended to include at least one monitoring location on Dapto Creek, upstream of the discharge point for the Whytes Gully RRP, as a control and a minimum of two locations downstream.

14.0 AIR QUALITY

This chapter provides a summary of the PAE Holmes (2012) "Air Quality Assessment: Whytes Gully Landfill Extension" (Air Assessment) provided in Appendix H of the EA to assess potential odour and dust impacts of the Project. The Air Assessment includes identifying methodology of assessment, existing environment, impact assessment (based on estimated emissions) and mitigation measures.

The Director-General's requirements	
■ ***Including a quantitative assessment of the potential air quality and odour impacts of the project including cumulative impacts; and***	**Chapter 14**
■ ***A demonstration that the proposal is able to comply with the Protection of the Environment Operations (POEO) Act 1997 and the POEO (Clean Air) Regulation (2002).***	

14.1 Assessment Methodology

14.1.1 Odour

This chapter and the Air Assessment have been prepared with consideration of the *Protection of the Environment Operations (POEO) Act 1997* and the *Protection of the Environment Operations (Clean Air) Regulation (2002)* and where relevant the assessment has demonstrated it is in compliance with this legislation.

Odour goals have been developed by OEH as outlined within the "Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales" (NSW DEC, 2005) (OEH Approved Methods). This includes the way in which the methods should be applied with dispersion models to assess the likelihood of nuisance impact arising from the emission of odour.

The OEH Approved Methods include ground-level concentration (glc) criterion for complex mixtures of odorous air pollutants, which have been refined by the OEH to take account of population density. Table 14.1 lists the odour glc criterion to be exceeded not more than 1 percent of the time, for different population densities. The difference between odour goals is based on considerations of risk of odour impact and not differences in odour acceptability between urban and rural areas.

Table 14.1: OEH assessment criteria for odour
(Source: Air Assessment, Appendix H)

Population of affected community	Impact Assessment Criteria for Complex Mixtures of Odorous Air Pollutants (OU, nose-response-time average, 99th percentile)
≤ ~2	7
~10	6
~30	5
~125	4
~500	3
Urban (2000) and/or schools and hospitals	2

For the number of residential properties in the area an assessment criterion of 5 ou would be more representative for the single residences to the northwest, northeast and southwest. However, the more stringent criterion of 2 ou would apply to the suburb of Farmborough Heights to the northeast of the site.

It should be noted that the odour assessment criteria are not intended to achieve 'no odour'. They are concerned with controlling odours to ensure offensive odour impacts would be effectively managed. As the

results for this assessment will show, there would be occasions when the 1-hour average odour concentration exceeds 5 ou at some sensitive receptors, but this is considered acceptable if these occurrences are infrequent and less than 1 percent of the time.

Measuring odour concentrations using dispersion models to confirm compliance with odour goals is also required. It will be necessary to demonstrate that peak-to-mean ratios for a range of circumstances provided for within OEH Approved Measures have been assessed to determine the relevant impact assessment criteria as provided in Table 14.1. For further explanation of methodology context and background including peak-to-mean ratios refer to Appendix H.

14.1.2 Dust

Table 14.2 and Table 14.3 summarise the air quality assessment criteria for particulate matter concentration and dust deposition.

The air quality criteria relate to the total dust burden in the air and not just the dust from the proposed Whytes Gully RRP cell construction. Put another way, the OEH Approved Measures requires consideration of background levels to be made when using these criteria to assess impacts of the Project and thus cumulative impacts are included within the assessment.

Table 14.2: OEH assessment criteria for particulate matter concentrations
(Source: Air Assessment, Appendix H)

Pollutant	Criteria	Averaging Period	Agency
Total suspended particulate matter (TSP)	90 μg/m^3	Annual mean	NHMRC[1]
Particulate matter <10 μm (PM_{10})	50 μg/m^3	24-hour maximum	OEH
	30 μg/m^3	Annual mean	OEH
	50 μg/m^3	(24-hour average, 5 exceedances permitted per year)	NEPM[2]

[1] National Health and Medical Research Council
[2] National Environment Protection Measure

In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by deposition of dust on surfaces. Table 14.3 shows the maximum acceptable increase in dust deposition over the existing dust levels. These criteria for dust fallout levels are set to protect against nuisance impacts.

Table 14.3: OEH assessment criteria for dust fallout
(Source: Air Assessment , Appendix H)

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

14.1.3 Modelling Methodology

The local meteorology was modelled using TAPM and CALMET models with output from TAPM, plus regional observational weather station data entered into CALMET. From this, a 1-year representative meteorological dataset was compiled, suitable for use in the 3-dimensional plume dispersion model, CALPUFF. Details on the model configuration and data inputs are provided in Appendix H.

The choice of the CALMET/CALPUFF modelling system for this study is based on the fact that simple Gaussian dispersion models such as AUSPLUME, assume that the meteorological conditions are uniform spatially over the entire modelling domain for any given hour. While this may be valid for some applications,

in complex flow situations, such as coastal environments, the meteorological conditions may be more accurately simulated using a wind field model such as CALMET.

14.2 Existing Environment

14.2.1 Local Meteorology

The CALMET generated windroses identify the annual predominant wind direction is from the north-northwest, while the BoM (Albion Park) and OEH (Kembla Grange) monitoring and weather stations identify winds predominantly from the west, northeast and south. This is not entirely unexpected given the proximity of the elevated terrain immediately of Whytes Gully RRP to the north-northwest potentially causing drainage flows (katabatic drift) at times.

Drainage flow is often invoked as the conditions under which maximum odour impacts from ground-based sources are likely to occur. This is the movement of cold air down a slope, generally under calm conditions. Under these conditions, dispersion would be slow and impacts can be greatest. Drainage flow conditions generally occur in the early morning or evening, when the atmosphere is at its most stable, and are more frequent in autumn and winter when the thermal mixing of the atmosphere is less than spring and summer. The difference in wind direction between the modelling and the weather station data may be due to a mixture of this drainage flow and terrain influence as a result of the relatively steep terrain to the north of Whytes Gully RRP.

In addition to prevailing winds at Whytes Gully RRP, relevant local meteorology conditions generated by CALMET in relation to odour and dust, including atmospheric stability and mixing height, have been modelled for the site. Refer to Appendix H for further information.

In addition to meteorological parameters, the OEH monitoring station at Kembla Grange also measures PM_{10} data using a Tapered Element Oscillating Microbalance (TEOM) system. Given the proximity of this monitoring station to Whytes Gully RRP, the data available at the OEH monitoring station is presumed to be representative of conditions at the Project site. The annual average is approximately 21 $\mu g/m^3$.

Refer to the Air Assessment (Appendix H) for results of existing PM_{10} data in proximity to the site, which were utilised in the assessment of the Project.

14.3 Estimated Emissions

14.3.1 Odour

Based upon existing operations it is considered the main odour source at Whytes Gully RRP (excluding the greenwaste to be relocated offsite in January 2012) is the active tipping face while it remains uncovered during daily operations. Other sources include two leachate ponds, a small leachate treatment plant, daily cover area (150 mm of cover over waste), intermediate cover area (300 mm of cover over waste) and a proposed waste relocation excavation area.

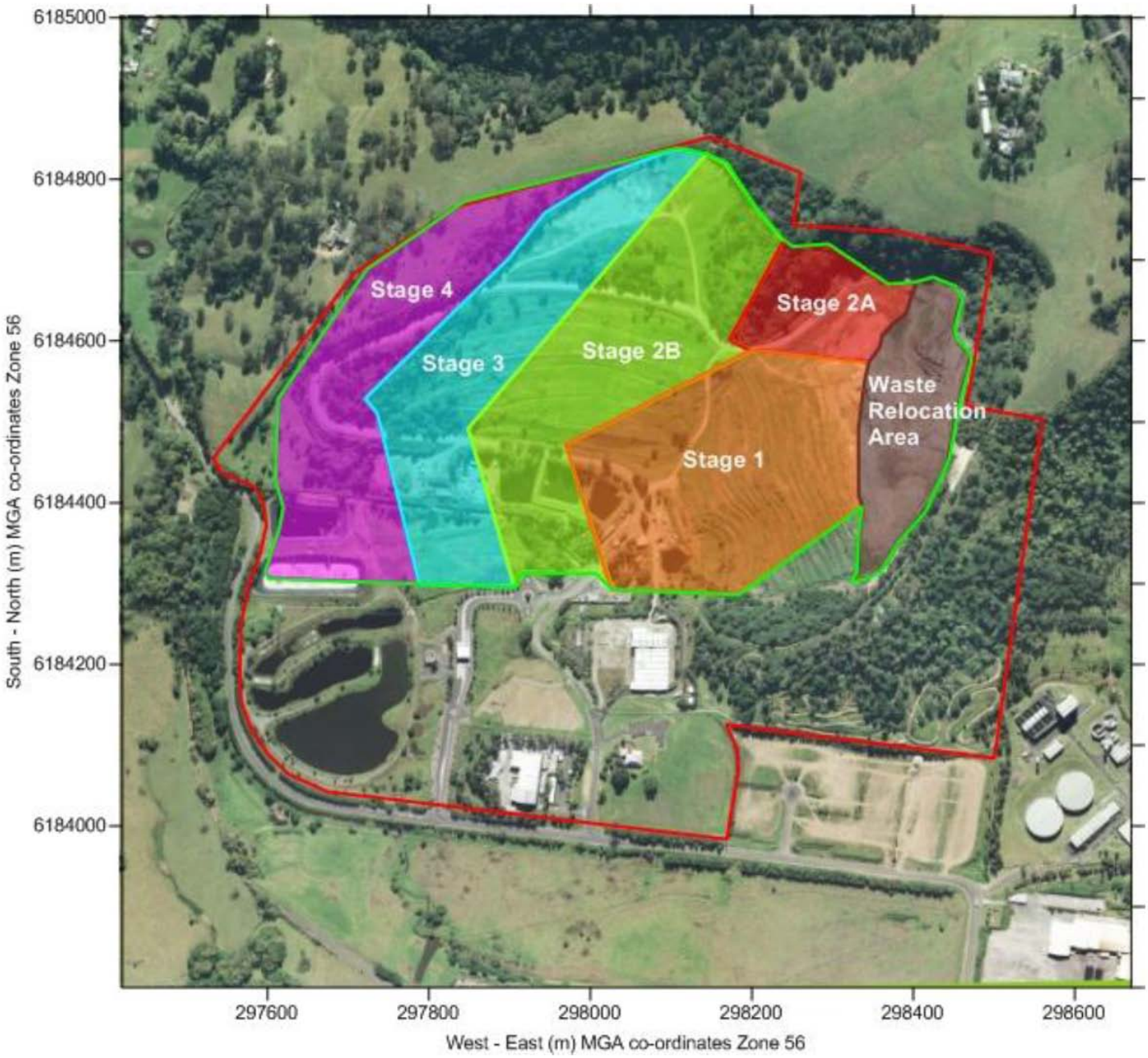
The location of the waste relocation area is a recently filled area which is proposed to be excavated and relocated into Stage 1 of the landfill cell construction over a period of one year. The waste relocation area would essentially be similar to that of the active tipping face and daily cover in terms of odour emission. Stage 1 would therefore constitute a worst-case scenario for the residences to the northeast of the site, and for residences in Farmborough Heights due to its proximity compared with the location of further proposed stages. For the residences to the north-northwest of Whytes Gully RRP, Stage 4 represents a worst-case scenario as operations are proposed to extend to the north-northwest boundary as shown in Figure 14.1.

The estimated odour emission rates of the Project are provided in Table 14.4 based upon site specific odour measurements. Although there are difficulties in estimating odour emission rates from large area sources such as landfills (where emissions are generally not constant across the site and vary with time), the results obtained are consistent with measurements made at other landfills in NSW and are therefore considered representative for the Project. For full results refer to the Air Assessment in Appendix H.

Table 14.4: Estimated odour emission rates of the Project
(Source: Air Assessment , Appendix H)

Stage 1			
Active tipping face	1.115	1,100	1,227
Waste Relocation area	1.115	1,800	2,007
Daily cover (150 mm)	1.023	19,800	20,255
90 days cover (300 mm)	0.035	14,000	490
Leachate ponds	0.153	5,000	765
Stage 4			
Active tipping face	1.115	1,000	1,115
Daily cover (150 mm)	1.023	1,300	1,330
90 days cover (300 mm)/ Intermediate cover	0.035	27,500	963
Leachate ponds	0.153	5,000	765

Figure 14.1: Proposed Staging of the Project
(Source: Air Assessment, Appendix H)



14.3.2 Dust

Dust generation during construction has been estimated based on the amount of material being excavated, stockpile areas, on-site traffic movement and areas exposed to wind erosion. Proposed operations would predominantly occur simultaneously with construction and haulage and daily covering have also being taken into consideration.

The most significant dust generating activities are identified in Table 14.5 with their respective dust emission estimates for the Project. For further information on the factors and parameters used to calculate these refer to Appendix H.

Table 14.5: Estimated dust emission rates for worst case year (kg/y)
(Source: Air Assessment , Appendix H)

Activity	Stage 1 - TSP Emission Rate (kg/y)	Stage 4 - TSP Emission Rate (kg/y)
Dozers ripping material	26,107	26,107
Excavators loading ripped material to trucks	95	279
Hauling material to stockpiles	1,353	3,995
Unloading material to stockpiles	95	279
Loading daily cover to trucks	259	158
Hauling daily cover to active tip face area	7,423	2,260
Unloading daily cover	259	158
Spreading daily cover	17,405	17,405
Wind erosion from material stockpiles	438	438
Wind erosion from exposed working areas	2,190	1,752
Total Dust (worst case year)	**55,625**	**52,831**

14.4 Impact Assessment

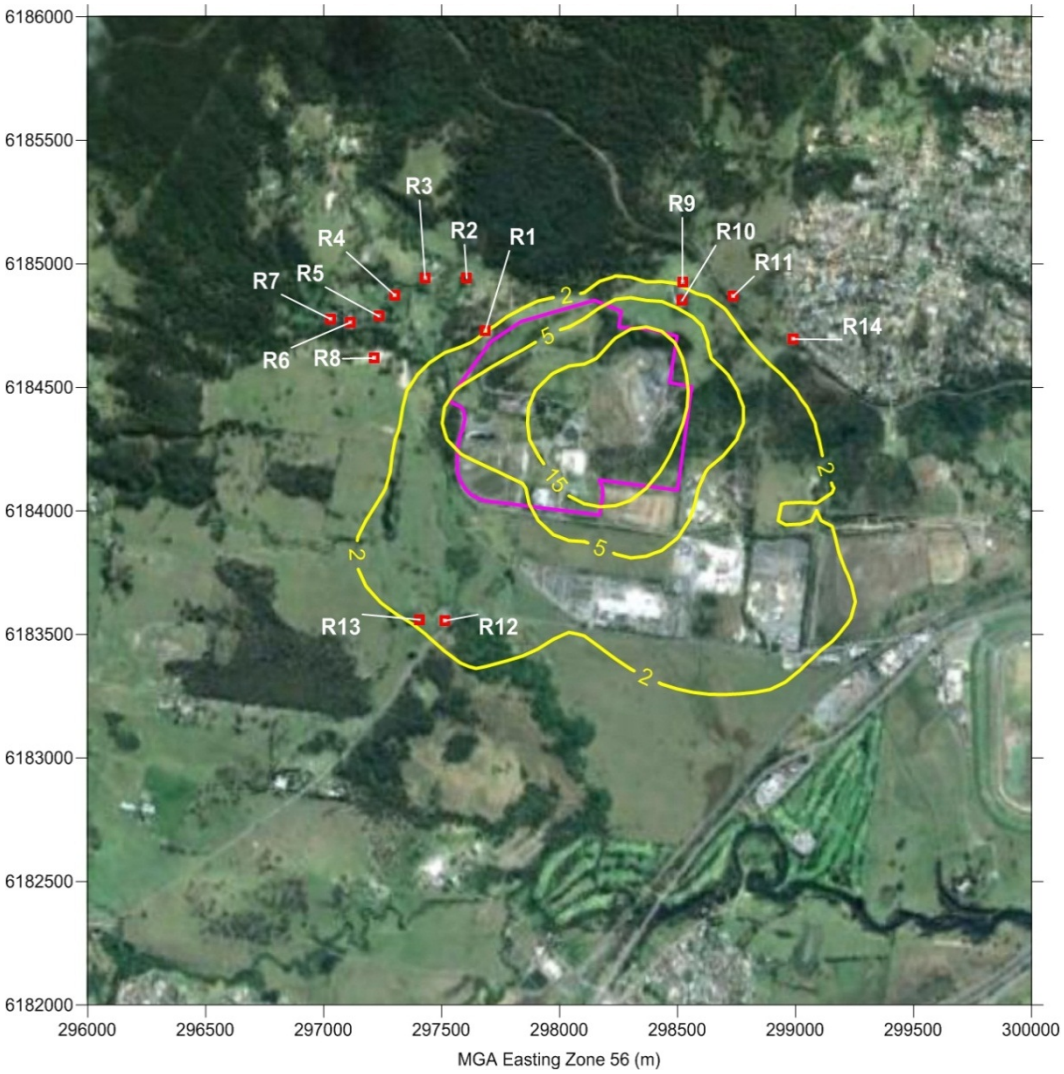
14.4.1 Odour

Utilising the CALPUFF dispersion modelling and the odour emissions data (refer to Table 14.4) the predicted odour concentrations do not exceed 3 ou at individual residences during the identified worst-case scenarios of Stage 1 and Stage 4 of the Project (refer to Table 14.6 and Figure 14.2 for residence ID locations and odour contours for Stage 1).

Assessed against OEH assessment criteria (refer to Table 14.1) the Project complies with OEH criterion at these individual locations. As further identified in Figure 14.2 it can be recognised that the predicted 2 ou contours do not extend to Farmborough Heights during the worst-case scenarios of Stage 1 and Stage 4. It is therefore considered that the Project would comply with the OEH criterion in accordance with relevant legislative requirements.

It should be reiterated that compliance with the OEH assessment criteria does not mean that odour would never be detected at identified receptors, but that it is not predicted to be detected more than 1 percent of the time (88 hours per year) at the relative level. It is considered that the Project is therefore in compliance with appropriate standards.

Notwithstanding this, the operations at the site should be managed so that odour emissions, particularly during Stage 1 and Stage 4, are kept to a minimum. Recommended mitigation measures are identified in Section 14.5.



Species:	Location:	Scenario:	Percentile:	Averaging Time:
Odour	Whytes Gully RRP	Stage 1	99th	Nose response
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF v6.262	Odour units (OU)	OEH =5 OU	2009 CALMET-Generated	J. Barnett

Figure 14.2: 99 percentile predicted odour levels for Stage 1 operations
(Source: Air Assessment , Appendix H)

Table 14.6: 1-hour average (99th percentile) odour concentrations at individual residences
(Source: Air Assessment , Appendix H)

Residence ID	Stage 1 (ou)	Stage 4 (ou)
R1	2	3
R2	1	1
R3	1	1
R4	1	1
R5	1	< 1
R6	1	< 1
R7	1	< 1
R8	1	< 1
R9	2	< 1
R10	3	< 1
R11	1	< 1
R12	2	1
R13	2	1
R14	1	< 1

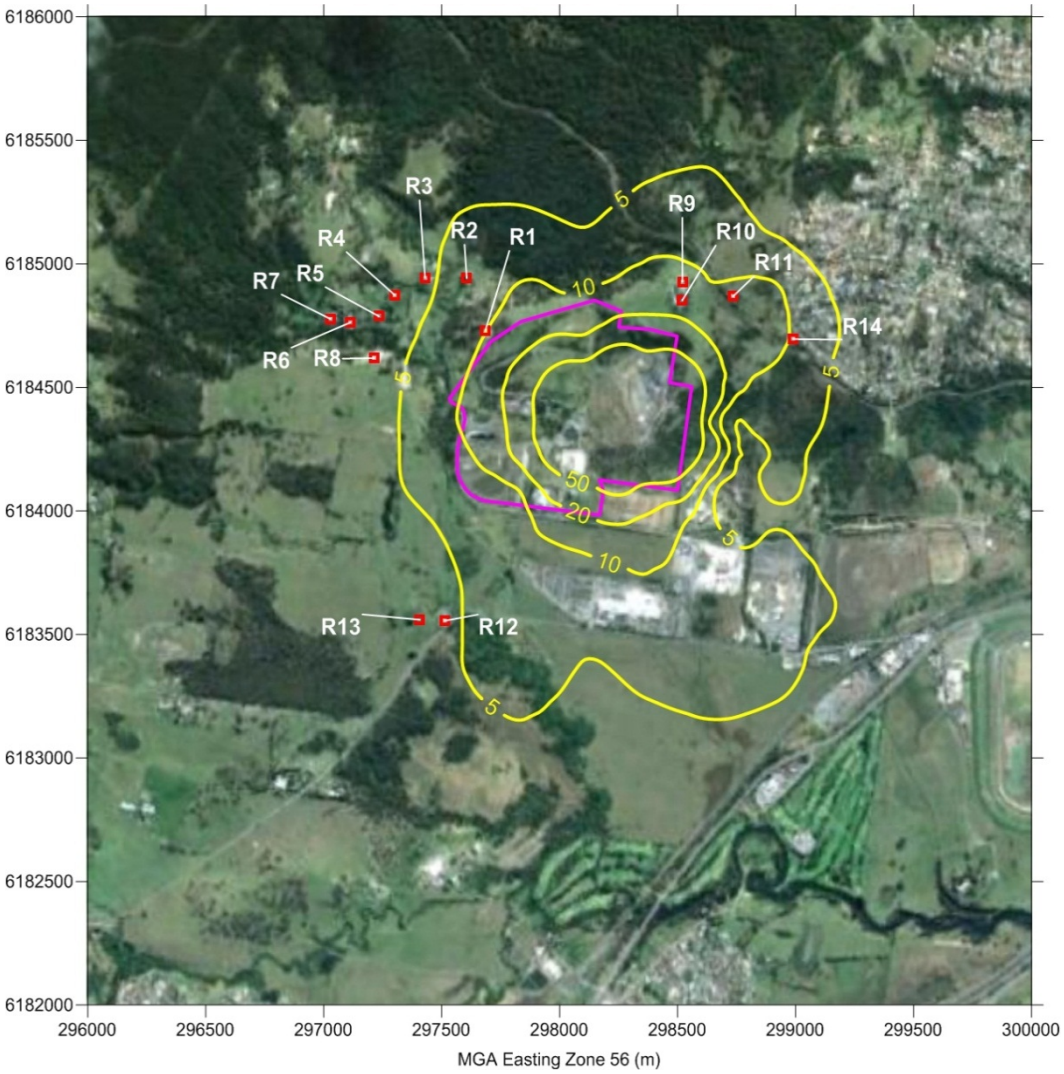
14.4.2 Dust

The results of the CALPUFF dispersion modelling using the estimated dust emissions summarised in Table 14.5 are presented as contour plots in Figure 14.3 and Figure 14.4. As identified in Figure 14.3 predicted 24-hour average PM_{10} concentrations at the closest residences are below 20 µg/m^3 and when the cumulative impact of the Project is measured there are no occassions where an exceedance is predicted due to the Project.

Furthermore the Air Assessment methodology is considered conservative as at least part of the existing background concentrations are likely to include existing operations at the Whytes Gully RRP and therefore there is an element of double counting in this approach. Notwithstanding this, the operations at the site should be managed so that dust emissions, particularly during construction, are kept to a minimum. Recommended mitigation measures are identified in Section 14.5.

