Dellara

ABN: 26 131 659 339

Further Modified Preferred Project Report

for the

Orchard Hills Waste and Resource Management Facility

Project Application No: MP 09_0074

Prepared by:

R.W. CORKERY & CO. PTY. LIMITED

in Conjunction with

GHD Pty Ltd

~~January~~ September 2011

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Prepared for:

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PREAMBLE

Dellara Pty Ltd (the Proponent) has commissioned RW Corkery & Co Pty Ltd, in conjunction with GHD Pty Ltd, and various specialist consultants, to prepare the Proponent's Further Modified Preferred Project Report for the development and operation of a waste and resource management facility within the former Erskine Park Quarry. Details are presented of the site establishment and operational components that focus upon resource recovery and waste recycling. The location of the project at a former quarry site also provides the opportunity for the on-site emplacement of wastes that have no economic value through re-use, re-processing or recycling. Emplacement of the wastes within specially designed landfilling cells would underpin the progressive rehabilitation of the former quarry within a 25 year operational period.

This document is a further modified version of the Modified Preferred Project Report (dated January 2011). This modified version incorporates a range of modifications to the Project in the light of the Land and Environment Court Proceedings Case 10928 of 2010, Expert Witness Reports, Joint Expert Conference Reports and consideration of the Draft Conditions of consent issued by Penrith Council and the NSW Department of Planning and Infrastructure. This document outlines how the Proponent effectively addresses each of the issues raised in the Court proceedings.

COMMONLY USED ACRONYMS

AHD	Australian Height Datum
C&D	Construction and Demolition
C&I	Commercial and Industrial
DECCW	Department of Environment, Climate Change and Water
DECCW-EP&RG	Department of Environment, Climate Change and Water – Environment Protection and Regulation Group
DSEWPAC	Department of Sustainability, Environment, Water, Population and Communities
ENM	Excavated Natural Material
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
HDPE	High Density Polyethylene
~~MRF~~	~~Materials Recycling Facility~~
VENM	Virgin Excavated Natural Material
WARR	Waste Avoidance and Resource Recovery

2.1 INTRODUCTION

2.1.1 Further Modified Preferred Project ~~Status~~

The Proponent, Dellara Pty Ltd, has assembled this Further Modified Preferred Project Report to provide a current description of Project Application No. 09_0074. In particular, the Further Modified Preferred Project Report was prepared to respond to the following matters raised in Court on 3-7 August 2011:

1 a reduction in the height of the northern face;

2 an increase in the recovery of shale/clay resources on the Project Site; and

3 a demonstration on how the extraction of resources and the emplacement of waste can occur in a co-ordinated manner.

The modifications aim to address the feedback from the community that the impacts of rehabilitating the site are important, and that impacts associated with the works (short term and long term) need to be minimised. It also reflects the feedback from Penrith City Council that the proposal should extract as much valuable light-–firing shale from the Project Site as practicable, and not sterilise the future resources.

The Further Modified Preferred Project Report has also been updated to include the modifications of which the Court granted leave to the Proponent to rely upon on 19 July 2011 as outlined in the Overview of the Amendments to the Modified Preferred Project) dated July 2011.

~~following a thorough review of the reasons relied upon by the Department of Planning in its report to the Minister for Planning recommending refusal to the Proponent's Major Project Application MP 09_0074.~~ **Table 2.1** displays the principal modifications to the Proponent's Project presented in the *Environmental Assessment* dated April 2010, the Preferred Project Report, dated July 2010, ~~and~~ the Modified Preferred Project Report, dated January 2011, the Overview of the Amendments to the Modified Preferred Project Report, dated July 201 and the Further Modified Preferred Project Report (this report). ~~It is noted that the Proponent has increased the level of recycling and re-processing compared with that proposed in the *Environmental Assessment* and Preferred Project Report.~~

Table 2.1
Record of Project Modifications

Activity	April 2010 *Environmental Assessment*	July 2010 Preferred Project Report	January 2011 Modified Preferred Project Report	July 2011 Amendments to the Modified Preferred Project Report	September 2011 Further Modified Preferred Project Report
Landfill Capacity (t)	7.8 million	6.3 million	4.8 million	4.5 million	4.3 million
Maximum Annual Waste Receipts (t)	600 000	450 000	450 000	450 000	450 000
Annual Throughput for Recycling and	200 000	200 000	350 000	350 000	350 000

Re-processing (t)					
Total Clay/Shale Extraction (t)	5 650 000	5 650 000	3 850 000	3 850 000	5 200 000[1]
Quantity of Extracted Clay/Shale Despatched from Site (t)	3 800 000	3 800 000	3 150 000	3 150 000	3 150 000
Maximum Daily Heavy Vehicle Movements	316	280	250	250	250
Weekday Operating Hours	6:00am-6:00pm	7:00am-6:00pm	7:00am-6:00pm	4:00am-6:00pm	7:00am-6:00pm
Saturday Operating Hours	8:00am-5:00pm	8:00am-5:00pm	8:00am-2:00pm	8:00am-2:00pm	8:00am-2:00pm
Project Life	30 years	25 years	25 years*	25 years[2]	25 years[2]
Maximum Annual Quantity of Extracted Clay/Shale despatched from Site (t)	400 000	400 000	160 000	160 000	160 000
	~~* Landfilling of first three cells completed in 21 years.~~ 1 Increase in clay and shale extraction is to recover additional resources of light–firing shale. Clay and shale extracted in this process will be utilised for landfill lining, capping, and daily covering of waste, resulting in no additional export of clay or shale from the Project Site. 2 Following the completion of the site establishment period.				

2.1.1A Modifications

The modifications to the Project include:

1 Reduction in height of the final landform:

- a reduction in the finished level of the northern face from 55m AHD to approximately 44m AHD, 3m to 4m above the pre-existing ground levels (the interim acoustic mound would be at 53m AHD for acoustic purposes);
- a reduction in the elevation of the northern face to a 5% slope profile to integrate more closely with the existing ground level; and
- the substantial removal of the southwestern, southern and eastern bund walls and the forming of part of the final landform during the course of the project, to reduce visual impacts.

2 Increased extraction of clay/shale resources (as outlined in the Alternate Draft Conditions in Reply - Shale/Clay Resources filed with the Court):

- extraction of additional clay/shale resources in Cell 2 by increasing the level of extraction from 37m AHD to 28m AHD; and
- no emplacement of waste in the final cell. The final cell would be backfilled with clay/shale.

3 Contingency stockpile:

- a new contingency stockpiling area, which would be located in the southeastern corner of the Project Site, enabling stockpiles of clay and shale destined for export to be stored as far from residents as possible; and
- consequential relocation of the site office and light vehicle parking area.

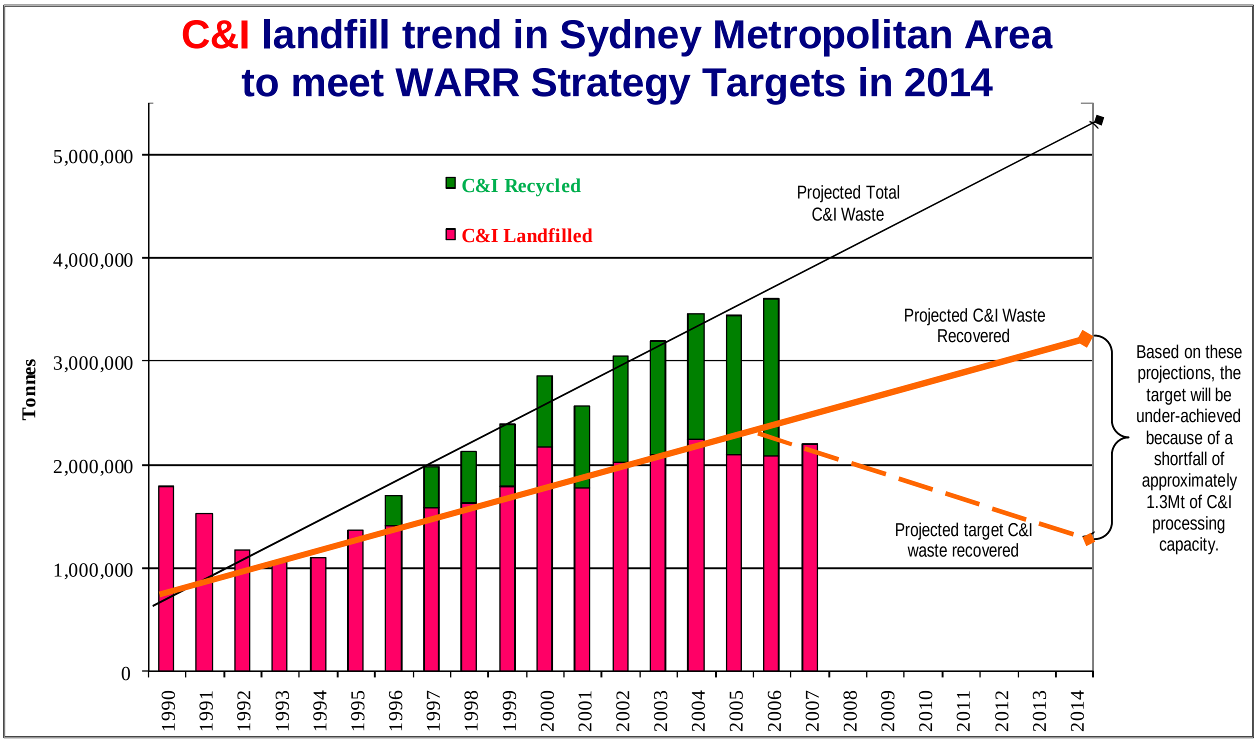
4 The modifications of which the Court granted leave to the Proponent to rely upon on 19 July 2011 as outlined in the Overview of the Amendments to the Modified Preferred Project) dated July 2011.

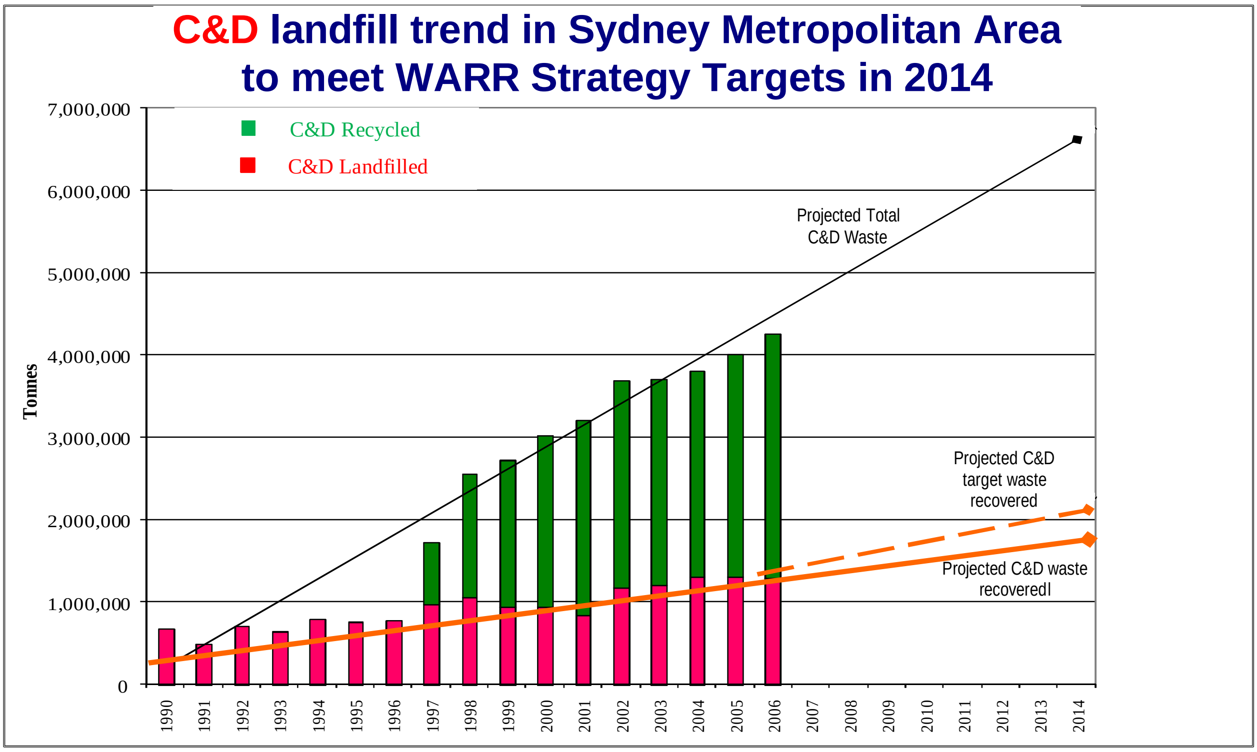
In summary, Nnotable reductions introduced to the project design include a reduction in waste receipts from 7.8 million tonnes to 4.38 million tonnes (leave to this modification was granted on 19 July 2011) and reduction of the final landform height from 65m AHD to 57m AHD to a level assessed to be appropriate by the independent visual assessment of the project (see **Appendix 4**). These reductions, together with the reduction in clay/shale extraction, would further minimise the impacts upon the noise climate and air quality around the Project Site.

Dellara's The Proponent's consideration of the issues raised in the assessment report prepared by the Department of Planning and its further investigations have strengthened its commitment to rehabilitate the existing quarry in a cost effective manner using non-putrescible wastes as a filling medium, extracting light-–firing shale from the three extraction cells to an elevation of 28m AHD and to provide a valuable contribution to increase waste recycling and resource recovery in Sydney.

The graphs in **Plate A** demonstrate the trends in disposal and recycling of Commercial and Industrial (C&I) and Construction and Demolition (C&D) wastes in the Sydney Metropolitan area, together with the State Government's landfill diversion targets. These graphs clearly demonstrate the focus of Dellara's modified preferred project and its increased emphasis upon recycling and re-processing.

Plate A Sydney Metropolitan Area C&I/C&D Landfill Trends





Source: Modified after Mike Ritchie & Associates (2010)

The height of each bar represents the total waste generated for the year in question. The bar is divided into a bottom red zone and a top green zone. The red zone represents the quantity sent for landfill disposal while the green zone represents the reported quantity recycled in that year.

The data available only covers the period to 2007, and it has been extrapolated to 2014 to indicate the likely quantity of total waste generated and the amount which will be recycled. Based on the current trends, these extrapolations predict Sydney's total C&I waste generation in 2014 to be 5 304 000 tonnes and the C&D total to be 6 740 000 tonnes.

The NSW targets for waste diversion from landfill are 63% for C&I waste and 76% for C&D waste. Applying these diversion targets to the projected figures for total waste generation indicates a total diversion of 3 341 520 tonnes of C&I material and 5 122 400 tonnes of C&D material will be required if the targets are to be met. These diversions are equivalent to the landfilled C&I waste not exceeding 1 962 418 tonnes and C&D not exceeding 1 617 600 tonnes.

Comparison of these maximum landfill rates with the projected trends for landfill indicate that while the C&D target is likely to be achieved, the C&I target will be missed by approximately 1.3 million tonnes.

2.1.2 Objectives

The Proponent's objectives for the development and operation of the Orchard Hills Waste and Resource Management Facility ("the Project") are to:

a) provide a facility that would assist the NSW Government meet its 2014 recycling targets resource recovery for C&I waste in particular, together with C&D waste;

b) recover a high proportion of the remaining high grade light-firing clay/shale resources for the brick industry and other clay/shale products for the construction industry;

c) develop a licenced facility able to receive and emplace unusable wastes and residual wastes from the on-site recycling and re-processing operations;

d) progressively rehabilitate a disused quarry site in a manner that re-instates the rural agriculturally productive land consistent with the adjoining land to the north and east; and

e) achieve (a) to (d) above in an environmentally and socially responsible manner.

2.1.3 The Project Site

The Project Site comprises Lot 40, DP 738126, a 60ha lot purchased by the Proponent in August 2008. **Figure 2.1** provides details of the form and dimensions of the Project Site.

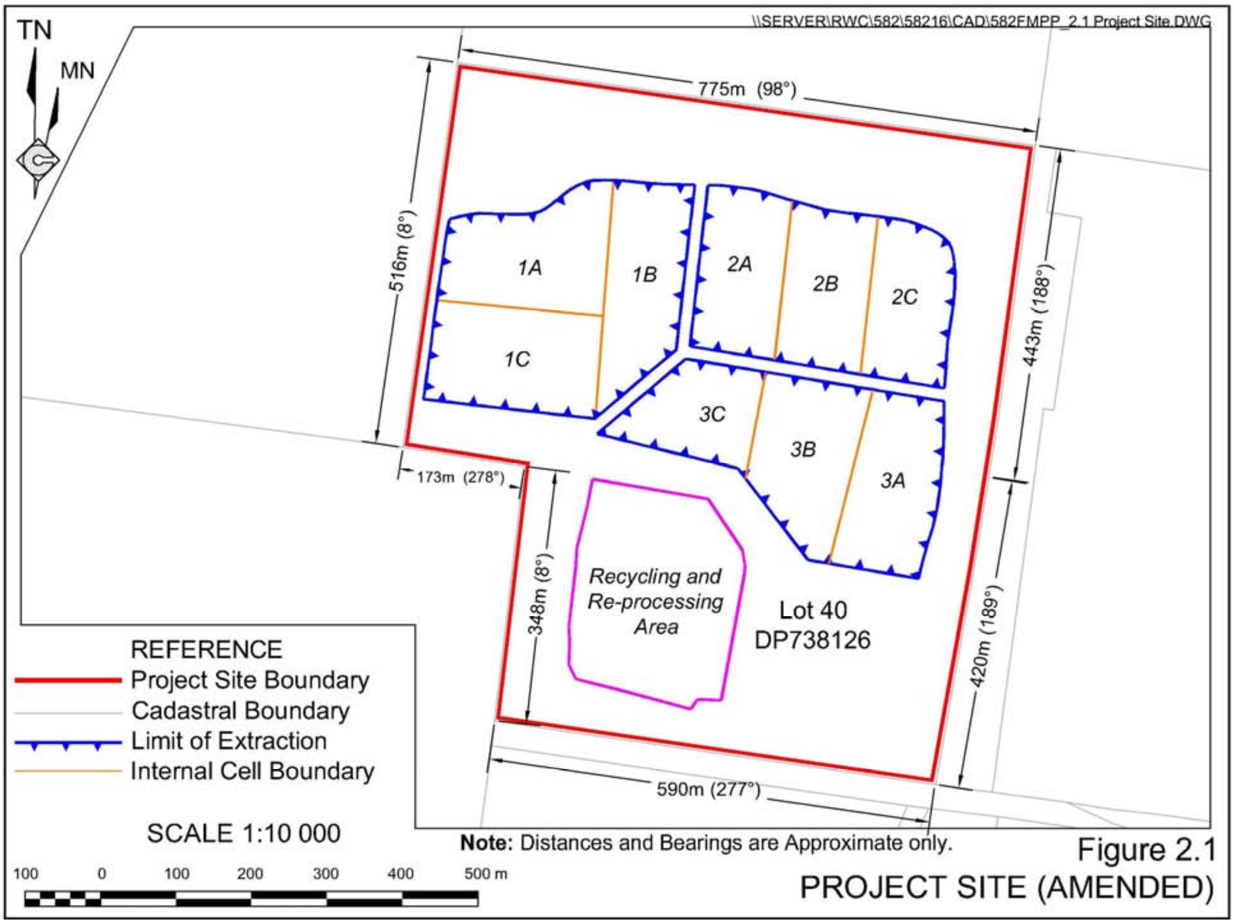


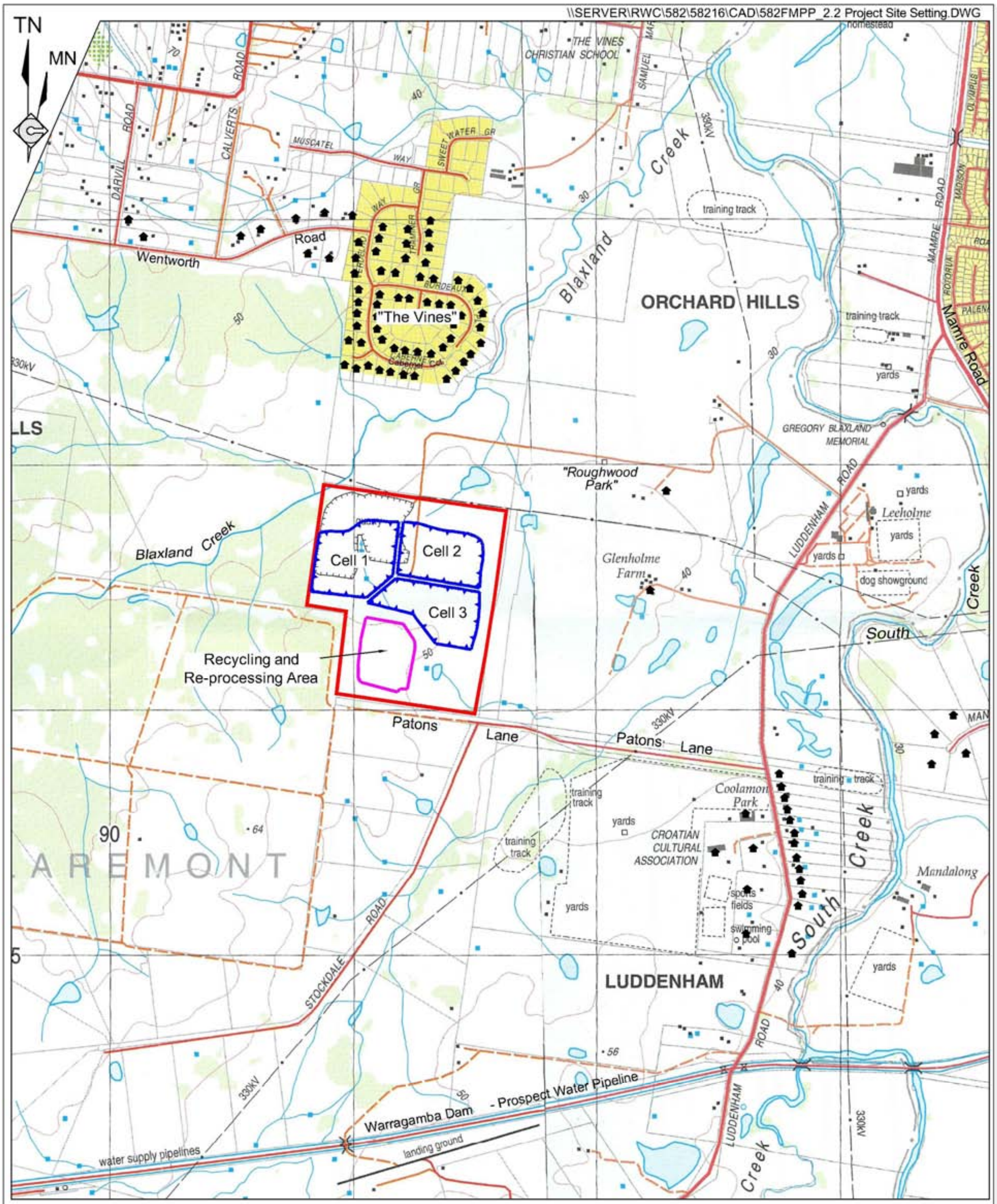
Figure 2.1
PROJECT SITE (AMENDED)

Access to the Project Site is provided from Luddenham Road via Patons Lane, a public road which is oriented parallel to the southern boundary of the Project Site and intersects Luddenham Road approximately 1.1km to the east-southeast of the entrance to the Project Site (**Figure 2.2**).

2.1.4 Project Overview

The Project would involve a number of components designed to collectively underpin an environmentally responsible facility able to provide an important resource management service and the ultimate re-instatement of productive rural grazing land in an area zoned for ongoing agricultural production. The principal Project activities would include the following.

- Construction/establishment and operation of a materials recycling facility for C&D and C&I waste.
- Resumption of clay/shale extraction (particularly light-firing clay/shale) to recover raw materials for use by the brick industry and other clay/shale materials as optimal cover material for the on-site waste emplacement and final capping.
- Development and operation of staged waste emplacement cells to contain all residual wastes from the recycling and re-processing facility, other imported wastes (unable to be re-processed) and selected construction and demolition wastes recovered from the existing on-site perimeter bund walls.



REFERENCE

- Project Site Boundary
- Residence
- Proposed Limit of Recycling and Re-processing Area
- Indicative Waste Emplacement Cell Boundary

SCALE 1:25 000

250 0 250 500 750 1000 1250 m

Base Map Source: Prospect (2001) and Penrith (2001) 1:25 000 Topographic Maps

Figure 2.2
PROJECT SITE SETTING
(AMENDED)

- Refurbishment of the former weighbridges and offices together with the construction of a range of on-site infrastructure including a site office for the recycling and re-processing facility, truck wheel wash, site workshop and water management structures.
- Selective removal and on-site disposal of material from the existing perimeter bund walls including disposal of waste materials previously illegally imported to site and incorporated into the bund walls in contravention of the requirements of the *Protection of the Environment Operations Act 1997* and the existing development consent for the site.

The details of the Project are presented in **Table 2.2**.

Table 2.2
Major Components of the Further Modified Preferred Project

Page 1 of 2

Aspect	***Description***
Project Summary	**Construction and operation of a waste recovery and disposal facility at the former Erskine Park Quarry site adjacent to Patons Lane, Orchard Hills**
Landfill Area	• Total Capacity: 4.3 million tonnes (excluding landfill caps) • Operational Life: 25 years including capping and revegetation • Maximum Final Landform Elevation: 57 m AHD • Staging: The landfill will consist of three waste cells, divided into various sub-cells. The recycling and re-processing area will be refilled with on-site clay and shale materials.
Waste	• Total Input: up to 450 000 tonnes per annum • Waste Recycled: up to 350 000 tonnes per annum • Waste Landfilled: up to 205 000 tonnes per annum • Types of Waste Received: general solid (non-putrescible) waste, including up to 100 000 tpa of contaminated soil which meets this waste classification. The general solid (non-putrescible) waste would predominantly comprise C&D and C&I wastes. • Types of Waste Recycled: C&D wastes such as concrete, bitumen, bricks and roofing tiles; C&I waste such as metals, wood, plastics and cardboard. • Types of Waste Landfilled: only waste classified as general solid (non-putrescible) and asbestos recovered from the bund walls on site.
Site Access	• Site access would be via Patons Lane. The Proponent proposes to complete the construction and sealing of the 1.3km section of Patons Lane between Luddenham Road and the Project Site entrance.
Recycling and re-processing area	• Area: approx. 5.6 ha • Components: Various buildings (recycling facility warehouse, C&I waste storage building, office, mobile C&D recycling equipment and outdoor product bays
Ancillary infrastructure	• Existing weighbridges (to be refurbished) • New site office and car parking areas • Site office for recycling facility, truck wheel wash, workshop and

Aspect	Description
	water management structures • Dams for storage of leachate and collection/storage or stormwater • Internal road network
Clay/shale extraction	Total resources proposed to be extracted from Cells 1, 2 and 3 (following the same sequence as the emplacement cells) to an average depth of 28 m AHD Clay/shale extracted: 5, 200, 000 tonnes. Clay/shale despatched from site: 3, 150, 000 tonnes (2, 184, 000 of light-firing clay/shale). Maximum resource export rate: 160, 000 tonnes per annum. Clay/shale on-site use: 2, 050, 000 tonnes. Cell 4 - 994 000 tonnes light firing shale available for future extraction
Amenity Bund Walls	Acoustic mounds and existing bund walls around the perimeter of the operational areas will provide noise protection and visual screening. All mounds and bund walls would be removed when no longer needed for noise mitigation. Details of the mounds and bund walls are as follows. • Northern Face and bund – reprofiled during the site establishment phase with on-site VENM • Central acoustic mound - VENM • Southern acoustic mound - VENM • Recycling and re-processing area acoustic mound – VENM to be – constructed during the site establishment phase • Eastern face • Southern face • South-western face
Employment	• Construction: 10-15 people • Operation: 20 people full time + up to 10 part-time contractors
Hours of Operation	Construction: • Monday to Friday 7am to 6pm; and • Saturday 8am to 2pm Operation: • Monday to Friday 7am to 6pm; and • Saturday 8am to 2pm
Heavy vehicle movements	250 heavy vehicle movements per day

Each of the above components and activities are discussed in greater detail throughout the remaining subsections in this section.

Additional information is contained in Appendix A including figures that show:

- how the northern bunds will be removed during the project to provide a final landform;

- a comparison of the further modified final landform compared to the modified final landform; and

- the extent of back fill within the former recycling and reprocessing area, which is lower than previously proposed.

Figure 2.3 displays an overview of the total quantity of waste materials to be received on site, together with the proportion that would be recycled and re-processed or emplaced on site as they can't be re-processed or recycled. The facility will receive up to 450 000 tonnes per annum of C&I and C&D wastes. It is anticipated that 100 000 tonnes will be soils unsuitable for re-use which would be emplaced directly into the active emplacement cell. The remaining 350 000 tonnes of material received shall be processed through the materials recycling facility to recover materials for re-use or re-processing. The recovery efficiency for this process is expected to be in the order of 70%. The balance of 30% (105 000 tonnes per annum) would be emplaced onsite. This level of re-processing and recycling is consistent with the NSW Waste Avoidance and Resource Recovery (WARR) Strategy.

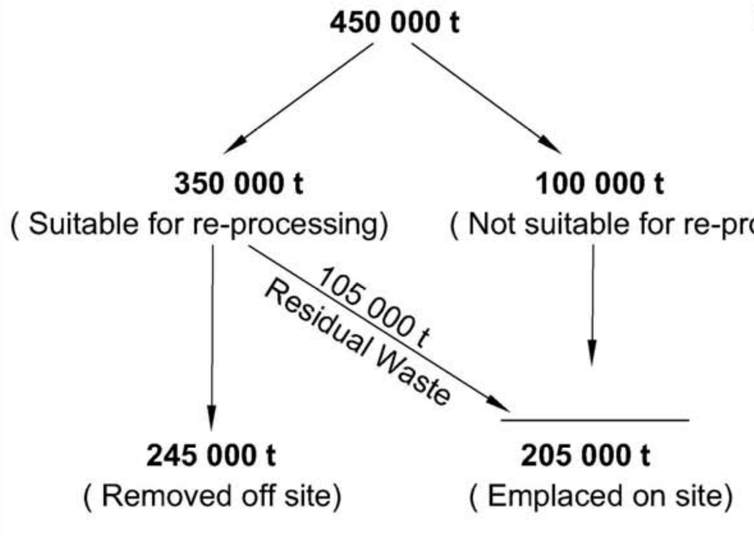


Figure 2.3
AVERAGE QUANTITIES OF MATERIALS RE-PROCESSED, REMOVED OFF SITE AND EMPLACED ON SITE

Not all C&D and C&I wastes are currently suited to re-processing and recycling, however, as the NSW waste levy progressively increases (to $120/tonne in 2015-2016), the proportion of C&D and C&I waste suited to re-processing and recycling will increase. The facility would accept up to 100 000tpa of wastes not suited for re-processing and recycling, although, this quantity may decrease throughout the life of the facility as technologies and re-processing costs improve. The annual emplacement of up to 205 000 tonnes of wastes unable to be re-processed and recycled would assist to rehabilitate the former quarry site back to rural grazing land.

Figure 2.4 displays a north-south cross section of the final landform in comparison with the landform presented in the *Environmental Assessment* (April 2010), Preferred Project Report (July 2010), the Further Modified Preferred Project and in pre-extraction landform (1980). ~~The Modified Preferred Project effectively produces a final landform which would have an overall form similar to the pre-extraction landform with the increased elevation at its northern end providing the necessary topographic barrier to control noise during the rehabilitation of the site~~. The existing bund walls at the northern end would be modified to form a northern face with temporary acoustic mounds above that provides the necessary topographic barriers to control noise during rehabilitation of the Project Site. The bund walls will then be progressively removed during the project to provide a final landform which has an overall form similar to the pre-extraction landform.

2.1.5 Approvals Required

The Proponent requires the following approvals for the Project to proceed.

- Project Approval under Part 3A of the *Environmental Planning and Assessment Act 1979*. Given the Project is now the subject of an appeal under Section 75K of the Act, the approval authority would be the NSW Land and Environment Court.
- Two Environment Protection Licences for:

  i) the waste resource recovery facility, and

  ii) the waste emplacement area (and ongoing clay/shale extraction).

  The licences would be issued under the *Protection of the Environment Operations Act 1997*. The issuing authority would be the Department of Environment, Climate Change and Water – Environment Protection and Regulation Group – DECCW-EP&RG.
- A Water Access Licence under the *Water Management Act 2000* to account for the minor groundwater seepage that would flow into voids on the Project Site throughout the Project life. The issuing authority is the Department of Environment, Climate Change and Water – NSW Office of Water.
- A variation to bore licence 10BL161098 to increase the volume of groundwater extracted from 16.0 to 32.0 megalitres from registered bore No. GW105054 in any 12 month period. The issuing authority is the Department of Environment, Climate Change and Water – NSW Office of Water.

It is noted that the proposed road upgrading activities along Patons Lane do not require any further approvals. Development Consent (DA03/0627) was granted by Penrith City Council on 3 July 2003 for the 'Realignment of Patons Lane and construction of a new intersection at the intersection of Patons Lane and Luddenham Road'. As part of this approval, a condition (No. 15) required the applicant to also upgrade the entire length of Patons Lane so that it was adequate to accommodate heavy vehicle traffic associated with the ongoing operation of the quarry. Engineering Construction Certificates were subsequently issued by Council for the realignment and intersection works and the upgrade of the remainder of Patons Lane respectively. The approved roadworks were physically commenced by the applicant via the realignment of Patons Lane and construction of a new intersection with Luddenham Road. The new intersection has been designed and constructed to cater for heavy vehicles up to 26m in length to turn into or out of Patons Lane. It is the Proponent's intention during the site establishment stage of the Project to complete the upgrade of the remainder of Patons Lane in accordance with the engineering plans endorsed by Council when issuing Engineering Construction Certificate No. v 05/0630.

It is also noted that as the site adjoins Commonwealth land, consideration was given to whether the Project should be referred to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC) in accordance with Clause 26 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In light of the predicted low levels of impact for matters relating to flora, fauna, noise and air quality, it was determined that it was not necessary to refer the Project to the DSEWPAC. This determination was verified in consultation with the Department of Defence, who manages the subject land on behalf of the Commonwealth.

2.1.6 Project Planning and Design

The Proponent has planned the further modified Project to maximise the economic resource recovery from the incoming waste. The further modified Project has been designed reflecting:

- current trends in waste management and recycling/re-processing technologies;
- projected waste sources (and types) from Sydney's planned northwest and southwest growth centres;
- current legislative requirements;
- the progressively increasing waste levy ($120/tonne in 2015-2016); and
- the assessment of the Project prepared by the Department of Planning.

2.2 SITE LAYOUT AND PROJECT COMPONENTS

Figure 2.5 displays the following principal project components.

- A waste recycling and re-processing facility within a designated area of approximately 5.6ha. The facility would incorporate a C&I waste storage building, materials recycling facility warehouse, product bays, storage shed, office and mobile recycling equipment suited to both C&I and C&D waste.
- Rehabilitation of the northern and eastern faces during the 6 month site establishment phase to create the visible sections of the final landform on the northern side and much of the eastern side of the property. The heights of the northern and eastern faces would provide acoustic protection for the earthmoving and other equipment/vehicles operating within the facility itself. Localised slope/aspect changes have been incorporated to create a visually appealing landform, including a more gently sloped landform on the northern side of the Project Site, ~~i.e. in accordance with the recommendations of Richard Lamb & Associates (see **Appendix 4**)~~. The alignment of the northern boundary of the northern face also accommodates the setback requirements of Transgrid, the owner of the 330kV transmission line that traverses the northern boundary of the Project Site.
- Partial rehabilitation of the existing southern and southwestern bund walls to effectively reduce the height of the southern and southwestern faces to elevations of between 57m AHD and 58m AHD with improved visual impacts compared to the existing bund walls.

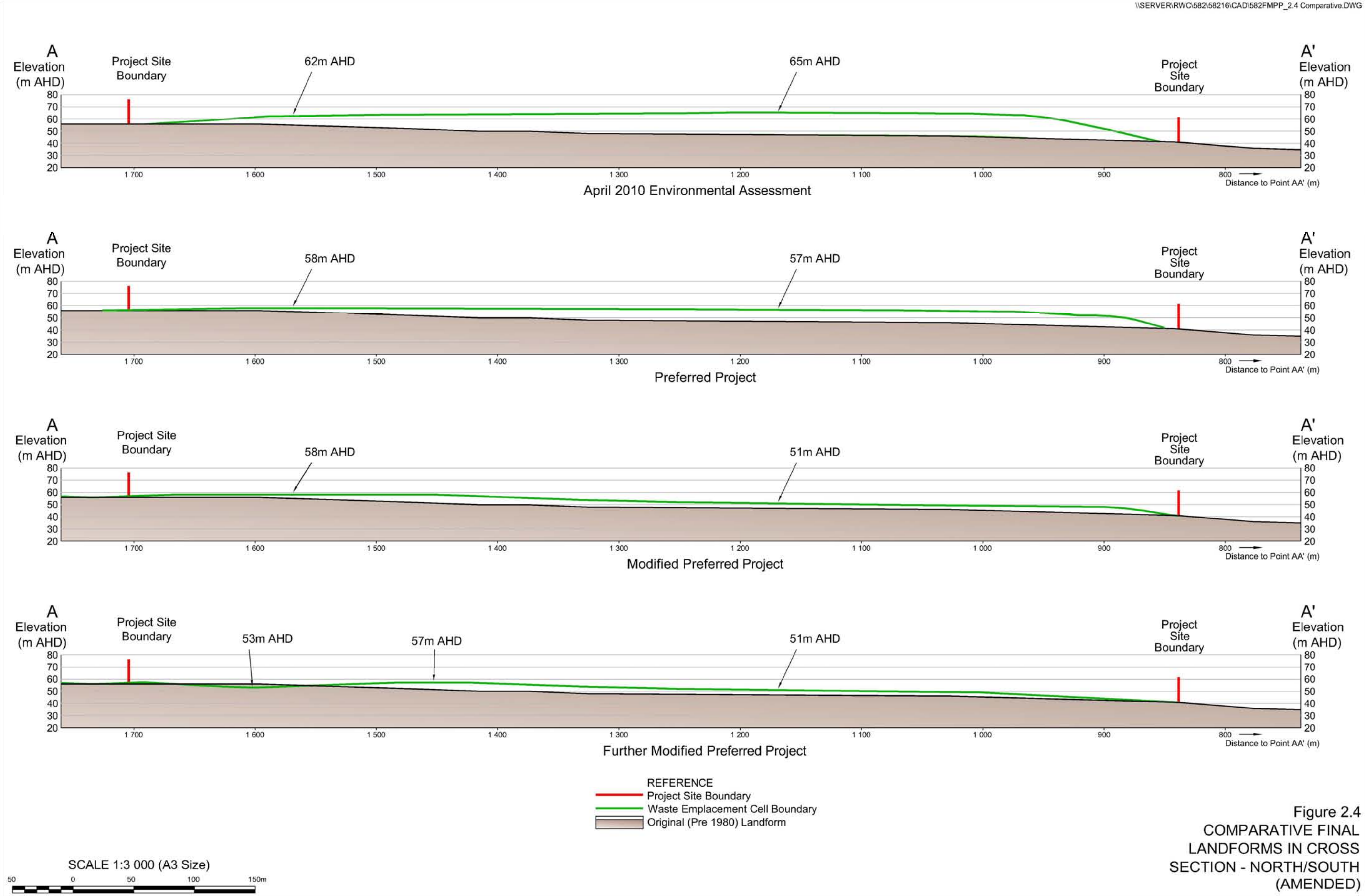


Figure 2.4
COMPARATIVE FINAL LANDFORMS IN CROSS SECTION - NORTH/SOUTH (AMENDED)

Figure 2.5
INDICATIVE PROJECT SITE LAYOUT (AMENDED)

- Ongoing clay/shale extraction with emphasis placed on the recovery of light-firing clay/shale from Cells 1, 2 and 3.
- The waste emplacement area divided into three cells, that is in addition to the final cell created within the Recycling and Re-processing Area. Each of the cells would be subdivided into ~~either two or~~ three sub-cells to achieve the planned progressive/staged approach to site operations and rehabilitation.
- A network of site access roads providing access to the waste recycling and re-processing plant and active waste emplacement cell.
- Site offices, amenities, workshop, weighbridges and wheel wash.
- Acoustic earth mounding around the Recycling and Re-processing Area.
- Various water management structures.

2.3 SITE ESTABLISHMENT

Site establishment would include the construction/shaping of the final rehabilitated landform along the northern and eastern sides of the property together with acoustic mounds above prior to the first waste materials being received on the Project Site. It is noted that during the site establishment period, the Proponent would also complete the construction and sealing of the 1.1km section of Patons Lane between Luddenham Road and the Project Site entrance.

Figure 2.6 displays the locations of each of the activities to be completed during the site establishment phase. The principal activities involved in site establishment would include the following.

i) Construction/shaping of the northern face and much of the eastern face to their final rehabilitated landform and landscaping of those faces (see Section 2.9.2).

ii) Construction of the northern face is achieved through the following.

   i. Reshaping the existing northeastern and northwestern bund walls, by reducing its height in some areas, raising its height in other areas to create an even northern face with a maximum elevation of 53m AHD, and a more gentle northerly slope than currently exists. The new northern face and acoustic mound would provide acoustic protection for the earthmoving and landfilling equipment/vehicles operating within Cells 1 and 2. The acoustic mound would be removed at the conclusion of capping in Cell 2 when it is no longer needed for acoustic protection.

   ii. Areas to the north of the acoustic mound would be regraded to their final rehabilitated landform with slopes of approximately 5% 1:20 (V:H). Final landscaping of these areas would occur during site establishment.

iii) Partial rehabilitation of the existing southern and southwestern bund walls through the reduction in the elevation to an approximate elevation of between 57m AHD and 58m AHD such that they would not be visible from any residence within The

Vines Estate. Once re-shaped, the surface and adjoining batter slopes would be revegetated.

iv) Upgrading and sealing of Patons Lane and upgrading the entrance to the Project Site (from Patons Lane) together with the refurbishment of the existing dual weighbridge and associated office.

v) Site preparatory works within the Recycling and Re-processing Area to create the required landform and create a suitable pad for the materials recycling facility warehouse and mobile recycling equipment.

vi) Construction and commissioning of the on-site wheel wash facility.

vii) Upgrading and sealing the internal road network beyond the proposed wheel wash facility to the exit point from the Recycling and Re-processing Area and the entry point to Cell 1.

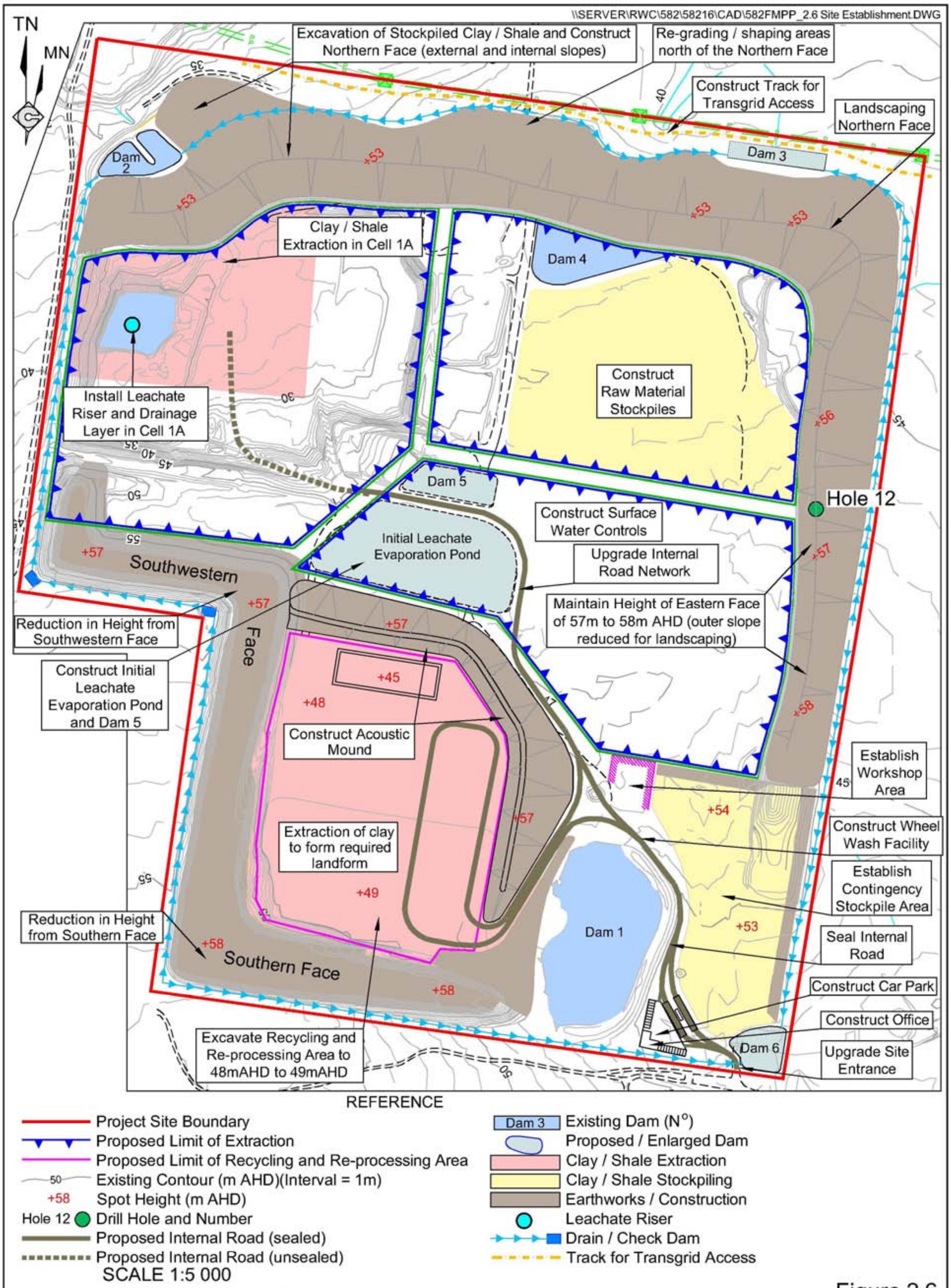


Figure 2.6
SITE ESTABLISHMENT ACTIVITIES (AMENDED)

viii) Installation of the required liners, drainage layer, leachate risers and associated infrastructure in Cell 1A (see Section 2.8.2 for details).

ix) Commence construction of the Initial Leachate Evaporation Pond and the surface water management structures within each of the active cells and elsewhere on site.

x) Commence removal of the saleable stockpiled clay/shale products and Excavated Natural Material (ENM) from site.

It is proposed that site establishment would occur over a period of approximately 6 months.

The Proponent would establish communications with the closest neighbours prior to and during the site establishment phase to discuss the timetable and details of the proposed works.

2.4 RECYCLING AND RE-PROCESSING OPERATIONS

2.4.1 Introduction

The Proponent's recycling and re-processing operation would be the principal component of the waste and resource management facility. The recycling and re-processing operation would be designed and operated to achieve the target diversion levels within the WARR Strategy, i.e. 63% for C&I waste and 76% for C&D wastes. It remains the Proponent's individual target to achieve an overall recovery efficiency of approximately 70% for those materials that can be recycled/re-processed on site (see **Figure 2.3**).

The Proponent intends to meet these targets and minimise dust and noise at surrounding residences by building a semi-enclosed warehouse which would have sound proofing on the walls and dust suppressant water sprays built into the facility.

Figure 2.7 presents a flowsheet displaying the full range of activities/equipment to be installed and used within the recycling and re-processing area.

This sub-section outlines the proposed recycling and re-processing operations on site and provides sufficient detail to enable the environmental impacts of the operations to be clearly identified.

2.4.2 Plant Components and Recycling/Re-processing Operations

The recycling and re-processing facility would be located within the Recycling and Re-processing Area at an elevation of 45m to 49m AHD. This area covers approximately 5.6ha. The proposed location of the waste recycling and re-processing plant is the most accessible on the Project Site from Patons Lane and is, importantly located at the furthest distance to surrounding neighbours to the north and east. Protection is provided by the existing perimeter bund walls that would assist to reduce potential amenity impacts. Furthermore, an acoustic earth mound would also be constructed to a maximum elevation of 57m AHD on the northern and eastern sides of the Recycling and Re-processing Area prior to the commencement of recycling and re-processing activities, i.e. to a height that is sufficiently low such that they would not be visible from any residence in The Vines Estate.