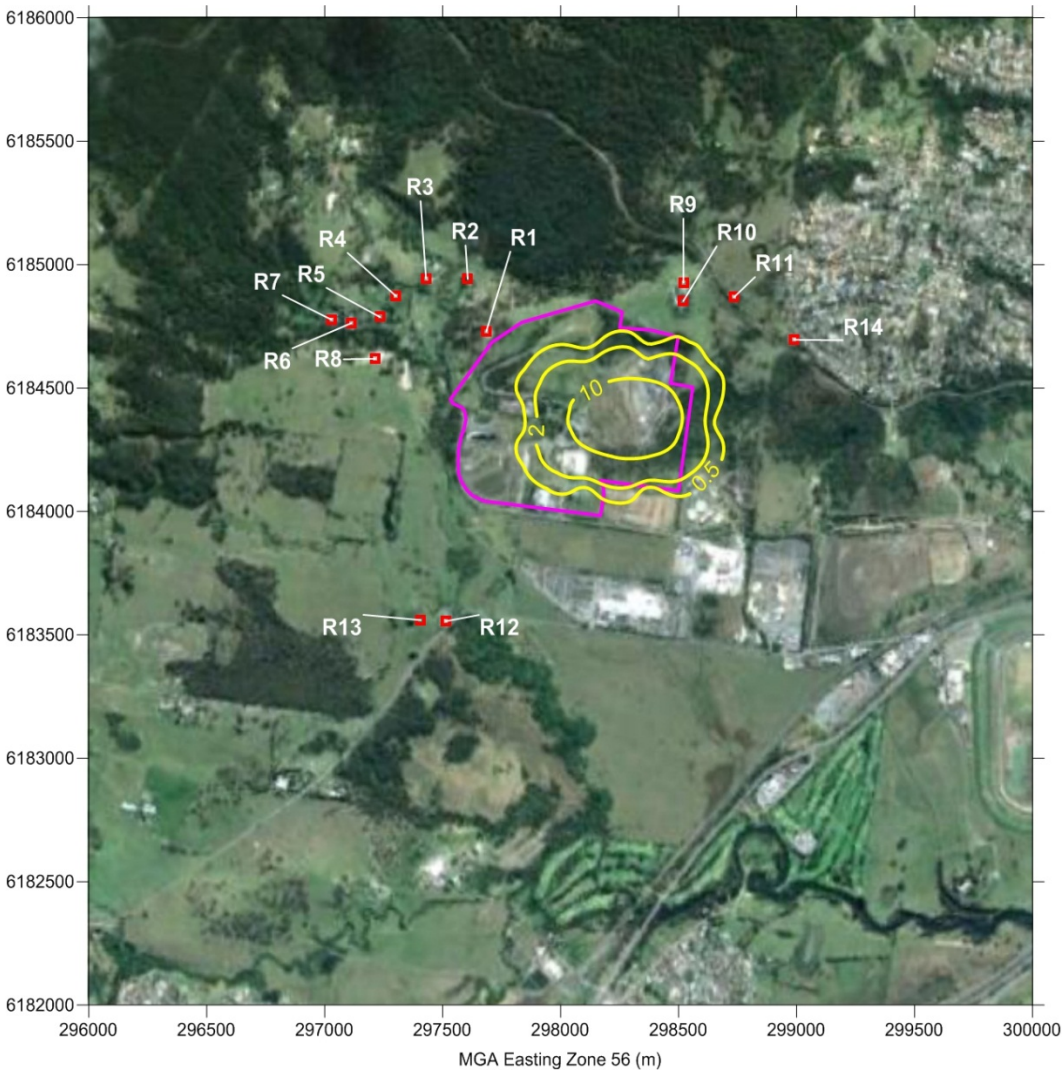
Assuming an annual average existing PM_{10} level of 21 µg/m^3 (refer to Section 14.2.1), predicted levels of approximately 1 µg/m^3 at the nearest residences would not cause an exceedance of the annual criterion (refer to Figure 14.4). Similary, predicted TSP and dust deposition levels are extremely low at the nearest residences.

Therefore predicted annual average dust concentrations are well below OEH criteria and it is predicted from these plots that dust levels would be very low, particularly for annual averages, and well below the relevant criteria. It is therefore considered that dust levels would meet relevant legislative requirements.



Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Whytes Gully RRP	Construction and Stage 1	N/A	24-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF v6.262	Micrograms / cubic metre ($\mu g/m^3$)	50 $\mu g/m^3$	2009 CALMET-Generated	J. Barnett

Figure 14.3: Predicted 24-hour average PM10 concentration during construction
(Source: Air Assessment , Appendix H)



Species:	**Location:**	**Scenario:**	**Percentile:**	**Averaging Time:**
Dust deposition	Whytes Gully RRP	Construction and Stage 1	N/A	Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF v6.262	grams/m^2/month (g/m^2/month)	2 g/m^2/month (Project alone)	2009 CALMET-Generated	J. Barnett

Figure 14.4: Predicted annual average dust deposition during construction
(Source: Air Assessment , Appendix H)

14.5 Mitigation Measures

The potential odour and dust impacts of the Project are assessed as being well within relevant OEH criteria (as summarised in Section 14.4).

Despite this, mitigation measures are proposed for potential dust emissions during construction and operation. These measures include:

- Watering of unsealed haul roads and disturbed surfaces (including construction areas);
- Restricting the size of disturbed areas as much as practicable;
- Available areas of disturbed areas would be rehabilitation progressively in accordance with the Landscape Strategy.
- Prevention of truck over-loading and covering dusty loads;
- Washing down trucks before they leave the site; and
- Temporarily suspending operations under extreme wind speed conditions.

Mitigation Measures proposed for odour control include:

- Reducing the footprint of the active cell area and daily cover and giving consideration to increasing the thickness of operational cover to control odour particularly during the operation of Stage 1 during waste relocation works and Stage 4.

15.0 TRAFFIC AND TRANSPORT

This chapter addresses the traffic and transport impacts of the Project and is based upon the "Whytes Gully New Landfill Cell Transport Impact Assessment 2012" (Transport Impact Assessment) completed by GTA Consultants (Appendix I). The Transport Impact Assessment examines existing traffic conditions surrounding the Whytes Gully RRP, the traffic generating characteristics of the Project during construction and operation, suitability of existing access arrangements for the site and the transport impact of the Project on the surrounding network.

The Director-General's requirements	
■ ***Traffic and Transport – including:*** ▪ ***details of traffic volumes that are likely to be generated during construction and operation of the project, and an assessment of the impact of this traffic on the safety and efficiency of the surrounding road network; and,*** ▪ ***details of suitable infrastructure required to ameliorate any traffic impacts and safety impacts associated with the project***	**Chapter 15**

15.1 Existing Environment

15.1.1 Reddalls Road

Reddalls Road is a local road under the care, control and management of the Proponent, Wollongong City Council, and provides connections to the site from West Dapto Road. It is a two-way road configuration with a two-lane (one in each direction), 9.3 m wide carriageway set within an approximate 23 m road reserve.

At the intersection with West Dapto Road, Reddalls Road carries approximately 840 vehicles a day (refer to Appendix E for traffic counts).

Figure 15.1 shows the local road network and access to Whytes Gully RRP. The site can be accessed via two entrances from Reddalls Road, the main site access entrance accessing the weighbridge to the west and the secondary entrance to the east accessing the Materials Recovery Facility (MRF) and administration building (Glengarry Cottage).

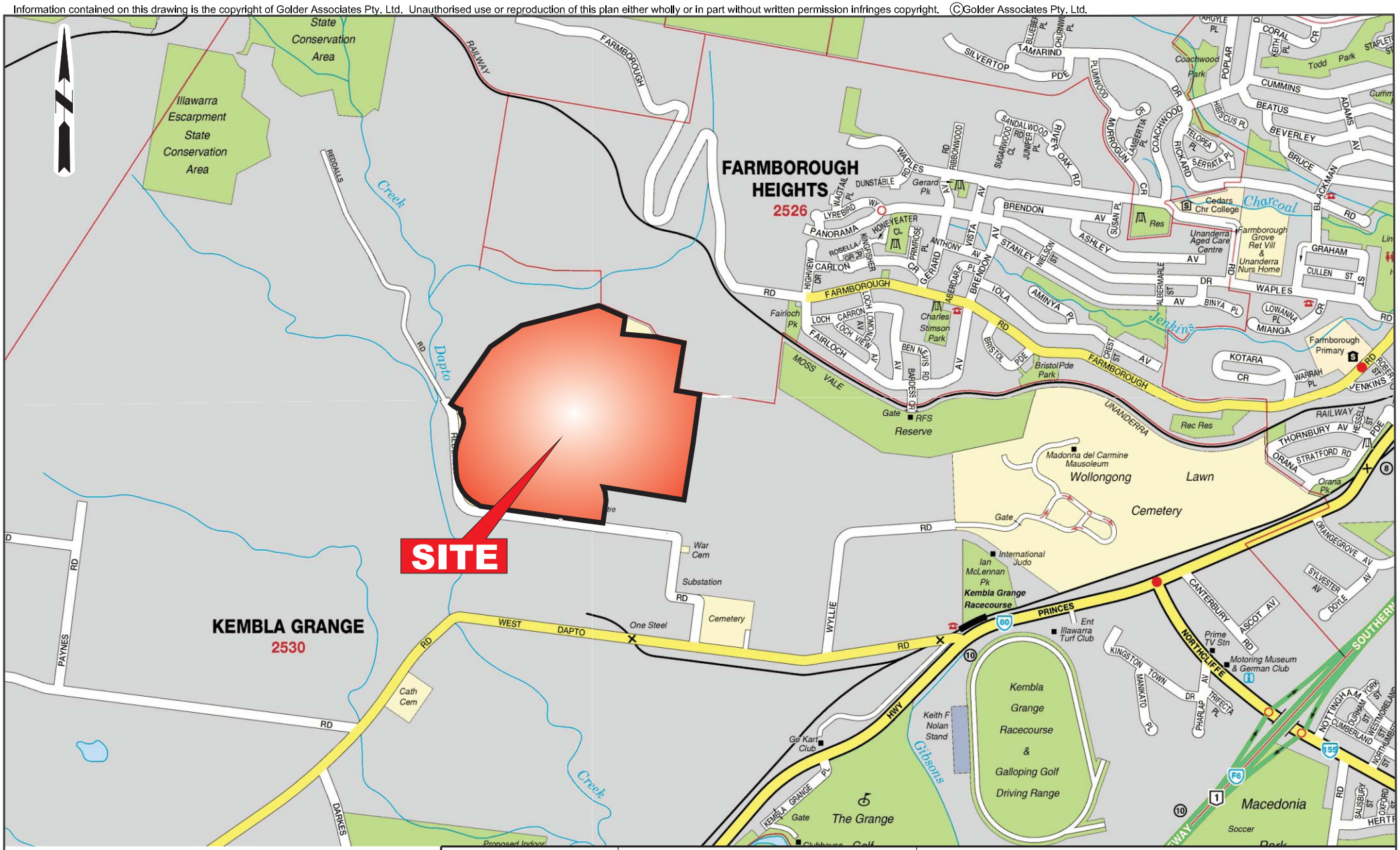
15.1.2 West Dapto Road

West Dapto Road is a local road under the care, control and management of the Proponent. It is a two-way road configured with a two-lane (one in each direction) 7 m carriageway. At its intersection with Reddalls Road, West Dapto Road has an Auxiliary Right turn (AUR) treatment providing an additional lane for vehicles turning right into Reddalls Road. Immediately east of the Reddalls Road intersection, West Dapto Road carries approximately 3,000 vehicles per day (refer to Appendix I for full details of traffic counts).

15.1.3 Princes Highway

The Princes Highway is classified as a Regional Road under the care, control and management of the Roads and Maritime Services (previously known as the Roads and Traffic Authority or RTA), which provides access to Whytes Gully RRP via connection with West Dapto Road. It is a four-lane (two in each direction) 15 m carriageway and provides a dedicated right turn lane into West Dapto Road.

Immediately north of the West Dapto Road intersection the Princes Highway carries approximately 10,300 vehicles per day (refer to Appendix I for full details of traffic counts). Figure 15.1 provides the road network to Whytes Gully RRP including the Princes Highway/West Dapto Road intersection.



Golder Associates
www.golder.com
GOLDER ASSOCIATES PTY LTD

CLIENT: WOLLONGONG CITY COUNCIL		PROJECT: WHYTES GULLY NEW LANDFILL CELL	
DRAWN: HC	DATE: 21.03.2012	TITLE: ROAD NETWORK	
CHECKED: JMc	DATE: 26.03.2012		
SCALE: 1:20,000	A4	PROJECT No.: 117625003	DOC No.: 159 / DOC TYPE: R / FIGURE No.: F0015 / REVISION: 0

FIGURE 15.1

15.1.4 Existing Site Traffic Volumes

From August 2010 to August 2011 the existing yearly traffic volume for Whytes Gully RRP was 108,568 inbound traffic movements via the main site access entrance (based on weighbridge data). This equates to an average of 298 inbound or 598 movements (inbound and outbound) per day at the site. In addition to this data supplemental traffic counts have been completed at the main site access entrance and the secondary entrance intersection at Reddalls Road during peak periods and intersection operation at Reddalls Road/West Dapto Road and Princes Highway/West Dapto Road have been observed and assessed using SIDRA to calculate intersection performance based upon vehicle delay.

Findings indicate that during AM and PM peak periods the level of service (as measured by average delay per vehicle) predominantly provided a Level of Service (LOS) of A, which equates to 0-14 seconds per vehicle, which is the best available LOS rating and indicates good operation.

At the intersection of Princes Highway/West Dapto Road there were some observations of LOS B (approximately 17 seconds delay per vehicle), which is defined as providing acceptable delays and spare capacity. Refer to Appendix I for full traffic count and intersection results.

15.1.5 Public Transport

Public transport provides limited access to Whytes Gully RRP with buses travelling on the Princes Highway, but no services using West Dapto Road. The nearest bus stop and train station are each located approximately 2 km from the site.

15.1.6 West Dapto Access Strategy

Whytes Gully RRP is located within the identified boundaries of the West Dapto Land Release Area, which covers approximately 4,700 hectares and proposes a staged release of 17,000 dwellings and 184 hectares of employment land over the next 30 to 40 years.

Separate to the Project, Wollongong City Council has developed a staged access strategy to improve road links to West Dapto to support this planned development. This includes installing traffic signals at the Princes Highway/West Dapto Road intersection to improve safety and future traffic capacity. This upgrade is scheduled for early 2012 (prior to the Project being constructed). In addition the West Dapto Access Strategy proposes staged widening of West Dapto Road over a number of years to accommodate anticipated traffic flows generated by future land release.

Further transport upgrades are also identified as part of the West Dapto Access Strategy. However, given their distance from the Project, these upgrades are of less relevance to transport impacts of the Project, but do demonstrate Wollongong City Council's (the Proponent's) consideration of, and planning for the amelioration of, existing and future transport impacts to Whytes Gully RRP and the surrounding area.

All works proposed within the West Dapto Access Strategy are identified in full in the Transport Impact Assessment (Appendix I). In addition the concept design of the Princes Highway/West Dapto Road intersection upgrade is provided within the Transport Impact Assessment. However, it should be noted this upgrade does not form part of the Project and has been approved separately.

15.2 Potential Traffic and Transport Impacts

The Project does not propose to change the existing main site access entrance or secondary entrance to Whytes Gully RRP with only the internal site layout proposed to be reconfigured to support the proposed landfill activities of the Project at the site.

As identified in Chapter 8 of the EA, construction of the proposed new landfill cells at Whytes Gully RRP would be staged. Construction of each new landfill cell would be based upon filling rates and available capacity of the operating cell.

The approximate timeframe for staging of the Project is provided in Table 15.1.

Table 15.1: New Landfill Cells Staging

Stage	Proposed Liner Construction Period	Proposed Capping Construction Period	Operation Period
1	2013 - 2016	2016 - 2019	end 2013 - early 2018
2A	2017 – 2018	2020 - 2021	early 2018 - mid 2020
2B	2019 – 2031	2023 - 2036	mid 2020 - mid 2035
3	2035 – 2041	2038 - 2047	mid 2035 - end 2046
4	2046 – 2050	2048 - 2055	end 2046 - early 2054

15.2.1 Construction Traffic Impacts

Construction of each stage would occur over a number of years, which may include periods of inactivity and/or potential peak periods in which one stage is capped while a further stage elsewhere on the Whytes Gully RRP site is having its liner constructed.

A traffic and transport impact assessment for scenarios including peak construction periods (liner construction and capping) is provided in the Transport Assessment (Appendix I), with the Project proposing construction periods of six days per week generating 6 construction workers on-site at any one time.

Construction Methodology

Construction of each stage consists of three sub-stages with regard to anticipated generation of traffic as follows:

- Extraction of material and preparation of ground (generating no additional external traffic movements as all material would be stored at Whytes Gully RRP for future use);
- Importing of material and construction of the liner (additional traffic movements to and from the site involved with importing material);
- Capping each cell as capacity is reached (additional traffic movements to and from the site involved with imported capping material); and
- Additional staff movements.

Based upon anticipated volume of material to be imported to Whytes Gully RRP (during liner construction and capping), the peak number of daily vehicle movements during construction is expected to be 24 truck movements per day and 16 truck movements on Saturdays (refer to Appendix I for construction vehicle traffic calculation assumptions including anticipated volume of material and truck capacities).

In a worst case scenario where both liner construction and capping are occurring at the same time, up to 48 truck movements would be anticipated, which would equate to an additional eight truck movements during peak hour.

An additional 12 vehicle movements during each respective peak hour have been estimated for construction staff movements (up to 6 construction workers during construction and for during capping) based on new cell construction and capping occurring simultaneously. The Traffic Impact Assessment identifies there is sufficient space on site to accommodate parking requirements for the additional workers anticipated during construction.

Construction Traffic Volumes

Based upon the methodology and calculations the estimated additional site-generated traffic volumes during construction in the AM and PM peak hours is approximately 20 movements (8 trucks and 12 staff).

As identified in Section 15.1.6 upgrade of the Princes Highway/West Dapto Road intersection (including installation of traffic signals) is scheduled prior to the Project approval determination and/or construction. This upgrade has been factored into the construction traffic volumes calculations at this intersection finding that operation at this intersection during the peak construction period would remain at LOS A or B. It is noted in the Traffic Impact Assessment that even if the intersection upgrade is delayed beyond construction of the Project there is adequate capacity to cater for the anticipated additional construction traffic generated by the Project.

The intersections of Reddalls Road/West Dapto Road and Reddalls Road site access are calculated to also remaining at LOS A. It is considered this is an acceptable transport impact given that LOS A indicates best level of operation and LOS B is defined as providing acceptable delays and spare capacity.

Based on these results the impact of construction traffic generated by the Project is considered low. Results and calculations of the construction methodology and anticipated traffic volumes are provided in Appendix I.

15.2.2 Operational Traffic Assessment

The total material received at the Whytes Gully RRP (i.e. including cover material to landfill) has been approximately 180,000 tonnes per annum for the past 5 years. Of this the total waste received at Whytes Gully RRP (including waste to the MRF, green waste processing and other resource recovery) has been approximately 120,000 to 150,000 tonnes per annum for the past 5 years. This includes approximately 27,000 tpa of green waste, which is to be relocated offsite in early 2012 (separate to the Project).

The population within the Wollongong LGA is predicted to increase at a rate of around 0.7 percent per annum over the coming years potentially resulting in increased waste generation. Conservatively, based on an annual increase of 0.7 percent, the total waste received at the Whytes Gully RRP (excluding Green Waste) would increase from 120,000 to 165,000 tonnes per annum by 2060 and total material (including cover and excluding green waste) received at the Whytes Gully RRP would increase from 150,000 to 210,000 tonnes per annum by 2060.

As discussed in Chapter 4 of the EA, prior to 2007 weighbridge data indicates that total material accepted at Whytes Gully RRP was approximately 225,080 tpa in 2002. Therefore the Project does not seek to increase the annual volume of material beyond what has previously been accepted at Whytes Gully RRP.

Operation Impacts

Despite the projected total material accepted at Whytes Gully RRP in 2060 (conservatively estimated at 210,000 tpa as a result of 0.7 percent population growth) being less than what has previously been accepted at the existing Whytes Gully RRP site (225,080 tpa in 2002), an assessment of traffic movements providing 210,000 tpa during operation has been undertaken in the assessment of operational traffic impacts of the Project.

The methodology for assessing operational traffic impacts of up to 210,000 tpa includes simultaneous construction and capping traffic movement estimates identified in Section 15.2.1, existing operational staff numbers (six) (which are not anticipated to increase as a result of the Project), and not including potential road upgrade of the Princes Highway/West Dapto Road intersection.

Operational traffic volume calculations delivering up to 210,000 tpa to Whytes Gully RRP indicate that at the Princes Highway/West Dapto Road intersection, Reddalls Road/West Dapto Road intersection and Reddalls Road site access would continue to be at LOS A or B. It is considered this is an acceptable transport impact with acceptable degrees of saturation and queues on all approaches.

Mitigating Factors to Potential Volume Material Generation

It is considered the assessment of operational traffic volume calculations are conservative as they assume the projected population of Wollongong LGA would result in a corresponding generation of the same amount of waste and material that is to be delivered to Whytes Gully RRP. However, this is likely to be an overestimate given that waste to landfill at Whytes Gully RRP has been progressively less in the last five years as a result of Wollongong City Council initiatives to increase waste minimisation and resource recovery and recycling and thereby divert waste from landfill.

In parallel with the potential increase in waste generation due to population, Wollongong City Council's Waste Strategy outlines existing and future measures to increase waste minimisation and resource recovery. The Waste Strategy projects diversion of MSW from landfill to increase from current (2011) 54 percent to 66 percent by 2014 and to 75 percent by 2035 (refer to Appendix B). This diversion would likely result in a reduced volume of material received at the Whytes Gully RRP and would also likely result in increase in waste flow to resource recovery and recycling facilities located onsite and off-site within Wollongong LGA. By 2014 Wollongong City Council's Waste Strategy also commits Wollongong City Council to reviewing alternative waste technologies which will significantly contribute to further reduction of waste in the long term.

Refer to Chapter 4 of the EA for further information on the existing and projected resource recovery statistics for Whytes Gully RRP (including figures).

Anecdotally it is considered that increase in waste volume to be accepted at Whytes Gully RRP as a result of population growth will be offset by waste minimisation and resource recovery and recycling initiatives within Wollongong LGA. This will result in less waste being delivered to Whytes Gully RRP and consequently lower traffic movements than what has been assessed above for the Project. Furthermore this conservative projection (and the consequential projected traffic movement assessment) during operation is less than what has previously been accepted during operation at Whytes Gully RRP.

15.2.3 Clause 123 of the ISEPP

Given the existing traffic volumes, efficiency and safety of existing access and egress to Whytes Gully RRP and the low transport impacts during construction and operation of the Project, it is considered that transport links to the Project are optimised to reduce the environmental and social impacts associated with transporting waste to the site. Therefore it is considered that clause 123(d) of SEPP Infrastructure 2007 is appropriately addressed and satisfied.

15.3 Mitigation Measures

Based upon the calculations completed as part of the Transport Impact Assessment (Appendix I) and the discussion and assessment within this chapter of the EA, it is considered the Project will have a low to negligible impact upon the safety and efficiency of the surrounding road network during construction and operation including at intersections within the vicinity of Whytes Gully RRP.

Identified intersections for access and egress to Whytes Gully RRP are expected to operate satisfactorily as a result of the Project with acceptable degrees and queues on all approaches. As a result it is considered that additional infrastructure to ameliorate potential traffic and safety impacts associated with the Project are not required. However, appropriate traffic management measures associated with the Project are proposed to be provided during construction and operation of the Project. These include:

- Appropriate management and maintenance of road pavement of Reddalls Road intersection to Whytes Gully RRP and site access are proposed to be provided.
- The CEMP for the Project would propose to include a traffic management plan identifying truck movements to and from the site, internal access, interactions with general public, parking and access requirements for construction personnel and safety signage and training of personnel (as appropriate) in traffic management in accordance with relevant requirements and guidelines of the RTA in terms of road safety and network efficiency.

16.0 HERITAGE

This chapter draws upon the heritage assessments completed to assess the potential impacts of the Project upon indigenous and non-indigenous heritage. They include "Whytes Gully New Landfill Cell Aboriginal Cultural Heritage Assessment Report" Biosis Research (January 2012) (Heritage Report) located in Appendix J1 and "Whytes Gully New Landfill Cell: Historical Heritage Assessment" Biosis Research (January 2012) (HHA) located in Appendix J2. In compliance with relevant guidelines and regulations this assessment has included archaeological investigations detailed within the Aboriginal Archaeological Report (refer to Appendix J1).

The Director-General's requirements	
■ ***Including an indigenous and non-indigenous assessment***	***Chapter 16***

16.1 Existing Environment

16.1.1 Desktop Assessment of Indigenous Heritage

The following information is based on the findings of the desktop assessment completed by Biosis as part of evaluating the indigenous heritage at Whytes Gully RRP. This desktop assessment includes a search of relevant heritage registers, background review of previous archaeological work, the landscape context of the site and surrounding area, the ethnohistory of the local area, regional trends of Aboriginal site locations and a site prediction model.

Findings of the desktop assessment included identification of a large number of heritage surface and sub-surface investigations previously having been completed throughout the Wollongong region, with eight Aboriginal heritage investigations having been completed within three kilometres of Whytes Gully RRP and a further two being completed on the site as part of previous assessment and approval of the Western Gully landfill and Eastern Gully landfill at Whytes Gully RRP.

An Aboriginal Heritage Information Management System (AHIMS) search was conducted using a 3x3 kilometre search area centred on Whytes Gully RRP. The search identified 16 Aboriginal sites within the search area consisting of isolated finds (nine) and open camp sites (seven). Of these identified sites one was located within Whytes Gully RRP, isolated artefact RR2 52-2-3867 (52-2-3867).

52-2-3867 is identified as an isolated quartz artefact recorded by South East Archaeology in 2001 (registered on the AHIMS database in 2011). The site was recorded in the central southwest of Whytes Gully RRP as shown in Figure 16.1. However the current field survey (refer to Section 16.1.2) identified that the location of the site is within an existing leachate pond. The field survey was unable to identify 52-2-3867. Given its location (within a leachate pond) it is considered the site has been removed and/or destroyed.

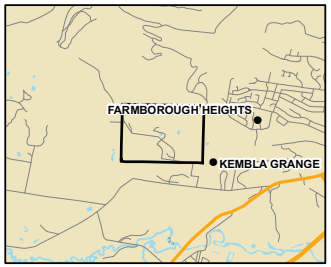
A model was formulated to broadly predict the type and character of Aboriginal cultural heritage sites likely to exist(ed) and where they are more likely to be located on the site. The model was based upon a range of factors including previously completed local and regional archaeological studies, site distribution in relation to landscape descriptions, site type, raw material types and site densities, ethnohistorical research on the potential for material traces and potential Aboriginal use of natural resources present or once present within Whytes Gully RRP.

The model identifies the most likely Aboriginal type of site to be present at Whytes Gully RRP would comprise flaked stone artefact scatters, which have been recorded on all landform types in the local region. However extensive disturbance from previous earthworks has removed large portions of natural soils and will likely have removed much of the potential for the flaked stone artefact scatters at Whytes Gully RRP. Furthermore, while there is potential for scarred trees in the local region, the majority of Whytes Gully RRP has been cleared apart from two sections of vegetation.

WHYTES GULLY NEW LANDFILL CELL ENVIRONMENTAL ASSESSMENT

WOLLONGONG CITY COUNCIL

HERITAGE AND ARCHAEOLOGICAL ITEMS



LEGEND

- AHIMS Results in Study Area
- Heritage Area (Glengarry Cottage)
- Aboriginal Archaeological Sites
- Site Boundary
- Extent of Landfill Works
- Cadastre

NOTES

Glengarry cottage heritage area provided by Council.

Aerial Ortho-Photograph provided by AAM Pty. Ltd. taken on 16 May 2011, Reference 18763A. Image Georeferenced.

Extent of landfill works as per Golder Design Report.

Aboriginal heritage areas as identified by Biosis (2011).

0 12.5 25 50 75 100 125 150 metres

SCALE (at A3) 1:4,000

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: 117625003
DATE: 5/03/2012
DRAWN: FA
CHECKED: JMc

FIGURE 16.1

Golder Associates

File Location: J:\GIS\Jobs\117625003_Wollongong Council_New Landfill Cell_Whytes Gully\Workspaces\117625003_124_R_F0001_Heritage_Rev0.mxd

16.1.2 Field Survey

In accordance with relevant guidelines including the *Code of Practise for Archaeological Investigation of Aboriginal objects in New South Wales* (DECCW 2010), a field survey of the Whytes Gully RRP was undertaken by Biosis on the 26 August 2011. The principle aims of the survey were to:

- Provide Registered Aboriginal Parties (RAPs) with an opportunity to view the Project area and to discuss previously identified Aboriginal object(s) and/or place(s) in or within close proximity to Whytes Gully RRP;
- To attempt to re-identify RR2 (52-2-3867) or to determine if it has been destroyed;
- To undertake a systematic survey of the site targeting areas with the potential for Aboriginal heritage;
- Identify and record Aboriginal archaeological sites visible on the ground surface; and,
- Identify and record areas of Potential Archaeological Deposits (PADs).

The field survey identified five PADs but was unable to re-identify 52-2-3867 (refer to Figure 16.1). The results from the field surveys as summarised from the Heritage Assessment are as follows:

- PAD 1
  - Covers the gently sloped portions of the ridge crest in the northwest of Whytes Gully RRP. While mature native trees are present in this area, no evidence of cultural scarring are identified. However, ridge crests are areas known to have a high potential for Aboriginal cultural material in the local area. The most likely potential Aboriginal heritage to be present in this PAD will be flaked stone artefact scatters.
- PAD 2
  - Covers a gentle “bump” on the lower slopes of a ridgeline in the western section of Whytes Gully RRP. This area overlooks West Dapto Creek to the west. The most likely potential Aboriginal heritage to be present in this PAD will be flaked stone artefact scatters.
- PAD 3
  - Covers a gently slopped hillcrest on the northern boundary of Whytes Gully RRP. While mature native trees are present in this area, no evidence of cultural scarring are identified. However, ridge crests are areas known to have a high potential for Aboriginal cultural material in the local area. The most likely potential Aboriginal heritage to be present in this PAD will be flaked stone artefact scatters
- PAD 4
  - Covers a portion of lower slope of the eastern ridgeline in the southeast section of Whytes Gully RRP. Shell fragments and quartz material was identified in this area, with shell species including *Anadara trapezia*, *Bembicium auratum* and *Bedeva hanleyi.* These shell species are all estuarine with the nearest possible source being Lake Illawarra 3.5 km to the southeast. The shell scatter is located in a black sandy loam across a terraced motorcross track. The PAD has been heavily disturbed by earthwork as part of the motorcross track construction. Sections of the motocross track above and below the terraced section show natural soil profiles of a thin grey loam over brown/orange clays and subsoils, which is substantially different from the soil profile in which shell material is present. This would suggest that material has been imported to site as part of the motorcross track construction. The most likely potential Aboriginal heritage to be present in this PAD is shell midden material.
- PAD 5

- Includes an area of gentle slope on lower slopes of a ridgeline in the southeast section of Whytes Gully RRP. The PAD area overlooks West Dapto Creek flood plains to the south. The most likely potential Aboriginal heritage to be present in this PAD will be flaked stone artefact scatters. PAD 5 is located within the curtilage of the local heritage listed Glengarry Cottage and is not proposed to be impacted upon by the Project.

PAD locations are shown in Figure 16.1.

16.1.3 Test Excavations

The field survey identified four PADs, PAD 1, PAD 2, PAD 3 and PAD 4 have the potential to be impacted by the proposed Project. Sub surface test excavations at these sites were undertaken to determine the extent, nature and significance of any potential Aboriginal cultural material in PADs that had the potential to be impacted upon by the Project.

PAD 5 is part of the curtilage of the local heritage listed Glengarry Cottage and is not proposed to be impacted by the Project. Therefore no test excavations were completed at this location.

Sub surface investigations had the following results as follows:

- PAD 1: one basalt flake artefact identified.
- PAD 2: no cultural material identified.
- PAD 3: One basalt core, one basalt angular fragment and one chert angular fragment identified.
- PAD 4: No shell material was identified in the soil deposits at PAD 4. Shell midden deposits were not confirmed and observations on site indicate that shell material was imported with fill that has been used to build up sections of the motocross track. There is potential for imported Aboriginal cultural material to be present within PAD 4 in a highly disturbed context.

The results of sub surface test excavations were consistent with the expectations of the Whytes Gully RRP site predictions, with low density flaked stone artefact scatters (52-2-3867, PAD 1 AND PAD 3) being the most common site type encountered.

Low density artefact scatters such as these are most likely the result of Aboriginal people moving across the landscape and indicate that Whytes Gully RRP was most likely a movement corridor between floodplains to the west and south and hills below the escarpment to the north.

The shell material at PAD 4 is in a highly disturbed context and has been imported to site. It is considered highly likely that this fill is from a nearby locality (such as Lake Illawarra) as the shell species present are common to the area.

Based upon these findings and a scientific significance assessment completed as part of the technical report (refer to Appendix J1) each of these PADs (in addition to 52-2-3867) are considered to be of low scientific significance.

16.1.4 Non-Indigenous Heritage

Appendix J2 includes the HHA completed by Biosis, which identifies Whytes Gully RRP includes the local heritage listed Glengarry Cottage (also known as Glengarry Homestead) identified within the *Wollongong (West Dapto) Local Environmental Plan (LEP) 2010* (the LEP) and the State Heritage Inventory (SHI). In addition a field survey has been completed for non-indigenous PADs, which identified no further non-indigenous heritage.

Glengarry Cottage is the last of the Veteran's Land Grants homes at Kembla Grange. The cottage was relocated a short distance from its original site in 2001, and was restored and transformed into an

administration building and education centre for Whytes Gully RRP. Applicable inventory cards available online[4] identifies Glengarry Cottage's significance as:

- *"a large and significant homestead and gardens representing the late Victorian Georgian style and the vernacular homestead in it's setting".*

The SHI assessment of significance lists Glengarry Cottage as having aesthetic and representative values, but does not identify a curtilage for the item. However, a curtilage is provided within the LEP as shown in Figure 16.1.

Off-site the nearest local heritage item in addition to Glengarry Cottage is a graveyard approximately 0.5 kilometres from Whytes Gully RRP with no known heritage streetscapes or views in the vicinity of the site.

16.2 Potential Impacts

16.2.1 Indigenous Consultation

In accordance with relevant regulatory requirements (including *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010), an extensive consultation process with Aboriginal communities has been undertaken to assess the Project. This has included:

- Notification of the Project to the following to identify appropriate stakeholders:
  - Wollongong City Council (the Proponent);
  - OEH Parramatta Office;
  - NSW Native Title Services Corporation Limited (NTSCORP Limited);
  - The Registrar, *Aboriginal Land Rights Act 1983* of Aboriginal Owners;
  - National Native Title Tribunal (NNTT);
  - Southern Rivers Catchment Management Authority (SRCMA); and,
  - Illawarra Local Aboriginal Land Council (ILALC).
- Public advertising.
- Registration of interest from seven Aboriginal stakeholder groups who subsequently became registered Aboriginal Parties (RAPs) including:
  - ILALC;
  - Korewal Elouera Jerrungurah Tribal Elders Council;
  - The Wodi Wodi Elders Corporation;
  - La Perouse Botany Bay Corporation;
  - Woronora Plateau Gundungara Elders Council;
  - Kullila Site Consultants and Koori Site Management; and
  - North Illawarra Aboriginal Collective Inc.
- Presentation of information about the Project.

[4] http://www.heritage.nsw.gov.au/07_subnav_04_2.cfm?itemid=2700558

- Gathering Information about Cultural Significance including participation by the RAPs in:
  - Review of draft methodology (and revised test excavation methodology);
  - Field Survey; and
  - Test excavation.
- Review of draft report by the RAPs.

For a full discussion of the consultation process for the Project and a record of all consultation associated with the Indigenous assessment refer to Appendix J1.

16.2.2 Indigenous Heritage

The Project will include the staged construction and operation of new landfill cells and will involve the following activities that could potentially harm Aboriginal heritage:

- Heavy vehicle movement within the Study Area with potential compaction of surface soils; and,
- Bulk earthworks, which will involve the removal of topsoil and subsoil.

Based upon the desktop assessment of the existing environment at Whytes Gully RRP (refer to Section 16.1.1), one isolated quartz artefact (AHIMS 52-2-3867) has been identified on the site, but subsequently cannot be located. Modelling predicted potential isolated artefact scatters. This is confirmed by the field surveys, which included test excavations at four locations revealing two artefact scatters in addition to imported Aboriginal cultural material. However, the artefact scatters identified within the PADs are not within the development footprint of the Project and therefore will not be impacted upon (refer to Figure 16.1).

Based upon these findings it is considered the Project will have low to negligible impact upon indigenous heritage.

16.2.3 Non-Indigenous Heritage

The Project will not have a direct or indirect impact upon heritage items including listed heritage items, conservation areas, streetscapes and/or views.

While the Project site of Whytes Gully RRP contains one locally listed heritage item (Glengarry Cottage), this item (and its identified curtilage) will not be directly impacted upon. It is also considered the Project will not impact upon the cottage's identified heritage significance of aesthetic and representative values. It is therefore considered the impact of the Project upon non-indigenous heritage will be negligible.

16.3 Mitigation Measures

While the potential impacts of the Project upon heritage are considered to be low, the following mitigation measures are proposed to further reduce potential impacts upon heritage. These are in addition to contingency plans, which may include the discovery of unanticipated Aboriginal cultural material.

- Continued consultation with the registered Aboriginal parties.
  - It is recommended that RAPs are informed about the management of Aboriginal cultural heritage sites within Whytes Gully RRP where they may be impacted upon by the Project. This recommendation is in keeping with the “Aboriginal cultural heritage consultation requirements for proponents” (DECCW 2010).
- Opportunity for Collection
  - It is recommended that where the proposed works cannot avoid impacting upon PAD 1, PAD 3 and PAD 4, Wollongong City Council provide an opportunity to RAPs to collect cultural material from site.
- Monitoring of construction will be completed for the Project where in proximity to listed heritage items (i.e. Glengarry Cottage) to ensure there is no disturbance to heritage significance.
- A heritage induction including indigenous and non-indigenous heritage is proposed to be incorporated within the general induction during construction of the Project.
- Should indigenous or non-indigenous cultural material be identified during any works, construction and/or operation will cease in the vicinity of the find and the appropriate representative at OEH will be contacted.

17.0 VISUAL

Chapter 17 provides an assessment of the potential visual impacts for the Project on the site and surrounding area. This chapter summarises findings of Corkery Consulting Landscape Architects' "Whytes Gully Resource Recovery Park: Proposed New Landfill Cell Visual Impact" (2012) (Visual Assessment) and "Whytes Gully Resource Recovery Park: Proposed New Landfill Cell Visual Impact Assessment Supplementary Report (2012)" (Supplementary Report) (Appendix K). The Visual Assessment includes identifying the existing landscape character and the extent to which the landfill operations would potentially be visible (Primary Visual Catchment), key viewing situations, the magnitude of visibility from the key viewing situations and the sensitivity of viewers who would potentially see the landscape changes resulting from the Project.

The Director-General's requirements	
■ ***Including an assessment of the potential visual impacts of the project on the amenity of the surrounding area.***	**Chapter 17**

17.1 Existing Landscape Character

17.1.1 Primary Visual Catchment

The existing landscape character of Whytes Gully RRP includes all of the existing infrastructure and operations of the current operations (landfill cells, leachate ponds and treatment plant, recycling facility, amenities and buildings, internal road network and other infrastructure), with the visual assessment providing consideration of potential impacts upon the amenity of the surrounding area including the extent to which the landfill operations are visible from public roads, residences, work places and recreational areas.

Based upon analysis of the existing landscape character, Figure 17.1 provides the approximate extent to which the proposed new landfill cell would be partly or wholly visible. This is referred to as the Primary Visual Catchment. Generally existing visibility of Whytes Gully RRP from a particular location within the Primary Visual Catchment is partly or fully blocked by vegetation, structures or local landforms located close to the viewer.

In addition to Figure 17.1, the top of the proposed new landfill cell landform may be partially visible from some hill tops located beyond the identified Primary Visual Catchment.

The proposed new landform created by the Project is likely to form the primary visual component that would potentially be visible from locations surrounding the landfill. The visual impact assessment therefore focuses on this component while considering the visibility of other elements of the proposed landfill. However, the proposed landform is designed to be a similar to the existing height for the final fill level of the Eastern Gully Landfill at RL 105 m AHD.

17.1.2 View Situations

Based upon the Primary Visual Catchment and further analysis, view situations to the existing Whytes Gully RRP operations and the proposed Project have been identified and assessed. This assessment process generally involves analysis of views from public roads to identify the extent to which the existing landfill is visible in addition to assessment of the likely extent of views from industrial/employment areas, residencies and recreational areas. The extent of views are cross checked by reference to panoramic photographs taken from the top of the existing landfill landform.

The Visual Assessment identifies and analyses approximately 24 separate view situations across roads, industrial/employment areas, residencies and recreational areas.

Key view situations are identified in Figure 17.2.

Figure 17.1: Primary Visual Catchment
(Source Visual Assessment Appendix K)

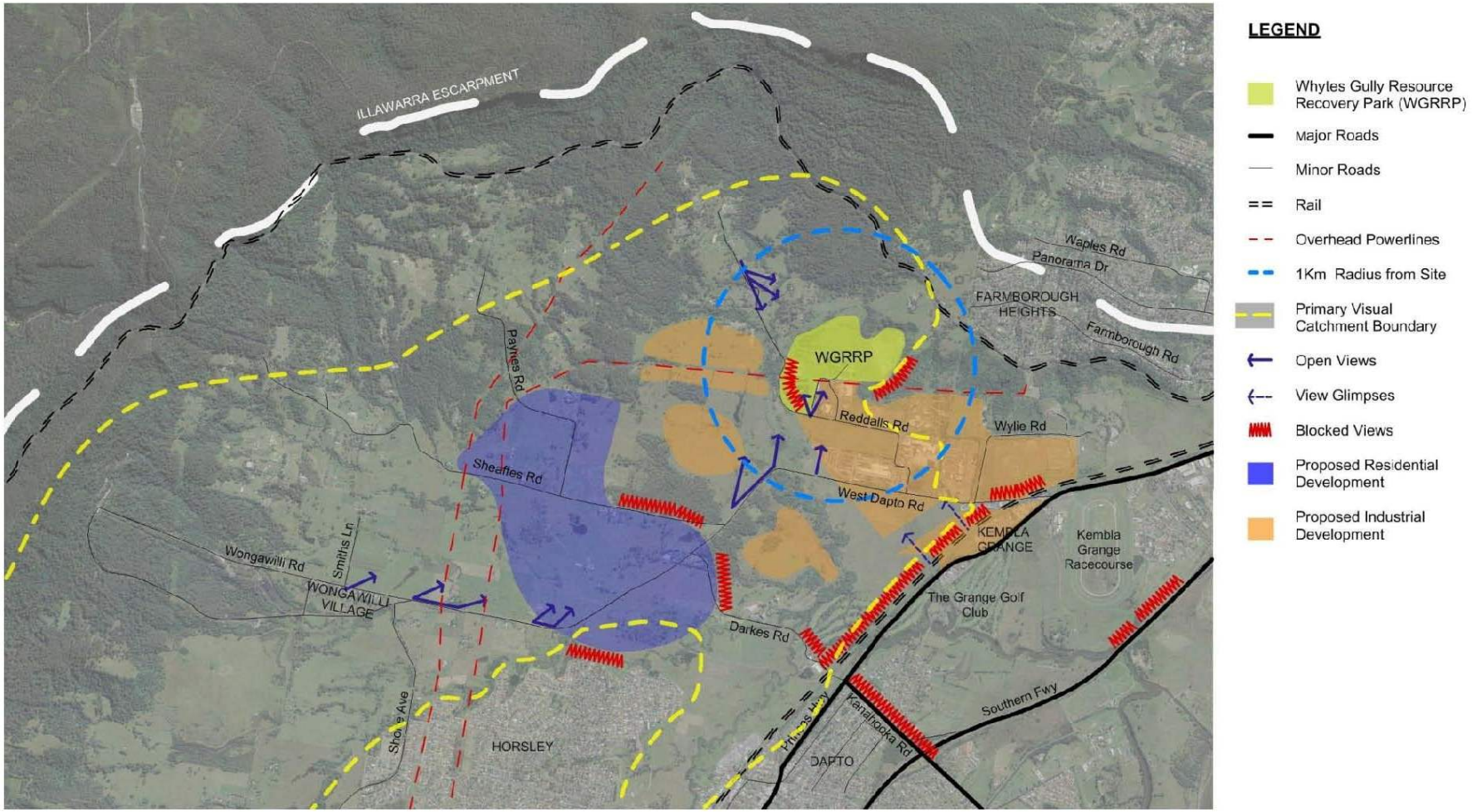
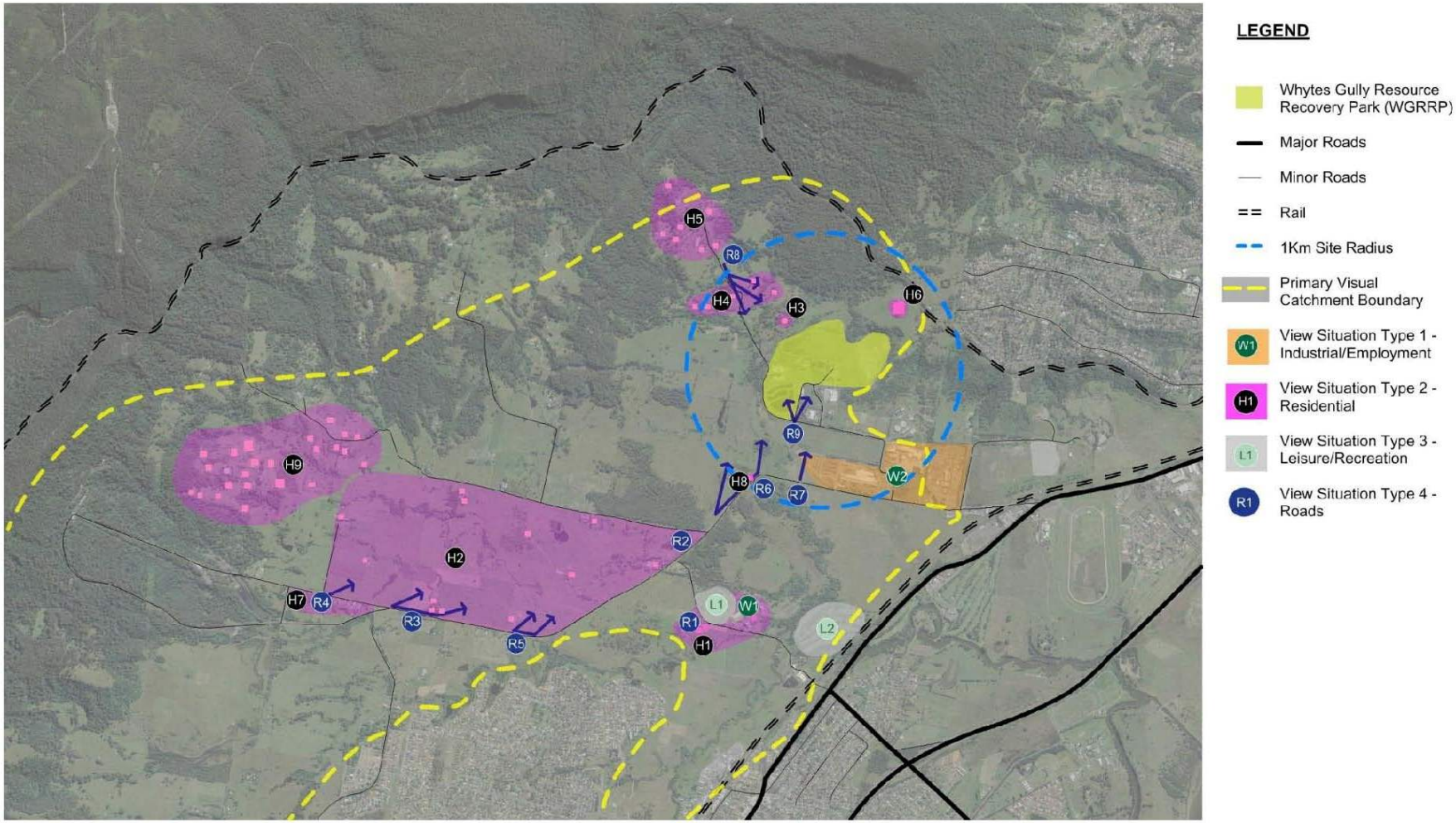


Figure 17.2: Key View Situations
(Source Visual Assessment Appendix K)



17.2 Potential Visual Impacts

17.2.1 Magnitude of Visibility

For each of the identified view situations, the magnitude of visibility for the Project is assessed through combination and analysis of a number of criteria including:

- The extent of areas from which the components of the landfill operations are visible;
- The number and type of viewers of the landfill operations;
- The distance of the view;
- The duration of the view;
- The scale of change to the view resulting from the landfill operations (i.e. proportion of the view occupied by the proposed development); and
- The degree of contrast between the visible portion of the landfill operations and the existing landscape elements in terms of form, scale, line, height, colour and texture.