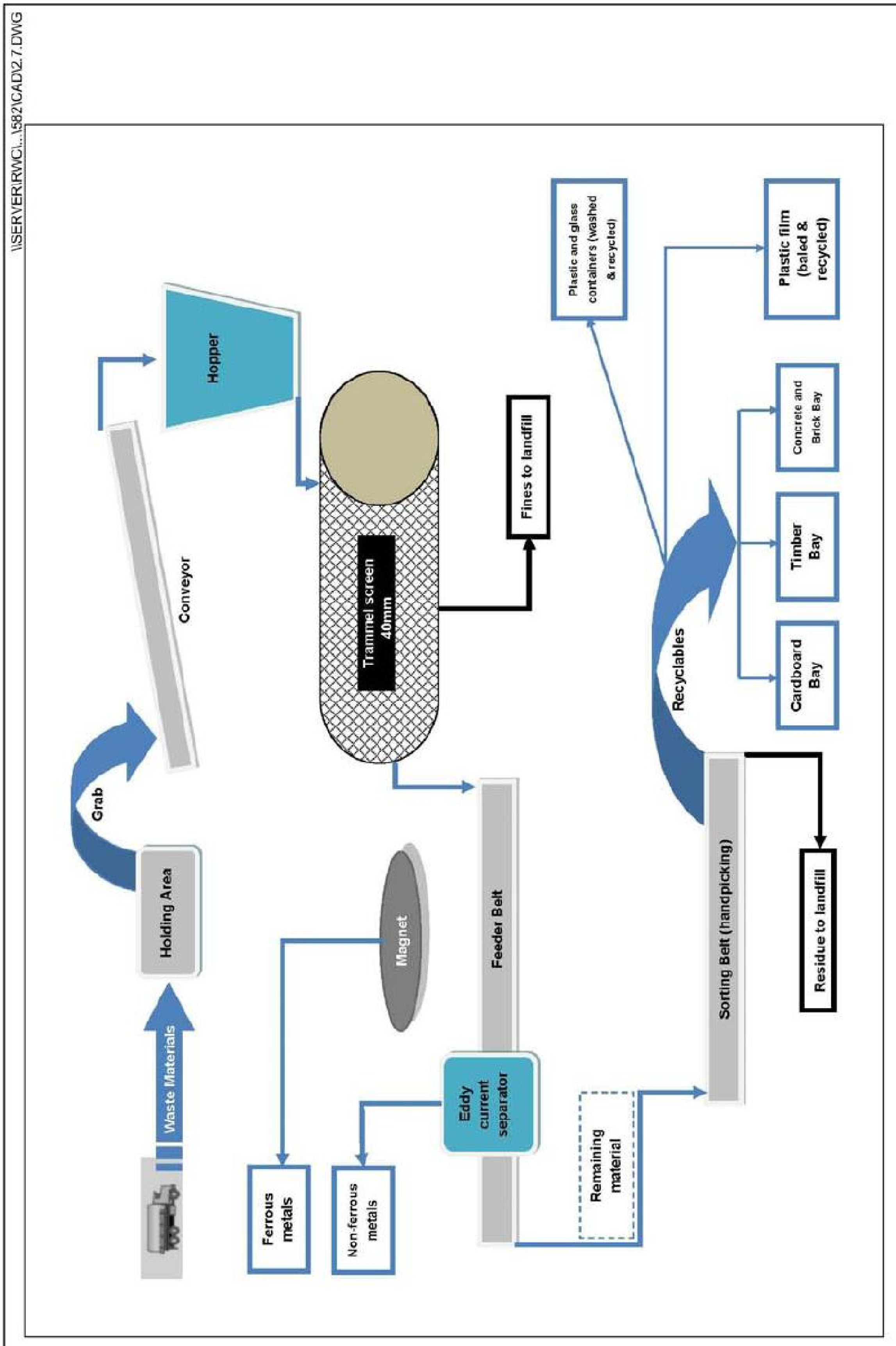


Figure 2.7
FLOW SHEET

Source: Hyder Consulting Pty Limited

Figure 2.8 presents the indicative layout of the recycling and re-processing area. The three principal components of the facility and the activities in each are as follows.

Commercial and Industrial (C&I) Recycling

The C&I recycling component would comprise a ~~materials~~ recycling facility ~~(MRF)~~ located within an 1 800m^2 warehouse open only to the south – see detail on **Figure 2.8**. The ~~MRF~~ recycling facility would separate the C&I waste by mechanical and manual sorting together with mechanical cleaning. ~~It is noted that the MRF warehouse~~ This equipment ~~w~~could ~~be~~ also be used for recycling lightweight C&D waste.

Raw feed for this facility would be predominantly placed in two stockpile areas south of the warehouse in a separate building. The first and closest raw feed stockpile area (covering approximately 2 000m^2) would be for the receipt/placement of wastes suited for directly feeding into the facility without sorting and the second, covering approximately 2 400m^2, is an area for the receipt/placement of materials requiring sorting prior to processing.

When a load of C&I material is directed to the Recycling and Re-processing Facility, it would be unloaded into one of the two areas specified for C&I material stockpiling. Large items (e.g. whitegoods) would be removed and stored in the large items shed (see **Figure 2.8**). Any C&D waste mixed with the C&I waste would be separated and removed and re-located to the C&D raw feed stockpile area.

The C&I materials stockpiled immediately adjacent to the ~~MRF~~ recycling facility warehouse would be loaded into a trommel inside the warehouse to remove the unwanted fines (see **Figure 2.7**). The separated >40mm materials would be conveyed to the first floor of the warehouse via conveyor belt to the picking station. Bins would be positioned on the outside of the warehouse for the residual fines from the trommel to be transferred by a roll-on/roll-off truck to be active emplacement area.

The initial process step prior to the picking station consists of a magnetic separator to recover ferrous metals and an eddy-current separator for the recovery of non-ferrous, principally aluminium. Ferrous metals would be directed towards Bin 1 and non-ferrous to Bin 2. As these bins fill up, they would be replaced with empty bins and the filled bins emptied at the product bays for ferrous and non-ferrous products.

Following the separation of the ferrous and non-ferrous metals, the materials would continue through the manual picking station. A bin would contain timber, which would be shredded and stored in the shredder timber product bay and sold as a fuel source. The shredder used would be located southwest of the warehouse.

Bin 5 would contain paper and cardboard. Once this is full, it would be shredded and then be mixed with the <15mm fines, and sold as landscaping pulp.

A rotary agitator would be used to wash plastic and glass containers. Wasted plastic containers would be suitable for re-sale to a plastics recycling facility and the glass containers would be suitable for sale directly to a specialist glass recycling facility.

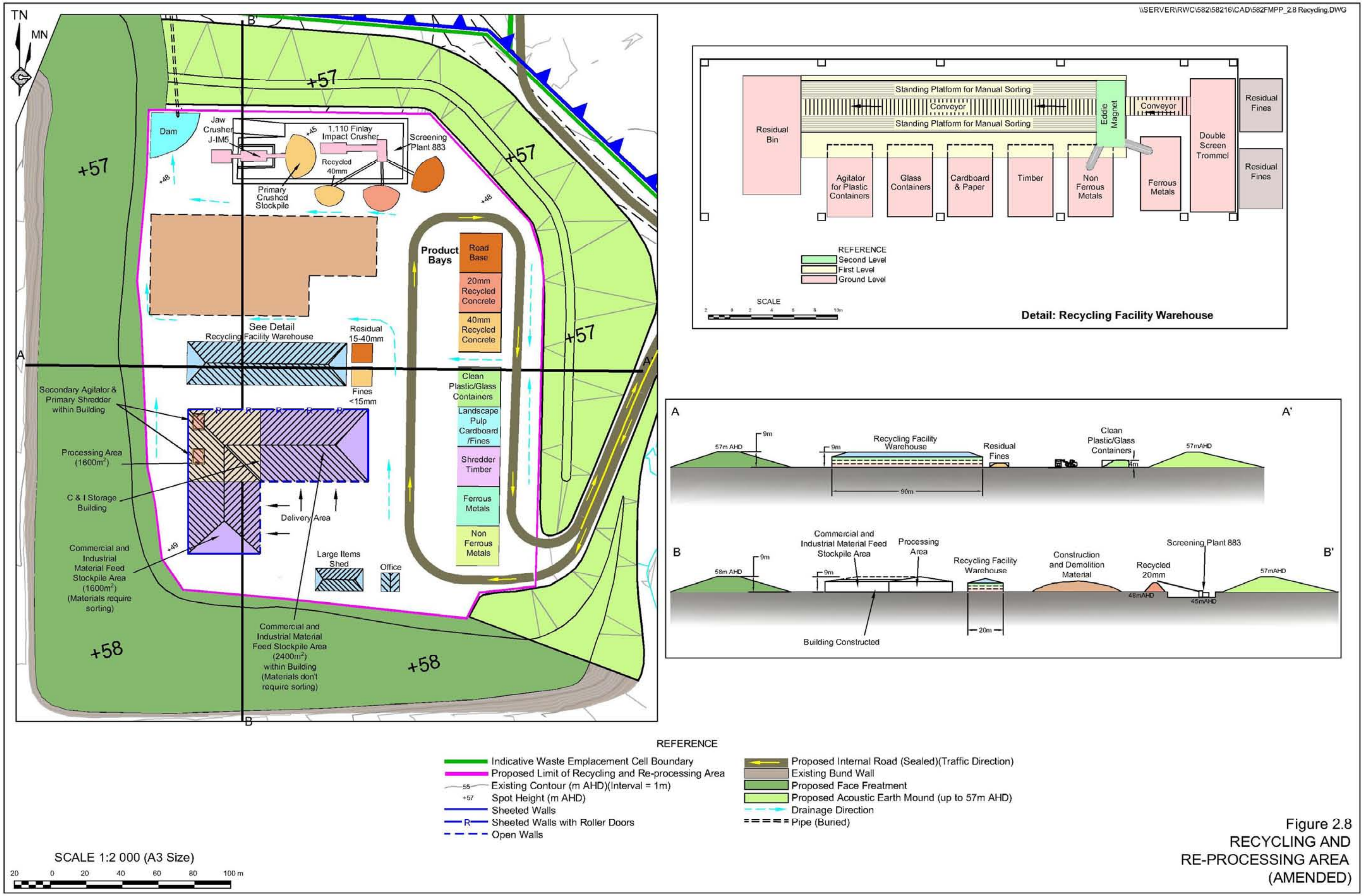


Figure 2.8
RECYCLING AND RE-PROCESSING AREA (AMENDED)

The contents of the residual bin at the end of the picking station and the bin containing 15-40mm fines would then be despatched to the on-site waste emplacement (via the on-site weighbridge). All the remaining C&I materials would be sorted, shredded and/or washed and stored in the product bays ready for sale.

The various equipment used in the warehouse would be supplemented by a primary shedder (e.g. M85 4000S) located southwest of the warehouse. Other supplementary equipment that would be utilised includes balers and possibly optical sorters and/or air classifiers.

Construction and Demolition (C&D) Recycling

The C&D recycling component comprises crushing and screening plant with a 6 600m^2 raw feed stockpile area – see layout on **Figure 2.8**.

The principal items of equipment used in processing C&D materials would be as follows.

1. A jaw crusher (eg. Finlay J-1175J-IM5) – with a hopper capacity of 9m^3 and throughput of 120t to 340t per hour.
2. An impact crusher (eg. Finlay 13121.110) fitted with a permanent steel magnet – with a throughput of 100t to 350t per hour.
3. A tracked mobile trommel screening plant (eg. Finlay J-790883) – with a hopper capacity of 7m^3 and throughput of 90t to 100t per hour.

The above equipment would be positioned within a rectangular slot with its floor at 45m AHD, i.e. 12m below the upper surface of the nearby acoustic earth mound of the northern side of the recycling and re-processing area.

The C&D raw feed materials would undergo separation of large items, metal items and lighter materials (i.e. timber). The large items would be placed in the large items shed, while metal items would be sorted into ferrous and non-ferrous metals, and the lighter materials such as timber and plastic would be transported to the MRF warehouse for treatment in the same manner as the C&I waste.

The remaining C&D materials would be fed into the jaw crusher and retained in a primary crushed stockpile. The materials would then be further reduced in size with an impact crusher after which the crushed materials would be conveyed to the screening plant to sort the material into three main products, namely:

1. Road base;
2. Recycled 20mm concrete; and
3. Recycled 40mm concrete.

Other products meeting alternative specifications could be produced, as required.

The products would then be transported by front-end loader into the respective product bays onto the eastern side of the Recycling and Re-processing Area.

2.4.3 Products and Product Stockpiles

A series of bays would be constructed for the storage of products produced within both the above facilities. A total of eight storage bays would be used, each covering an area of approximately 600m^2 with a capacity of approximately 2 000t of products.

It is proposed that the saleable products to be produced from the C&D recycling and re-processing would include the following.

- Roadbase products.
- Steel reinforcing.
- Standard fill (clean soil).
- Ferrous metals.
- Varying sizes of aggregate (typically 20mm and 40mm).

Saleable products likely to be produced from the C&I recycling and re-processing would include the following.

- Plastics (various types).
- Glass.
- Cardboard.
- Metal.
- Paper.
- Woodchips (mulch/fired boilers).

2.4.4 Innovation to Increase Diversion

The Proponent is committed to maximising waste diversion from landfill. Throughout the life of the Project, new products would continue to be investigated as markets and additional resource recovery exemptions are introduced and new re-processing and recycling technologies become available. Particular emphasis would be placed upon reducing the quantity of low level contaminated soils emplaced on site and maximising the quantity of treated soils removed off site.

2.4.5 Residual Wastes

Following re-processing, the remaining residual wastes would be loaded into an articulated truck or roll-on/roll-off truck and taken back over the incoming weighbridge to the active waste emplacement cell. Based on an average of 350 000tpa of waste received on site being suitable for re-processing and a recovery rate of approximately 70%, an average of approximately 105 000t of residual wastes would be generated each year from the recycling and re-processing operations (see **Figure 2.3**).

The actual quantity of residual waste remaining after the re-processing of the incoming waste stream would be dependent upon the composition of the feed material. This composition may vary as a result of waste minimisation programs undertaken within industry, and changes in the legislation. The potential to recover 245 000 tonnes from 350 000 tonnes of feed is based upon the Proponent's understanding of the waste stream recently characterised by the Department of Environment, Climate Change and Water (DECCW).

Further, other materials that are unsuitable for recovery and recycling would be directed at the weighbridge directly to the active waste emplacement cell. It is expected that an average of 100 000tpa of these wastes would be directly emplaced i.e. without on-site processing.

The residual waste would be inspected to ensure compliance with the permitted waste classification, i.e. general solid waste (non-putrescible).

2.5 WASTE SOURCES AND CHARACTERISATION

The facility would have the capacity to receive a maximum of 450 000tpa of general solid waste (non-putrescible) generated predominantly in the Sydney Metropolitan Area with some wastes potentially transported from the Blue Mountains. It is expected that the volume of waste received would quickly ramp up over the first few years, with the level of 450 000 tonnes per annum of incoming wastes achieved by about Year 3. The waste accepted on site would consist of C&D and C&I waste. No liquid, restricted or dangerous materials would be accepted at the facility.

The principal C&D wastes targeted for receipt (and re-processing) include concrete, bitumen, bricks and roofing tiles. Small quantities of mixed C&D waste unable to be economically separated are also likely to be received.

The Proponent would adopt a waste screening and refusal procedure both at the weighbridge and the unloading area(s) to ensure that only approved waste is accepted at the facility. The procedure would be incorporated in the Landfill Environmental Management Plan which would be regularly reviewed and updated.

The Proponent envisages receiving low level contaminated soil currently not suitable for re-use or re-processing from a number of potential sources including from remediation and demolition sites. The rate of receival of contaminated soil would be dependent on construction and demolition activity and remediation projects in the greater Sydney region with potentially larger quantities received during peak years. The type of soil contaminants anticipated are a range of contaminants such as low level metals, hydrocarbons, polycyclic aromatic hydrocarbons and, potentially, chlorinated hydrocarbons that have undergone prior thermal treatment. The level of contamination would always be below the level which the soils would otherwise be considered hazardous waste. The Proponent would require chemical analyses of all received soils confirming the level of contamination is below these threshold levels.

Putrescible materials identified within the incoming feed material would be separated and placed in a covered skip(s). The skip would be removed daily and the organic wastes sent to a facility licensed to appropriately process or dispose of these wastes. The proposed management of the small quantity of putrescible materials would be sufficient to ensure adverse impacts on surrounding neighbours are avoided. No liquid, hazardous or restricted waste or dangerous materials would be accepted on site. The site would not be open for waste receipts from the general public thereby providing considerable control over wastes received.

2.6 GEOLOGY AND RESOURCES

2.6.1 Geological Setting

The clay/shale resources within the Project Site occur within the Bringelly Shale, a geological unit common throughout Sydney's western suburbs and comprising interbedded claystones, siltstones, laminites and minor sandstones and carbonaceous units (Herbert, 1979). The Bringelly Shale lies above the Ashfield Shale which, in turn, lies above the Hawkesbury Sandstone.

2.6.2 Site Geology

In the vicinity of the Project Site, the Bringelly Shale dips gently to the south at approximately 5^{o} and, based on descriptive drill logs of a bore on the Project Site, the shale is almost 90m thick. The rock units within the Bringelly Shale show strong lateral facies variation, especially in the coarser grained sandstone beds, resulting in difficult lithological correlation between drill holes. Faulting is evident within the existing extraction area but is not thought to significantly constrain the geological interpretation between drill holes.

Weathering is a common feature on site with well-developed clays and weathered claystones and siltstones generally encountered within 4m to 8m below the natural surface.

2.6.3 Site Investigations

Approximately 30 cored diamond drill holes have been drilled on the Project Site since the early 1980s by either the land owner/quarry operator or brick companies. Only the top 25m to 35m of the Bringelly Shale beneath the Project Site has been investigated in detail for its resource potential. The most recent investigation and assessment of the clay/shale resources within the Project Site was undertaken by R.W. Corkery & Co. Pty Limited in 2004 to assist in defining the optimum areas for the recovery of light-firing claystone and siltstone. The claystones and siltstones are collectively referred to as "shale". The results of the 2004 investigation drew upon the available data from the previous investigations.

2.6.4 Resources

2.6.4.1 Introduction

In 1981, when the quarry commenced and more recently in the April 2010 *Environmental Assessment*, the definition of the resources within the Project Site focused upon maximising the recovery of light-firing clay/shale materials for the Sydney brick industry. The Proponent still intends to focus on maximising the recovery of light-firing clay/shale, however, the overall quantity of clay/shale recovered would be less than that nominated in the preferred project report as the Proponent has reduced the void volume for the receipt of wastes. The ~~reduction in~~ clay/shale recovery has ~~therefore~~ targeted the ~~non-~~light-firing clay/shale resources~~, principally within Cell 2~~. This sub-section focuses principally upon those materials that would be recovered during the life of the project.

It is noted that the quantity of clay/shale to be extracted within the Project Site would be approximately ~~3.8~~5.2 million tonnes, i.e. a reduction of approximately ~~32~~8% from that proposed in the April 2010 *Environmental Assessment* and July 2010 Preferred Project Report. This reduction is largely due to changes in the void space and capping thickness~~the restriction of the extraction depth in Cell 2 to 37m AHD compared to the previous depth of 28m AHD~~. The Proponent would maintain a quality control program to maximise the separation of light-firing clay/shale raw materials throughout the life of the modified Project.

The resources identified on site that would be extracted either in situ or from existing bund walls or stockpile, include the following.

- In situ clay/shale.
- Existing bund walls.
- Existing clay/shale stockpiles.

2.6.4.2 Clay/Shale Resources

~~Within Cell 1, in the order of 630 000t of clay/shale would be removed to create the preferred cell floor and to maximise the cell's storage capacity. The materials would be removed from Cell 1 to an average depth of approximately 28m AHD.~~

~~An estimated 670 000t of clay/weathered shale would be recovered from Cell 2 in the event these materials in that cell are extracted to an average elevation of approximately 37m AHD.~~

~~An estimated 2 370 000t of clay/shale would be recovered from Cell 3 in the event extraction in that cell occurs to an elevation of 28m AHD.~~The clay/shale resources to be extracted within Cells 1, 2 and 3 occur within the weathered, upper and the bulk of the middle units identified in the 2004 Resource Assessment Report.

Table 2.3~~2~~ summarises the recoverable resources proposed for extraction within Cells 1, 2 and 3 (as outlined in the Supplementary Statement of Evidence of Robert Corkery (Extractive Volumes).

Table 2.3
Recoverable Clay/Shale Resources

Resource	Cell 1[1] Quantity	Cell 2[1~~2~~] Quantity	Cell 3[1] Quantity	~~Final Cell~~	Total
Clay/weathered shale	250 838t~~125 000t~~	841 286t~~450 000t~~	698 407t~~720 000t~~	~~180 000t~~	1 790 531t~~1 475 000t~~
Cream-firing shale[2]	120 909t	308 495t	422 308t		851 712t
Light - pink-firing shale[2]	149 860t~~65 000t~~	401 890t~~-~~	782 390t~~880 000t~~	-	1 334 140t~~945 000t~~
Red-firing shale[~~2~~3,3]	~~440 000~~212 208t	~~220 000~~459 682t	~~770 000~~568 548t	-	1 240 438t~~1 430 000t~~
~~TOTAL~~**Total**	**733 815t**~~630~~	**2 011 353t**~~670 000t~~	**2 471 653t**~~2 370 000t~~	~~180 000t~~	**5 216 821t**~~3 850 000t~~

	000t				

1. To an average depth of 28m AHD 2 To an average depth of 37m AHD

3 2. 1m[3] shale = 2.1 tonnes 3. Incorporates limited quantities of sandstone and laminite

The Proponent is mindful of the on-site requirements for red-firing shale for daily cover and capping and clay for cell lining and capping. Accordingly, it is proposed to retain in the order of 480 0001.1,040,000 million tonnes of clay and 220 0000.951,010,000 million tonnes of shale onsite for these purposes throughout the project life.

2.6.4.3 Existing Bund Walls

The existing bund walls around the perimeter of the Project Site contain a substantial quantity of clay/shale that was extracted from the area within the Project Site now nominated as Cell 1. At least 60% of the materials within the existing bund walls are clay/shale or ENM. An estimated 160 000t of ENM removed during the lowering of the existing southern and southwestern bund walls would be surplus to on-site requirements during the site establishment phase. Hence, these materials are also considered as a resource that could be despatched off site during the life of the Project.

2.6.4.4 Existing Clay/Shale Stockpiles

An estimated 200 000t of clay/shale remains stockpiled on site, the bulk of which is suited to brick manufacture.

2.7 CLAY/SHALE EXTRACTION

2.7.1 Introduction

The approach to the extraction of clay/shale would vary depending upon the intended use of the material. This sub-section reviews the approach to the extraction method, stockpiling and proposed extraction rates.

2.7.2 Extraction Method

Extraction operations would generally be undertaken on a campaign basis depending upon market demand for both light-firing and red-firing clay/shale and/or the on-site need for cover material. Extraction would be undertaken using ripping and pushing methods without the need for blasting. Extraction operations would typically be undertaken as follows.

- Topsoil and subsoil (where present – Cell 3 only) would be stripped to depths determined by the soil structure typically using a scraper and either stockpiled for future use in rehabilitation or directly transferred to an area awaiting rehabilitation.

- Where clay is present, it would be recovered using a scraper and stockpiled in an area not required for waste emplacement for some time or delivered by articulated truck to an area of the final landform being capped.
- Underlying shale units would be ripped using a bulldozer and either loaded directly into road registered trucks for despatch off site or into a haul truck or scraper for stockpiling either in a product stockpile or a cover material stockpile.

In the event extraction depths in the shale exceed approximately 15m, a 5m wide bench may be retained as a safety measure.

2.7.3 Stockpiling

Clay/shale would be stockpiled for two main reasons.

1. It is the preference of the brick industry for stockpiles of light-firing clay/shale to be created to achieve a high level of blending to achieve good quality control for all material in the stockpile.
2. Material (normally red-firing material) which is in excess of market sales.

Any stockpiles of light-firing clay/shale extracted from Cell 1 would be created in areas yet to be developed for waste emplacement or in the contingency stockpile area located near the Project Site entrance which has the capacity to store up to 250~~,~~ 000 tonnes of material. For example, clay/shale extracted from Cells 1A and 1B ~~w~~could be stockpiled in the footprint of Cell 2 or the contingency stockpile area. All clay/shale stockpiles on site would have a maximum elevation of 5~~6~~4m AHD to ensure they are not visible from The Vines Estate. Similarly, clay/shale extracted from Cell 2B would be stockpiled in the ~~western~~ eastern side of Cell 3 beyond the optimum clay/shale extraction area or in the contingency stockpile area. Red-firing material and undifferentiated clay/shale destined for construction projects would preferentially be loaded directly within the extraction area and removed directly from site without stockpiling. Clay/shale to be used as cover material would be transported to a defined area near the active emplacement area and stockpiled typically in stockpiles of approximately 250t to 500t.

2.7.4 Extraction Rates

Extraction rates and frequency of extraction campaigns for the in situ clay/shale would be determined largely by external sales of the clay/shale products and the on-site requirements for the clay/shale materials. The maximum~~oretically, the average~~ annual rate of clay/shale extraction would be ~~approximately 1~~260 000t per annum (tpa), with the maximum annual removal rate of material from site being 160 000 tpa~~ throughout the life of the project. The recovery of the ENM materials (from the elevated sections of the southern and southwestern bund walls) and clay/shale (from the existing stockpiles) would proceed at an annualised average rate of approximately 35 000t/year although in reality much of this material may be removed during the first 4 years of the Project life.~~.

2.7.5 Extraction Sequence

It is proposed that the sequence of extraction would generally follow the staged emplacement cells, namely 1A → 1B → 1C → 2A → 2B →2C → 3~~A~~C → 3B → 3A~~C~~. **Figure 2.9** displays the locations of each of these sub-cells.

2.8 ANCILLARY WASTE EMPLACEMENT

2.8.1 Introduction

The design and operation of the on-site waste emplacement or landfill is based on achieving the environmental requirements nominated within:

- the *Protection of the Environment Operations Act 1997;* and
- the Environmental Goals in Environmental Guidelines: Solid Waste Landfills (EPA, 1996).

Figure 2.9
LEACHATE COLLECTION SYSTEM (AMENDED)

Additionally, a number of best practice environmental management techniques are proposed in the design and operation of the ancillary waste emplacement to minimise the environmental impacts from the facility.

The following subsections outline the:

- concept design for the engineered waste emplacement cells;
- the operation of the waste emplacement;
- cell development;
- emplacement sequence;
- leachate management; and
- methane management.

Subject to the nominated volume of clay and shale being extracted and despatched from site, the maximum design capacity could be approximately 4.~~8~~3 million tonnes, i.e. assuming extraction in Cells 1, 2 and 3 is undertaken to the depth nominated in **Table 2.2**. Once fully operational, it is anticipated that the quantity of residual waste and other wastes unable to be processed destined for emplacement on site would be in the order of 205 000tpa.

The Proponent intends to undertake sufficient compaction of the wastes emplaced in the landfill cells to achieve a density of 1 t/m^3. Actual compaction rates achieved would be determined throughout operations and reported to the DECCW.

The conceptual design of the landfill cells addresses the environmentally secure emplacement of waste classified as General Solid (non-putrescible) Waste and encompasses the following principles and design elements.

2.8.2 Design

2.8.2.1 Introduction

The design of the ancillary waste emplacement focuses upon the area contained within the proposed limit of extraction. The areas to both the north and east of Cells 1 and 2 would be fully rehabilitated during the site establishment phase and supplemented with visual and acoustic bunds to ensure operational areas within the ancillary waste emplacement are not visible and noise levels comply with nominated criteria.

The design of the overall emplacement and its components has been undertaken by Aquaterra Consulting Pty Ltd whose integrated emplacement cell design is detailed in Aquaterra (2010). The principal objective of the design is to achieve the following specific environmental requirements.

1. Leachate needs to be contained on site to ensure that groundwater and surface water is not polluted off site.

2. The negligible quantities of gas generated on site would be contained within the Project Site such that it does not migrate off site through the subsurface. Furthermore, the comparatively small quantities of gas generated by the emplaced waste would be managed to ensure that it does not create offensive odour off site, and is subject to oxidation to minimise greenhouse gas emissions.

The conceptual design outlined below takes into account the design capacity up to 4.3~~8~~ million tonnes and the emplacement of waste above and below the groundwater table in the shale beneath the Project Site.

Cells would be set back at least 10m from the site's perimeter in accordance with conservative modelling work undertaken by Dupen (1993) for containment of leachate in unlined clay/shale quarries in Sydney.

This subsection considers the design of the cell barriers and the cells themselves. It is noted that the design features of the cell barriers and the cells would be compiled in detail within a construction quality assurance plan and reviewed throughout the life of the Project. Where appropriate, design adjustments would be incorporated into the design of the remaining cell barriers and cells in response to site observations, monitoring or technological advances.

2.8.2.2 Cell Barriers

At least 10m of clay/shale would exist between the emplacement cells and the Project Site's boundary. This natural clay/shale geology would act as the primary barrier to prevent the off-site migration of contaminants as it has a low permeability. An engineered barrier of compacted clay would be constructed on the floors of all cells.

Aquaterra demonstrated through laboratory tests that the on-site clays are able to be re-compacted to achieve a permeability of less than 7.3 x 10^{-10} m/s and that, provided the clay it is placed with a thickness of at least 37cm, it would offer an equivalent hydraulic performance as the DECCW's benchmark clay liner of 0.9m of clay with a permeability of 1 x 10^{-9}m/s.

The engineered liner constructed on the cell floor would comprise ~~0.4m to ~~0.9m of re-compacted clay with a permeability between 7.3 x 10^{-10}m/s and 1 x 10^{-9}m/s.

The walls of the cells would be very steeply sloped which naturally enables leachate to run down them where leachate would pool on the floor of the cells, if it is not extracted. The Proponent proposes to line the sides of all cells with a HDPE liner from the natural ground level around the perimeter of the cell to the cell floor. The lower section of the wall liner would be keyed into the compacted cell floor.

2.8.2.3 Emplacement Cells

Cell Definition

The waste emplacement area within the Project Site has been designed with ~~four~~three defined cells, namely three cells nominated as Cells 1, 2 and 3~~ and the Final Cell~~. Cells 1, 2 and 3 have been divided into three sub-cells~~ whereas Cell 2 and the Final Cell have been divided into two sub-cells~~. The boundaries of the ~~four~~three cells and their sub-cells are displayed on **Figure 2.9**.

Cells 1, 2 and 3

The design of Cells 1, 2 and 3 is summarised as follows.

- The cell floors of Cells 1, 2 and 3 would comprise the in situ shale, weathered shale or clay (with very low vertical permeability) with an engineered compacted clay liner with a permeability of <1 x 10^{-9}m/s.

- Within all cells, a leachate drainage layer with a transmissivity satisfying the DECCW's benchmark gravel would then be placed over the entire surface of the engineered liner. Above the drainage layer, a separation geotextile would be placed to prevent fines entering and clogging the leachate drainage layer. The leachate drainage layer would slope at 1% horizontally and 3% in the transverse direction.

  The basal leachate drainage layer would comprise one of the materials described in **Table 2.34**.

Table 2.4
Possible Basal Leachate Drainage Layers

Material Description	Specification
Basalt Gravel (or similar material)	Transmissivity > 3x10-4 m^2/s, rounded (< 30% misshapen), < 10% passing the 10mm sieve, <3% passing the 0.075mm sieve
Triplanar Geonet	Transmissivity greater than 4.05x10-4 m^2/s at 500kPa (Aquaterra, 2010)
Basalt Gravel with concrete	Transmissivity > 3x10-4 m^2/s, rounded (<30% misshapen), < 10% passing the 10mm sieve, <3% passing the 0.075mm sieve, < 20% by mass concrete*, <0.5% foreign matter (anything other than concrete or gravel) – at 500kPa
Geotextile	Non-woven, mass > 270g/m^2/s, O95 < 0.21mm, Grab Strength N > 900, Trapezoidal Tear N > 350, Puncture Strength N > 350, Burst Strength kPa > 1700
Source: Aquaterra (2010) – Table 4.1	

  The leachate drainage layer would incorporate HDPE collection pipes spaced at 50m intervals selected to withstand the weight of the overlying waste without buckling (see Aquaterra, 2010). The leachate drainage pipes would report to a riser from which leachate would be extracted out of the cell once a pre-determined level is reached and pumped to the active evaporation pond.

- Dual leachate/gas drainage chimneys may be placed against the cell walls at regular intervals around the cells. This would prevent the build up of leachate and/or gas pressure against the cell's outer walls thereby containing it within the cell allowing gas extraction in a controlled manner.

  In the unlikely event sufficient quantities of gas are generated, the gas would be extracted from the emplacement cells and its methane component oxidised in accordance with the regulatory requirements (which are yet to be stipulated by the Federal Government) to minimise the Project's greenhouse impact. At a minimum, the gas would be collected and oxidised from the rehabilitated cells.

- At the northern sides of Cells 1 and 2 and between the Final Cell and Cell 3 only Virgin Excavated Natural Material (VENM) would be emplaced to achieve the final contours. This would negate the need for including a leachate underdrain system for these areas.

The design of each cell is fully in accordance with *Environmental Guidelines: Solid Waste Landfills* (EPA, 1996).

Final Cell

During site establishment, the base of the Final Cell would be constructed within elevations of between 45m AHD to 49m AHD. The geology at these elevations consists of clays and some weathered shale and is expected to be above the groundwater level in the underlying shale. ~~As for Cells 1 to 3, prior to the emplacement of waste, an engineered liner would be installed for the Final Cell which meets the DECCW liner permeability requirements. A leachate drainage layer and collection system would also be installed together with leachate/gas drainage chimneys, if required. The cell design would be fully in accordance with Environmental Guidelines: Solid Waste Landfills (EPA, 1996)~~ The Final Cell would be filled to final levels using clay/shale and would not require lining or leachate drainage.

2.8.3 Cell Operations

2.8.3.1 Introduction

The operation of the ancillary waste emplacement or landfill component of the facility would be undertaken by an established and experienced waste management company.

The facility would only receive waste from commercial operators and would not be open to the general public.

2.8.3.2 Waste Receipts and Placement

Waste received from off site would be screened at the weighbridge as a first check to ensure that it meets the general solid waste (non-putrescible) classification. Some loads would be directed to the recycling and re-processing facility for the recovery of materials where a second stage of screening would take place. All other waste received at the site, after initial screening at the weighbridge, would be directed to the active emplacement cell and subjected to secondary screening as it is deposited/unloaded from the vehicle.

Any vehicle entering the site which contains waste which does not meet the classification of general solid waste (non-putrescible) would be directed back off site. In the event that waste not meeting the classification of general solid waste (non-putrescible) is deposited on site and the vehicle has departed the site, the waste would be collected and stored in a covered skip bin until it can be taken off site to a facility which can lawfully receive it. This would be acted on as a priority.

Waste resulting from de-constructing the existing bund walls would be screened during de-construction to confirm that it meets the classification of general solid waste (non-putrescible). At that stage, any waste identified for recovery of resources would be excavated and transported to the on-site recycling and re-processing facility. The remaining waste material from the existing bund walls that cannot be re-processed would be transported into the active waste emplacement cell for emplacement.

A fine misting spray of water would be applied over the area of the existing bund wall, when wastes are being removed, as a safeguard to prevent the airborne emission of any asbestos fibres, should they be present.

Any waste identified in the existing bund walls not meeting the classification of general solid waste (non-putrescible) would be managed in accordance with the requirements of the *Protection of the Environment Operations Act 1997*.

Figures 2.10a to **2.13** depict the progressive emplacement and rehabilitation of the Cells 1, 2 and 3 and the Final Cell. The additional rehabilitation intended for the section of the eastern face adjacent to Cell 3 would be undertaken concurrently with the progressive rehabilitation of Cell 3. The indicative emplacement and progressive cell rehabilitation sequence is outlined in **Table 2.45**. **Figures 2.14** and **2.15** display a sequence of north/south and east/west cross-sections that similarly explain the sequence of clay/shale extraction, cell development, waste emplacement and rehabilitation.

Table 2.5
Indicative Emplacement and Cell Rehabilitation Staging

Year[#]	Activity*
Year 1 (see **Figure 2.10**)	Cell 1A is prepared to receive waste and filling commences. De-construction of the section of the existing eastern bund wall located over the clay/shale extraction area within Cell 2 is underway and all wastes placed in Cell 1A.
Year 2	Cell 1B is excavated and leachate infrastructure installed and is available for waste emplacement. The northern section of Cell 1A is capped and rehabilitated soon after.
Year 5	Cell 1C is excavated and leachate infrastructure installed and is available for waste emplacement. The northern section of Cell 1B is capped and rehabilitated soon after.
Year 8 (see **Figure 2.11**)	Cell 2A is excavated and leachate infrastructure installed and is available for waste emplacement. Cell 1C is capped and rehabilitated soon after.
Year 10	Cell 2B is excavated and leachate infrastructure installed and is available for waste emplacement. The northern section of Cell 2A is capped and rehabilitated soon after.
Year 12Year 14	Cell 2C is excavated and leachate infrastructure installed and is available for waste emplacement. The northern section of Cell 2B is capped and rehabilitated soon after.Cell 3A is excavated and leachate infrastructure installed and is available for waste emplacement. Cell 2B is capped and rehabilitated soon after.
Year 15Year 18 (see **Figure 2.12**)	Cell 3C is excavated and leachate infrastructure installed and is available for waste emplacement. The northern section of Cell 2C is capped and rehabilitated soon after. Cell 3B is excavated and leachate infrastructure installed and is available for waste emplacement. Cell 3A is capped and rehabilitated soon after.
Year 18 Year 21 (see **Figure 2.13**)	Cell 3B is excavated and leachate infrastructure installed and is available for waste emplacement. Cell 3C is capped and rehabilitated soon after. Cell 3C is filled to finished levels, capped and rehabilitated soon after.
Year 21 to 23 Year 22 to 24	Cell 3A is excavated and leachate infrastructure installed and is available for waste emplacement. Cell 3B is capped and rehabilitated whilst Cell 3A is filled to finished levels. Cell 3A is capped and rehabilitated.The Final Cell is filled to final levels,

Year#	Activity*
	~~capped.~~
Year 24 to 25~~Year 25~~	The area of the recycling and reprocessing facility is filled to final levels and rehabilitated.~~All remaining disturbed areas on site are rehabilitated.~~
# Indicative Only	* Assumes an average waste emplacement rate of 205 000 tpa See **Figure 2.~~10~~ 9** for individual cell location.

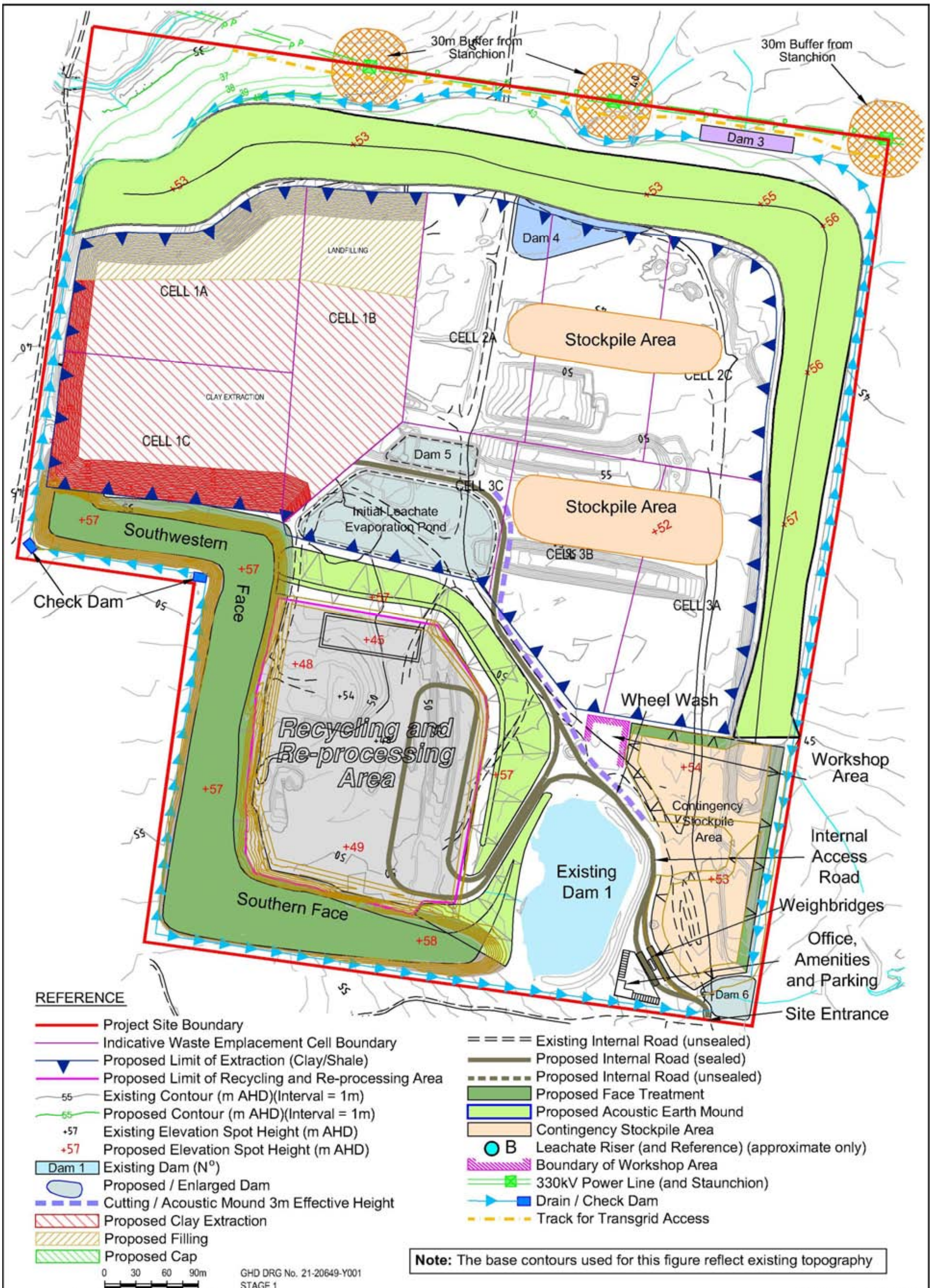


Figure 2.10a
STAGE 0 OPERATIONS (AMENDED)

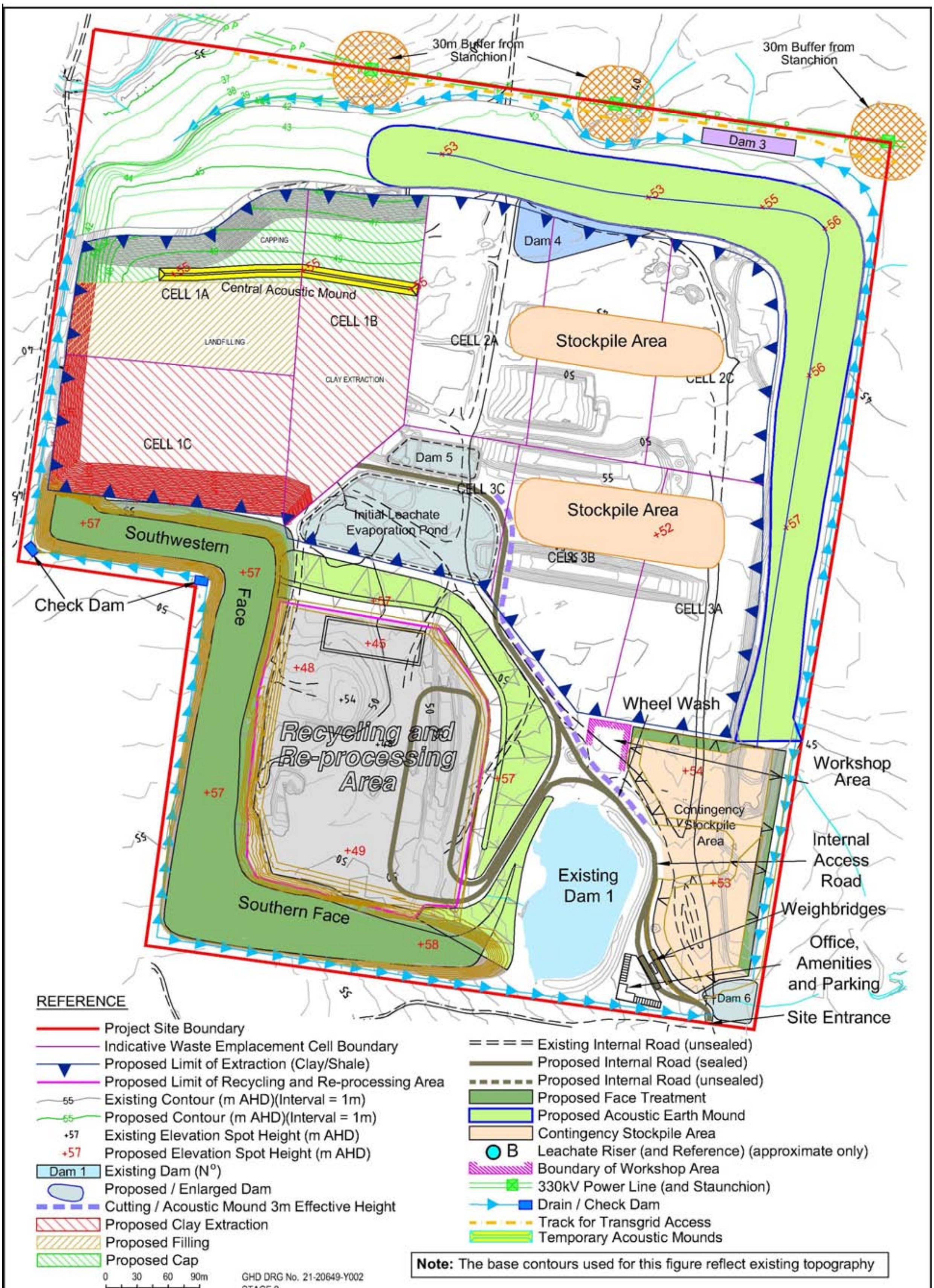


Figure 2.10b
STAGE 2 OPERATIONS (AMENDED)

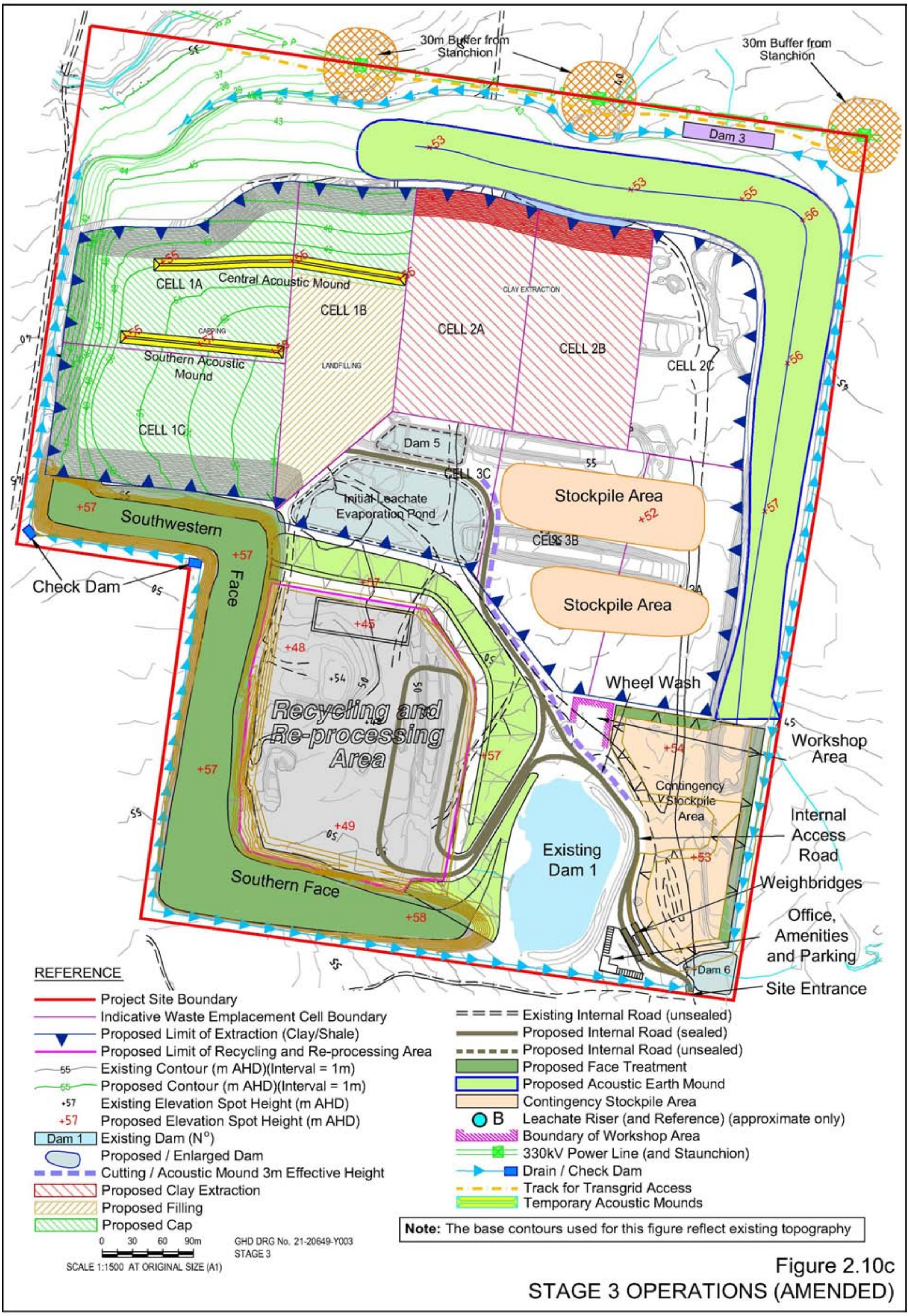


Figure 2.10c
STAGE 3 OPERATIONS (AMENDED)

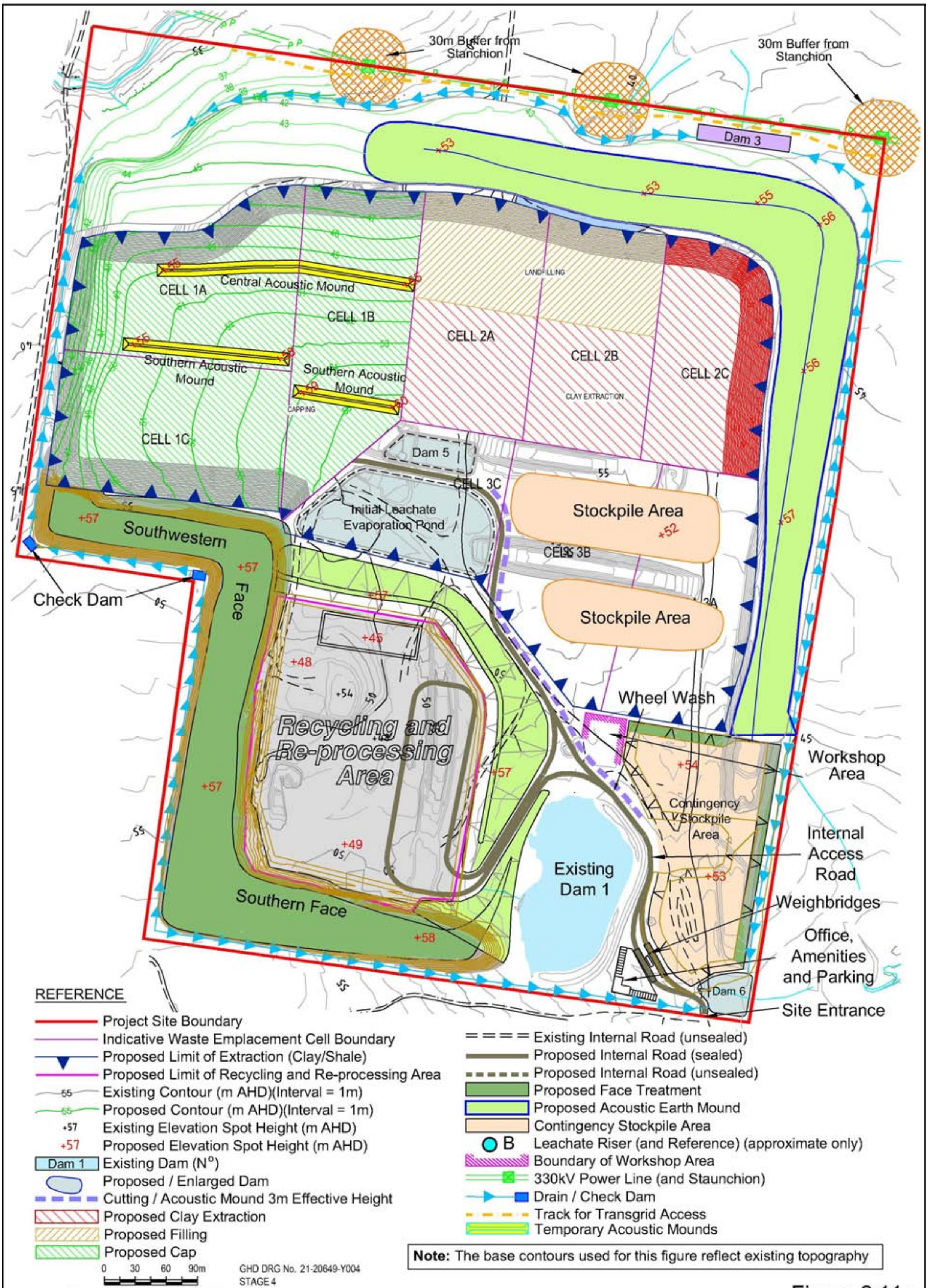


Figure 2.11a
STAGE 4 OPERATIONS (AMENDED)