The various criteria used to assess the magnitude of visibility are summarised in Table 17.1.

Table 17.1: View Situation Assessment Criteria
(Source Visual Assessment Appendix K)

Criteria	Definition
View Distance	
Long	> 5 km
Medium	2-5 km
Short	1-2 km
Very Short	<1 km
Period of View	
Long Term	>2 hrs
Medium Term	>1 minute to 2 hrs
Short Term	<1 minute
Number of Viewers	
High	>5,000 people per day
Moderate	1,000-5,000 people per day
Low	1,00-1,000 people per day
Very Low	<100 people per day

Refer to for the results of the Visual Assessment magnitude of visibility at key viewing situations.

For a full description of the methodology results of all magnitude of visibility for all identified key view situations refer to the Visual Assessment in Appendix K.

17.2.2 Viewer Sensitivity

Viewer sensitivity is the perceived extent to which a viewer is able and/or willing to accept a change to the existing view that would result from the Project.

Viewer sensitivity is influenced by a combination of:

- Location and context of the view (e.g. residences, workplaces, recreation/open space areas, roads/highways);
- Expectations and activities of the viewer (e.g. resident relaxing at home, people engaged in work activities, motorists travelling, people participating in recreation/sporting activities); and
- Importance of the view (e.g. is it identified as a regional scenic resource, referenced in tourist maps/guides, numbers of people deliberately seeking the view, reference to the view in literature and media).

Those with the highest level of viewer sensitivity generally include residents with affected views, users of public open space where their attention is focused on visual landscape values (e.g. scenic lookouts, natural landscape areas with attractive views) and communities in which changes to the landscape setting of views are valued by the community.

Key viewer sensitivity results are provided in with full results provided in the Visual Assessment in Appendix K.

17.2.3 Visual Impact Assessment

For each identified key view situation the magnitude of visibility and the viewer sensitivity are combined within a matrix to provide a preliminary visual impact assessment of the Project as follows.

Table 17.2: Visual Impact magnitude Matrix
(Source Visual Assessment Appendix K)

Magnitude of Visibility	Low Viewer Sensitivity	Medium Viewer Sensitivity	High Viewer Sensitivity
High	Moderate	Moderate/High	High
Medium	Low/Moderate	Moderate	Moderate/High
Low	Low	Low/Moderate	Moderate
Negligible	Negligible	Negligible/Low	Low

The Visual Assessment analyses approximately 24 separate view situations across roads, industrial/employment areas, residencies and recreational areas, with three of the key view situations identified as having a moderate to high a impact as identified in (H3, H4 and H6).

For a full description of the methodology and results of the Visual Assessment upon all identified key view situations refer to Appendix K.

Based upon the findings of the Visual Assessment, the Supplementary Report has been completed (Appendix K) to further assess the visual impact of the three sites identified as potentially having a moderate to high (H3, H4 and H6) impact. This has included additional site visits at these locations where permission was granted by the occupants (H3 and H4) to obtain material appropriate for photomontages from these locations to the Project site. Where no response was received to access the identified sites further assessment has been made based upon the closest available location.

The revised findings and comments of the Visual Assessment of the Project upon H3, H4 and H6 are provided in Table 17.3.

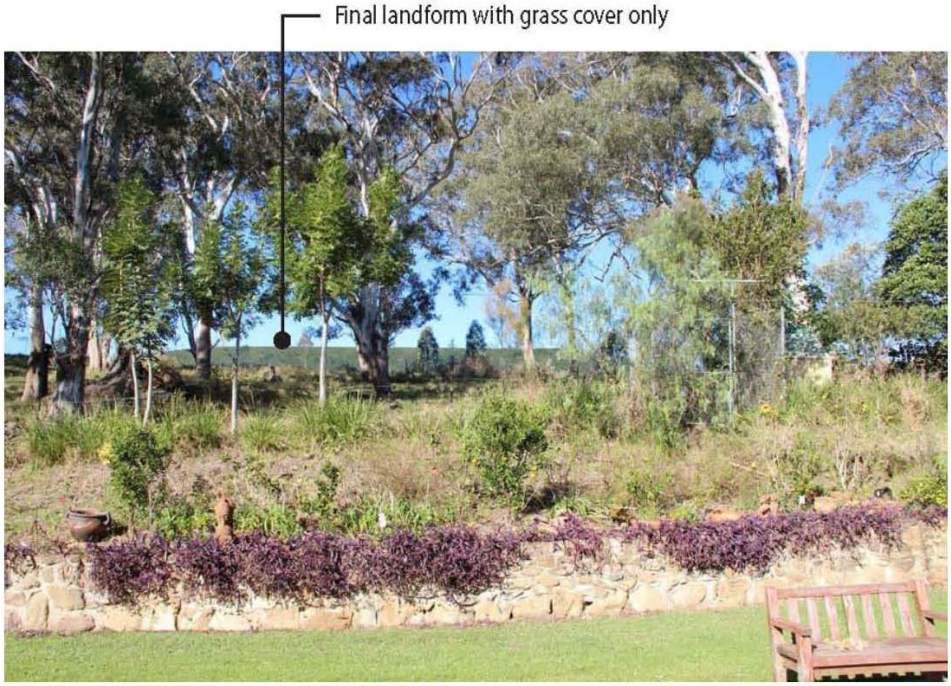
Table 17.3: Visual Impact Assessment for Key View Situations assessed as Moderate to High

View Situation	Magnitude of Visibility	Viewer Sensitivity	Visual Impact Assessment	Revised Visual Impact Assessment (based on the Supplementary Report)	Comment
(H3) Lucas Residence on Reddalls Road	Medium	High	Mod/high	Low	Proposed final landfill landform would be partially visible from this location without screening. However, as shown in Figure 7.3 this would be low when taking into consideration the existing and future vegetation, which would obscure obscured views to and from this property.
(H4) Residences (6) on Reddalls Road less than 1 km from Whytes Gully RRP	Medium	High	Mod/high	Negligible	The existing landfill is obscured by existing vegetation and topography between the landfill and these residences.
(H6) Farnborough Farm	Medium	High	Mod/high	Low	The proposed landfill landform would be partially visible from this residence, However existing trees block a substantial proportion of the potential views to the landfill. Further the final landform will create a low visual impact and not block the distant regional views dur to elevation distance of the Project.

A Photomontages of H3 is provided in Figures 17.3 and demonstrate that the Project would have a low impact upon this residence based upon a variety of factors including topography and vegetation as discussed further in this section. While further photomontages have not been completed for H4 and H6 due to access requirements it is clear from the findings of the Supplementary Report that the Project would have a low to negligible impact upon the view situations of H4 and H6.

Figure 17.3: Photomontage of H3

CURRENT VIEW FROM BACK OF RESIDENCE (H3)



PHOTOMONTAGE OF COMPLETED LANDFILL SLOPE AFTER REVEGETATION WITH GRASS COVER AND WITHOUT ANY SCREEN PLANTING

PHOTOMONTAGE OF COMPLETED LANDFILL LANDFORM AND SCREEN PLANTING ESTABLISHED ALONG BOUNDARY FENCE

While the Project would involve similar operations to those currently being carried out at Whytes Gully RRP, the Project would result in changes to the existing site with the largest visible component being the proposed new landform to be developed. However, the proposed final landform height of 105 m AHD is similar to the existing Eastern Gully landfill and after likely settlement of the proposed new landfill cell this height is likely to be lower than existing.

The Project would also involve reconfiguring and/or upgrading of existing infrastructure including the leachate ponds, recycling area, surface water ponds and roads, which may have some impact upon existing visual amenity.

Clearing of existing vegetation may contribute to the visual impact of the Project. However, it is considered the most visible component of the landfill operations would result from the contrast in colour between the landfill cover material and the adjoining vegetated slopes. To address this issue it is proposed to establish vegetation cover on the proposed landfill slopes with the visual character becoming similar to grass covered slopes on adjoining areas (refer to Figure 17.4). As a result of this mitigation measure the magnitude of visibility is anticipated to decrease over time as the revegetation matures.

The existing visual screening provided by vegetation and landform at Whytes Gully RRP generally results in the site not being fully visible from most of the public roads in the vicinity of the site. Furthermore there are a limited number of houses within the primary visual catchment located within 1 km of the Whytes Gully RRP site that would have views of the proposed landfill operations due to the visual screening provided by existing landforms and vegetation and land use zoning.

In addition general low elevation and gently undulating valley in which a large portion of the viewers of the Whytes Gully RRP are located, results in long distance views often being screened by vegetation, buildings or local landforms in the foreground and mid distance and prominent vegetation covered ridgeline against the skyline. While the proposed landfill cell would be visible from sections of public road, it is considered the existing traffic flows and the views from most sections of public road are blocked by a combination of buildings associated with existing and proposed light industry and landforms and trees. The highest visibility from a public road would occur at the entry road to Whytes Gully RRP (refer to label R9 in Figure 17.2).

Figure 17.4 Photomontage of existing Landfill, Landform after Project completion and after Rehabilitation.
(Source Visual Assessment Appendix K)

EXISTING SITUATION (R7)

PHOTOMONTAGE OF COMPLETED LANDFILL LANDFORM AFTER INITIAL GRASS COVER ESTABLISHED

PHOTOMONTAGE OF COMPLETED LANDFILL LANDFORM AFTER REVEGETATION WITH SHRUBS, SMALL TREES AND GRASS

17.3 Mitigation and Management Measures

The Project is identified to have a potentially medium to high visual impact upon residential receivers at three locations. The following mitigations measures are proposed to be implemented to ensure potential visual impacts of the Project are reduced.

- Planning of landfill activities to reduce the extent to which they would be visible during construction and operation of the Project.
- Implementation of the rehabilitation strategy to reduce potential long term visual impacts. This strategy is provided in Appendix N.
- Reduce the area of un-vegetated landfill slope, both permanent and temporary, by staging the operations and progressively establishing a vegetation cover on each section of slope as they are completed.
- Revegetate the landfill slopes with mix of shrubs and small trees with areas of grass to create a landscape character similar to adjoining rural areas.
- Develop a landscape strategy that includes establishment of scattered shrubs and trees on portions of the upper slopes and top of the new landform combined with areas of grass that maintain open views from the top of the landform and visually modify the flat top appearance of the new landform to make it visually compatible with the surrounding landscape topography.
- When suitable adopt dark toned colours for existing and proposed structures to reduce their visual contrast with their landscape setting.
- Consult with adjoining residents (H3, H4 and H6) to discuss the potential for planting to be carried out close to their houses to screen views of the landfill operations.

It is considered that implementation of these mitigation measures will result in the overall potential visual impact of Whytes Gully RRP and the Project assessed as generally low to moderate.

Figure 17.4 provides a photomontage from site R7 of the existing visual situation and the implementation of proposed mitigation measures including revegetation with grasses, shrubs and trees. It is considered that Figure 17.4 indicates that the establishment of vegetation on the landfill slopes as part of the site rehabilitation program would progressively reduce the visual contrast between the landfill operations and the surrounding rural landscape and where the proposed new landfill cell are visible they would appear as an extension and expansion of the existing landform and vegetation cover.

18.0 SOCIO-ECONOMIC

This chapter provides an assessment of the social and economic impacts of the Project, including identification of the socio-economic characteristics of the surrounding area of the Whytes Gully RRP and the wider Wollongong LGA. The existing impacts of Whytes Gully RRP, potential social and economic impacts of the Project and appropriate mitigation and management measures are also assessed.

It is considered the Project would be of net benefit to the community, providing for ongoing and efficient waste management and resource recovery within Wollongong LGA.

The Director-General's requirements	
■ ***Including a comprehensive assessment of the economic and social impacts of the project, demonstrating that it would have a net benefit for the community, paying particular attention to the potential impacts of the proposal on waste minimisation and resource recovery in the region.***	**Chapter 18**

To identify potential impacts and/or issues the assessment is supported by background research including information reviews, an analysis of demographic profiles and existing impacts of Whytes Gully RRP, including the preparation and implementation of an extensive community, business and stakeholder consultation program (refer to Chapter 3 of the EA) and analysis and research of existing and similar activities.

Based upon the socio-economic assessment, plans and strategies for monitoring and managing the impacts during both the construction and operational stages are identified to demonstrate and ensure the Project would have a net benefit for the community.

18.1 Existing Environment

18.1.1 Wollongong LGA Demographics[5]

Wollongong LGA is the third largest LGA in NSW with approximately 201,200 people in June 2011. The population is projected to increase to 235,800 by 30 June 2036 (or approximately 0.7 percent per year) as identified by the Department of Planning (2009) *New South Wales Statistical Local Area Population Projections, 2006-2036* (refer to Table 4.1 in Chapter 4 of the EA).

Based on 2006 census information[6], in comparison with the NSW statistical average Wollongong LGA has a larger proportion of low income households (those earning less than $500 per week) (24.7 percent compared to NSW average of 20.1) and a smaller proportion of high income households (21.3 percent compared to NSW average of 23.9 percent). Average household size is approximately similar at 2.51 persons per household.

Unemployment in Wollongong LGA is higher than the NSW State average (7.6 percent compared to 5.9 percent). The largest employment sectors in the LGA being manufacturing, healthcare and retail.

Age structure within Wollongong LGA shows a similar proportion of infants (0-4 years) and children (5-17 years) to the statistical average, but has a slightly lower proportion of adults aged 18-64 years (61 percent compared to 62.2 percent NSW average) and a larger proportion of mature adults aged 65-84 years (13.8 percent in comparison to NSW average of 12.1 percent).

5 Unless otherwise stated, all statistics are provided http://profile.id.com.au/Default.aspx?id=302&pg=107&gid=10&type=enum and are identified on Wollongong City Council website http://www.wollongong.nsw.gov.au/city/demographics/Pages/default.aspx

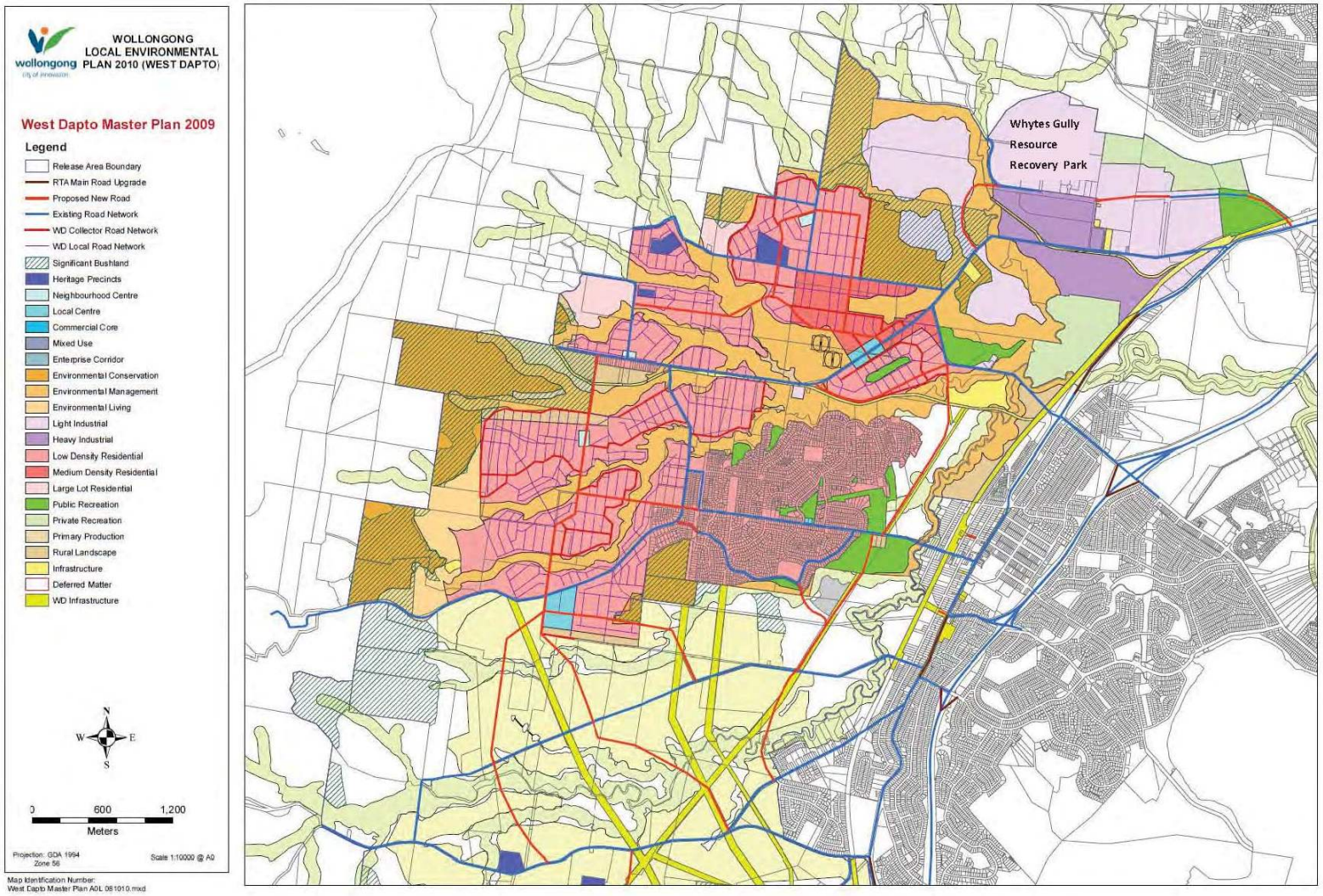
6 2006 census data is utilised for assessment of the Project as the August 2011 census data was not available at time of assessment.

West Dapto/Kembla Grange

Within Wollongong LGA, the West Dapto/Kembla Grange area is predominantly a rural, residential and industrial area, with residential areas located mainly to the east. Land in the West Dapto/Kembla Grange area has previously been used for farming and grazing with significant development occurring in the post-war years aided by immigration and public housing construction.

While the residential population of this area has increased similarly to Wollongong LGA population growth in the past, it is expected to grow considerably in the next 30 to 40 years as a result of being identified as a priority new urban release area for the Illawarra region. This urban release area has been labelled the West Dapto Release Area (refer to Figure 18.1).

Figure 18.1: West Dapto Release Area
(Source: Wollongong Local Environmental Plan 2010)



The West Dapto Release Area covers approximately 4700 hectares and is projected to provide an additional 17,000 dwellings for 50,000 people, including a new town centre for Dapto in accordance with *Wollongong Local Environment Plan (LEP) (West Dapto) 2010* (the LEP).

As identified in Figure 18.1, Whytes Gully RRP is located within the northern border of the West Dapto Release Area (and the LEP) within an existing industrial land use area. The existing industrial areas within the West Dapto Release Area are identified to be maintained in all supporting studies, policies and legislation including the "Wollongong Development Control Plan 2009 Chapter 16: West Dapto Release Area" (DCP), the West Dapto Access Strategy[7] and the "Social Cultural and Recreational Needs Study for the West Dapto New Release Area" Elton Consulting, (July 2007).

In addition to the identified studies, strategies and legislation, further assessment of the West Dapto Release Area has been completed and/or reviewed by stakeholders including Wollongong City Council, government agencies and the community to ensure suitable development in the future.

Proposing to extend the capacity of the existing landfill at Whytes Gully RRP, the Project is considered an integral part of the desired future character of the West Dapto Release Area, consistent with the objectives, structure and development controls of all relevant legislation, policies and studies that support and guide the West Dapto Release Area. The Project is also consistent with further policy documents such as the Department of Planning (January 2007) "South Coast Regional Strategy".

18.2 Impact Assessment

18.2.1 Baseline Conditions of Whytes Gully RRP

Whytes Gully RRP has been operating with a landfill since 1983. The site operates in accordance with existing conditions of approval and is widely promoted and publicised by Wollongong City Council as a waste management facility that accepts all MSW of Wollongong LGA in addition to materials suitable for recovery and recycling (refer to chapters 7 and 8 of the EA for further information). Accepting between 120,000 to 150,000 tonnes per annum of waste over the last five years, Whytes Gully RRP has provided a key role in the waste management of Wollongong LGA including the facilitation and improvement of resource recovery (as identified in Chapter 4 of the EA).

The current landfill airspace at Whytes Gully RRP is projected to be at capacity by the end of 2013. This means that Wollongong LGA would have no existing available landfill airspace for MSW waste if the Project is not implemented.

Wollongong City Council employs up to 10 full time staff (5 on weekends) at the Whytes Gully RRP site.

Wollongong City Council engages regularly with the community on relevant issues associated with Whytes Gully RRP (principally through the Whytes Gully RRP Community Consultative Committee). Where attributable to Whytes Gully RRP, issues identified during engagement with the community and further stakeholders are addressed by Whytes Gully RRP staff to ensure suitable outcomes. Issues identified with the existing operations of Whytes Gully RRP predominantly relate to amenity of the surrounding area.

[7] Refer to http://www.wollongong.nsw.gov.au/services/majorprojects/westdaptoaccess/Pages/default.aspx

18.2.2 Project Impacts

Broad and local social and economic impacts of the Project are identified and assessed within this section and summarised in Table 18.1. The purpose of this assessment is to demonstrate the Project would have a net community benefit in accordance with the DGRs.

Employment

As identified in the 2006 census, employment in waste services make up 1 per cent of total employment within Wollongong LGA. Enabling Whytes Gully RRP to continue to accept waste to landfill, the Project would maintain employment at the site during operation that would otherwise be lost if the site were to be closed. In addition the Project would create a further 6 workers for capping and 6 for cell preparation activities, which would occur over a number of stages and years (refer to Chapter 8 of the EA for approximate timing of staging).

Agglomeration

Continuing to have the landfill for residual wastes co-located with existing waste management infrastructure, (such as the small vehicle transfer station, MRF, recoverable and recyclables drop off etc) would provide benefits to the surrounding community through the reduction of trips associated with the transfer of waste and promotion of business agglomeration, which may potentially include increased productivity and innovation associated with existing and future resource recovery to be located at Whytes Gully RRP. This agglomeration has the potential to generate future economic benefits (including potential economic multipliers) to the local area.

Local Expenditure

The estimated capital expenditure of the Project is approximately $80 million. This is predominantly to be spent on maintaining and upgrading operations and construction of the new landfill cell and associated infrastructure. This expenditure would contribute to and strengthen the local and regional economy.

In addition to the expenditure associated directly with the Project, there is likely to be further expenditure associated with the site for future resource recovery activities, such as those identified within the Concept Site Masterplan (refer to Chapter 4 of the EA).

Economic Costs of Waste Disposal to Landfill

As noted in Chapter 4 of the EA, the NSW waste and environment levy (in accordance with the *Protection of the Environment Operations Act 1997*), provides an economic driver for resource recovery as it imposes a levy on all waste received for disposal at landfills. This levy has been principally introduced to encourage waste minimisation and resource recovery, which has driven resource recovery of MSW at Whytes Gully RRP to 54 percent in 2011. However, despite this driver there would continue to be a community need for a landfill facility as identified within the Waste Strategy. This is because no known resource recovery system can achieve a 100 percent landfill diversion performance. Consequently all resource recovery activities require access to a facility that would allow the disposal of residual material to landfill.

Given that landfill capacity is required to accept residual waste and the existing landfill airspace at Whytes Gully RRP is projected to be at capacity by the end of 2013, the issue to be addressed is the identification of the most suitable location for Wollongong LGA residual waste disposal to landfill. As discussed in Chapter 5 of the EA it is considered the Project location of Whytes Gully RRP provides the most suitable location for landfill activities with key issues including the site being centrally located within Wollongong LGA and co-located with existing resource recovery infrastructure. It is therefore considered that the Project is the most suitable location to provide cost savings associated with potential transportation of waste and recovered materials for Wollongong LGA. Development of additional landfill capacity at this location would maintain accessibility for the growing community and would reduce potential transport costs associated with extended transport distances to other landfill sites outside the Wollongong LGA.

For Wollongong City Council the increasing economic cost of placing material in landfill supports consideration of the financial attractiveness of alternative resource recovery technologies. Wollongong City Council seeks to maintain and upgrade existing facilities and technologies at Whytes Gully RRP to ensure

resource recovery is maximised. However, there would still be a need for landfill capacity at the lowest possible cost in the future. In accordance with the *Local Government Act 1993* Wollongong City Council is required to provided domestic waste management services on a cost neutral basis (i.e. they cannot make a profit from waste). Therefore economic cost savings associated with the Project are effectively passed on to the residents of Wollongong LGA. It is considered the Project contributes to the most cost effective solution to waste management within Wollongong LGA as identified within the Waste Strategy.

Equitable access to waste management services

The issue of social equity relates to the effect of the Project on social services and needs. Wollongong City Council has an obligation to manage waste from domestic premises in accordance with the *Local Government Act 1993* and to provide these services in an equitable manner within Wollongong LGA. While Wollongong City Council provides for resource recovery it recognises the need to provide landfill capacity at an appropriate location for residual waste in addition to contingency capacity if resource recovery methods fail.

As discussed in Chapter 5 of the EA, while alternatives of the Project have been considered, additional capacity for landfill of residual waste at Whytes Gully RRP offers Wollongong City Council the most cost-effective solution for the management of residual wastes, which reduces Wollongong City Council's expenditure on waste services thereby providing for increased social equity. Furthermore it is considered the location of the site is centrally located within Wollongong LGA, which provides suitable access to Wollongong LGA, thereby providing for social equity including access to resource recovery infrastructure.

Attainment of Waste Management Objectives

As discussed in Chapter 4 of the EA, the Project is part of an integrated waste management solution for Wollongong LGA as set out in the Waste Strategy (Appendix B), and as such, the Waste Strategy underpins the development of the Project. The waste management objectives in the Strategy have been articulated to include the specific aim of development of the Project, which is considered to support net community social and economic benefit of waste management.

The Waste Strategy explicitly identifies development of the proposed new landfill cell (the Project) as part of a program to maintain and upgrade waste management facilities within Wollongong LGA. This key focus area is one of several identified within the Waste Strategy to ensure ecologically sustainable waste management, which includes seeking to meet State and Commonwealth objectives and targets for waste management in addition to Wollongong City Council's commitment to its overarching policy documents and community expectations for waste management.

Given the current diversion rate of 54 percent of MSW, it is envisaged that improvements within the focus areas of the Waste Strategy (identified below) would enable Wollongong City Council to progress towards the diversion rate objectives and aims of appropriate State and Commonwealth legislation including the *Protection of the Environment Operations Act 1997* and the waste management objectives of the WARR Act, including the waste hierarchy of avoidance, resource recovery and disposal.

Despite the planned progression to promoting and achieving appropriate waste minimisation and resource recovery, it has been identified that landfill capacity at Whytes Gully RRP is required. This is due to disposal of residual waste material to landfill continuing to be needed in the future, with no landfill capacity available for Wollongong LGA MSW by late 2013. External and internal drivers (identified in Chapter 4 of the EA) including the Concept Site Masterplan (to ensure adequate allowance for future resource recovery technology) at the Project site would continue to promote waste minimisation and resource recovery in the region, in addition to the focus areas identified within the Waste Strategy to build upon existing resource recovery and waste minimisation. These include:

- **Planning Controls** to strengthen the existing *Development Control Code* to promote source separation approaches and to respond to changing waste processing infrastructure.

- **Education programs** would be developed at every level throughout the community to provide information to explain and encourage use of the waste hierarchy and to also train staff and the community in waste minimisation/resource recovery strategies and tools.
- **Services** would be reviewed and enhanced to provide the necessary services that underpin the overall objective including On-Call Domestic Kerbside Cleanup Collection Services.
- **Price controls** predominantly for disposal of wastes to continue to encourage and reward source separation of materials and material reuse, including introduction of pricing incentives to support source separation.
- **Facilitation** to encourage the development of industries and markets that would reuse, recycle, recover or reprocess waste materials.
- **Advocacy** would continue to remain high on Wollongong City Council's agenda. Council would continue activity within State and Regional programs, as available.
- **Enforcement** would be strengthened by Wollongong City Council through implementing actions in relation to the illegal dumping and littering strategy.
- **Leadership:** Wollongong City Council would lead the wider community by practicing the tenets of the waste hierarchy in its own operations, particularly in procurement and reuse of materials.
- **Facilities:** Wollongong City Council would continue to provide existing and upgraded facilities to ensure the facilities allow for ease of use and recovery of as much material as feasible prior to landfilling. However, it is also recognised that landfill capacity is a necessary part of sustainable waste management within Wollongong LGA.
- **Finance:** Wollongong City Council needs not only to provide price controls but to also to operate its waste business in a manner that is financially viable and sustainable in the long term. Council propose to review the long term financial model for waste services.

The Project would allow efficient and ongoing provision of resource recovery initiatives and infrastructure including the Small Vehicle Waste Transfer Station, MRF, Small Vehicle Recyclables Drop off, Recoverables Drop Off and Buy Back, in addition to the surface water and leachate ponds, landfill gas extraction and leachate treatment plant augmentation. Together with contributing to the focus areas of the Waste Strategy and planning for potential future infrastructure through a Concept Site Masterplan (refer to Chapter 4.2.3 of the EA), it is considered the Project would have a positive impact upon on waste minimisation and resource recovery in the region.

Amenity

In addition to community input of the existing operation at Whytes Gully RRP, Wollongong City Council has undertaken an extensive community consultation program for the Project (refer to Chapter 3 of the EA for further information).

Stakeholder consultation associated with the Project has identified issues of concern associated with the existing Whytes Gully RRP and the potential amenity issues associated with the Project. These issues relate to impacts on the amenity of surrounding residences, workers and visitors and include potential odour (air), noise, visual and traffic impacts of the Project.

Disturbances to sensitive receivers of noise, air quality and visual are addressed in relevant chapters of this EA. It has been found that with appropriate mitigation and management, impacts of the Project would not exceed the relevant performance goals and criteria identified within the relevant guidelines and policies. However, given that amenity concerns have been identified for the existing site it is considered likely that amenity issues would continue to remain a concern for community stakeholders.

Potential negative disturbances would include noise from plant, equipment and vehicles, air quality impacts from odour and traffic impacts such as additional traffic movements during construction. As addressed in relevant chapters of the EA, the impacts of the Project upon the amenity of residents, workers and visitors would, with appropriate management measures, comply with relevant environmental amenity criteria and legislation.

Summary of Impacts

Given the Project proposes to extend the life of Whytes Gully RRP (including the capacity to accept waste to landfill) within the existing site footprint, the Project would have no social and economic impacts related to property acquisition and not impact upon existing public access. Furthermore given the Project is looking to extend the existing activity of Whytes Gully RRP, it is considered there would not be potential impacts arising from issues such as community use of the site and economic land value. The Project does not propose to increase intensity of landfill activity and/or traffic movements during operation and therefore it is considered potential social and economic impacts from issues such as traffic congestion would be negligible.

It is considered the Project provides the most suitable option of providing landfill capacity within Wollongong LGA, which would provide the most cost-effective economic and environmental outcome to Wollongong LGA. Existing and potential Project impacts are summarised within Table 18.1.

Table 18.1: Summary of Potential Socio-Economic Issues during Construction and Operation

Potential Impact	Impact
Employment: Generation of construction and operation related employment	Employment generation benefits would occur on commencement of the project's planning, design and construction works.
Agglomeration: the ability for businesses to cluster together and the flow on benefits.	Benefits of the Project upon waste service business agglomeration may potentially increase productivity and innovation associated with existing and future resource recovery to be located at the site.
Local Expenditure: - leading to strengthening local economy.	A significant positive investment in waste infrastructure that would not restrict potential future resource recovery infrastructure.
Economic Cost of Waste Disposal through Landfilling	While there is an economic driver for resource recovery in comparison to waste to landfill, it is recognised there is a need for residual waste to landfill that must be met. Given this, it is considered the Project is the most suitable location for a landfill as it would utilise existing waste management infrastructure and offer reduced transport costs in comparison to alternatives.
Equitable Access to Services: social equity of appropriate waste service provision.	The Project is the most cost-effective solution to providing for landfill capacity within Wollongong LGA, thus providing waste services in the most equitable manner available to Wollongong City Council.
Attainment of Waste Management Objectives: including the waste management heirarchy and the aims and objectives of the WARR Act and POEO Act.	The Project proposes ongoing provision of resource recovery initiatives and infrastructure including the small vehicles waste transfer station, MRF, Small Vehicle Recyclables Drop off, Recoverables Drop Off and Buy Back, surface water and leachate ponds, landfill gas extraction and leachate treatment plant. Together with the proposed new landfill cell and focus areas of the Waste Strategy as part of an integrated waste management solution the Project would have a positive impact upon waste minimisation and resource recovery in the region.
Perception of Amenity: Including predominantly air (odour).	While meeting all applicable performance criteria for relevant environmental amenity issues, it is considered that the Project would result in the perception of impacts upon amenity associated with the existing Whytes Gully RRP.
Visual amenity and land use integration: Impact to the	Potential impacts to the visual character, appeal and integration of places as a result of construction and operation of the Project. However, as

Potential Impact	Impact
integrity and quality of the local built and natural environment.	identified in chapters 17 and 20 of the EA it is considered these are acceptable with appropriate management.
Further Issues: Including impact on land values, public access and community use.	The Project would extend the life of an existing activity at Whytes Gully RRP and have negligible impact upon these issues.

18.3 Mitigation and management

It is considered that the Project addresses the need for landfill capacity, which is projected to expire in late 2013, and provides the most feasible option for providing a net economic and social benefit to the community while continuing to provide for waste minimisation and resource recovery in the region.

The following mitigation measures are recommended to address identified socio-economic issues associated with the Project.

- A Stakeholder Engagement Plan would be implemented throughout the delivery of the Project. Provided as part of the environmental management documentation the stakeholder engagement plan would provide procedures for communication with stakeholders, for the dissemination of information to the community, identification of the communication channels available for the community and stakeholders to provide feedback on the Project, a protocol for the Project to respond to any enquires or feedback, and for managing site visits and property inspections as required.
- Implementation of measures to reduce the potential for construction and operation impacts upon amenity as identified within the relevant chapters of the EA and the draft Statement of Commitments.

19.0 HAZARDS AND RISK

Chapter 19 of the EA provides a summary of findings of the Golder Associates "Whytes Gully New Landfill Cell – Preliminary Hazards Analysis" (2012) (refer to Appendix L), which evaluates the potential hazards associated with the Project. This chapter also provides discussion of potential bushfire risks based on Golder Associates (2012) "Whytes Gully New Landfill Cell Project: Bushfire Report" (Bushfire Report) in Appendix M of the EA.

The Director-General's requirements	
■ ***Including a Preliminary Hazard Analysis (PHA) of the project, and an assessment of the potential bushfire risks of the project***	**Chapter 19** **Appendix L** **Appendix M**

19.1 Hazard Analysis

19.1.1 Methodology

SEPP No. 33 Hazardous and Offensive Development (SEPP 33) aims to ensure that development that is deemed a 'hazardous' or 'offensive' industry is identified and assessed appropriately including identifying of appropriate mitigation and management measures.

The Project is considered to be a potentially offensive industry as the waste related activities may potentially impact upon the surrounding localities, even after measures are taken to reduce potential impacts. However, in accordance with the guidelines if assessment can demonstrate that the offense can be controlled to a level that is not significant (i.e. in accordance with an Environmental Protection Licence (EPL) issued for the Project under the *Protection of the Environment Operations Act 1997*) then the activity is not considered offensive.

Whytes Gully RRP operates in accordance with an existing EPL and if approved, the Project would require a new or updated EPL prior to construction and operation. Subject to complying with the EPL it is considered the Project is not an offensive industry.

SEPP 33 specifies that a Preliminary Hazard Analysis (PHA) must be prepared for development that is a 'potentially hazardous industry'. In accordance with SEPP 33 and the DGRs for the Project, a PHA has been completed (refer to Appendix L) to assess if the Project would result in a significant risk to human health, life or property or the biophysical environment.

The PHA consists of:

- Identification and analysis of the potential hazards and risks associated with construction and operation of the Project including potential nonstandard hazards, which may impact upon the Project (such as off site flooding);
- Assess the risks against relevant risk assessment criteria guidelines and,
- Identify opportunities for risk reductions including mitigation and management measures as appropriate.

The PHA for the Project has been completed in accordance with the general principles of risk evaluation and assessment and documentation as outlined in *Guidelines for Hazard Analysis: Hazardous Industry Planning Advisory Paper No. 6* (Department of Planning, 2011), addressing the requirements of State Environmental Planning Policy No. 33 (Hazardous and Offensive Development) (SEPP 33) and *Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines* (Applying SEPP 33).

Assessed risks are compared to the qualitative risk assessment criteria developed in accordance with Australian Standard/New Zealand Standard (AS/NZS) 4360:2004 *Risk Management* (AS/NZS 4360:2004).

In accordance with *Guidelines for Hazard Analysis: Hazardous Industry Planning Advisory Paper No. 3* (Department of Planning, 2011), it is considered the PHA will be re-addressed as the Project progresses through construction and operation.

19.1.2 Hazard and Risk Screening

A hazard and risk screening of the Project has been conducted in accordance with SEPP 33 and Applying SEPP 33.

The screening procedure is principally based on the type quantity and conditions (storage and/or use) of potentially hazardous materials (as defined within the "Australian Code for Transportation of Dangerous Goods by Road and Rail" (seventh edition 2007) (Australian Dangerous Goods Code) associated with the Project (including storage, transport, use, production) and the distance of these materials from the site boundary.

A list of the quantities of hazardous materials to be used and stored for the Project are identified in Table 19.1.

Table 19.1: Hazardous Materials at Whytes Gully RRP

Plant Area / Use	Chemical/Product	Approximate anticipated use/storage Qty	Screening Threshold Class (Australian Dangerous Goods Code)
Leachate Treatment Plant Use	Sodium Hydroxide Solution	1000 litres (equivalent to 1 tonne)	Class 8 5 tonne (packing group I) 25 tonne (packing group II) 50 tonne (packing group III)
Chemicals for maintenance / repair work and clean up	Chemicals used in workshops	Various minor quantities of chemicals, managed through standard processes.	NA
Transformers	Insulating oil	Minor quantities stored in separate bunded area	C1 combustible liquid NA.
Recyclable Drop off area	LPG gas bottles, car batteries, florescent tubes, waste oil,	Minor quantities of chemicals removed from site at regular intervals in accordance with standard processes.	NA

The hazardous materials of the Project do not exceed screening thresholds in accordance with the Australian Dangerous Goods Code and Applying SEPP 33. While sodium hydroxide (associated with the Leachate Treatment Plant) may store up to approximately 1000 litres (or 1 tonne), this is five times under the appropriate screening threshold and would be stored in a central location of Whytes Gully RRP (in proximity to the Leachate Treatment Plant) and not be near the site boundary, thereby having less potential for offsite impacts.

The operation of the existing Whytes Gully RRP currently utilises and stores the same materials and quantities identified for the Project, with existing staff familiar with the handling and necessary technical and management safeguards of these materials currently in place.

As a result of the hazard and risk screening it is considered there are low levels of risk associated with the Project and therefore the PHA level of analysis required is identified to be qualitative.

For further discussion of risk screening associated with materials identified within Table 19.1 and discussion of the identification of a qualitative risk assessment for the Project, refer to the PHA provided in Appendix L.

19.1.3 Potential Hazardous Scenarios

The PHA identifies a number of potentially hazardous scenarios associated with the Project. Each of these identified scenarios represents existing potential hazards at the Whytes Gully RRP with management of these hazards to the site and surrounding area ongoing since the commencement of operations in 1983. Potential hazardous scenarios identified include:

- Loss of containment, fuel or oil leading to environmental pollution and possible fire if an ignition source is present.
- Fire at the landfill (waste and/or gas).
- Fire in site vehicles, infrastructure and/or buildings.
- Bush fire at site boundary.
- Gas extraction (including flare operation).
- Delivery and/or processing of waste not licenced to be accepted at Whytes Gully RRP.
- Air quality (including dust and odour).
- Noise generation.
- Loss of containment of leachate and/or stormwater from storage ponds.
- Stormwater impacts
- Flooding.
- Biological hazards.
- Amenity (including spread by litter, vermin and pests).
- Injury to public (accessing unauthorised areas).
- Disruption to Services.
- General Occupational Health and Safety Hazards.

The identified hazardous scenarios for the Project, their potential cause, consequence and safeguards, mitigation and management are provided in Table 19.2, which has been adopted from the PHA in Appendix L.

In accordance with Department of Planning *Guidelines for Hazard Analysis: Hazardous Industry Planning Advisory Paper No. 6* (2011), while the PHA has identified a number of potential hazardous scenarios associated with the Project, with safeguards and mitigation measures identified within Table 19.2 (and discussed further in relevant chapters of the EA), it is considered the Project would not be a significant risk to human health, life or property or the biophysical environment. This includes potential bushfire risks of the Project, which in accordance with the DGRs have been assessed in detail in the Bushfire Report (Appendix M) and summarised in Section 19.2 of this chapter of the EA.

Table 19.2: Hazard Identification Scenarios

Event	Cause / Comments	Potential Consequences	Prevention / Protection / Safeguards
Loss of containment, fuel or oil Possible fire if ignition source is present.	Mechanical failure of site or public vehicles Loss of containment of hydraulic oil from equipment	Environmental damage if spill is not contained Risk of Fire Personnel hazard and damage to property	■ Regular inspections and maintenance ■ Any spills cleaned up immediately. Spill kits located at appropriate location on site with staff appropriately trained in their use. ■ Spill containment to be managed in accordance with AS 1940. ■ Site emergency response plan including emergency contact numbers provided within management system for the site. ■ Fire protection (including fire extinguishers, separation distances etc. provided and inspected periodically. Distances in accordance with AS 1940 and as advised within the Bushfire Report (Appendix M). ■ No smoking around plant equipment.
Fire at the landfill (waste or gas)	Decomposition of solid waste in anaerobic conditions can generate heat, methane and other gases. Possible ignition of combustible materials. Waste relocation works	Fire on landfill Environmental damage if spill is not contained. Risk of fire Personnel hazard and damage to property	■ Covering waste (refer to draft LEMP (Appendix P) for proposed methods of cover) ■ Waste compaction (refer to draft LEMP (Appendix P) for proposed methods) ■ No smoking at landfill. ■ Ongoing monitoring by operators to ensure potential fire situations are identified and addressed appropriately. ■ Fire management strategy (as outlined in the LEMP Appendix P). ■ Water carts available at the site. ■ Gas monitoring and alarms.

Event	Cause / Comments	Potential Consequences	Prevention / Protection / Safeguards
			■ Training to site personnel. ■ Site emergency response plan including emergency contact numbers provided within management system for the site.
Fire in site vehicles, infrastructure and/or buildings	Overheating of combustible materials. Ignition of flammable material or combustible material	Damage to property/vehicles Personnel hazard Fire may develop to further areas	■ Training of operators. ■ Maintenance of vehicles. ■ No smoking outside of designated areas. ■ Fire suppression systems serviced and inspected periodically. ■ Training and procedures in place for fire management (refer to the LEMP). ■ Site emergency response plan including emergency contact numbers provided within the LEMP for the site. ■ Regular maintenance/housekeeping of buildings. ■ Spillage of flammable materials to be cleared up immediately. ■ Appropriate measures to reduce the threat of fire spreading including mitigation and management identified within the Bushfire Report (Appendix M). This includes: ▪ An Asset Protection Zone (APZ) of 10 m should be maintained around existing site buildings. ▪ The site vegetation (landscaping) should not exceed a fuel load of 2 t/ha. ▪ Planted trees that are retained on the site are to have the lower branches trimmed (cut off) to a height of 2 m above the ground.

Event	Cause / Comments	Potential Consequences	Prevention / Protection / Safeguards
Bush fire at site boundary	External cause	Threat to people, property and environment on site	■ Measures as identified within the Bushfire Report (Appendix M) including: ▪ A perimeter firebreak cleared of all vegetation is to be established around the entire site (roads and access tracks may be utilised to form the fire break) and around buildings ▪ Wind-blown litter is to be controlled. ▪ Flammable materials must be removed from site fencing.
Fire or explosion from Gas extraction risks	Leak of flammable gas which ignites.	Material damage, personnel injury potential and/or potential for spread to other areas	■ Gas (installation) construction plan as part of the provision for landfill gas capture at the site. This would include adequate piping material and appropriate construction materials and methods. ■ Monitoring of gas flow and quantity. ■ Fire protection system available on site to reduce damage from fire. ■ Hazard and Operability (HAZOP) study techniques or other similar methodology would be required to assess the potential impact of implemented gas extraction systems to ensure that the risks associated with the methane handling is reduced to As Low As Reasonably Practicable levels. ■ Emergency response plans and procedures.
Delivery and/or processing of waste not licenced to be accepted at Whytes Gully RRP.	This may include delivery and/or processing of Special waste (includes clinical waste and waste tyres), Liquid waste, Hazardous waste and/or Restricted solid waste.	Generation of toxic fumes Personnel exposure to toxic substances	■ Waste screening Strategy (refer to draft LEMP Appendix P). ■ Operational procedures for management of waste (refer to draft LEMP Appendix P).
Particulate generation (dust and odour)	Generation of dust and odour from operation of heavy	Personnel hazard and potential offsite impacts.	■ Maintaining equipment and plant appropriately.

Event	Cause / Comments	Potential Consequences	Prevention / Protection / Safeguards
	equipment.		■ Dust would be controlled with water carts and by using sealed roads on site. ■ Covering waste (refer to draft LEMP (Appendix P) for proposed methods of cover). ■ Further measures as identified within relevant chapters of the EA.
Noise generation	Generation of noise from operation of heavy equipment.	Personnel hazard and potential offsite impacts.	■ Maintaining equipment and plant appropriately. ■ Adhering to existing hours of construction and operation. ■ Use of Personal Protective Equipment. ■ Further measures as identified within relevant chapters of the EA and the LEMP.
Loss of containment of leachate and/or surface water from storage ponds	Leak or overflow at storage	Surface water and/or groundwater contamination if not contained appropriately.	■ Management and mitigation in accordance with Chapter 12 of the EA and the draft LEMP (Appendix P).
Biological hazards	Exposure Risk of infection such as tetanus from cuts and abrasions. Pathogen containing putrescibles wastes.	Threats to people and the environment, on site personnel and/or spread of disease offsite	■ Not allowing the general public access to the landfill. ■ Compacting waste and applying cover material at regular intervals. ■ Waste screening (refer to draft LEMP Appendix P). ■ Litter control. ■ Vermin and pests continue to be controlled as outlined in the draft LEMP (Appendix P). ■ Hygiene practices and Personal Protective Equipment. ■ Implementation of a site OH&S plan.