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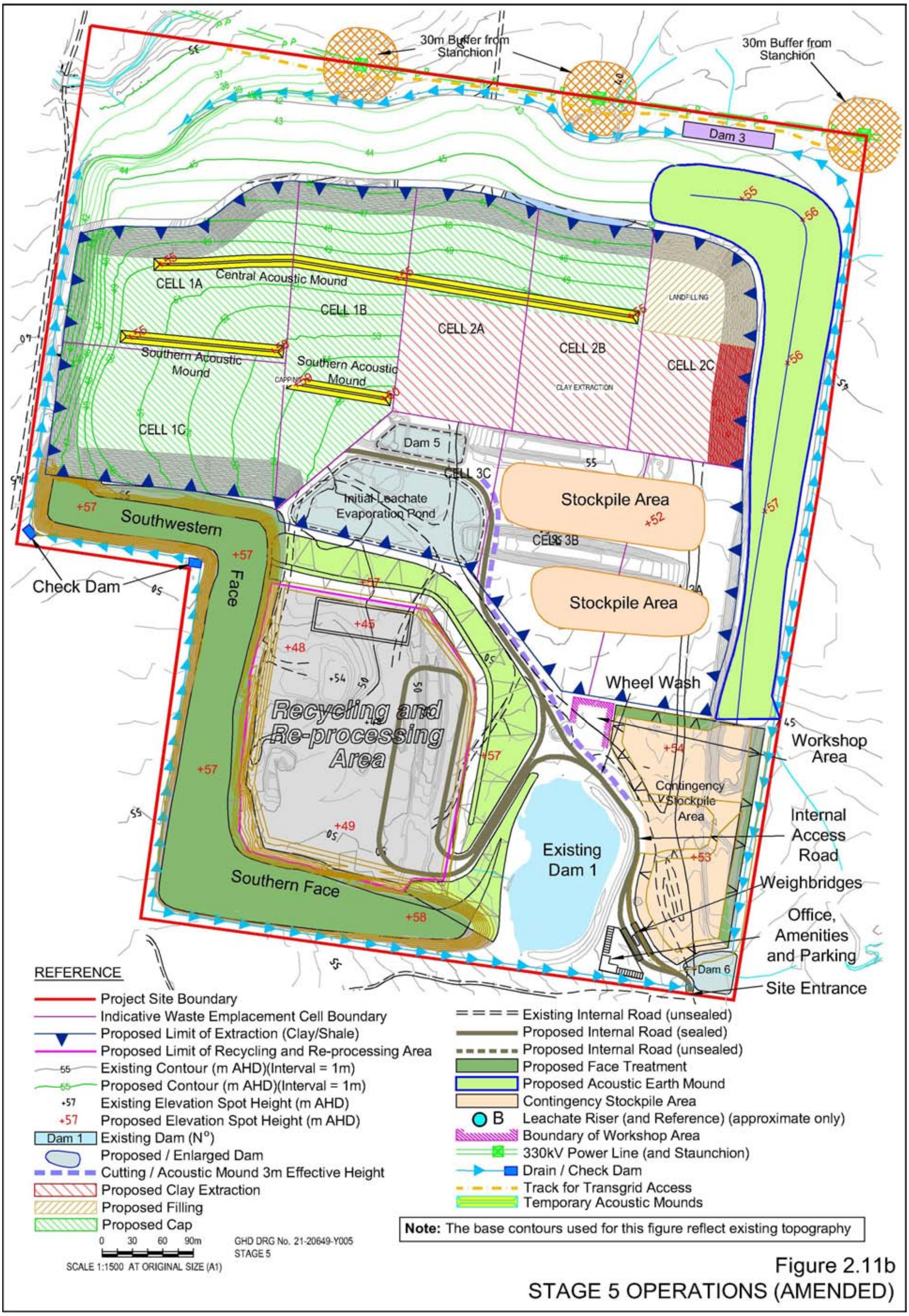


Figure 2.11b
STAGE 5 OPERATIONS (AMENDED)

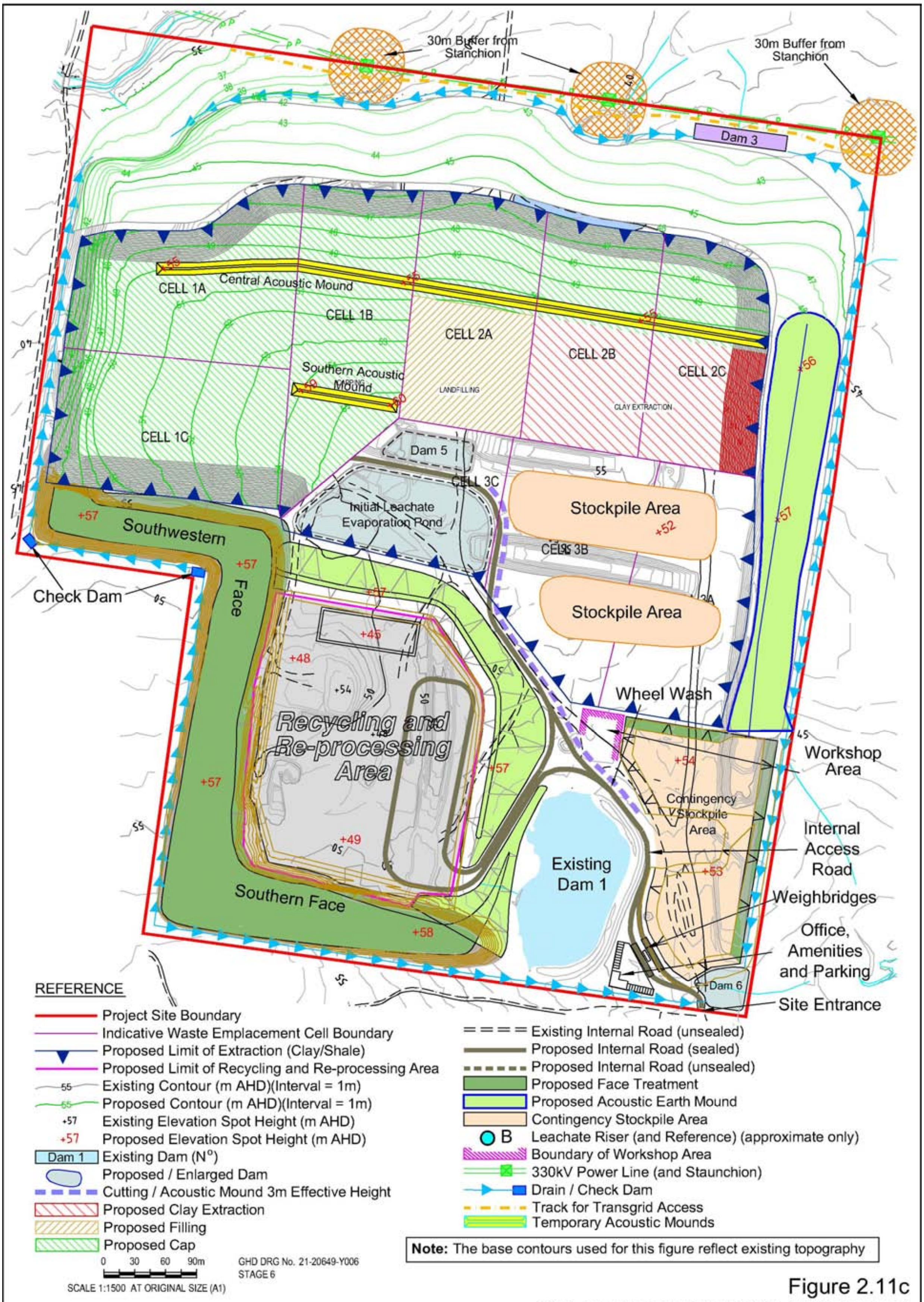


Figure 2.11c
STAGE 6 OPERATIONS (AMENDED)

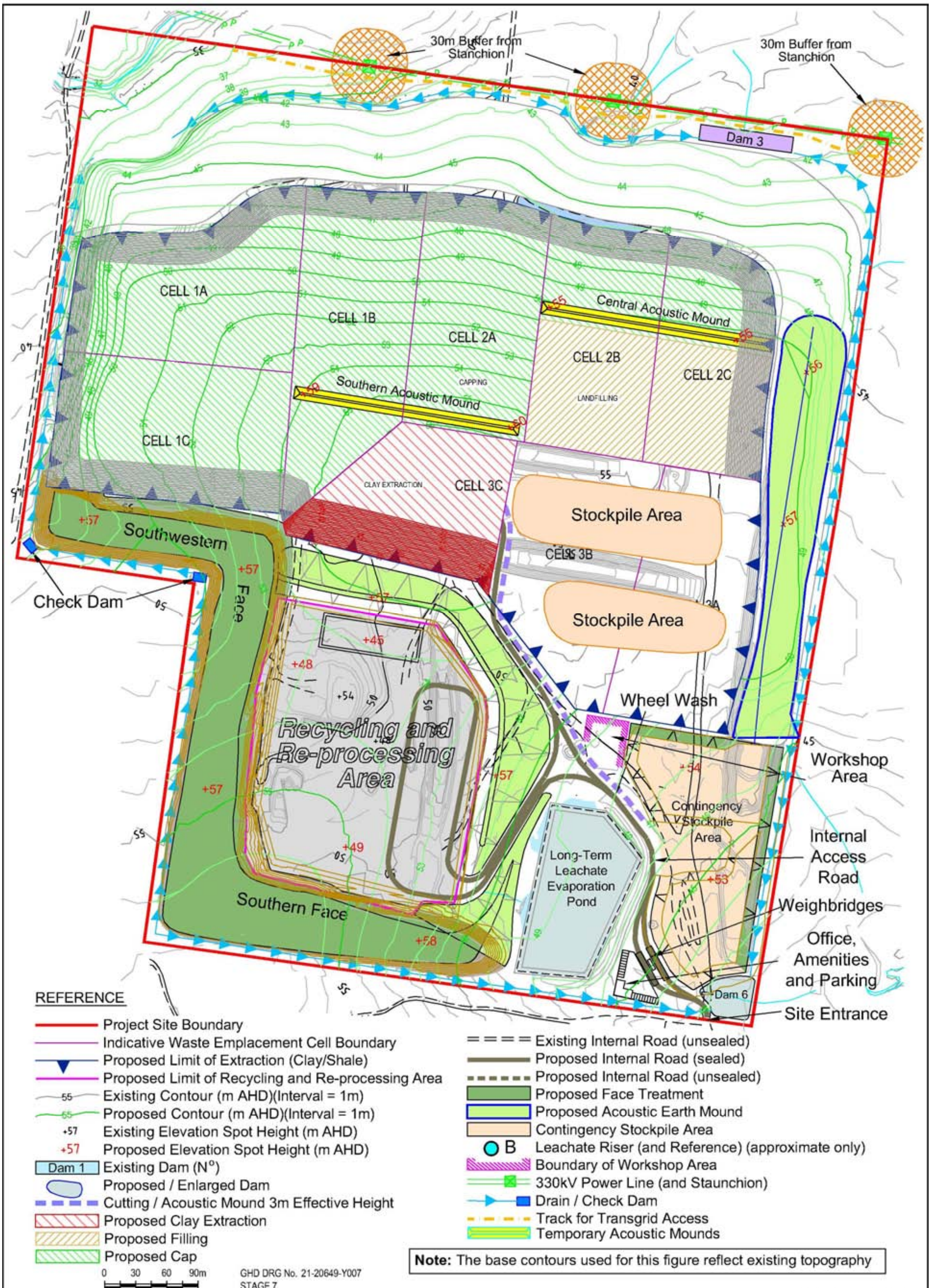


Figure 2.11d
STAGE 7 OPERATIONS (AMENDED)

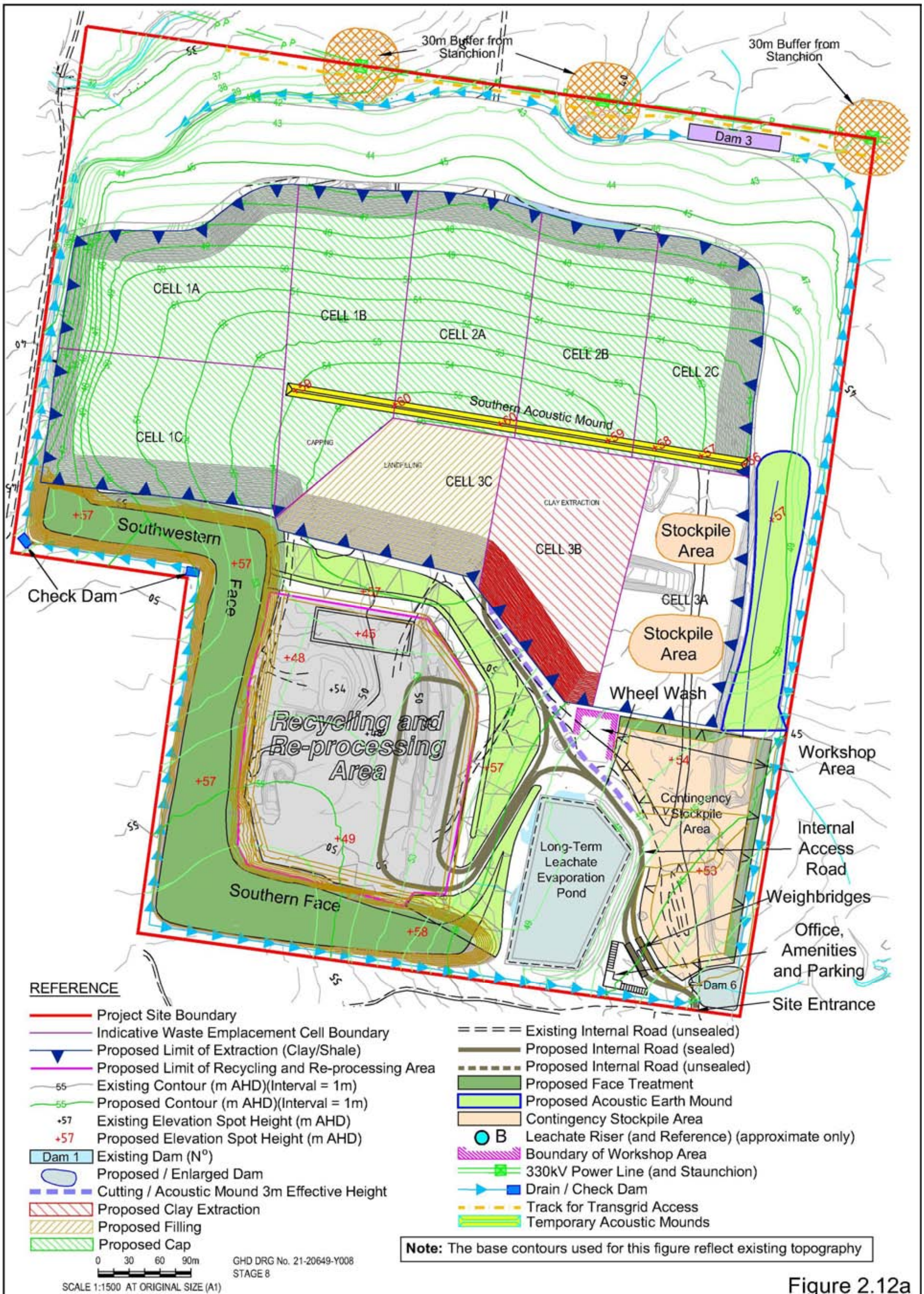


Figure 2.12a
STAGE 8 OPERATIONS (AMENDED)

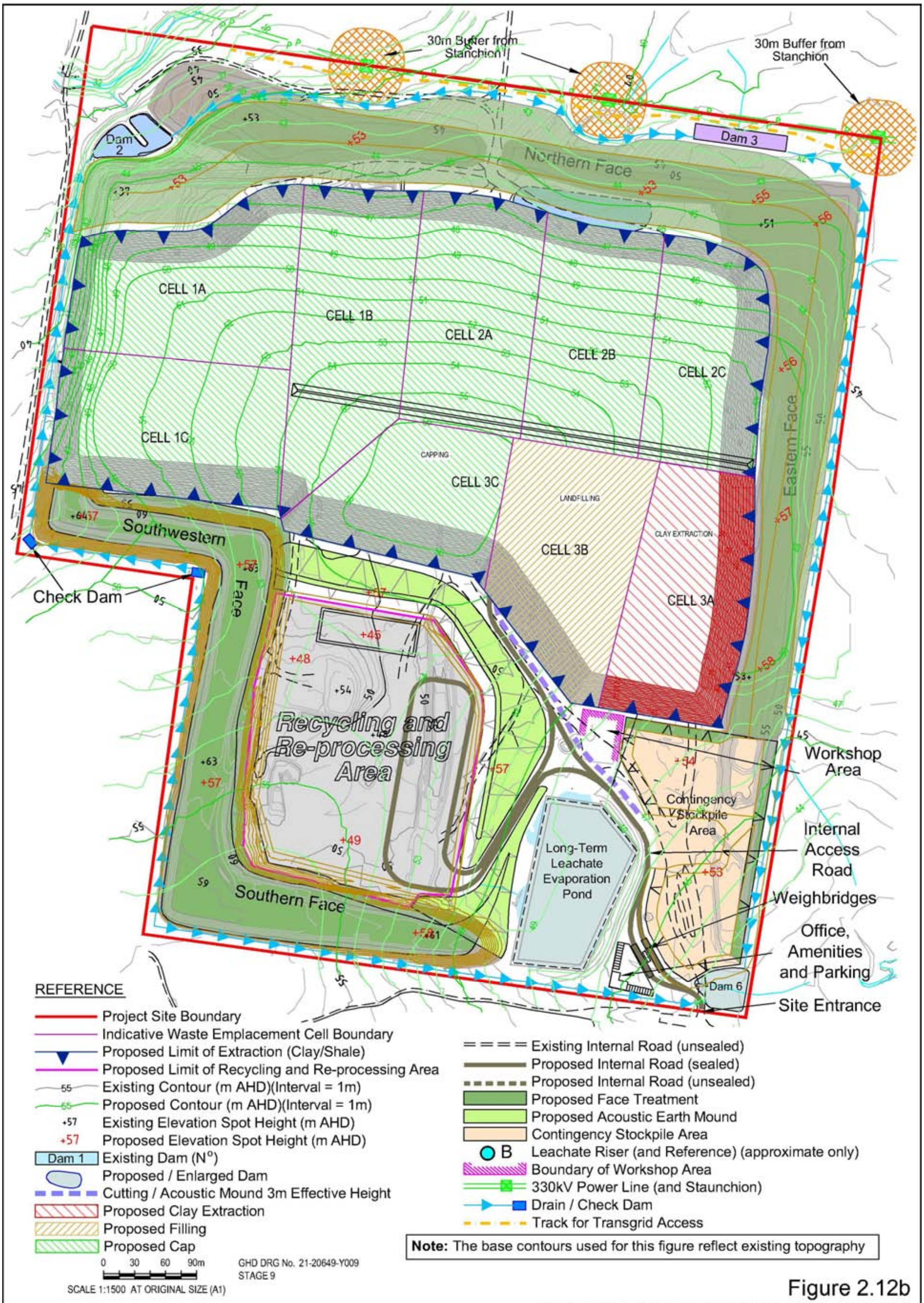


Figure 2.12b
STAGE 9 OPERATIONS (AMENDED)

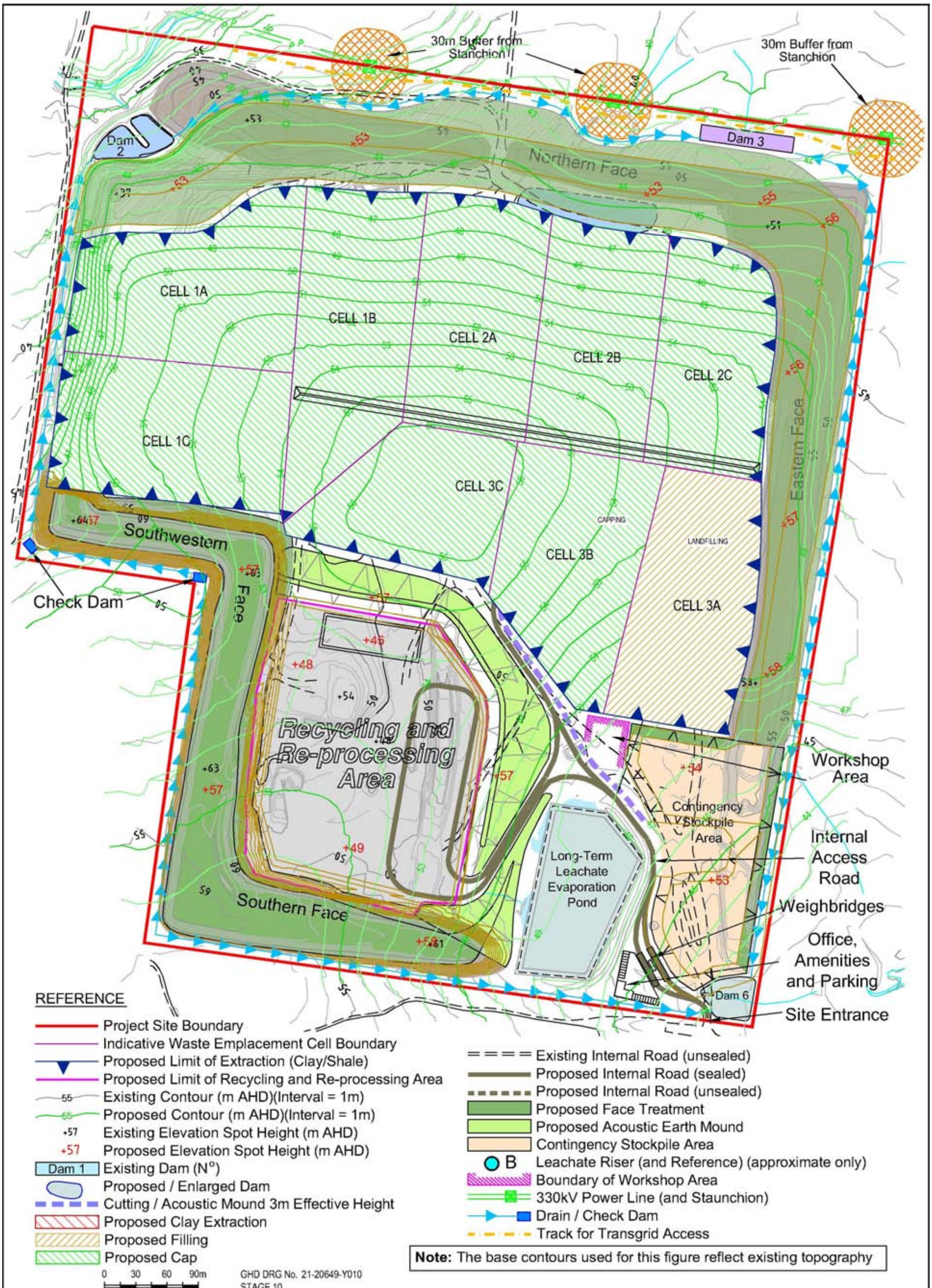


Figure 2.12c
STAGE 10 OPERATIONS (AMENDED)

Figure 2.13
STAGE 11 OPERATIONS (AMENDED)