Event	Cause / Comments	Potential Consequences	Prevention / Protection / Safeguards
Injury to public (accessing unauthorised areas)	Entry/access of unauthorised persons to site areas	Potential injury to person on site.	■ Security of the site would be maintained during operation and construction including security fencing, which is locked after hours of operation. ■ Not allowing unauthorised persons access to areas of the site including the landfill. ■ Appropriate signage and controls to direct unauthorised people appropriately.
Disruption to Services Hazards	Disruption of underground or overhead services (electricity, and telecommunications) during construction.	Impact upon people and property.	■ Services would be located on site prior to construction. Where appropriate services would be relocated prior to construction to ensure potential disruptions are reduced.
General occupational health and safety hazards to workers during construction and operation	Working in proximity to industrial equipment and workplaces	Personnel hazard	■ Operational maintenance procedures and training (refer to draft LEMP Appendix P) ■ Implementation of a site OH&S plan in accordance with the draft LEMP Appendix P).

19.2 Bushfire Risk

The Bushfire Report (refer to Appendix M) has been completed to assess the potential bushfire risks of the Project including identification of measures to mitigate the potential of fire occurring within or impacting upon Whytes Gully RRP.

19.2.1 Methodology

In accordance with the requirements of the *Rural Fires Act 1997* and the specifications and requirements of "Planning for Bush Fire Protection" (NSW Rural Fire Service 2010), the methodology to complete the Bushfire Report has included a desktop assessment of relevant material (including legislation, guidelines, existing weather conditions, mapping and topography, bushfire history and the Flora and Fauna Report in Appendix F), field investigation and consultation with the NSW Rural Fire Service and Wollongong City Council staff to identify and assess potential bushfire hazards associated with Whytes Gully RRP and the Project.

For full details of the methodology and discussion of these issues refer to Appendix M.

19.2.2 Bushfire Risk Assessment

Whytes Gully RRP is identified on mapping to contain areas that are classified as "Vegetation Category 1" in addition to the buffer of this category (100 metres). The site also contains land that has no vegetation category 1 or 2 present.

There is no history of bushfire threatening or burning at Whytes Gully RRP with the greatest threat to the site being identified as bushfire originating in the west, northwest or north. The steep, vegetated slopes beyond the northern perimeter of the site associated with the creek line that flows towards Dapto Creek and also between the Western and Eastern Gully landfills may act to funnel fire towards Whytes Gully RRP, as these slopes are also northwest / north in aspect increasing the risk of fire spreading towards the site.

However, the Illawarra Bush Fire Management Committee has rated the likelihood of a fire occurring at Whytes Gully RRP as *'Unlikely'* with a consequence of *'Low'* to produce an overall risk rating of *'Low'* with no specific fire prevention measures recommended.[8]

The proposed development of the new landfill cell does not propose the construction of buildings, or alter the present separation distances of existing buildings on the Whytes Gully RRP site. The potential risk of these existing buildings (including the weighbridge, MRF and administration building (Glengarry Cottage)) are considered to have a low bushfire attack level and low potential for attack from radiant heat or flame being located outside of the 100 metre buffer of Category 1 vegetation.

The Project would predominantly not alter the bushfire risk of the existing Whytes Gully RRP site, although the proposed removal of existing vegetation in the form of Lantana, a Weed of National Significance that adds greatly to the fuel load present at the site would reduce the fuel load and the likelihood of a fire igniting and spreading off site.

19.2.3 Bushfire Mitigation Measures

The Bushfire Report identifies a number of risk reduction measures, which are divided into managing the physical bush fire hazards (Hazard Management) and the behaviours that contribute to bush fire and the safety of personnel (Risk Management).

The risk reduction measures and safeguards comply with the aims and objectives of the NSW Rural Fire Service (2010) "Planning for Bushfire Protection" and the acceptable solutions of the performance criteria within this document including "4.3 -Planning Controls for Infill and Other Developments on Bush Fire Prone Land".

[8] Illawarra Bushfire Management Committee 2008, Bushfire risk management plan, New South Wales Rural Fire Service, Government of New South Wales

Bushfire Hazard Management

- An APZ of 10 m would be maintained around existing site buildings with a firebreak 5 m wide to be maintained around temporary site buildings during construction of the new cells or site infrastructure.
- A perimeter firebreak of 5 metres would be established and maintained to be clear of all vegetation around the entire site (roads and access tracks may be utilised to form the fire break e.g. Reddalls Road) and around buildings (with the exception of remnant vegetation as identified within the flora and fauna assessment Chapter 13 of the EA).
- Two way sealed roads and access tracks would be constructed at the site to enable all weather access by Category 1 fire fighting vehicles.
- A secondary site access and egress is considered to be the existing site road adjacent to Glengarry Cottage.
- Fire hydrant outlets at the site would be cleared of vegetation so as to facilitate unrestricted access.
- Planted trees that are retained on the site are to have the lower branches trimmed (cut off) to a height of 2 m above the ground. (The remnant Lowland Dry Subtropical Rainforest and Moist Box Redgum Foothills Forest vegetation associations are to be protected and are not subject to this requirement). The tree trimming works may be staged with priority given to the protection of assets and fuel load reduction adjacent to roads.
- The canopy of any tree retained at the site would be not less than 10 m from any building, where this separation distance cannot be achieved by trimming branches consideration is to be given to the removal of the tree. Advice to be sought on a case by case basis taking into consideration the building construction, location and purpose.
- A vegetation management plan (including weed management) would be developed to ensure that vegetation is managed to not exceed recommended fuel loads in relevant guidelines. Weeds are to be managed at the site by a control program to ensure that they do not constitute a fire hazard (refer to the LEMP Appendix P).
- Wind-blown litter would be controlled in accordance with the LEMP.
- Roadside vegetation adjacent to internal site access roads would be slashed or mown for at least a distance of 1 m up slope and 4 m down slope and maintained cleared during the declared bushfire season.
- Trees planted within 20 m of a building would be spaced so as to ensure that crowns are no closer than 10 m apart.
- Retained vegetation at the site would be irrigated or watered regularly during the declared bushfire season so as to retain moisture (be kept as green as possible).
- Flammable materials would be removed from site fencing.
- Holes in site fencing would be repaired.
- On days of declared Catastrophic Fire Danger for the district site works would be conducted in accordance with those activities permitted under a Total Fire Ban. This includes vehicles not to be operated in bushland.
- Motor vehicles shall not drive over long dry grass and shall remain within defined parking and trafficable areas where applicable.
- Site vehicles would be fitted with a fire extinguisher.

- Maintenance of security including appropriate fencing to prevent unauthorised access and potential arson attack of the site.
- A security presence is maintained at the site.

Bushfire Risk Management

- A Fire Management Strategy for the Project is to be implemented. This document all proposed recommendation and safeguard measures of the Bushfire Report (refer to the LEMP for Fire Management Strategies including fire control, litter control and waste management).

19.3 PHA Key Findings

In accordance with *Guidelines for Hazard Analysis: Hazardous Industry Planning Advisory Paper No.* (Department of Planning, 2011), a PHA are been completed for the Project.

While the PHA has identified a number of potential hazardous scenarios associated with the Project, with safeguards and mitigation measures it is considered the Project would not result in a significant risk to human health, life or property or the biophysical environment. As such, the Project is not considered to be a hazardous based upon the hazard and risk screening, specific bushfire risk assessment and identification and assessment of potentially hazardous scenarios identified to be potentially associated for the Project.

Subject to complying with the existing and future EPL for Whytes Gully RRP it is considered the Project is not an offensive or hazardous in accordance with SEPP 33, , and that identified risk levels associated with the Project do not preclude approval with appropriate mitigation and safeguards.

20.0 REHABILITATION AND FINAL LANDFORM

The Director-General's Requirements	
■ ***Rehabilitation and Final Landform including:*** ▪ ***A justification of the final landform and details regarding the potential future land uses for the site; and*** ▪ ***A detailed description of how the site would be progressively rehabilitated and integrated with the final landform***	**Chapter 20**

20.1 Proposed Rehabilitation and Final Landform

Rehabilitation activities would be undertaken progressively throughout the life of the Project to reduce impacts upon the Whytes Gully RRP site and surrounding areas. Proposed rehabilitation activities provide:

- A barrier to the migration of water into the waste therefore reducing the amount of leachate generated and the potential for contamination of groundwater.
- Controlling emissions to the atmosphere by reducing landfill gas emissions, which are controlled by installation of a landfill gas collection system as part of the cap design.
- A long-term stable barrier between waste and the environment in order to protect human health and the environment.
- Land suitable for its intended after use.
- Stability of the proposed landfill to limit potential erosion and dust.
- Surface water runoff from the landform without causing unacceptable erosion or further potential environmental impacts;
- Visual integration with the surrounding area.

20.2 Final Landform

The final landform footprint is proposed to be roughly rectangular and measure approximately 850 m (E-W) by 550 m (N-S), extending between the crests of the natural eastern and western ridge lines at the Whytes Gully RRP site. The footprint includes pulling back from the current extent of waste by up to 35 m in the area of the proposed eastern waste cutback (refer to Appendix O). The total landform footprint area is approximately 35 ha.

The peak of the landform is at elevation is proposed to have an RL of 111 m. From the high point, slopes extend to the north to meet the natural ground surface at RL 75m to RL 95m. The lowest point of the landform is at RL 19 m along the southern edge, with a 500 m length of the southern edge at RL 25m or less.

Approximately half of the final landform footprint is piggyback area where new waste would be placed over the existing Eastern Gully and Western Gully landfills. The piggy back area is approximately 17 ha.

For the Eastern Gully landfill, the maximum existing waste thickness is approximately 50 m (30 m in Western Gully) and the maximum new waste thickness of the Project would be approximately 30 m (40m in Western Gully).

The principal landform batter is south and southwest-facing with a maximum height of greater than 80 m and a 4.5H:1V average inclination. North and east-facing batters would have a steeper average inclination of 4H:1V and but a maximum height of less than 30 m.

The batters of the final landform are proposed to be at a slope of 4H:1V towards the landform toe and would be intersected by 5 m wide grassed benches every ten vertical metres. This would result in an average slope

of approximately 4.5H:1V. The benches would have a fall of 2 percent towards the surface water drop structures and perimeter drains along the eastern and western toe of the proposed final landform. The purpose of the slope benches is to reduce runoff velocity and erosion potential for the final capping system to increase overall landform slope stability, and to provide access on the slope for capping system and gas extraction system inspection and maintenance.

A small area near the peak of the landform has relatively flat design grades of approximately 5 percent.

The Project landform design allows for access around the entire site perimeter and to the landform summit for groundwater monitoring, site inspection and maintenance, and bushfire protection. The design also includes surface water drains along the entire perimeter, with combined drains and access tracks in some areas. In addition, the design setback distance of 20 m along the western ridge property boundary also provides space for a nature strip and screening planting.

The proposed distance from the design limit of landfill waste placement to the closest adjacent residence buildings is approximately 70 m to the residence near the western ridge and 160 m for the residence to the north of the Eastern Gully landfill area. It is noted the design limit of landfill waste placement is approximately 10 m inside the edge of the landform footprint.

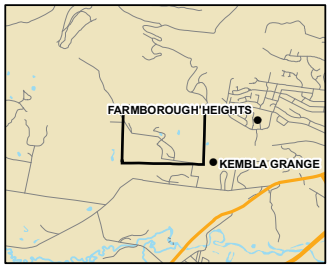
The final landform is presented in Figure 20.1

Refer to the Preliminary Design Report (Appendix O) for further detail of final landform.

WHYTES GULLY NEW LANDFILL CELL ENVIRONMENTAL ASSESSMENT

WOLLONGONG CITY COUNCIL

FINAL LANDFORM



LEGEND

- Site Boundary
- Extent of Landfill Works

NOTES

Historic locations digitised by Golder from reports supplied by Wollongong City Council

Aerial Ortho-Photograph provided by AAM Pty. Ltd. taken on 16 May 2011, Reference 18763A. Image Georeferenced.

0 15 30 60 90 120 150 metres

SCALE (at A3) 1:4,000

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: 117625003
DATE: 25/01/2012
DRAWN: FA
CHECKED: BJF

FIGURE 20.1

Golder Associates

File Location: J:\GIS\Jobs\117625003_Wollongong Council_New Landfill Cell_Whytes Gully\Workspaces\117625003_128_R_F0001_Final_Landform_Rev0.mxd

20.3 Staging

The Project final landform would be created across a number of stages (Stage 1, Stage 2A, Stage 2B, Stage 3, Stage 4). A summary of the staging is presented in Chapter 8 of the EA.

20.4 Capping System

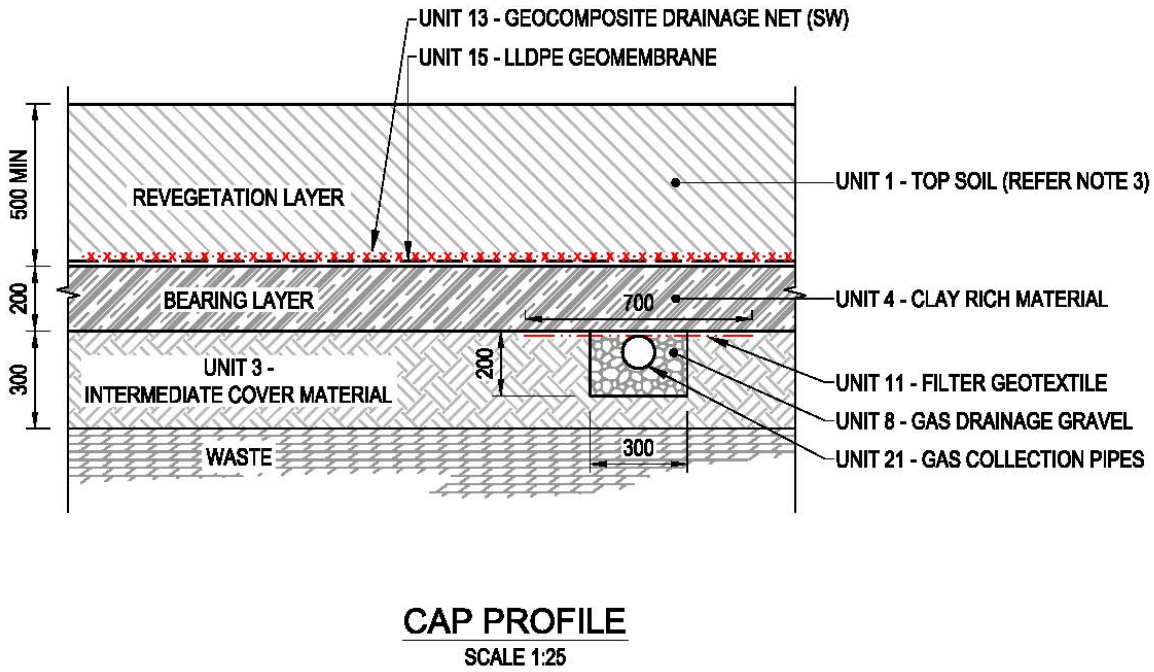
The Project capping system is proposed to be constructed progressively as the landfill is being filled and has been designed to reduce infiltration into the landfill waste, reduce the amount of leachate generated, reduce potential impacts of odour emissions and provide separation from waste. The capping system would be constructed progressively as landfilled areas have achieved their final level.

A profile of the capping system is shown in Figure 20.2 and is proposed to comprise (from top to bottom):

- 500 mm to 1 m revegetation layer. To support vegetation growth to limit erosion from the cap and to provide visual amenity; provide sufficient thickness to reduce potential for human contact with cell materials.
- Geocomposite drainage system with geotextile. To drain infiltrating rainwater from above the barrier liner..
- Linear Low Density Polyethylene (LLDPE) geomembrane liner . Tolimit infiltration of water and oxygen into the landfill and contain waste.
- 200 mm clay rich bearing layer to form a low permeability and smooth base for geomembrane liner placement. The layer is designed to reduce infiltration through the capping system and to reduce the likelihood of damage to the LLDPE geomembrane.
- 500 mm intermediate cover remaining from the landfill operation.
- Landfill gas collection trenches underneath the cap, consisting of gravel aggregate and perforated collection pipes connected to an active landfill gas collection system. To remove landfill gas from beneath the cap.

Refer to the Preliminary Design Report (Appendix O) for further detail of the capping system.

Figure 20.2: Profile of the Capping System



20.5 Revegetation

Revegetation associated with the Project is summarised below and is outlined in more detail in the Landscape Strategy (refer to Appendix N). The Landscape Strategy incorporates the following key components associated with revegetation:

- Staging of revegetation would aim to ensure the area of un-vegetated landfill slope is reduced by progressively establishing a vegetation cover on each section of slope as it is completed;
- Subject to bushfire protection requirements (such as trimming of mature trees), existing native vegetation would be retained where possible to provide visual screening and contribute to the landscape character of Whytes Gully RRP;
- Vegetation to be established on the landfill slopes would include a mix of shrubs and small trees with areas of grass that would create a landscape character similar to adjoining rural areas;
- Screen planting with dense tall tree planting on natural ground would be used to block views to the site, particularly from adjoining residences;
- Biodiversity and habitat values would be maintained and increased where possible by planting a range of indigenous species;
- The visibility of drainage channels on the slopes would be minimised by design options that could include the use of dark coloured stone and native grasses;
- Provision of a maintenance program that includes regular removal of identified weed species (refer to the LEMP); and
- Coordination of vegetation planting and removal with bushfire management requirements that include access tracks and fuel management zones.

A full list of species selected for the revegetation of the site is provided in the Landscape Strategy (Appendix N). The proposed plant species and planting structure would establish vegetation that forms a sustainable ecosystem similar to the adjoining areas of remnant vegetation providing wildlife habitat and contributing to the ecological values of the region.

20.6 Surface Water Management

Capped areas of the landfill would be revegetated as soon as feasible. Until vegetation has been fully established, the capped areas as well as the run-off from these areas would be treated in accordance with the Department of Environment and Climate Change NSW 2008, *Managing Urban Stormwater, Soils and Construction, Volume 2B Waste landfills*, DECC, June 2008. This would include management of revegetated surfaces for the first few months after sowing. Management would include use of silt fences, and full reestablishment and vegetation of capped areas where erosion has occurred. Runoff from vegetated areas would be direction to the existing surface water ponds until vegetation has been fully established or at least for two years following vegetation of the landfill cap. Following this surface water can be discharged directly into surrounding water bodies as required.

Surface Water Management systems are outlined in detail in Chapter 12 of the EA, Appendix G4 and the Preliminary Design Report (Appendix O) addressing Soil and Water issues.

20.7 Leachate Management

While the ongoing management of leachate would be addressed through appropriate landfill capping and design (refer to Preliminary Design Report Appendix O) the landfill would continue to generate leachate with the closure of Whytes Gully RRP. This leachate post-closure is proposed to continue to be collected by the Project's leachate collection system, which includes being piped to the leachate ponds, then the LTP. The treated leachate would be discharged to sewer under the trade waste agreement number 11205.

Leachate management systems of the Project are outlined in detail in Chapter 12 of the EA, Appendix G5 and the Preliminary Design Report (Appendix O).

20.8 Landfill Gas Management

While the ongoing management of landfill gas would proposed to be addressed through appropriate landfill capping and design (refer to the Preliminary Design Report Appendix O), the landfill would continue to generate landfill gas with the closure of Whytes Gully RRP. This landfill gas post-closure is proposed to continue to be collected by the Project's landfill gas collection system.

Landfill gas management systems of the Project are outlined in Chapter 8 of the EA, and the Preliminary Design Report (Appendix O).

20.9 Post Closure Monitoring and Maintenance

Following closure of Whytes Gully RRP, environmental monitoring of surface water, groundwater, leachate and landfill gas would continue in accordance with the monitoring identified within the LEMP (refer to Appendix P). The proposed environmental monitoring system is outlined in the draft LEMP, with post closure monitoring to include site walkovers to detect potential areas of cap degradation, excessive settlement, erosion and slumping.

The LEMP also outlines contingency and remediation measures should environmental monitoring indicate that the closed landfill is impacting upon air, surface water, groundwater or amenity of nearby receptors. In addition to procedures for maintaining the landfill surface post closure and repairing damage to the capping system.

Upon closure of the Whytes Gully RRP it would be proposed to be retained by Wollongong City Council for a number of years to enable ongoing monitoring and management and maintenance of the site.

Refer to the draft LEMP provided in Appendix P for further detail on monitoring, management and maintenance.

20.10 Final Land Use

Potential future land use of Whytes Gully RRP is proposed to be associated with passive open space, which would be compatible with recreation and/or environment protection zoning under the existing LEP. It is considered this potential future land use is appropriate given the existing environment and location of Whytes Gully RRP, the Project activity and the proposed rehabilitation activities.

Visual impacts of the Project are addressed within Chapter 17 (Visual) and the Visual Assessment in Appendix K of the EA, ensuring appropriate integration with the surrounding area. In addition the Landscape Strategy (refer to Appendix N) addresses visual integration of the final landform with the surrounding area and includes:

- Views to the coast be maintained from a potential lookout area on the landfill ridgeline and from properties upslope of Whytes Gully RRP;
- The top of the new landform is proposed to be modified to ensure it is visually compatible with the surrounding topography; and
- The potential for future public open space facilities such as a lookout and/or passive recreation areas with access is identified with potential upgrading of a maintenance track to the top of final landfill landform.

As identified within the Landscape Strategy the final landform of the Project is propose to be designed to provide passive open space following completion of the landfill operations and closure of the Whytes Gully RRP site. This final land use design of passive open space would not limit future potential uses of the site and given the long timeframe until completion of the Project (40+ years), it is considered the final land use be reviewed in the future to ensure the proposed post-closure land use is appropriate and compatible with the land use of the surrounding area.

WHYTES GULLY NEW LANDFILL CELL
ENVIRONMENTAL ASSESSMENT
WOLLONGONG CITY COUNCIL

LANDSCAPING PLAN

LEGEND

- Site boundary
- New landfill boundary
- Proposed contours (5m intervals)
- Existing trees to be retained
- Proposed screen planting along boundary
- Proposed small tree & shrub planting on landfill
- Proposed tree planting on natural ground
- Proposed grass on landfill slopes
- Existing ponds retained
- A — Potential lookout area
- B — Potential passive open space recreation area
- Existing industrial buildings on site
- Existing residential buildings adjoining site

Golder Associates

FIGURE 20.3

Figure provided by

Landscape Architect

Corkery Consulting

Landscape Architecture
Urban Design

21.0 DRAFT STATEMENT OF COMMITMENTS

This chapter of the EA details the draft Statement of Commitments to outline all proposed environmental management and monitoring measures to reduce adverse impacts of the Project.

The Director-General's requirements	
■ ***A statement of commitments, outlining all the proposed environmental management and monitoring measures***	**Chapter 21**

21.1 Overview

Measures to monitor and manage the potential impacts of the Project have been identified throughout the EA and are provided within the draft Statement of Commitments presented in Table 21.1.

The draft Statement of Commitments may be revised in response to submissions to the EA, further data collection and design development. The final Statement of Commitments would be considered by the Department of Planning and Infrastructure during assessment and prior to determination of the Project. Should approval be granted by the Minister for Planning and Infrastructure, the final Statement of Commitments will inform part of the Project approval conditions.

Following project approval, the finalised Statement of Commitments would guide subsequent phases of the proposed development. It is intended that any consortium or contractor selected to undertake future works associated with the Project would undertake all works in accordance with Project approval conditions, which would include compliance with the final Statement of Commitments in addition to environmental management plans including the final LEMP (which is provided in draft form in Appendix P of the EA).

Wollongong City Council commits to implementing the commitments provided in Table 21-1 of the EA.

Table 21.1: Draft Statement of Commitments

Issue	Commitments
General	■ Wollongong City Council would implement the Project in accordance with the EA and conditions of approval as provided by the determining authority. ■ Wollongong City Council commit to considering the Concept Site Masterplan for future planning of resource recovery activities on the Whytes Gully RRP site. This includes consideration of an appropriate footprint for future resource recovery activities and access requirements. ■ By 2014 Wollongong City Council's Waste Strategy commits Wollongong City Council to reviewing available alternative waste technologies as identified in Wollongong City Council's Waste Strategy. ■ If the Project is approved, it is proposed that Wollongong City Council would surrender existing development consents of relevance to the Project site. This does not include the existing development consent for the MRF, which is not affected by the Project.
Waste Management Strategy	■ Wollongong City Council would implement the Project in accordance with the "Wollongong City Council Waste and Resource Recovery Strategy 2012 to 2022" as provided in Appendix B and future updates of this document as relevant to the Project. ■ Detailed design of the Project would consider and address constraints and opportunities identified within the EA.

Issue	Commitments
Environmental management plans	■ A Construction Environmental Management Plan would be prepared and implemented to guide environmental management and monitoring activities during construction. The CEMP would include specific environmental issue sub-plans to reduce potential impacts and in accordance with relevant commitments identified within the EA and within this table. A monitoring program shall be conducted throughout the construction period to monitor compliance with the CEMP. ■ The Landfill Environmental Management Plan (LEMP) would be implemented to be consistent with the draft LEMP provided in Appendix P. This includes implementation measures to guide environmental management and monitoring activities during operation as identified within the EA in addition to further specific issues identified within this Table.
Noise	Wollongong City Council commit to the following with regard to noise: ■ All mobile equipment would be selected to minimise noise emissions. Equipment would be fitted with silencers and be in good working order. ■ Broadband reversing alarms would be used for all site equipment. ■ Construction activities would be limited to the recommended construction hours where feasible and reasonable. ■ Consultation with residents who are identified as potentially affected by cumulative and operational noise exceedances and communication of details of the construction and operational program on a regular basis. ■ Provide a community liaison phone number and permanent site contact so that noise complaints would be received and addressed in a timely manner.
Greenhouse Gas	Wollongong City Council commit to the following: ■ An active landfill gas management system would be installed including flaring and/or combustion to reduce potential greenhouse gas emissions from the landfill. ■ Potential energy efficiency measures would be considered in the detailed design phase of the Project and be implemented and monitored through an Energy Savings Action Plan in accordance with the “Guidelines for Energy Savings Action Plans (DEUS 2005).
Erosion and Sedimentation Control	■ An Erosion and Sedimentation Control Plan would be developed as part of the CEMP in general accordance with the following erosion and sedimentation control principles including: ▪ Construction of earth bunds and diversion drains upslope and around the perimeter of construction areas where surface disturbance occurs, to prevent clean surface water entering these areas. ▪ Erection of silt fences or straw bales at strategic locations (i.e. around stockpiles) to manage the migration of fines. ▪ Construction of temporary sediment retention ponds.

Issue	Commitments
	▪ Dust suppression as needed. ▪ Reducing the surface area disturbed by construction activities at any one time. ▪ Regular inspection and maintenance of sediment and erosion control structures. ▪ Protecting and retaining vegetation and surface cover where possible. ▪ Placement of an erosion protection barrier (e.g. grassing) at the completion of works. ▪ Using designated access roads and paths where possible. ▪ Removing soil adhering to the wheels and undercarriage of trucks (e.g. by wheel wash) prior to departure from the Project site. ▪ Limit both the size of any stockpile footprints and the time between excavation and removal off-site of materials. ▪ Do not place stockpiles within 30 m of any watercourse. ▪ Stabilise all disturbed areas as soon as practicable. Temporary vegetative destabilisation techniques must be applied to any disturbed soil to prevent areas remaining bare for more than 28 days. ▪ Stabilise all temporary and permanent drainage immediately. ▪ Maintain all sediments and erosion control measures in effective condition until the works are completed and the site is stabilised. ▪ Release “Dirty” Stormwater, captured and stored by sediment and erosion control measures or site works, after treatment and testing to confirm compliance with relevant criteria. ▪ A monitoring program shall be conducted by throughout the construction period to monitor compliance with the CEMP. ■ Proposed erosion and sediment control measures that would be applied during operation of the Project are outlined in the draft LEMP (Appendix P).
Acid Sulfate Soils	In the event of discovery of Acid Sulfate Soils, procedures would be implemented/adopted to mitigate potential impacts on the environment in accordance with appropriate guidance and legislation and as identified in Chapter 12 of the EA.
Contamination	In the event of discovery of previously unidentified area(s) of potentially contaminated material, procedures would be implemented/adopted to mitigate potential impacts on the environment, employees and the public in accordance with appropriate guidance and legislation and as identified in Chapter 12 of the EA.
Surface water	■ A Surface Water Management Plan would be developed as part of the CEMP in general accordance with the following control principles: ▪ Bund fuels, oils, paints, and other chemicals onsite to comply with the

Issue	Commitments
	requirements of relevant legislation. ▪ Bunds must be fitted with an impervious floor and must not be fitted with a drain valve. ▪ Remove accidental spills of soil or other materials. ■ Wollongong City Council would commit to the following key principles in developing the surface water management controls for operation of the Project. ▪ Diversion of clean drainage directly into Dapto Creek. Runoff from areas that are unaffected by the development would be allowed to discharge directly from the site to Dapto Creek. ▪ Runoff from areas that are likely to generate sediment such as the new cell construction areas and stockpile areas would be directed into the Surface Water Ponds. ▪ Reduce the volume of runoff to Surface Water Ponds by reducing the contributing catchment area at any particular time. ▪ Keep sources of different water quality types separate from each other. ▪ Construction of a perimeter bund around the entire active landfill area to prevent surface water from entering the landfill area. ▪ Construction of a diversion drain around the entire landfill area to collect all runoff from disturbed areas (but outside exposed/uncapped active waste cell area(s)) which would drain to the sedimentation basin ▪ The existing surface water ponds would be used for Stage 1 to 3 of the development. ▪ The Surface Water ponds would be downsized for Stage 4 onwards, as Stage 1 to 3 would be rehabilitated and runoff would be directed offsite to Dapto Creek. ▪ Re-use 'dirty' water for dust suppression.
Groundwater	■ A Construction Quality Assurance (CQA) system would be implemented for cell construction. Detailed CQA requirements are embedded in the Technical Specification of the Design Report (Appendix O). ■ During the operational phase of the Project a number of engineering measures and management strategies would be used to mitigate impacts to groundwater. Further documented within the EA these include: ▪ Leachate Barrier System and Leachate Collection System ▪ Leachate Pond ▪ Leachate Treatment Plant ▪ Groundwater separation ▪ Monitoring – A network of groundwater bores would be used to monitoring

Issue	Commitments
	groundwater quality and trends at the Project Site. This would include a regular programme of groundwater sampling and assessment as detailed in the LEMP. – The leachate management system would be monitored in accordance with measures described in the LEMP including direct monitoring for the purposes of system integrity, leachate quantity and quality. – Groundwater Assessment Program to monitor background concentrations. If a significant change in concentration for any of the indicator parameters is detected over two consecutive monitoring periods, then the affected groundwater monitoring bores would be resampled and assessed and OEH notified (if required). Following this a groundwater remediation plan may be developed in accordance with the LEMP.
Leachate Management	Wollongong City Council commit to the following with respect to leachate management: ■ Segregation of leachate from surface water and groundwater; ■ Maintain pond levels with adequate freeboard to minimise the potential for overflow; ■ Continue to monitor leachate discharge to sewer in accordance with Trade Waste Agreement.
Flora & fauna	Wollongong City Council commit to the following to ensure the Project maintains or improves the biodiversity values of the region. ■ Clearing for the purposes of bushfire protection would be restricted to non-native vegetation communities (Acacia Scrub/Exotic, Closed Exotic Grassland, Planted). In accordance with the Bushfire Assessment, clearing or trimming of the Illawarra Subtropical Rainforest on the site is proposed to be avoided. ■ Removal of native vegetation communities and fauna habitats during construction and operation of the Project be avoided and minimised where possible. ■ Undertaking two additional targeted surveys for the Green and Golden Bell Frog in the peak breeding season to confirm results of targeted surveys undertaken in November/December 2011 and early January 2012. ■ Waterbody removal and associated vegetation removal being undertaken over the spring or summer months when fauna species are most active. ■ Undertaking protection of all retained trees. Tree protection measures such as temporary fencing will be implemented for any trees potentially indirectly impacted by the Project. ■ Installation of protective fencing around all retained native vegetation. This is particularly important for areas of ISTR EEC where there is a risk of indirect impact. ■ Installation of sediment and erosion controls as required including for

Issue	Commitments
	potential indirect impacts to the ISTR EEC. ■ Ensure machinery parking, equipment or materials storage compounds, temporary stockpiling of excavated material and work areas are outside sensitive natural features including retained native vegetation, wetlands and drainage lines. ■ Logs removed with any vegetation removal would be relocated into areas of retained vegetation, for the purpose of providing fauna habitat. ■ A weed control program would be undertaken in accordance with the LEMP. ■ Undertake revegetation of cleared and disturbed areas using a range of native species of local provenance for the purpose of managing weeds, controlling soil erosion, and maintaining fauna habitat in accordance with the Landscape Strategy (Appendix N). ■ Maintain suitable buffer distances from nearby waterways. These buffer distances are recommended based on the stream orders of waterways and the subsequent categories identified within the "Wollongong City Council Development Control Plan 2009". ■ Following the disturbance of existing surface water ponds, landscaping would be undertaken to enhance existing riparian zone vegetation associated at the ponds to be in accordance with appropriate riparian buffer widths. The vegetation buffer is proposed to be constructed to an average width of 5 metres where possible to improve the existing aquatic habitats. ■ Extend the current water quality monitoring program to include one monitoring location on Dapto Creek, upstream of the discharge point and two locations downstream. ■ Biodiversity and habitat values would be maintained and increased where possible by planting a range of indigenous species.
Air quality	Wollongong City Council commits to the following with regard to air quality: ■ Watering of unsealed haul roads and disturbed surfaces (including construction areas). ■ Restricting the size of disturbed areas as much as practicable. ■ Disturbed areas would be rehabilitation progressively in accordance with the Landscape Strategy. ■ Prevention of truck over-loading and covering dusty loads. ■ Washing down trucks before they leave the site. ■ Maintaining equipment and plant appropriately to ensure efficient operation. ■ The active landfill area would be covered following the completion of waste placement at the end of each day with landfill lids or approximately 150 mm of daily cover material or other cover system. ■ Adhering to appropriate hours of construction and operation.

Issue	Commitments
	■ Temporarily suspending operations under extreme wind speed conditions. ■ Giving consideration to reducing the footprint of the active cell area and daily cover and increasing the thickness of daily cover to control odour as required, particularly during the operation of Stage 1 during waste relocation works and Stage 4. ■ An air quality (including dust and odour) management strategy would be incorporated into the CEMP. ■ Monitoring in accordance with the EPL and ongoing assessment.
Traffic and transport	Wollongong City Council commit to: ■ Appropriate management and maintenance of road pavement of Reddalls Road intersection to Whytes Gully RRP and site access. ■ The CEMP for the Project would include a traffic management plan identifying truck movements to and from the site, internal access, interactions with general public, parking and access requirements for construction personnel and safety signage and training of personnel in traffic management in accordance with relevant requirements and guidelines of the RTA in terms of road safety and network efficiency. ■ Where possible, trucks to the site would be scheduled to avoid peak hour and within standard hours of operation, except in emergencies.
Heritage	Wollongong City Council commit to the following with regard to heritage (indigenous and non-indigenous): ■ Registered Aboriginal parties identified within the EA would be informed about the management of Aboriginal cultural heritage sites within Whytes Gully RRP where they may be impacted upon by the Project. ■ Identified potential archaeological deposits within the Whytes Gully RRP site would be left in their identified location and not salvaged unless the Project cannot avoid impacting upon these sites. If salvage is required Wollongong City Council would consult with the relevant statutory bodies and provide an opportunity for collection of the cultural material from the site. ■ Monitoring of construction would be completed for the Project where in proximity to listed heritage items (i.e. Glengarry Cottage) to ensure there is no disturbance to heritage significance. ■ A heritage induction including indigenous and non-indigenous heritage is proposed to be incorporated within the general induction during construction of the Project. ■ Should indigenous or non-indigenous cultural material be identified during any works, construction and/or operation will cease in the vicinity of the find and the appropriate representative at OEH will be contacted.
Visual	Wollongong City Council commit to: ■ Staging and planning of landfill activities to reduce the extent to which they would be visible during the construction and operation of the Project.

Issue	Commitments
	■ Implementation of the Landscape Strategy (Appendix N of the EA) to reduce and manage potential long term visual impacts. ■ Reducing the area of un-vegetated landfill slope, both permanent and temporary, by staging the operations and progressively establishing a vegetation cover on each section of slope as they are completed. ■ Revegetating the proposed landfill slopes with mix of shrubs and small trees and grass to create a landscape character similar to adjoining rural areas. ■ Adopting design options (when suitable) to be in keeping with the surroundings of the site including native grasses and dark toned colours for existing and proposed structures to reduce their visual contrast with their landscape setting. ■ Consulting with residents (as identified within the relevant chapter of the EA) to discuss the potential for planting to be carried out close to their houses to screen views of the landfill operations. ■ Subject to bushfire protection requirements (such as trimming of mature trees), existing native vegetation would be retained where possible to provide visual screening and contribute to the landscape character of Whytes Gully RRP. ■ Screen planting with dense tall tree planting on natural ground would be used to block views to the site, particularly from adjoining residences.
Socio-Economic	Wollongong City Council commit to ensuring: ■ A Stakeholder Strategy would be implemented throughout the delivery of the Project. Provided within environmental management documentation (LEMP) the Stakeholder Strategy would provide procedures for communication with stakeholders, procedures for the dissemination of information to the community, identification of the communication channels available for the community and stakeholders to provide feedback on the Project, a protocol for the Project to respond to any enquires or feedback and for managing site visits and property inspections. ■ Implementation of measures to reduce the potential for construction and operation impacts upon amenity as identified within the relevant chapters of the EA and the draft Statement of Commitments.
Hazards and Risk	Wollongong City Council commit to ensuring: ■ No smoking around plant equipment and within designated areas only. ■ Any dangerous goods would be stored in accordance with normal dangerous goods storage procedures. ■ Spill containment to be managed in accordance with relevant Australian Standards. ■ Safety hazards would be managed through occupational health and safety procedures. ■ Environmental hazards would be managed through the CEMP and LEMP.

Issue	Commitments
	■ Fire protection (including fire extinguishers, separation distances) would be provided in accordance with relevant Australian Standards and as identified within the EA. ■ Fire suppression and protection systems serviced and inspected periodically. ■ Water carts would continue to be made available at the site. ■ Site emergency response plan including emergency contact numbers provided within management system for the site. ■ The site landscaping would not exceed a fuel load of 2 t/ha. ■ Planted trees that are retained on the site would have the lower branches trimmed (cut off) to a height of 2 m above the ground. The tree trimming works may be staged with priority given to the protection of assets and fuel load reduction adjacent to roads. ■ An asset protection zone (APZ) of 10 m would be maintained around existing site buildings. ■ A perimeter firebreak of 5 metres be established around the entire Whytes Gully RRP site and around buildings (roads and access tracks including offsite roads and tracks, may be utilised to form the fire break). ■ Wind-blown litter would be managed as outlined in the LEMP. ■ Coordination of vegetation planting and removal with bushfire management requirements that include access tracks and fuel management zones. ■ Flammable materials would be removed from site fencing as outlined in the LEMP. ■ The LEMP would be implemented to ensure reduction of hazards and risk associated with delivery and/or processing of waste. ■ A Vegetation Management Strategy (including Weed management) would be developed within the LEMP to ensure that vegetation is managed to not exceed recommended fuel loads in relevant guidelines. ■ The general public would not be allowed direct access to the landfill. ■ Security of the site would be maintained during construction and operation including security fencing, which is locked after hours of operation. ■ Waste entry and flows would be monitored and controlled in accordance with the LEMP.
Rehabilitation and Final Landform	Wollongong City Council commit to: ■ Development of a final landform that integrates with the surrounding landscape and environment. ■ Implementing of the Design Report to ensure that appropriate capping of the landfill is completed progressively throughout the Project. ■ Implementing the LEMP to ensure appropriate post closure monitoring and

Issue	Commitments
	maintenance. This includes contingency and remediation measures should environmental monitoring indicate that the closed landfill is impacting upon air, surface water, groundwater or amenity of nearby receptors. This also includes procedures for maintaining the landfill surface post closure and repairing damage to the capping system.
Stakeholder Engagement	Wollongong City Council commit to ongoing regular consultation with the community on the Project through: ■ Community Consultative Committee for the Whytes Gully RRP. ■ Phone line to communicate issues to Whytes Gully RRP management. ■ Complaints management process (as provided in the draft LEMP). ■ Clear signage at construction sites during construction. ■ Stakeholder satisfaction surveys and feedback forms (as part of wider Wollongong City Council activity). ■ Ongoing use of interactive web-based activities including updates of the Project website.

22.0 PROJECT JUSTIFICATION AND CONCLUSION

This chapter provides concluding justification to the Project and in doing so addresses considerations of the suitability of the Whytes Gully RRP site; the economic, social and environmental impacts of the Project as a whole and whether it is consistent with the objects of the EP&A Act including the principles of ESD.

The Director-General's requirements	
■ ***A conclusion justifying the project, taking into consideration: the suitability of the sites; the economic, social and environmental impacts of the project as a whole; and whether it is consistent with the objects of the Environmental Planning and Assessment Act 1979, and in particular the principles of ecologically sustainable development.***	**Chapter 22**

22.1 Overview

This EA has been prepared to consider the potential impacts of the construction and operation of the Project, which proposes to increase landfill capacity at Whytes Gully RRP through construction and operation of a new landfill cell and 'piggy-backing' it over the existing landfill. The EA provides an assessment of the potential environmental, social and economic impacts of the Project while considering and recommending management and potential impact mitigation measures.

The EA has been prepared in accordance with the EP&A Act as a "transitional Part 3A project" and demonstrates the Project is consistent with relevant Commonwealth and NSW State legislative aims and objectives, and that it will contribute to the sustainable waste management practice of Wollongong LGA. The assessment of the Project includes evaluation of economic environmental and social issues as identified by regulators and by the Proponent during the assessment process. Key assessment issues include:

- Noise;
- Greenhouse Gas;
- Soil and Water;
- Flora and Fauna;
- Air Quality and Odour;
- Traffic and Transport;
- Heritage (indigenous and non-indigenous);
- Visual;
- Socio-economic;
- Hazard and risk; and,
- Rehabilitation and Final Landform.

Assessments of the key issues have included mitigation and management measures to avoid or reduce potential impacts of the Project. These proposed measures are consolidated in Chapter 21 of the EA Statement of Commitments (draft).

22.2 Strategic Need for the Project

The strategic need for the project is presented in Chapter 4 of the EA. Chapter 4 identifies that the Project addresses a number of economic, social and environment drivers that are external and internal to Wollongong City Council and Wollongong LGA, which are framed by legislation, policy and strategy documents at the Commonwealth, New South Wales State and local council level.

Key strategic need benefits of the Project include:

- Securing landfill capacity for waste that cannot be diverted from landfill.
- Securing landfill capacity for residual waste associated with existing and future resource recovery activities.
- Contingency capacity for waste minimisation and resource recovery activities.
- Meeting the needs of Wollongong City Council to adequately provide for suitable waste and economic management in the future.
- Addressing legislative requirements for waste management.
- Ensuring existing and future facilities and technologies are managed appropriately in coordination with the proposed landfill.

Refer to Chapter 4 of the EA for full details of the strategic need drivers for the Project.

22.3 Site Suitability and Alternatives

The environmental assessment has identified that Whytes Gully RRP is a suitable location for the Project based upon its existing environmental setting, land use of the site and surrounding area, the potential impacts of the Project and the proposed mitigation and management measures.

The justification of the Project is also based on the absence of less feasible alternatives that could address the project strategic needs as effectively and efficiently as the Project. Alternatives considered included the alternatives to landfill, the 'do nothing' alternative, alternative landfill sites outside of Wollongong LGA and alternative new landfill sites within Wollongong LGA or elsewhere and alternative existing landfill sites within Wollongong LGA.

It is considered the Project is preferred in comparison to all available alternatives. Some of the key reasons include:

- **Alternatives to landfill**
  - Landfilling of waste would still be required in the future to compliment resource recovery and waste avoidance initiatives.
- **"Do Nothing'**
  - Wollongong City Council would no longer be able to accept waste at the site or at another landfill within the LGA.
- **Alternative Landfill Sites Outside of Wollongong LGA**:
  - Additional economic, environmental and social costs associated with transporting waste would be incurred.
  - Limited landfill capacity and ability of alternate landfill sites outside of the LGA to accept waste generated by Wollongong LGA.
  - Imposition of the externalities generated through Wollongong LGA waste generation and management would be placed upon other LGA's.

- **Alternative New Landfill Sites within Wollongong LGA or Elsewhere**
  - The waste footprint within Wollongong LGA or elsewhere would be increased in comparison to the Project (the Project would provide additional capacity within the existing waste footprint).
  - Resource recovery and associated waste infrastructure would need to be relocated and/or re-established (ponds, treatment plant etc).
  - Existing resource recovery activities and infrastructure would be less efficient as residual waste to landfill would require increased transportation costs (environmental, economic and social). The greater distance (such as outside of Wollongong LGA) the greater cost.
  - A new landfill site is likely to require more time for design, approval and construction (and subsequent cost) in comparison to providing for new landfill cells within an existing landfill site.
- **Alternative Existing Landfill Sites within Wollongong LGA (Helensburgh landfill)**
  - The Helensburgh landfill would not offer a feasible alternative. Constraints include:
    - Existing capacity constraints.
    - Unlined landfill in a potential environmentally sensitive area.
    - Low design potential to provide for new landfill cells and capacity.
    - Change to waste flow would be required.
    - Location to the north of the Wollongong LGA and not in proximity to large waste generation areas.
    - Requirement of additional traffic movements for ingress and egress to the site.

Further details associated with consideration of alternatives are provided in Chapter 5 of the EA.

22.4 Ecologically Sustainable Development

Ecologically sustainable development (ESD) is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD have been an integral consideration throughout the assessment of the Project.

The EP&A Act recognises that ESD requires the effective integration of economic and environmental considerations in decision-making processes. There are four main principles supporting the achievement of ESD:

- Precautionary principle.
- Inter-and intra-generational equity.
- Conservation of biological diversity and maintenance of ecological integrity.
- Improved valuation and pricing of environmental resources.

These are discussed below.

Precautionary Principle

The precautionary principle deals with certainty in decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

The “transitional Part 3A” development assessment process itself is precautionary, providing a procedure to assess and evaluate certainty prior to determination. Environmental investigations have been undertaken as

part of the Project development (and documented within the EA) identifying the Project as a whole would result in no threat of serious or irreversible environmental damage.

The threat of serious or irreversible environmental damage is one of the essential preconditions to the engagement of the precautionary principle. As the EA does not identify a threat of serious or irreversible environmental damage the precautionary principle does not apply.

Inter- and Intra-Generational Equity

Inter-generational equity is the concept of fairness between people of different generations. In this context, it refers to the need to minimise the passing on of economic, social and environmental costs to future generations.

Intra-generational equity is the concept of fairness between people of the same generation. It is also called social equity, and refers to the need for fairness in the distribution of economic, social and environmental costs and benefits.