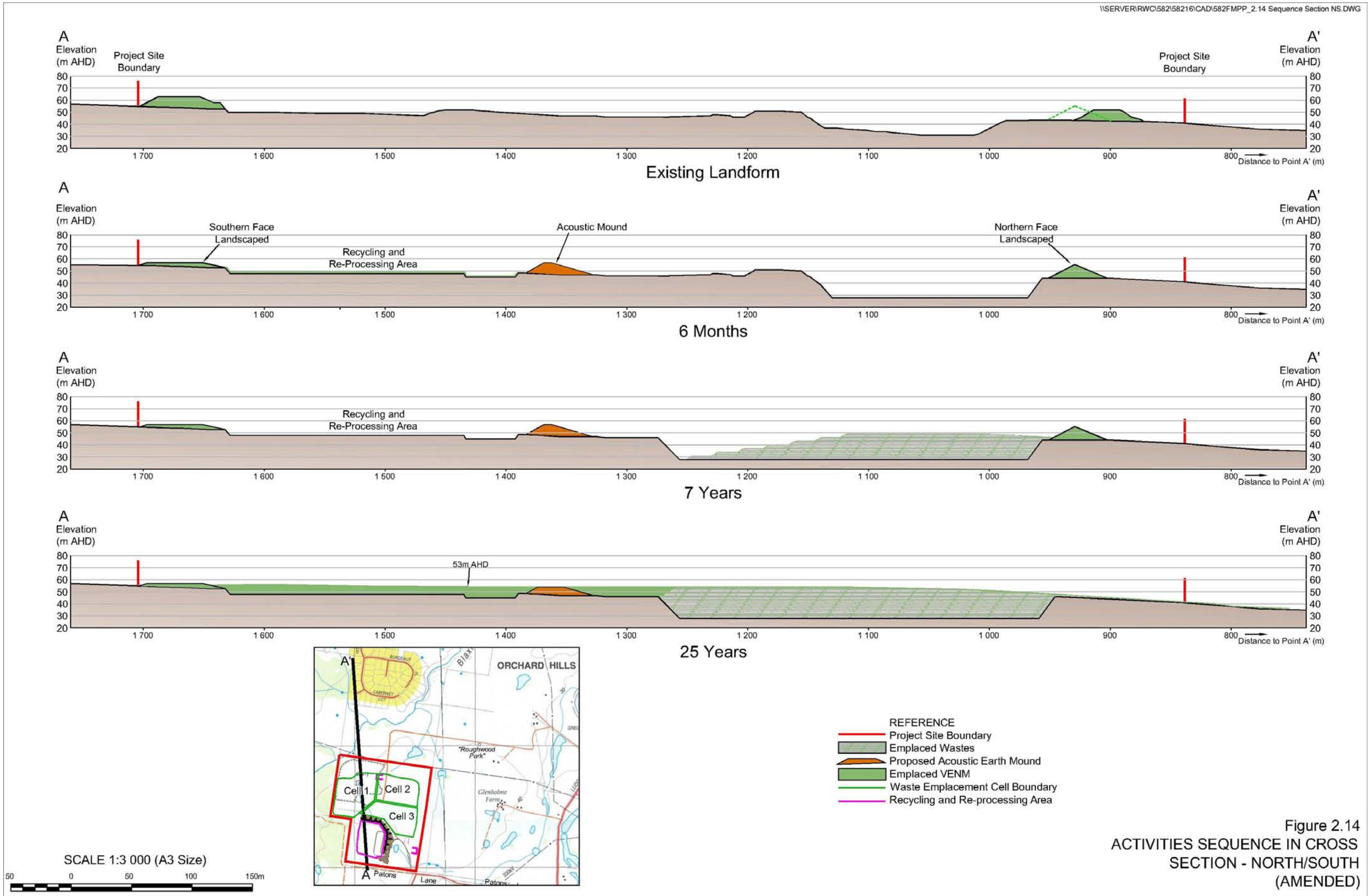


Figure 2.14
ACTIVITIES SEQUENCE IN CROSS SECTION - NORTH/SOUTH (AMENDED)

Figure 2.15
ACTIVITIES SEQUENCE IN CROSS SECTION - EAST/WEST (AMENDED)

Each of the cells would be progressively filled to finished levels so that only a small area of each cell remains to be capped and rehabilitated when emplacement activities commence in the next cell. This approach would ensure that minimum time is taken to cap and rehabilitate each cell, rather than leaving the area to be completed in one exercise. This also reduces the risk of rainfall delaying these works and minimises the generation of leachate.

2.8.3.3 Compaction and Daily Cover

All emplaced waste would be compacted to optimise the use of the cells' airspace. Compaction equipment would comprise a Caterpillar 825H (or similar) to achieve a compaction level of 1 tonne per m^3 of emplaced waste, or greater.

At the completion of each day's waste placement, daily cover would be applied to the exposed waste in order to contain offensive odours, minimise windblown litter and infiltration by stormwater and prevent access to vermin. Daily cover would be drawn from:

i) VENM, ENM (or a DECCW approved alternative material) applied to a depth of at least 150mm;
ii) material processed on site and suitable and approved by DECCW for use as daily cover;
iii) sprayed-on latex or similar types of temporary impermeable membranes; and/or
iv) re-used mining conveyor belt or similar material capable of performing the role of daily cover.

The Proponent would ensure that a stockpile of between 250t and 500t of either materials ~~1~~ i) or ~~2~~ ii) above is maintained close to the active emplacement area. The cover material would be drawn principally from the active extraction area. Any material delivered to site which is suitable for cover material and cannot be recycled would be preferentially used as cover material.

Each day's operations would involve the emplacement of approximately 650t of waste, i.e. assuming average annual input to the emplacement cells of 205 000t. In order to minimise the consumption of airspace, each day's tipping area would be restricted to an area with the typical dimensions of 1.4m batter height, length of 80m and a width of 6m.

The uncovered daily emplacement area would be bunded at all times to ensure any leachate does not enter the stormwater system. The uncovered daily emplacement area would also be either totally covered or reduced in size when rainfall is occurring.

2.8.3.4 Stormwater and Leachate Management

Daily cover comprising VENM, ENM or alternative materials would be placed by the compactor with the finished surface completed with divots from the compactor's sheep feet. If it is deemed necessary to prevent these divots from holding rainwater and increasing the potential for leachate generation, the operator could either roll the daily cover with a smooth drum roller or grade the compacted cover to remove the divots and thereby limit infiltration. It is noteworthy that neither rolling or grading would be required if (iii) or (iv) above are used as daily cover. Run-off from daily cover would then be directed to the stormwater system (provided it has not come into contact with uncovered waste or leachate). This would minimise the generation of leachate by ensuring rainfall infiltration is less than 25% of rainfall (Aquaterra, 2010) for the cells which have not yet been capped and rehabilitated.

2.8.3.5 Litter, Dust and Fire Controls

The most effective way of controlling litter and preventing fire is by the application of daily cover.

Litter would be controlled at the facility by regular clean-up campaigns during windy conditions and through the application of mobile litter fences, trash racks on stormwater flow lines and the collection of all litter on a regular basis.

Dust emissions would be minimised by:

- the progressive rehabilitation of the emplacement cells;
- regular watering of exposed surfaces and highly trafficked areas (with the on-site water truck);
- a fine misting spray of water applied to the areas of the existing perimeter bund walls which are being shaped and partially deconstructed; and
- the suspension of clay/shale extraction and despatch of clay/shale products on days predicted and/or recorded to experience elevated PM_{10} levels, or high temperatures and/or wind speeds.

A fire management plan is documented in Aquaterra (2010).

2.8.4 Leachate Management

Leachate management arising from the waste emplacement cells and de-constructing the existing bund walls containing waste capable of generating leachate would be centred on minimising its generation and ensuring that any leachate generated does not pollute groundwater or surface water. Emphasis would be placed upon the use of evaporation to reduce the volume of leachate generated on site.

Figure 2.9 depicts the leachate drainage network for all emplacement cells. The leachate riser in each cell would have a pump installed which would automatically extract leachate from the cell once the level of leachate around the riser reaches a pre-determined level. The level at which leachate would be automatically extracted would be:

- 0.3m above the floor of each cell where the floor is above the surrounding groundwater table (Final Cell, and possibly Cells 2 and 3); and
- 2m below the groundwater level for Cell 1 (and possibly Cells 2 and 3), to ensure the inward flow of groundwater into these cells. In the case of Cells 2 and 3, this would be applicable if they are excavated at least 2m below the level of the surrounding groundwater table.

The Proponent proposes to commence pumping any leachate generated within Cell 1A directly into the initial leachate evaporation pond which will be constructed and available before waste is emplaceda 25 000L tank positioned near the leachate riser in Cell 1A. The use of the tank would occur during the period between the commencement of waste acceptance and the completion of the Initial Leachate Evaporation Pond, a period when leachate generation is expected to be negligible. Following the completion of the 1223.4ML (30.6ML with freeboard) capacity Initial Leachate Evaporation Pond, leachate would be pumped to the pond during operations in Cells 1 and 2. Following the completion of operations within Cell 1 and 2 and commencement within Cell 3, the ~~12~~24ML (30.6ML with freeboard) capacity Long-Term Evaporation Pond would be constructed and the Initial Leachate Evaporation Pond decommissioned.

Both the Initial and Long-Term Leachate Evaporation Ponds would be lined with 1.0 mm (nominal) HDPE on a rolled subgrade of clay free of protrusions. This composite liner would be installed with strict quality control and accordingly it would leak less than 1150L/ha/day, as required by DECC (Giroud, 1997). Should the level of leachate in the evaporation ponds reach the pond's freeboard, a signal would be sent back to the pumps preventing them from pumping leachate and thereby preventing leachate overflowing from the evaporation ponds and entering the stormwater system.

The pipeline from the risers to the leachate evaporation ponds would also have pressure controls included to prevent leachate being pumped out of the cells if the transfer pipeline has ruptured, again to prevent leachate entering the stormwater system.

It is possible when de-constructing the existing perimeter bund walls which contain some waste, i.e. those in the northeastern, eastern and possibly the southwestern bund walls, that stormwater coming into contact with the waste could contaminate stormwater at concentrations above the ANZECC 2000 95th percentile values. Should this be the case, this water would be managed in the same manner as leachate and this circumstance has been included in the leachate modelling. As a safeguard, all sections of existing bund walls which are being deconstructed and known to contain waste that would generate leachate would have an earthen bund and/or silt fence installed around their lower points to contain run-off from rainfall, before the decision is made on whether the run-off would be managed as stormwater, or leachate.

2.9 EXISTING BUND WALL MANAGEMENT

2.9.1 Existing Bund Walls

It is known that the former owner of the Project Site illegally imported a range of construction and demolition materials and incorporated those materials within sections of the existing bund walls (5m to 19m high) around the perimeter of the Project Site. The Proponent commissioned Douglas Partners Pty Ltd to undertake a drilling program to characterise the materials within the existing perimeter bund walls. A full copy of the in situ waste classification assessment completed by Douglas Partners Pty Ltd is reproduced in full as Part 1 of the *Specialist Consultant Studies Compendium*.

The investigations undertaken by Douglas Partners which were undertaken in May 2009 involved drilling 20 holes through the existing bund walls and the collection and analysis of 60 samples. This level of investigation is recognised to be preliminary in nature, however, has provided the Proponent with a good understanding of the nature and properties of materials that need to be managed throughout the life of the facility.

The results of the analyses were assessed in accordance with the DECC *Waste Classification Guidelines* (July 2009). The guidelines define General Solid Waste to include VENM and C&D waste. However, Douglas Partners (2009) notes that by definition (EPA website) 'Excavated material that has been stored or processed in any way cannot be classified as VENM'.

Therefore, the natural material on site that has been stored in the existing bund walls is referred as ENM.

Based on site observations and laboratory results, Douglas Partners (2009) concluded that the materials within the existing perimeter bund walls are largely general solid waste (non-putrescible) comprising excavated natural material and general building rubble. Asbestos was found embedded in plaster fragments in one sample near the surface of the existing eastern bund wall (within Hole 12 see **Figure 2.6**), slightly above the reporting limit of 0.1g/kg at 0.42g/kg. Material containing this level of asbestos is referred to by Douglas Partners as Special Waste (Asbestos). Douglas Partners also clarify that this material was in fact bound "asbestos containing material" for which less stringent health standards apply. Asbestos was also detected, but below the reporting limit, in six other samples recovered from other bores in the existing eastern bund wall where construction and demolition materials were identified. It is noted that the recently released Western Australian health-related *Guidelines for the Assessment, Remediation and Management of Asbestos* recognise that small but detectable quantities of asbestos can safely occur in materials placed around homes, day care centres, parks and commercial premises.

The Proponent commissioned Douglas Partners to undertake further investigations in the vicinity of Hole 12, at the request of Penrith City Council, to confirm the amount of C&D waste containing levels of asbestos above the reporting limit. The report by Douglas Partners dated 19 July 2010 concluded that "the extent of special waste in the vicinity of Borehole 12 is broadly similar that delineated in the previous report dated 2009".

It is estimated that approximately 900 000t (650 000m^3) of material is incorporated in the existing perimeter bund walls on the Project Site. As a result of the investigation by Douglas Partners, it is estimated that:

- approximately 540 000 tonnes (60%) of the materials comprise ENM originating from Cell 1 within the Project Site;
- approximately 355 000 tonnes (40%) of the materials comprise general solid waste (non-putrescibles) being general builders rubble including largely demolition waste and waste concrete and similar materials; and
- up to 5 000 tonnes (<0.01%) of material comprises special waste (asbestos).

In light of the 2009 and 2010 investigation results compiled by Douglas Partners, the Proponent would consider all C&D wastes that need to be removed from within the vicinity of Hole 12 (**Figure 2.6**) to achieve the required final landform as Special Waste (Asbestos) and therefore dispose those wastes on site in accordance with the procedures related to Special Waste (Asbestos) nominated by the DECCW. Section 2.9.2 further describes the Proponent's plans for the partial de-construction and shaping of the existing perimeter bund walls on the Project Site.

2.9.2 Bund Wall Management

The existing bund walls on the Project Site would require management throughout the life of the Project as:

i) their outer slopes are currently too steep and need to be reduced in angle;

ii) the upper sections of the existing bund walls are visible from elevated residences within The Vines Estate and Orchard Hills;

iii) they are located in places on the footprint of the waste emplacement cells that are planned to be extracted as part of the Project;

iv) they contain C&D waste classified as general solid waste (non-putrescibles) and, in one location, a small quantity of special waste (asbestos); and/or

v) they contain substantial quantities of excavated natural materials (from Cell 1) that could either be transported off site for use as fill materials or used on site for cover materials for the waste emplacement cells.

An important component of the management of the northern and eastern faces (**Figure 2.5**) would be the early completion and landscaping of both faces such that no further earthmoving activities are necessary after the site establishment phase. Only maintenance of the landscaping would be required beyond the site establishment phase. The Proponent has committed to lowering the height of the existing southern and southwestern bund walls to an elevation of 57m AHD to 58m AHD – principally to remove the upper sections of these existing bund walls from the views from residences within The Vines Estate.

The Proponent has also committed to remove the defined special waste (asbestos) from in the vicinity of Hole 12 on the surface of the existing eastern bund wall – **Figure 2.6** and emplace it within Cell 1 within 3 months of the commencement of emplacement activities in Cell 1A.

The Proponent proposes to improve the external visual appearance of the existing bund walls on the northern and eastern sides of the Project Site principally to create the final northern and eastern faces of the final landform during the first 6 months of activities on site, i.e. during the site establishment phase.

The general sequence and type of work on the various existing perimeter bund walls would be as follows.

1. During the site establishment phase, the existing northwestern and northeastern bund walls would be reshaped to create a single continuous landform referred to as the "northern face". The western section of the existing northwestern bund wall would be excavated and reshaped with the excavated material placed on the northern side of the existing northwestern bund wall. Further clay and shale would be excavated from within Cell 1 to create the northern face in the manner recommended by Richard Lamb & Associates i.e. ensuring that the slope does not have an engineered appearance. Rather, variations are provided to gradient and aspect ~~(see **Appendix 4**)~~.

   Figure 2.~~16~~ 16 displays threea representative sections through the northern face recording intended approach to the placement of VENM on the final slopes. At the completion of this earthworks program, the newly created northern face would have an elevation of approximately 55m AHD along its full length. Revegetation of the completed northern face is discussed further in Section 2.14.6.

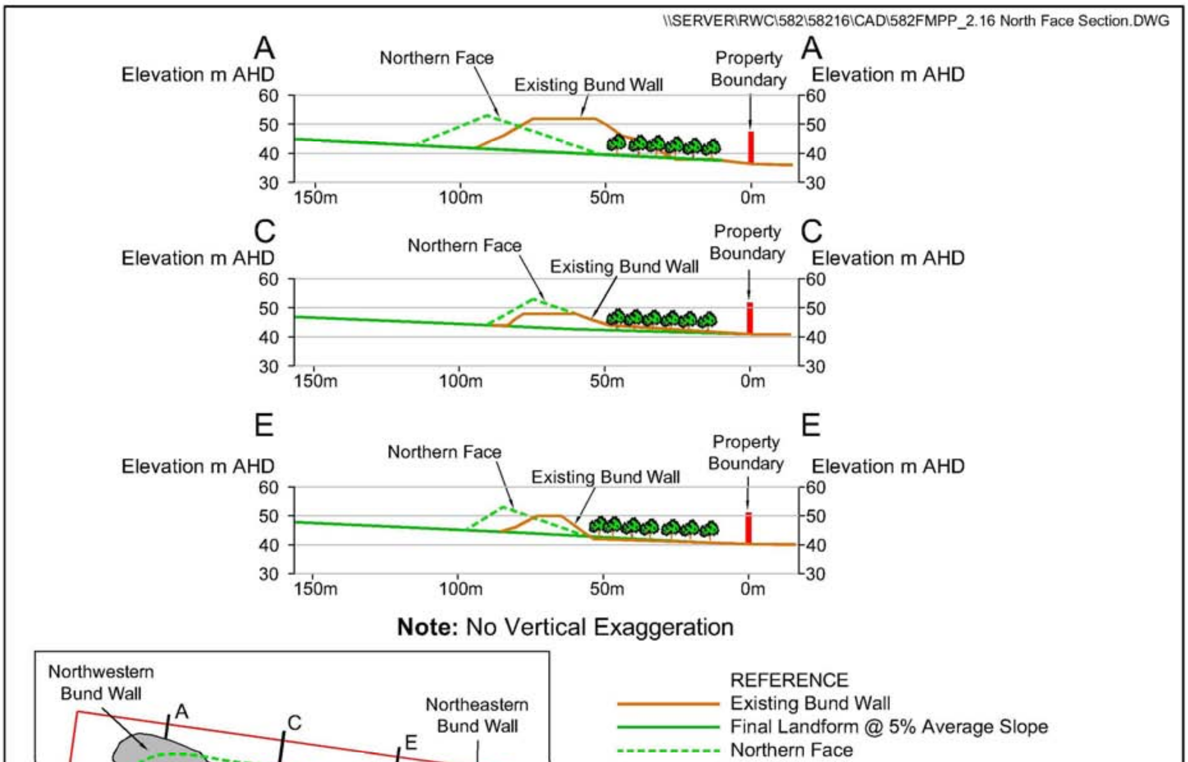


Figure 2.16
NORTHERN FACE TYPICAL SECTIONS (AMENDED)

2. The existing eastern bund wall adjacent to Cell 2 comprises an elevated section set back 10m from the eastern boundary (52m-55m AHD) and a lower area (approximately 50m AHD) within the footprint of Cell 2. The Proponent intends, during the latter stages of the site establishment stage to commence to de-construct the outer steeper face of the existing bund wall to achieve a final slope of ≤1:3 (V:H). The final configuration/presentation of the eastern face would similarly reflect the recommendations of Richard Lamb & Associates. **Figure 2.~~17~~ 17** displays the proposed ~~sequence to create the eastern face~~stage of the eastern face that would be constructed during the site establishment phase. This face would be constructed from compacted clay and would provide long term containment of the remaining C&D wastes.

The Proponent proposes to slightly increase the elevation of the eastern face where it is currently <55m AHD and retain those sections of the existing eastern bund wall adjacent to Cell 3 already at an elevation of 58m AHD. The additional elevation would be achieved through the placement of VENM from Cell 1 to the desired elevation prior to the placement of compacted clay and topsoil. The section of the eastern face adjacent to Cell 3 would ultimately be reduced in height during the rehabilitation of the eastern side of Cell 3. It is proposed to complete the creation of the eastern face within the final two months immediately prior to the completion of the site establishment phase.

3. During the site establishment phase, the Proponent intends to de-construct the bulk of the existing southern and southwestern bund walls. This material would be removed largely using an excavator operating on the surface of the bund wall and casting the material to the base of the wall within the Project Site. This material would be relocated from the base of the bund wall either by registered trucks, for despatch off site, storage within the contingency stockpile area or by on-site haul trucks for use on site for the acoustic mound construction.

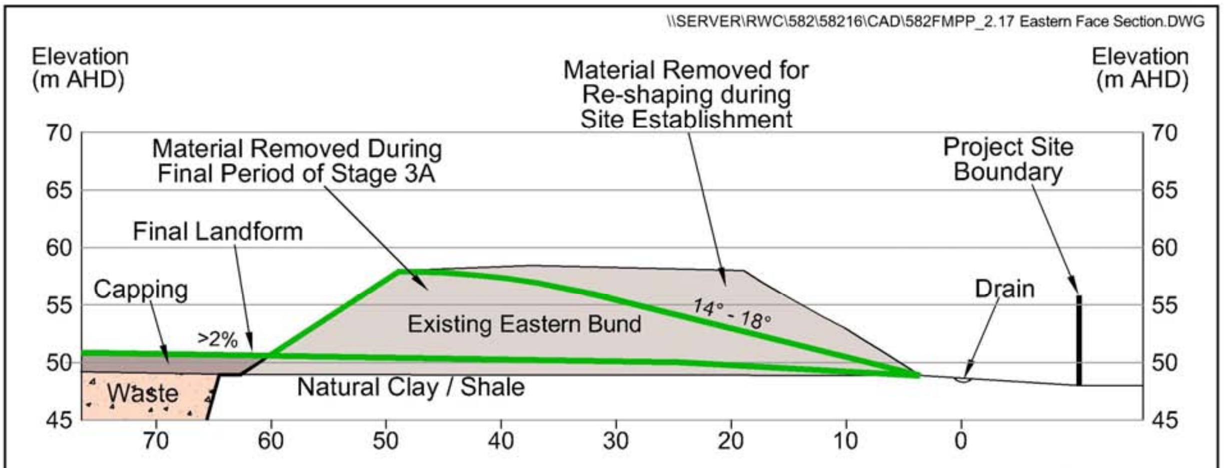


Figure 2.17
INDICATIVE DECONSTRUCTION OF THE EASTERN FACE (AMENDED)

4. For those sections of existing bund walls where construction and demolition wastes are encountered during the re-shaping of the bunds, the Proponent would adopt a procedure to confirm the materials are general solid waste (non putrescible). This material would be loaded into a site haul truck and transported either to a raw feed stockpile area within the recycling and re-processing plant or the active waste emplacement area for burial in conjunction with incoming wastes. Sufficient C&D materials would be removed to allow up to 1m of clay to be placed (and compacted) above the remaining materials to achieve the final landform.

   In addition to the proposed capping layer above the general solid wastes (non putrescible), the bunds are positioned upon 4m to 8m of clay which provides an added level of protection in the event leachate is generated from the C&D waste in the bunds. Furthermore, the groundwater below the bunds moves very slowly and the low point in Cell 1 (and possibly Cells 2 and 3) would act as a sump to draw groundwater into the site.

2.10 PROJECT TRAFFIC AND TRANSPORTATION

2.10.1 Introduction

The location of the Project Site and the nature and origins/destinations of the wastes and clay/shale deliveries dictates that the Project is reliant upon road transportation. This subsection reviews the proposed routes to be used by vehicles travelling to and from the Project Site together with the vehicle types and traffic levels.

It is noted that the upgrading of Patons Lane would be undertaken by the Proponent during the site establishment phase in accordance with the existing development consent and engineering construction certificate already issued by Penrith City Council and approved on 25 February 2005.

Figure 2.18 displays details of a typical section of the overlay pavement along Patons Lane. The sealed width of the road would be 9m, with a 1.5m wide table drain on either side. The two coat 14mm/20mm hot bitumen seal would be supported by 250mm of compacted thickness DGB30 basecourse and 220mm existing sub-base pavement. The upgrade to Patons Lane would be completed prior to the receipt of any waste from or despatch of clay/shale via the external road network.

2.10.2 Transport Routes

Figure 2.19 displays the road network in the vicinity of the Project Site and likely transportation routes. All vehicles would approach the Project Site via Mamre Road, Luddenham Road and Patons Lane. Vehicles travelling to/from the north would likely exit/enter Mamre Road from either the M4 Western Motorway or Great Western Highway. Vehicles travelling to/from the south would enter/exit Mamre Road from Elizabeth Drive and subsequently the Westlink M7.