The Project would deliver inter-and intra-generational equity by delivering an accessible, reliable and affordable waste facility that would cater to the broad range of socio-economic groups that live in the serviced locations (i.e. Wollongong LGA). By addressing the Waste Strategy and securing landfill capacity within Wollongong LGA, Wollongong City Council is proposing to manage its waste in a sustainable manner that enhances social equity across Wollongong LGA through ensuring the Project has reduced adverse environmental impacts in comparison to feasible project alternatives.

The Project also provides a secure waste handling legacy for future generations. As an integral part of Wollongong City Council's Waste Strategy, the Project would provide long-term benefits in terms of the environment and urban living and link wider Council policy documents including land use and planning strategic objectives for improved urban environments. It would also meet future generations' waste needs: it will be critical to allow those generations the same, if not better, waste handling options than available to current generations.

Conservation of Biological Diversity and Ecological Integrity

The twin principles of biodiversity conservation and ecological integrity have been considered in the design of the proposed extension to the existing Whytes Gully RRP. Environmental components, systems and habitats values potentially affected by the Project are assessed within the EA.

Identified potential key issues are addressed in chapters 10 to 20 of the EA with mitigation and management measures proposed to reduce potential negative impacts. Utilizing existing land and infrastructure the Project is considered to not pose a significant impact upon any biological diversity or ecological integrity including rehabilitation and the final land use.

Improved Valuation, Pricing and Incentive Mechanisms

The principle of internalising environmental costs into decision making requires consideration of all environmental resources which may be affected by a project, including air, water, land and living things.

Placing a reliable valuation on the residual, environmental and social effects of the Project presents a number of challenges. Nonetheless the Project, including the design options, has been developed based upon the objective of minimising potential impacts upon the surrounding environment. This can be recognised by the extent of environmental investigations, planning and design of impact mitigation measures to minimise adverse environmental impacts, and consideration of economic costs of the Project, including construction and operation environmental management plans.

Detailed design of the Project, together with specific issue-based management plans and maintenance and implementation of infrastructure committed to within the EA represent further assurance to the recognition of the value of reducing environmental impacts. Implementation of the conditions of approval would result in an economic cost (capital and operating) to Wollongong City Council demonstrating that environmental resources assessed as part of the Project EA have been given an appropriate valuation.

22.5 Socio-Economic Considerations

The socio-economic assessment provided in Chapter 18 of the EA demonstrates that the Project would provide both direct and indirect benefits to the local, regional and state economies during construction and operation. In particular, the Project would provide for ongoing and efficient waste management and resource recovery within Wollongong LGA and greatly assist in securing the waste management needs within Wollongong LGA (as identified within the Waste Strategy) providing for equitable access to waste management services.

Direct economic benefits in the form of local employment opportunities during construction and operation of Whytes Gully RRP would be realised through the generation of employment opportunities and potential income to local businesses, in addition to securing long term cost efficiencies such as agglomeration (waste activities being located closer together) and densification of waste resources. These cost efficiencies would be passed onto the rate payers. In addition, indirect benefits would be created through Project implementation include securing the long term viability of waste management and potential increased business activities associated with potential resource recovery options made available by the Project.

Overall the Project is estimated to create approximately 6 workers for capping and 6 for cell preparation activities and maintain up to 10 jobs at the Whytes Gully RRP site for operation and maintenance.

The Project and the ongoing operation of Whytes Gully RRP are consistent with the West Dapto land release strategies, which include socio-economic considerations. The Project provides for an accessible, reliable and affordable waste facility within an area identified as appropriate for this activity.

The Project would generate broad economic benefits to the State and Commonwealth through the implementation of increased financial constraints for landfilling activities such as the S.88 levy and carbon tax. While seeking to discourage landfill through increased costs for landfilling activities, there is a demonstrated need for landfill in the foreseeable future and the State and Commonwealth is positioned to financially benefit from this disincentive.

Given the direct and indirect benefits associated with the Project's construction and operation, it is considered the proposed Project is justifiable on socio-economic grounds.

22.6 Meeting the objects of the EP&A Act

The objects of the EP&A Act provide a policy framework within which the justification of the Project can be considered. Table 22.1 outlines those objects and provides comment on their relevance to the project.

Table 22.1: Relevance of the EP&A Act objects to the project

EP&A Act Objects	Comment
Encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.	The Project would improve the management of waste resources and through this management promote the use of waste avoidance and sustainable resource recovery practices thereby providing for the appropriate management of natural resources.
Encourage the promotion and coordination of the orderly and economic use and development of land.	The Project would provide waste management infrastructure that addresses an immediate and long term waste need. Its benefits would have a positive social benefit and economic value. The integration of the project with surrounding land uses has been a key consideration and has been addressed through a concurrent Concept Master Plan process. The proposed new landfill cell would piggy back on top of the existing landfill cells within Whytes Gully RRP and hence, promotes the orderly and economic development of land.
Encourage the protection, provision and coordination of communication and utility services.	The Project has been designed to minimise impacts on communications and utility services. The Project has identified in the draft statement of commitments that the existing easements would be relocated and/or exinguished in coordination with the relevant communication and/or utility service provider.
Encourage the provision of land for public purposes.	Through implementation of the Project the waste management footprint of Wollongong City Council would not be increased. Agglomeration and densification of waste management activities promoted by the Project would ensure that Wollongong City Council would have the opportunity to provide for alternate land uses (such as those for public purposes) on existing land owned by Council. The proposed new landfill cell would enable residual waste generated by residents of Wollongong LGA to

EP&A Act Objects	Comment
	be placed in Whytes Gully RRP beyond 2013 and hence, achieves the object of providing land for public purposes.
Encourage the provision of coordinated community services and facilities.	The integration of waste management facilities at Whytes Gully RRP has been fundamental to the Project development process. This is demonstrated in the Concept Masterplan process that has run concurrently with the Project.
Encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.	The Project would have a low impact on native animals and plants. The proposed piggy back landfill arrangement within the existing Whytes Gully RRP would ensure a low likelihood of threatened flora or fauna species or endangered ecological community being adversely affected by the development.
Ecologically sustainble development	The project would positively address the principles of ESD as addressed in this Chapter of the EA.
Provide and maintain affordable housing	The project does not involve the provision of affordable housing. Notwithstanding, it would have positive intra-generational effects by contributing to a high standard waste service for a broad range of socio-economic groups.
Share the responsibility for environmental planning between the different levels of government in the state.	The responsibility for environmental planning and approval in relation to the Project rests with the NSW Government. Consultation has, however, occurred across all levels of government.
Provide increased opportunity for public involvement and participation in environmental planning and assessment.	The project development process has involved extensive consultation with relevant parties.

22.7 Overall Justification of the Project

Consequences of Not Proceeding

In addition to relevant issues already addressed in this chapter of the EA, the consequences of not proceeding with the Project are provided in the points below.

- If the Project is not implemented landfilling at Whytes Gully RRP would be at capacity in the near future and the site would no longer accept waste to landfill. As a result Wollongong City Council would not have the capability to accept waste generated within Wollongong LGA including all MSW.
- Wollongong City Council would not be able to meet its immediate need to provide waste services (including landfilling) to Wollongong LGA.
- Wollongong City Council would be required to identify a further location that is deemed suitable by determining authorities. This would likely involve additional time and cost associated with site selection, design, approval, construction and operation.
- There would be a significant reduction in the landfill capacity of Wollongong LGA and the region in the near future, which would result in the regional demand for landfills for residuals not being satisfied.
- Wollongong City Council would not have contingency capacity.
- Waste generated within Wollongong LGA would increase capacity at other regional landfills.
- It is considered that Wollongong City Council would not be able to adequately address its policy documents (including "waste services… that meet the needs of the community, achieves improved environmental outcomes and controls the financial impact of waste management on the community."[9]
- The ability of Wollongong City Council to address relevant state and commonwealth legislation would be impacted upon and/or reduced. For example, it is considered that the Commonwealth and State requirements to dispose of waste to landfill in an "environmentally sound" or "environmentally responsible" manner in the short (and potentially long) term would be reduced.
- Direct detrimental economic impact upon the existing workforce that operates the landfill at Whytes Gully RRP. This includes the existing 10 full time employees.
- Project construction activity and associated employment and regional expenditure effects may not occur as anticipated.
- There would be potential impacts upon the effective implementation of the West Dapto Land Release area, which includes development potential for approximately 6,900 residential dwellings and 175 ha of new employment lands and three town centres.
- Potential impacts upon Wollongong City Council to provide cost effective, accessible, reliable and affordable waste facilities.
- Existing resource recovery infrastructure and new resource recovery infrastructure, which is committed to as part of the Project would need to be re-assessed given their feasibility is dependent on nearby landfill space to accept residual waste.
- The potential impacts of the Project would not occur.

[9] Wollongong City Council Key priority "Strategic Directions 2011-2014".

22.8 Conclusion

Wollongong City Council is committed to delivering sustainable waste management to Wollongong LGA. It is considered the Project is an important and vital component of this waste management as identified within council policy documents including the Waste Strategy and the Project represents Wollongong City Council's commitment to securing and providing waste management services to Wollongong LGA, as part of a major investment in the region's sustainable growth and prosperity.

Through securing landfill capacity and providing for the ongoing operation of Whytes Gully RRP, it is considered that the Project would deliver outcomes consistent with relevant NSW State and Commonwealth legislation including progressing towards diversion of waste targets as identified within the WARR Strategy.

The EA has been prepared in accordance with Schedule 6 (transitional Part 3A projects) of the EP&A Act. In particular, it addresses the requirements of the Director-General of the NSW Department of Planning and Infrastructure and incorporates the assessment of issues identified by NSW State government agencies.

Key environmental issues have been examined throughout the Project development, construction and operation planning processes. Consultation with the community and stakeholders has been undertaken during the Project to ensure that key potential impacts have been identified and discussed at an early stage, and, where feasible, appropriate mitigation measures are identified to reduce potential impacts of the Project.

A draft Statement of Commitments has been included in the EA (Chapter 21) incorporating a comprehensive suite of mitigation measures and management strategies to reduce the severity of any residual impacts arising from the Project. Further investigations would be undertaken as the Project progresses into the detailed design and construction stages. Where necessary this would include updating the draft LEMP (Appendix P) and further environmental management plans. These updated plans would assist in further mitigating any residual adverse impacts of the Project.

22.9 The next steps

Wollongong City Council is seeking approval for the construction and operation of a new landfill cell at Whytes Gully RRP. The next steps in the process are:

- Exhibition of the Environmental Assessment for a minimum of 30 days and invitation for the community and stakeholders to make submissions.
- Consideration of submissions. Submissions received by the Director-General would be provided to the Wollongong City Council and any relevant public authorities. Wollongong City Council may then be required to prepare and submit:
  - A submissions report, responding to issues raised in the submissions.
  - A preferred project report, outlining any proposed changes to the project and measures to reduce its environmental impacts.
  - A revised Statement of Commitments.
- Determination of the Environmental Assessment. The Director-General of the Department of Planning and Infrastructure provides an assessment report on the Project to the Minister for Planning and Infrastructure (or delegate), who then makes a decision on the project and, if approved, sets Conditions of Approval.

REFERENCES

NSW State Legislation and Environmental Planning Instruments

Contaminated Lands Management Act 1997

Environmental Planning and Assessment Act 1979

Environmental Planning and Assessment Regulation 2000

Environmental Planning and Assessment Amendment (Part 3A) Repeal Act 2011

Environmental Planning and Assessment Amendment Regulation 2011

Fisheries Management Act 1994

Heritage Act 1977

National Parks and Wildlife Act 1974

Native Vegetation Act 2003

Protection of the Environment Operations Act 1997

Roads Act 1993

Rural Fires Act 1997

State Environmental Planning Policy (Major Development) 2005.

State Environmental Planning Policy (Infrastructure) 2007.

State Environmental Planning Policy No. 33 Hazardous and Offensive Development.

State Environmental Planning Policy No. 44 Koala Habitat Protection.

State Environmental Planning Policy No. 55 Remediation of Land.

Threatened Species Conservation Act 1995
Waste Avoidance and Resource Recovery Act 2001 (WARR Act)

Water Act 1912

Water Management Act 2000

Wollongong Local Environment Plan (West Dapto) 2010

Commonwealth Legislation

Clean Energy Bill 2011

Environmental Protection and Biodiversity Act 1999

National Greenhouse and Energy Reporting Act 2007

Privacy Act 1988

"Australian Code for Transportation of Dangerous Goods by Road and Rail" (seventh edition 2007)

1:100,000 geological map 'Wollongong-Port Hacking' (Department of Primary Industries, 1985)

AS/NZS 4360:2004 – Risk Management

Australia ICOMOS Burra Charter

Australian Rainfall & Runoff Volume, A Guide to Flood Estimation, Volume 1 &2 (1987) "ARR"

Australian Standard AS 2436:2010 – "Guide to noise and vibration control on construction, demolition and maintenance sites".

Australian Standard/New Zealand Standard (AS/NZS) 4360:2004 Risk Management (AS/NZS 4360:2004).

Biosis Research (2012a) "Whytes Gully New Landfill Cell Terrestrial and Aquatic Flora and Fauna Assessment"

Biosis Research (January 2012b) "Whytes Gully New Landfill Cell Aboriginal Cultural Heritage Assessment Report"

Biosis Research (January 2012c) "Whytes Gully New Landfill Cell: Historical Heritage Assessment"

BMT WBM, 2010. Mullet and Brooks Creeks Flood Study – Final Report. Reference No. R.B14142.001.05.Final.doc, dated March 2010.

Bureau of Meteorology (2011) Climate Data Online, viewed 28 November 2011, http://www.bom.gov.au/climate/data/

Central Mapping Authority NSW (1979) "Wollongong Topographical Map 9029-11-S, 1:25,000"

CIRIA (2007) Assessing risks posed by hazardous ground gases to buildings, C665, 2007

Code of Practise for Archaeological Investigation of Aboriginal objects in New South Wales (DECCW 2010)

Corkery Consulting (January 2012) "Whytes Gully Resource Recovery Park – Landscape Strategy Summary Report"

Corkery Consulting Landscape Architects' "Whytes Gully Resource Recovery Park: Proposed New Landfill Cell Visual Impact"

DEC (2005) "Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales"

DECC (2008) "Managing Urban Stormwater: Soils and Construction, Volume 2B Waste Landfills , 2008" "Landfill Blue Book".

DECC (2009) "Threatened species survey and assessment guidelines: Field survey methods for fauna - Amphibians."

DECCW (2010) "Aboriginal cultural heritage consultation requirements for proponents"

Department of Climate Change and Energy Efficiency (2009) "State and Territory Greenhouse Gas Inventories 2009"

Department of Climate Change and Energy Efficiency (July 2011) "National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for the estimation of greenhouse gas emissions from facilities in Australia".

Department of Climate Change and Energy Efficiency "NGER Solid Waste Calculator V1.6"

Department of Energy, Utilities and Sustainability (2005) "Guidelines for Energy Savings Action Plans".

Department of Environment and Climate Change (1999) "Environmental Criteria for Road Traffic Noise"

Department of Environment and Climate Change (2000) "Industrial Noise Policy"

Department of Environment and Climate Change (2009) "Interim Construction Noise Guideline"

Department of Environment and Climate Change and Water (2011) "NSW Road Noise Policy"

Department of Environment and Conservation and Department of Primary Industries (2005) "Draft Guidelines for Threatened Species Assessment - Part 3A of the Environmental Planning and Assessment Act 1979."

Department of Planning (1994), "Applying SEPP 33", Hazardous and Offensive Industry Development Application Guidelines

Department of Planning (1996) "EIS Guideline: Landfilling"

Department of Planning (2008) NSW State and Regional Population Projections, 2006-2036 2008 Release, Sydney: Department of Planning

Department of Planning (2011) Guidelines for Hazard Analysis: Hazardous Industry Planning Advisory Paper No. 6

Department of Planning (2011) Guidelines for Hazard Analysis: Hazardous Industry Planning Advisory Paper No. 3

Department of Planning (January 2007) "South Coast Regional Strategy".

Department of Primary Industries "Protected Species Records Viewer" (accessed May 2011)

Department of Sustainability, Environment, Water, Population and Communities "Protected Matters Search Tool" (Accessed May 2011)

DEWHA (2009a) Environment Protection and Biodiversity Conservation Act 1999 "Policy Statement 1.1"

DEWHA (2010) "Survey guidelines for Australia's threatened birds (guidelines for detecting birds listed as threatened under the EPBC Act 1999)"

DEWHA (2010) "Survey guidelines for Australia's threatened frogs (guidelines for detecting frogs listed as threatened under the EPBC Act 1999)"

Elton Consulting, (July 2007). "Social Cultural and Recreational Needs Study for the West Dapto New Release Area".

EPA VIC 2010, Siting, Design, Operation and Rehabilitation of Landfills, EPA Victoria, September 2010

EPA Victoria (2010) "Best Practice Environmental Management Siting, Design, Operation and Rehabilitation of Landfills, 2010"

Fisheries Management Act 1994

Forbes and Rigby 2001, Review of Environmental factors for Proposed Deviation of Reddalls Road, Kembla Grange

Forbes Rigby, September 2003, Whytes Gully Waste Disposal Facility Leachate and Stormwater Ponds Civil Works, Reddalls Road, Kembla Grange for Wollongong City Council

GHD (July 2010) Whytes Gully Annual Environmental Monitoring Report,

Glengarry Cottage inventory card, State Heritage Inventory (http://www.heritage.nsw.gov.au/07_subnav_04_2.cfm?itemid=2700558 accessed 13 January 2012).

Golder Associates (1981) "Preliminary Geotechnical Investigation of Possible Waste Disposal Depot at Whytes Gully, Reddalls Road, West Dapto"

Golder Associates (2010a) "Final Landform and Fill Plan, Whytes Gully Landfill"

Golder Associates (2010b) Preliminary Environmental Assessment: Whytes Gully New Landfill Cell

Golder Associates (2011) "Golder Associates Preliminary Environmental Assessment: Whytes Gully New Landfill Cell"

Golder Associates (2012a) "Whytes Gully New Landfill Cell, Geotechnical Investigation Report"

Golder Associates (2012c) "Whytes Gully New Landfill Cell, Hydrogeological Investigation Report"

Golder Associates (2012d) "Whytes Gully New Landfill Cell, Preliminary Design Report"

Golder Associates (2012e) "Whytes Gully New Landfill Cell, Preliminary Environmental Site Assessment (PESA)"

Golder Associates (2012f) "Whytes Gully New Landfill Cell, Preliminary Hazards Analysis"

Golder Associates (2012g) "Whytes Gully New Landfill Cell, Landfill Environmental Management Plan" (draft)

Golder Associates (2012h), "Whytes Gully New Landfill Cell, Bushfire Report"

Golder Associates (2012i) "Greenhouse Gas Report"

Golder Associates (2012j) "Leachate Treatment Plant Operation Review"

Golder Associates (2012n) "Whytes Gully New Landfill Cell Noise Impact Assessment"

GTA Consultants (2012) "Whytes Gully New Landfill Cell Transport Impact Assessment"

http://profile.id.com.au/Default.aspx?id=302&pg=107&gid=10&type=enum

http://www.wollongong.nsw.gov.au/services/majorprojects/westdaptoaccess/Pages/default.aspx

Illawarra Bushfire Management Committee (2008) "Bushfire risk management plan", New South Wales Rural Fire Service, Government of New South Wales

ISO 9613 Acoustics – Attenuation of Sound during Propagation Outdoors).

Managing Urban Stormwater: Soils and Construction, Volume 2B Waste Landfills (2008) "Landfill Blue Book"

Maunsell (1992a) "Site Investigations and Geotechnical Assessments for the Phase 2 Development of a Waste Disposal Depot at Whytes Gully, West Dapto"

Maunsell (1992b) "Whytes Gully Landfill Extension Environmental Impact Statement"

Maunsell (1998) "Whytes Gully Landfill Extension Environmental Management Plan"

National Greenhouse Accounts Factors by Department of Climate Change and Energy Efficiency - July 2011 (NGA Factors).

National Greenhouse and Energy Reporting (Measurement) Technical Guidelines 2011

National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for the estimation of greenhouse gas emissions from facilities in Australia, Department of Climate Change and Energy Efficiency, July 2011

NPWS (2002) "Native Vegetation of the Illawarra Escarpment and Coastal Plain"

NSW DECC (2008) "Managing Urban Stormwater, Soils and Construction, Volume 2B Waste landfills"

NSW EPA (1996) "Environmental Guidelines: Solid Waste Landfills"

NSW Rural Fire Service (2006) "Planning for Bushfire Protection"

NSW Rural Fire Service (2010) "Planning for Bushfire Protection"

OEH http://www.environment.nsw.gov.au/climatechange/emissionsoverview.htm accessed March 2012

Investigation of Central Ridge – Whytes Gully Waste Disposal Area (P Tobin, Council of the City of Wollongong, pers. comm., 20 March 1991)

PAE Holmes (March 2012) "Air Quality Assessment: Whytes Gully New Landfill Cell"

Protection of the Environment Operations (Clean Air) Regulation 2002.

Protection of the Environment Operations (Clean Air) Regulation 2010.

Protection of the Environment Operations Act 1997

RTA (2002) "Guide to Traffic Generating Developments" (Version 2.2)

RTA Guide to Traffic Engineering Developments"

Rural Fires Act 1997

Scott and Furphy 1982, Environmental Impact Statement – Proposed Waste Disposal Depot at Reddalls Road West Dapto

Scott and Furphy Engineers (1982) "Proposed Waste Disposal Depot at Reddall's Road West Dapto, Environmental Impact Statement"

Scott and Furphy Engineers (1982) "Proposed Waste Disposal Depot at Reddall's Road West Dapto, Environmental Impact Statement Addenda"

State Environmental Planning Policy No. 33 (Hazardous and Offensive Development)

Threatened Species Conservation Act 1995

Tozer et al (2006) "Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. Version 1.0 (SCIVI)"

Wollongong City Council (March 1991) "Investigation of Central Ridge – Whytes Gully Waste Disposal Area (P Tobin, Council of the City of Wollongong, pers. comm., 20 March 1991)

Wollongong City Council (July 1991) "Geotechnical Assessment – Proposed extension of Whytes Gully Waste Disposal Depot, South of Reddalls Road, Kembla Grange"

Wollongong City Council (2010) "Draft Illawarra Biodiversity Strategy 2010"

Wollongong City Council (April 2011) Draft Waste Strategy

Wollongong City Council "Development Control Plan 2009"

Wollongong City Council 2011, Library, Kembla Grange, Historic Buildings, viewed 06 December 2011, http://www.wollongong.nsw.gov.au/library/onlineresources/suburbprofiles/pages/kemblagrange.aspx#buildings

Wollongong City Council Key priority "Strategic Directions 2011-2014".

Wollongong City Council website http://www.wollongong.nsw.gov.au/city/demographics/Pages/default.aspx

Wollongong City Council, 2009. Wollongong Development Control Plan – 2009.

Wollongong City Council, 2010. Wollongong Local Environment Plan (West Dapto) – 2010 (Reference No. 8450_URB_CL1_010_020_20100301.pdf).

Wollongong City Council, 2011, Whytes Gully Waste Disposal Facility, Annual Report, Period 01 June 2010 – 31 May 2011

Wollongong City Council, March 1985, various drawings relating to the Western Gully Landfill

Wollongong Development Control Plan 2009 "Chapter 16: West Dapto Release Area"

Wollongong Development Control Plan, Chapter E14 Storm Water Management (2009) "DCP"

Wollongong Local Environment Plan (LEP) (West Dapto) 2010 (the LEP).

Wright Corporate Strategy Pty Ltd (2009) "Public Review Landfill Capacity and Demand"

At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

Golder Associates Pty Ltd
124 Pacific Highway
St. Leonards, New South Wales 2065
Australia
T: +61 2 9478 3900

Golder Associates