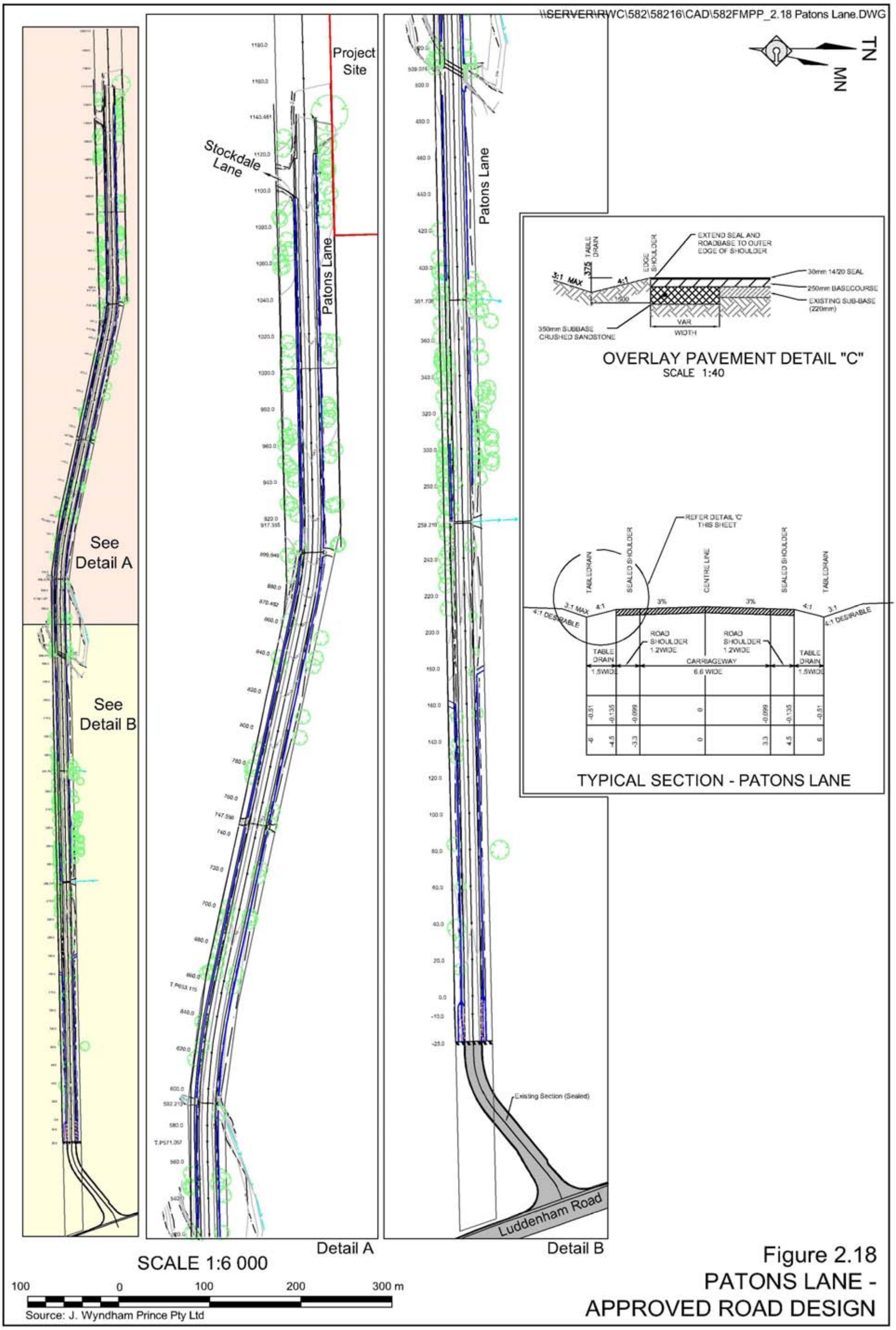
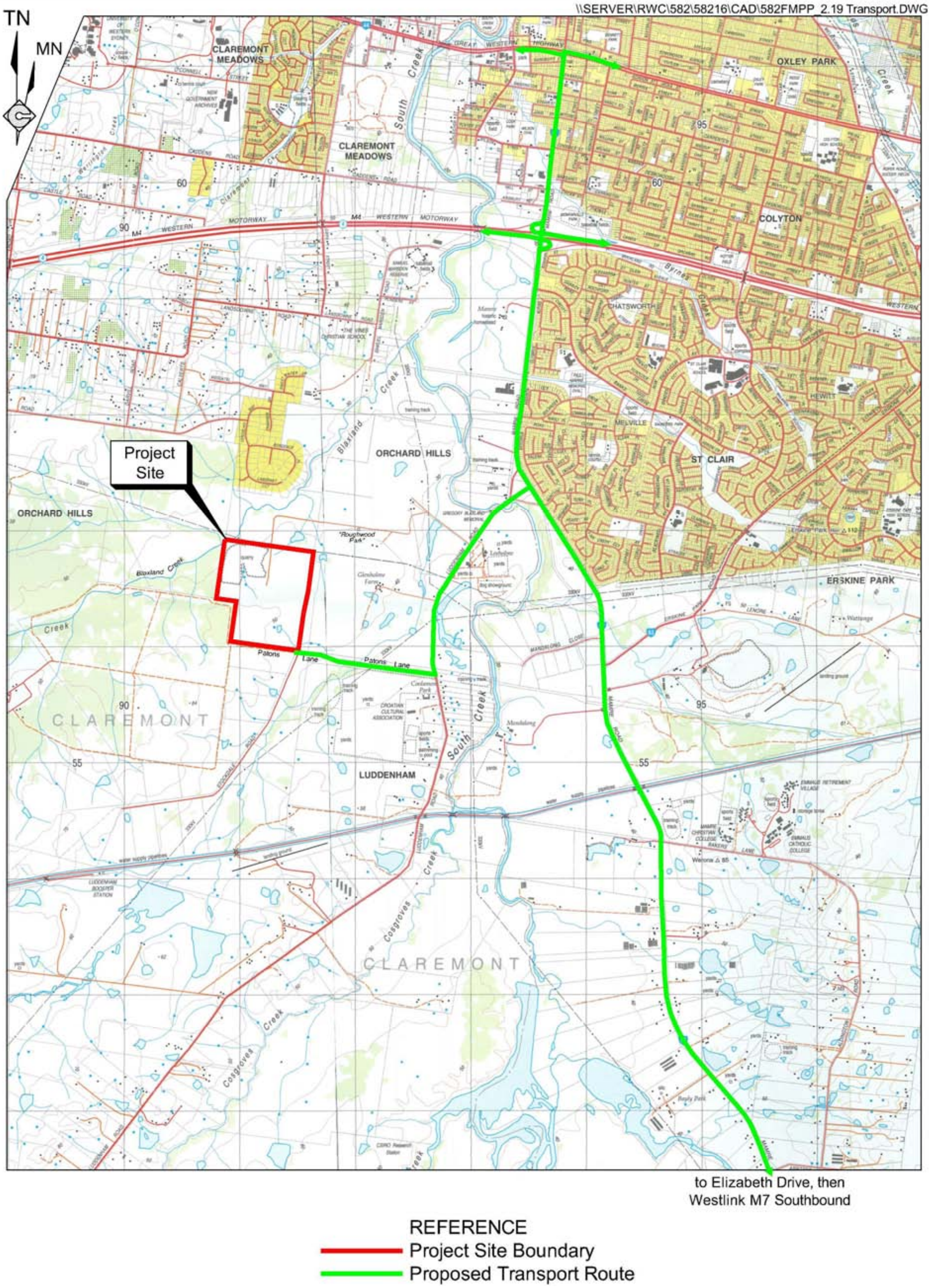


Figure 2.18
PATONS LANE - APPROVED ROAD DESIGN



SCALE 1:50 000

0.5 0 0.5 1.0 1.5 2.0 2.5 km

Base Map Source: Prospect and Penrith 1:25 000 Topographic Maps

Figure 2.19
PROPOSED TRANSPORT ROUTES

Vehicles would not travel on local roads between the Project Site and the M4 Western Motorway or Westlink M7 except when materials are being received from/delivered to those areas.

For planning purposes, the Proponent estimates that 80% of the truck movements to and from the Project Site would occur along Mamre Road northwards whilst the remainder of truck movements would occur along Mamre Road southwards.

2.10.3 Vehicle Types and Traffic Levels

2.10.3.1 Site Establishment

During the site establishment period, a range of goods and equipment would be transported to and from the Project Site. The principal vehicle types would be as follows.

- Low loaders delivering earthmoving equipment (up to 2 loads/4 movements per day for up to 5 days during the site establishment period).
- Table-top trucks or tankers delivering parts/equipment/fuel/drainage material for use on site (up to 4 loads/8 movements per day for 25 days during the site establishment period).
- Tri-axle truck and dog trailers for use in transporting clay/shale from the site for brick manufacture or for the construction industry (up to 20 loads/40 movements per day throughout the period of site establishment after Patons Lane is sealed).
- Light vehicles used by employees, couriers and visitors (up to 25 return vehicle trips (50 movements per day).

2.10.3.2 Operations – Heavy Vehicles

Waste Receipt

Heavy vehicles transporting waste to the Project Site would typically range from two axle rigid trucks including covered open bin vehicles (roll on/roll off) and compactor vehicles, truck and dog trailers, six axle semi-trailers and B-doubles. For the purposes of the assessment of impacts of heavy vehicles delivering waste to the Project Site, two levels of waste deliveries are proposed representing the initial and long term levels of waste deliveries. Only two levels are considered appropriate given the Proponent intends to reach and maintain the upper level within 3 years of commencing operations. Based on an average load of 30 tonnes[1], would generate the heavy vehicle movements listed in **Table 2.~~5~~6**.

[1] Reduced truck movements compared to the Preferred Project Report are proposed given industry advice that it is more appropriate to rely upon an average payload of 30 tonnes per waste truck compared to 20 tonnes as previously provided for.

Table 2.6
Average Daily Heavy Vehicle Movements for Waste Deliveries

Scenario	Annual Waste Deliveries	Average Daily Deliveries	Average Daily Heavy Vehicle Movements*
1	300 000t	1090t	72[1]
2	450 000t	1640t	110[1]
* Assumes receipts on Saturday = 50% weekday quantities			

Clay/shale Despatch

Trucks transporting clay/shale from the Project Site would invariably be truck and dog trailers carrying an average 30t load. For the purposes of the assessments of impacts of heavy vehicles transporting clay/shale from the Project Site, two production levels are proposed representing the likely lower and upper levels of production. Based on an average load of 30 tonnes, would generate the heavy vehicle movements listed in **Table 2.~~6~~7**.

Table 2.7
Average Daily Heavy Vehicle Movements for Clay/Shale Despatch

Scenario	Annual Clay/shale Despatched	Average Daily Clay/shale Despatched	Average Daily Heavy Vehicle Movements@
1	120 000t	480t	32
2	160 000t	660t	44
@ Assumes clay/shale despatched Mondays to Fridays only			

Recycled / Re-processed Product Despatch

The products produced by the recycling and re-processing plant and existing Excavated Natural Material (ENM) from bunds being removed would be despatched from site, with a small proportion as backloads in heavy vehicles carrying an average 30t load. For assessment purposes, two production levels are considered representing the lowest and highest level of production of the recycled and re-processed products. The production levels and their corresponding average daily movements are listed in **Table 2.~~7~~8**.

Table 2.8
Average Daily Heavy Vehicle Movements for Product/ENM Despatch

Scenario	Recycled/Re-processed Products Despatched	Average Daily quantity Despatched	Average Daily Movements#
1	190 000t	690	46
2	245 000t	890	60
# Assumes products despatched on Saturday = 50% weekday quantities			

Cumulative Heavy Vehicle Traffic Movement

In order to establish a realistic cap to place on overall heavy vehicle traffic levels, the average daily heavy vehicle movements listed in **Tables 2.~~5~~ 6** to **2.~~7~~ 8** have been considered collectively. The proposed cumulative heavy vehicle traffic movements presented in **Table 2.~~8~~ 9** do not make any allowance for back loading. Hence, the total movements are considered to be conservative.

Table 2.9
Cumulative Heavy Vehicle Transport Scenarios

Scenario	Waste Deliveries		Extracted Clay/Shale Despatched		Recycled / Re-processed / Stockpiled ENM Products Despatched		Total Truck Movements
	Quantity (t)	Av. Daily Movements	Quantity (t)	Av. Daily Movements	Quantity (t)	Av. Daily Movements	
1	450 000	110~~[1]~~	160 000	44	245 000	60	214
2	300 000	72~~[1]~~	120 000	32	190 000	46	150

Based on the scenarios listed in **Table 2.~~8~~9**, the maximum average heavy vehicle movements for deliveries of wastes to the Project Site or clay/shale and recycled/re-processed products/existing ENM (removed from bunds) from the Project Site would vary from 150 to 214 per day (75 to 107 loads). In reality, whilst these scenarios are based on average levels, above average traffic levels would occur, not necessarily for all three materials on the one day. It is therefore proposed to set a maximum number of heavy vehicle movements at a level of 10% above the average level for Scenario 1 in **Table 2.~~8~~9**, i.e. 236 movements or 118 loads per day.

During the operational life of the facility, there would be periods when low loaders would be used to deliver/remove earthmoving equipment. Other trucks likely to travel to and from the Project Site during operational periods include those delivering fuel, tyres, gravel for leachate drainage, leachate piping, etc. For the purpose of predicting traffic-related impacts, it is anticipated these other trucks would generate up to 7 additional truck loads or 14 additional heavy vehicle movements per day, Monday to Saturday. Hence, the maximum daily heavy vehicle movements would be 250.

It is the Proponent's intention to cap the total number of heavy vehicle movements travelling to and from the Project Site to 250 truck movements or 125 loads per day, irrespective of the type of material carried. This maximum number would accommodate the daily variations of each of the deliveries/despatches referred to in **Table 2.~~8~~9**.

2.10.3.3 Operations – Light Vehicles

The number of light vehicles travelling to and from the Project Site daily would typically vary between 20 and 30 or generating between 40 and 60 light vehicle movements. These movements would be concentrated at the beginning and end of each operational day. Typically, morning and afternoon light vehicle levels would be between 10 and 15 with the remainder spread throughout the remainder of the day. On-site parking for light vehicles would be constructed during the site establishment period, adjacent to the site office (20 spaces) and workshop (5 spaces). The parking adjacent to the office would be provided in two banks of ten spaces on the northern and eastern side of the compound (see **Figure 2.5**).

2.11 PROJECT STAGING, HOURS OF OPERATION AND PROJECT LIFE

2.11.1 Project Staging

The Proponent intends to undertake the site establishment stage in a period of approximately 6 months with the construction of the northern face completed within the first 4 months. The eastern face would be shaped during the final 2 months of the site establishment phase. The recycling and re-processing area would also be profiled and the surrounding earth mound completed during the site establishment phase subject to the availability of the bulldozer. During the first 12 months following site establishment, the Proponent would establish each of the components of the recycling and re-processing area. During that period, the Proponent anticipates receiving at least 200 000tpa of waste increasing up to a level of 300 000tpa by Year 2 and 450 000tpa by Year 3.

Table 2.~~4~~ 5 has set out the estimated years for the respective extraction, filling and capping of each sub-cell across the Project Site. In summary, the indicative periods for the emplacement of wastes in the various cells on site are as follows.

Cell 1:	Years 1 to 7
Cell 2:	Years 8 to ~~11~~14
Cell 3:	Years ~~12~~ 15 to ~~21~~24
Final Cell:	Year~~s~~ ~~22 to 24~~25
Final Rehabilitation:	Year 25

2.11.2 Hours of Operation

During the site establishment phase, all activities would be undertaken during the period from 7:00am to 6:00pm Monday to Friday and 8:00am to 1:00pm on Saturdays, public holidays excluded.

Table 2.~~9~~ 10 records the proposed hours of operation for all activities, public holidays excluded.

Table 2.10
Proposed Hours of Operation

Activity	Monday to Friday	Saturday	Sunday
Site Establishment/Construction	7:00am to 6:00pm	8:00am to 2:00pm	-
Waste Receipts and Recycled Products Despatch	7:00am to 5:00pm	8:00am to 2:00pm	-
Clay/Shale Transportation	7:00am to 6:00pm	8:00am to 2:00pm	-
Extraction Activities	7:00am to 6:00pm	8:00am to 2:00pm	-
Waste Re-processing	7:00am to 6:00pm	8:00am to 2:00pm	-
Waste Emplacement Management	7:00am to 6:00pm	8:00am to 2:00pm	-
Non-audible Maintenance	Anytime	Anytime	Anytime

No trucks travelling to the facility would be permitted to enter Luddenham Road before 7:00am of a weekday or 8:00am of a Saturday.

2.11.3 Project Life

The overall project life of the facility would be a maximum of 25 years.

2.12 EMPLOYMENT

2.12.1 Site Establishment

It is expected that between five and ten persons would be employed by the Proponent during the site establishment stage. A further five persons would be employed by contractors throughout this stage, i.e. on an equivalent full time basis.

2.12.2 Operations

Once fully operational, the Project would directly employ approximately 20 people on a full-time basis. The Project would also provide part-time employment for up to 10 contractors on site.

The Project would also support employment within the western Sydney through flow-on benefits, including the purchase of consumables and spending of employee wages.

2.12.3 Transportation

An estimated 10 to 20 truck drivers would be employed for delivery of clay/shale and recycled/re-processed materials from the site.

2.13 INFRASTRUCTURE, UTILITIES AND SERVICES

2.13.1 Infrastructure

2.13.1.1 Internal Roads

The Proponent would construct a network of internal roads to provide access for off-road haul trucks to transport materials on site (eg. cover material) or road-registered trucks to deliver wastes to the active emplacement area(s). The central road to Cell 1 would be constructed at an elevation of 47mAHD beyond the road diverging to the recycling and re-processing area. This would involve excavation of a cutting up to 3m deep which would assist in reducing noise from trucks travelling to and from the emplacement cells. With the exception of the central road to Cell 1 and the road to the recycling and re-processing area, all internal roads would be unsealed and surfaced and graded, as required, for regular use. Where any internal roads are located close to any steep slopes or directly adjacent to in-ground leachate ponds or dams, a roadside barrier would be constructed to a height at least one half the wheel height of the vehicles travelling on that section of road.

The internal roads would be re-located as required throughout the life of the Project.

2.13.1.2 Wheel Wash Facility

The Proponent would install a wheel wash facility near the site office and approximately 130m from the outgoing weighbridge for all departing road registered trucks. The facility would be fitted with spreader bars, sprays and a recirculating water system.

2.13.1.3 Workshop Area

The Proponent would continue to use the existing workshop area in the northwestern corner of Cell 2 until extraction commences in that area. After that time, a new workshop area would be established ~~near the southeastern corner of the Project Site~~immediately south of the Cell 3 workshop area. The workshop area would comprise a covered work area for earthmoving equipment, one or more containers for equipment and tool storage, storage of diesel, oils and greases, and parking of earthmoving equipment overnight. Access would be provided to allow earthmoving equipment to gain access to the workshop area on its northern side.

2.13.2 Utilities and Services

2.13.2.1 Electricity and Lighting

Currently, no electricity is connected to the site with previous extraction-related activities, offices etc. utilising power from on-site diesel generators. The Proponent has investigated a range of energy sources for electrical power requirements and accordingly proposes the use of the following.

It is proposed that diesel generators would initially continue to provide the necessary power requirements. However, it is proposed that a substation and transformer would be installed on site and three phase electricity connected to provide power for the office and facilities and to operate the recycling and re-processing plant. Initial discussions with energy providers indicate that power could be brought to site from existing lines on Luddenham Road via Patons Lane using overhead lines.

Lighting would be required on site during the period May to August when insufficient daylight is present between 5:00pm and 6:00pm to enable safe operations on site. Lighting would be positioned between the entrance of the Project Site and the site weighbridge and directed towards the centre of the Project Site. Lighting would also be provided in the vicinity of the site office, amenities and parking area and the proposed workshop area (see **Figure 2.5**).

2.13.2.2 Water

Water is currently available on site from the internal sediment dams including the sump of the existing clay/shale extraction area, the existing water storage dam (Dam 1) and a registered groundwater bore (GW 105054). It has been established through the water balance for the Project that the existing water supply should be sufficient to supply both the recycling and re-processing plant and dust control for the extraction operations and waste emplacement activities on the Project Site under normal conditions. The Proponent would lodge an application with the NSW Office of Water to extend the permissible quality of groundwater pumped from the on-site groundwater bore Registration No. GW105054 from 16MLpa to 32MLpa. Once in place, the Proponent would have sufficient water for the entire project life. It is noted that the water currently stored in Dam 1 on site would be more than adequate for all dust suppression activities throughout both the site establishment phase and the first 12 months of operation. Emphasis would be placed upon sourcing water for dust suppression from the on-site sedimentation dams with water drawn from the registered groundwater bore as the final source.

Potable water would be trucked to site, as required, and/or delivered in bottles.

2.13.2.3 Sewage

Sewage treatment is currently achieved using a septic tank system. The septic system would be upgraded as required to accommodate the expected number of employees on site and use by truck drivers.

The availability of sewer has been assessed to be unnecessary to dispose of leachate generated at the site. Aquaterra (2010) has demonstrated that through the implementation of best practice leachate controls the site can dispose of all leachate, via evaporation. Aquaterra concluded that at no time would the Site's leachate storage capacity be exceeded. This modelling is very conservative and monitoring would be undertaken of the actual leachate generation, storage and disposal volumes to demonstrate that the Site would always have into the future sufficient leachate storage and evaporative disposal capacity.

2.13.2.4 Communications

The site currently has telephone lines to operate phones, faxes and internet facilities. Mobile phones would also be utilised together with two-way radios for on-site communications.

2.13.2.5 Fuel

All fuel required for earthmoving equipment either permanently or intermittently on site would be stored and dispensed from a double-skin fuel tank located within the workshop area.

2.14 SAFETY AND SECURITY

2.14.1 Site Security

The entire perimeter of the Project Site is currently fenced with standard stock fencing. Given the surrounding rural properties and the fact that the gates across Patons Lane would remain locked outside of operational hours, this level of fencing is considered sufficient for security purposes. The site would be supervised during operational hours and, in addition to the gate across Patons Lane, a security gate across the Project Site entrance would be locked at all other times.

Limited lighting would be required for security and safety purposes and would be designed to comply with AS 4282 – 1997. Security lighting would result in no significant light overspill.

2.14.2 Visitor Safety

As there would be no delivery of waste to the site by the general public, access to the general public would be very limited. In any event, appropriate signage would be installed throughout the site to ensure both waste delivery vehicles and any visitors remain within nominated areas.

As part of their induction, all on-site employees and contractors would be made aware of potential hazards and risks on-site to both staff and visitors and the appropriate management and safeguard measures required to mitigate these risks.

2.14.3 Staff Safety and Human Health

The Project Site would be operated in accordance with an appropriate occupational health and safety system, including relevant procedures, prepared in accordance with relevant safety legislation. A comprehensive integrated Safety Management Plan relating to all on-site activities would be prepared and comprehensively implemented throughout the life of the Project. Site inductions would be implemented and all staff would receive sufficient training to ensure they can complete their jobs in a safe manner.

2.15 REHABILITATION

2.15.1 Introduction

Successful rehabilitation of the Project Site is one of the Proponent's principal objectives for the overall Project. It is recognised that rehabilitation would need to be progressive to achieve both slope and soil stability and acceptable visual impacts. Progressive rehabilitation of waste emplacement cells would assist in minimising the leachate generation volumes and achieving the oxidation of the limited gases produced.

This subsection reviews the intended final land use for the Project Site which provides the focus for the approach to rehabilitation together with the plans for ultimately decommissioning the site. Specific issues discussed which are relevant to the rehabilitation of the site relate to final landform, rehabilitation during the site establishment phase, design of the emplacement and capping and revegetation of the completed northern and eastern faces. The discussion concludes with a review of the staged approach to rehabilitation and post operational approach to management and monitoring of the site.

The form of the final landform and the approach to the revegetation of the entire site has been established in consultation with Richard Lamb & Associates whose principal focus has been to minimise the visual impacts of the Project both during and following the operational life of the facility. ~~**Appendix 4** presents visual assessment for the Project.~~

2.15.2 Final Land Use

It is intended that the bulk of Project Site would be returned to land suitable for grazing, although selected areas of the Project Site would be revegetated with a range of woodland and riparian species for its ongoing use for nature conservation. Fencing would be provided to protect woodland and riparian vegetation from grazing stock.

The dams retained on site would also provide an opportunity for irrigation of the area developed for grazing.

2.15.3 Site Decommissioning

The operational area for the recycling and re-processing plant would be removed at or near the end of Year 23~~1~~ and site decommissioning would commence following the completion of waste emplacement in ~~the final c~~Cell 3. The final cell would be progressively ~~rehabilitated in the same manner as Cells 1 to 3~~filled with clay/shale.

Once the acceptance of wastes on site ceases, the Proponent would remove the weighbridge and associated infrastructure. It remains the Proponent's intention to retain the on-site offices until the Environment Protection Licence is relinquished. The Long-Term Leachate Evaporation Pond would be retained on site until it is no longer required. Based upon forecasts by Aquaterra (2010), the Long-Term Leachate Evaporation Pond could be decommissioned approximately 8 years after the cessation of waste emplacement activities.

2.15.4 Final Landform

The final landform would result in the creation of a gently sloping grassed knoll with an elevation of approximately 5~~8~~7m AHD (see **Figure 2.20**). This elevation is ~~the same as~~marginally lower than the maximum natural elevation (58m AHD) near the southern boundary of the Project Site. The final landform has been designed in consultation with Richard Lamb & Associates to ensure its form and slopes are appropriate to achieve a visually unobtrusive area beyond the end of the Project life.

Figure 2.4 incorporates a cross-section displaying the comparison between the pre-extraction landform and the proposed landform displayed on **Figure 2.20**. Overall, the final landform would be an average of ~~5~~4m above the pre-extraction landform, with the exception of the recycling and re-processing area where the profile would be lower than the original landform. The final landform (i.e. following decommissioning of required leachate management structures) would incorporate four dams and perimeter diversion banks providing long-term water management and storage.

2.15.5 Design of Emplacement and Rehabilitated Surface

The design of the final cap and rehabilitated surface is detailed in Aquaterra (2010). The role of the capping system is to:

- minimise rainfall infiltration and hence minimise the generation of leachate;
- create a stable landform;
- enable revegetation to grow;
- enable surface run-off from the vegetated surface to be released directly offsite, without entraining unacceptable concentrations of suspended solids; and
- control and oxidise the emission of any gas generated.

In order to fulfil these roles, a multiple layer capping system would be installed.

The design of the capping above the emplacement areas which has either a leachate underdrain system or only VENM has been emplaced has the following layers starting from the bottom to the surface.

- Gas collection layer at set intervals comprising selected C&D waste aggregates, overlaid with a geotextile.
- A seal-bearing layer of ~~up to 1~~300mm of crushed shale.
- A sealing layer of ~~up to~~more than 0.~~6~~3m of clay with a permeability of less than ~~1x 10-8 m/s~~ 1 x 10^{-9}m/s.
- ~~A clay moisture regulating layer of up to 200mm of crushed shale~~A geomembrane layer of thickness greater than 1mm.
- A drainage layer of 300mm with a permeability greater than 1 x 10^{-3}m/s.
- A soil revegetation layer of at least 1m comprising at least 750mm of on-site clay and 250mm of topsoil which may be manufactured from selected incoming waste. Also included in this layer would be a gas distribution layer which would comprise selected C&D waste aggregates and a perforated HDPE pipe.

A schematic section through the capping is displayed on **Figure 2.20**.

The final landform construction and capping operation would be undertaken with recognition that some areas would be elevated requiring only one item of earthmoving equipment to be presents to ensure compliance with the overall noise criteria for the operation. As much activity as possible would be undertaken behind earth mounds, however, these will be progressively spread out as the final landform construction is completed.

Any gas generated would be passively extracted from beneath the seal-bearing layer and directed into the landfill gas drainage layer within the vegetation layer. The methane component of the gas would then be subject to oxidation by naturally occurring bacteria in the revegetation layer, thereby reducing the site's greenhouse impact (Passive Drainage and Biofiltration of Landfill Gas Using Recycled Materials- DEC, 2006).

A research project underway in Australia is the Australian Alternative Capping and Assessment Program. This and other capping studies would be reviewed and may result in changes to the design of the capping works. Any changes to the design of the capping works would be agreed with DECCW, before the works are constructed.

2.15.6 Revegetation

All areas of the final landform would be progressively revegetated soon after the areas are shaped and covered with topsoil.

Revegetation would commence during the site establishment phase principally to stabilise the constructed drainage channels and embankments and the northern and eastern faces. Emphasis would be placed upon rapid stabilisation using hydromulch and a pasture mix with native grass.

Following initial stabilisation, the entire northern face, the nearby riparian zone adjoining Blaxland Creek and the eastern fence would be revegetated with native trees and shrubs, (see **Figure 2.21)**.

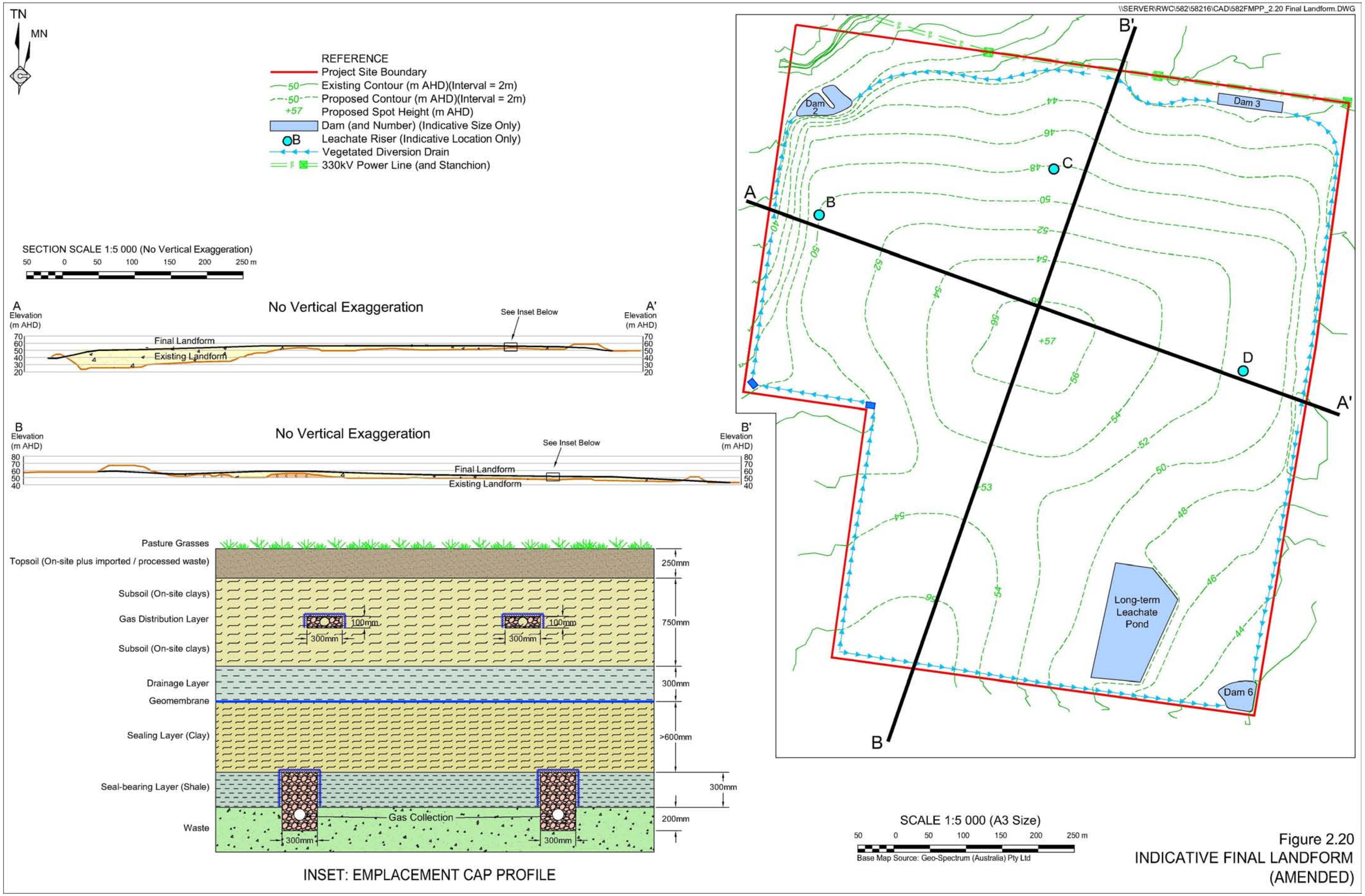


Figure 2.20
INDICATIVE FINAL LANDFORM (AMENDED)

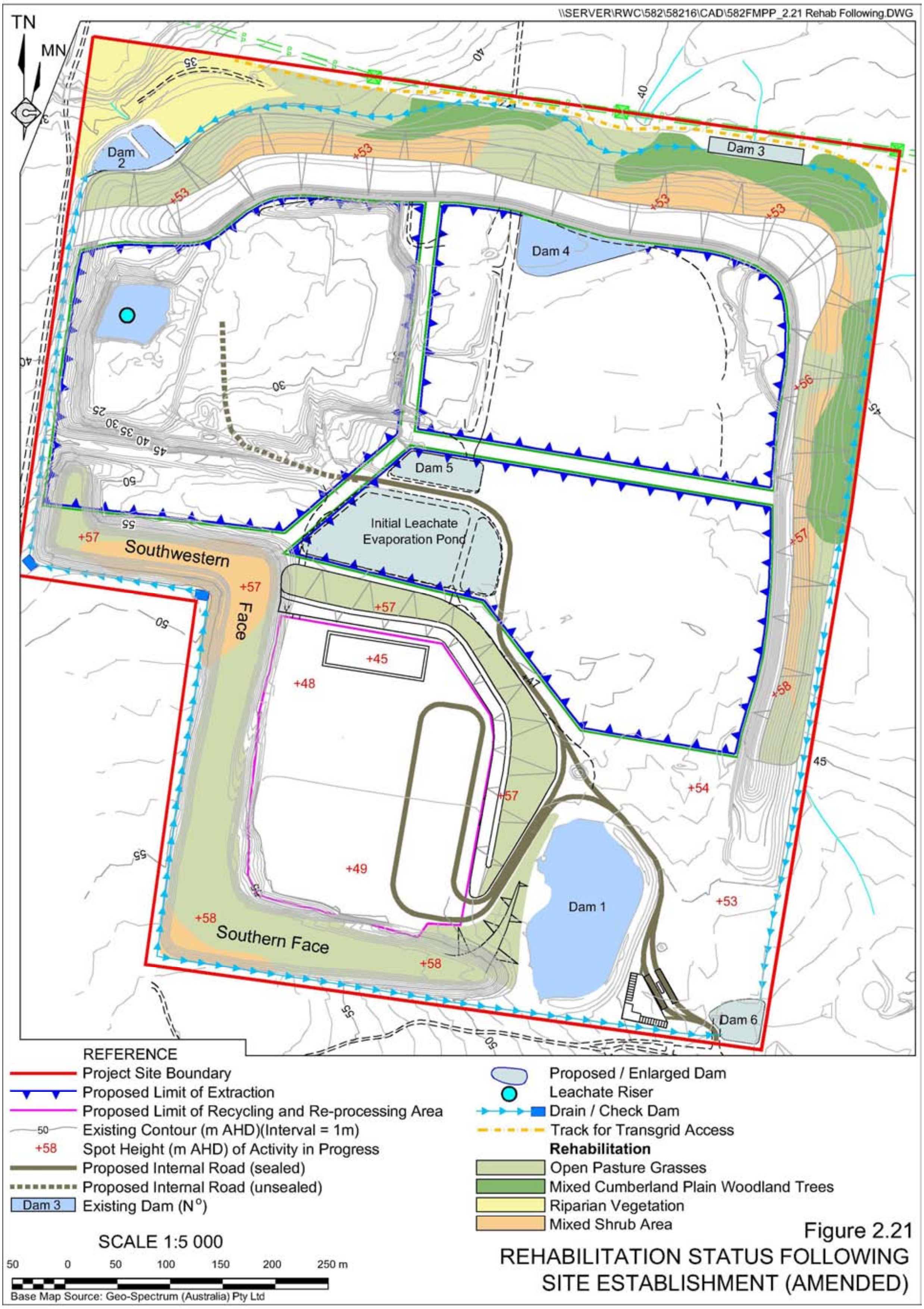


Figure 2.21
REHABILITATION STATUS FOLLOWING SITE ESTABLISHMENT (AMENDED)

Attachment A in **Appendix 3** of the MPPR records the species proposed for use in both the stabilisation and landscaping of the areas completed during the site establishment phase. The vegetation would be planted in drifts and comprise species either consistent with the Cumberland Plain Woodland which is on the adjoining Commonwealth land or riparian vegetation already present adjacent to Blaxland Creek. The various species would be grown using both direct seeding and tubestock. It is noted that the groundcover species nominated in Attachment A of **Appendix 3** would be planted once the tree and shrub growth is well advanced.

The bulk of the final landform across the Project Site would be revegetated with the pasture grass mix and native grasses to enable those areas to be used for grazing long term. Some additional stands of trees would be grown on the final landform, but only in areas where waste has not been emplaced – see **Figure 2.22**.

2.15.7 Staging

Rehabilitation activities would be staged to follow the cessation of waste emplacement in each sub-cell. It is proposed that capping is undertaken when areas of 1ha to 2ha achieve the required height.

2.15.8 Post Operational Management and Monitoring

Following the completion of emplacement activities in each cell, the Proponent would commence post operational management. The principal components of the post operational management would be as follows.

- Capping, revegetation and sediment and erosion control maintenance.
- Leachate and gas management and maintenance.

Typical maintenance works would involve filling any depressions in the capping layer where settlement may occur to ensure that surface water does not pond above the emplaced waste. Also landfill gas bio-oxidation works would be maintained as required, for example, by moisture addition to optimise the oxidation of any methane present.

The Proponent intends to continue its monitoring regime throughout the latter years of the Project life and beyond the closure of the facility. It is proposed to monitor the following.

- Surface and subsurface gas (methane) monitoring.
- Leachate generation, level and disposal monitoring.
- Surface and groundwater monitoring.
- Vegetation status monitoring.
- Settlement monitoring of the capping to ensure that the design grades are maintained.

The monitoring data collected on site would be reviewed annually in conjunction with the Annual Return for the site's environment protection licences to ensure it remains meaningful. Any appropriate adjustments would be discussed with the DECCW.

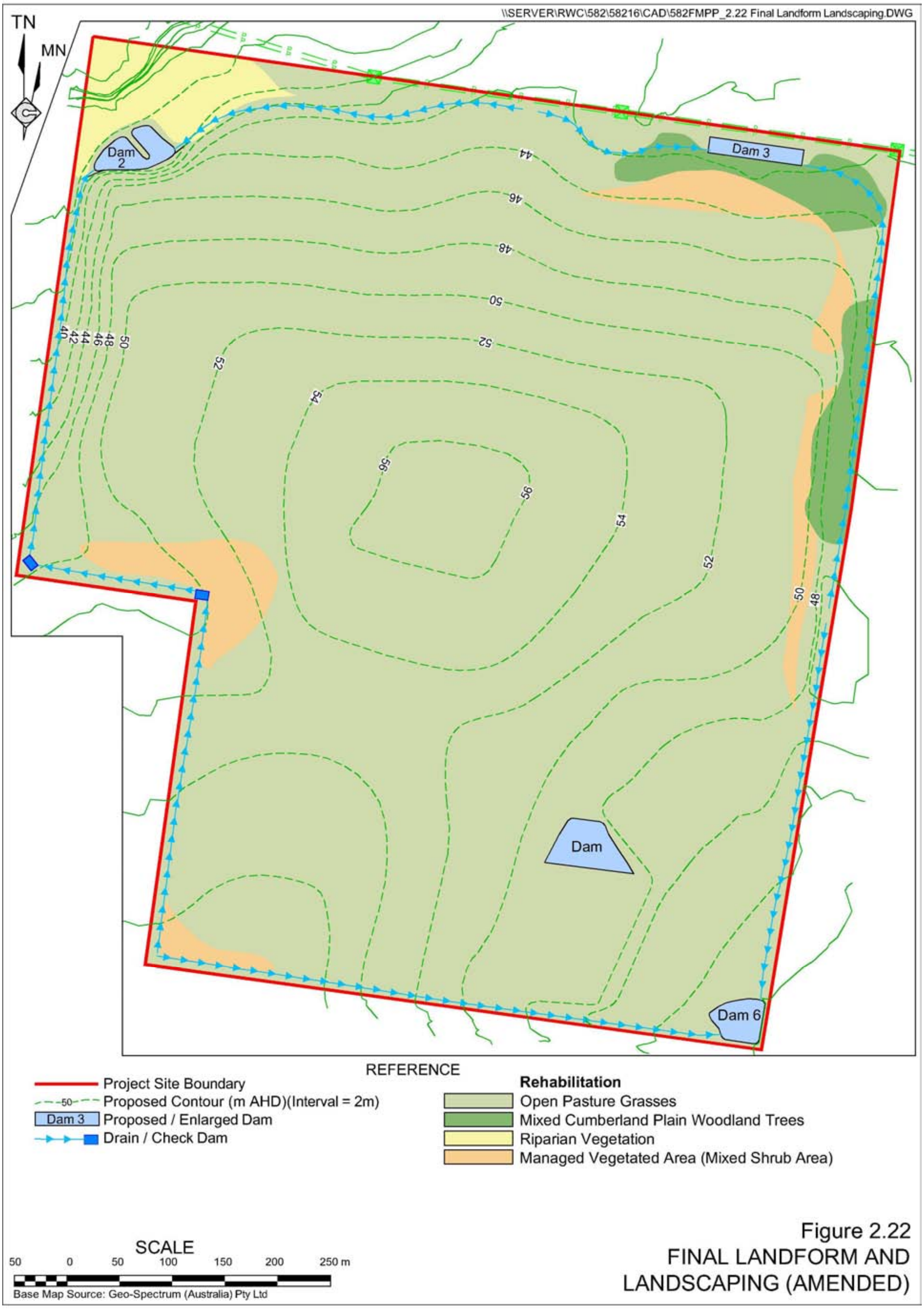


Figure 2.22
FINAL LANDFORM AND LANDSCAPING (AMENDED)

2.16 REFERENCES

Aquaterra Consulting Pty Ltd (2010). *Cell Design and Groundwater Assessment*, prepared on behalf of Dellara Pty Ltd (Part 2 of the Specialist Consultants Studies Compendium).

DEC (2006). Passive *Drainage and Biofiltration of Landfill Gas Using Recycled Materials*.

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Dupen, P. (1993). Landfills *in Brickpits – A Virtue of Necessity*, Proc of Conf on Geotechnical Management of Wastes and Contamination, ed Fell, et al.

EPA, 1996. *Environmental Guidelines: Solid Waste Landfills.*

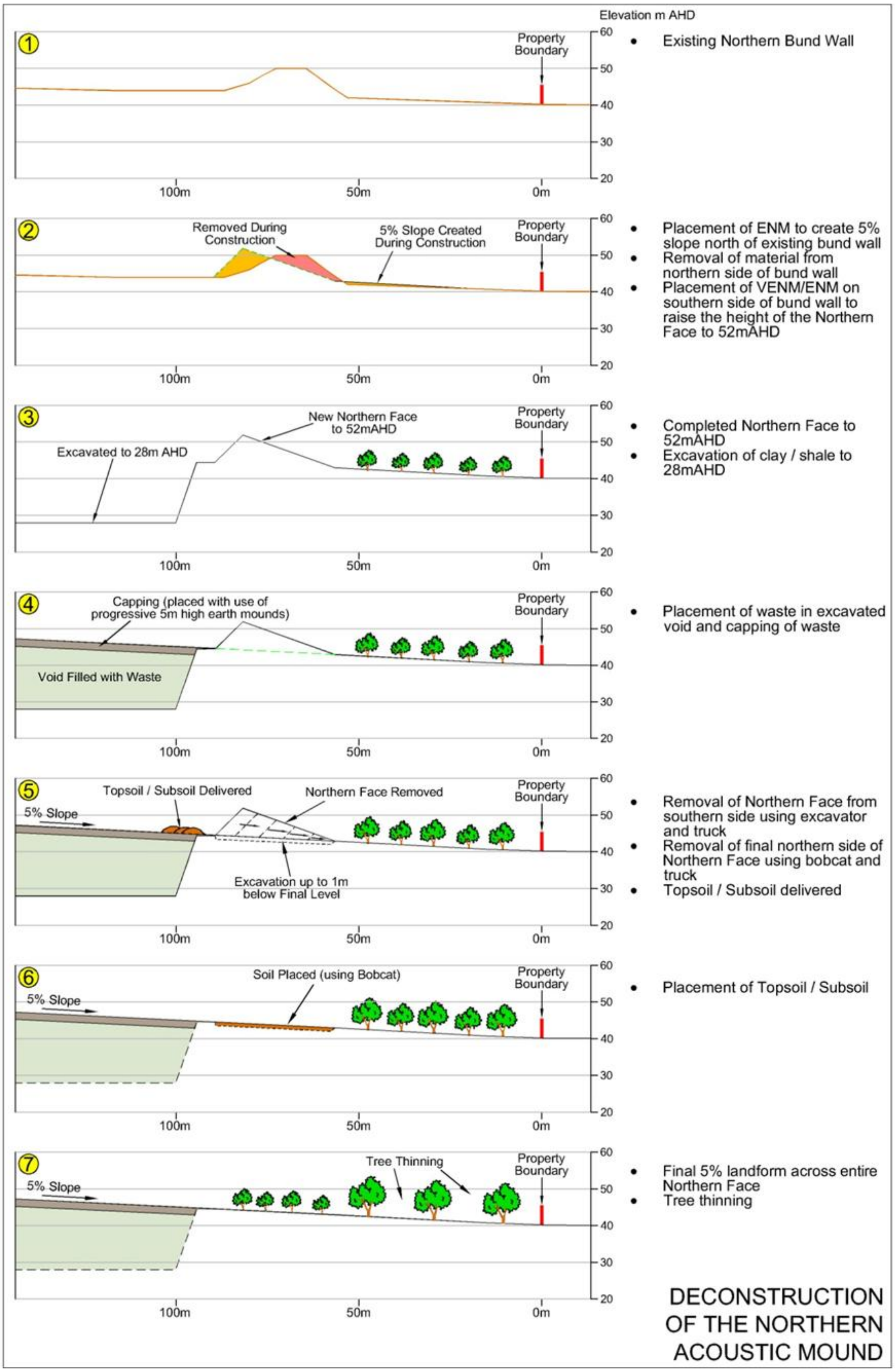
Giroud JP. *Equations for Calculating the Rate of Liquid Migration Through Composite Liners Due to Geomembrane Defects, Geosynthetics International*, Vol 4, Nos. 3-4 pp.335-348, 1997.

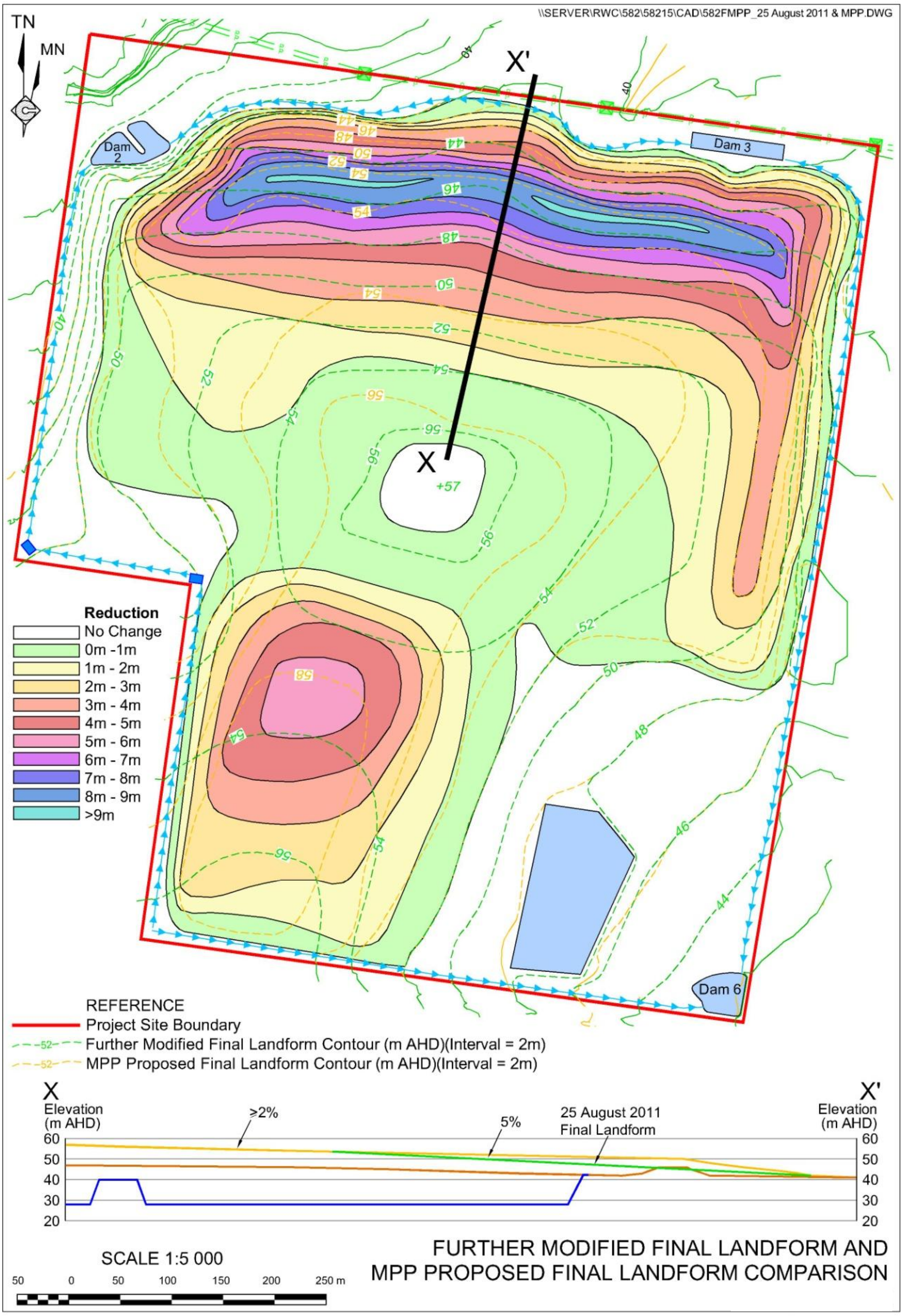
Herbert, C. 1979. *The Geology and Resource Potential of the Wianamatte Group* – Geological Survey of New South Wales – Bulletin 25. 203p.

Mike Ritchie & Associates (2010) *"Recycling/Resource Recovery Capacity"* – Supporting Information for the Response to Submissions dated 30 July 2010 prepared for Dellara Pty Ltd.

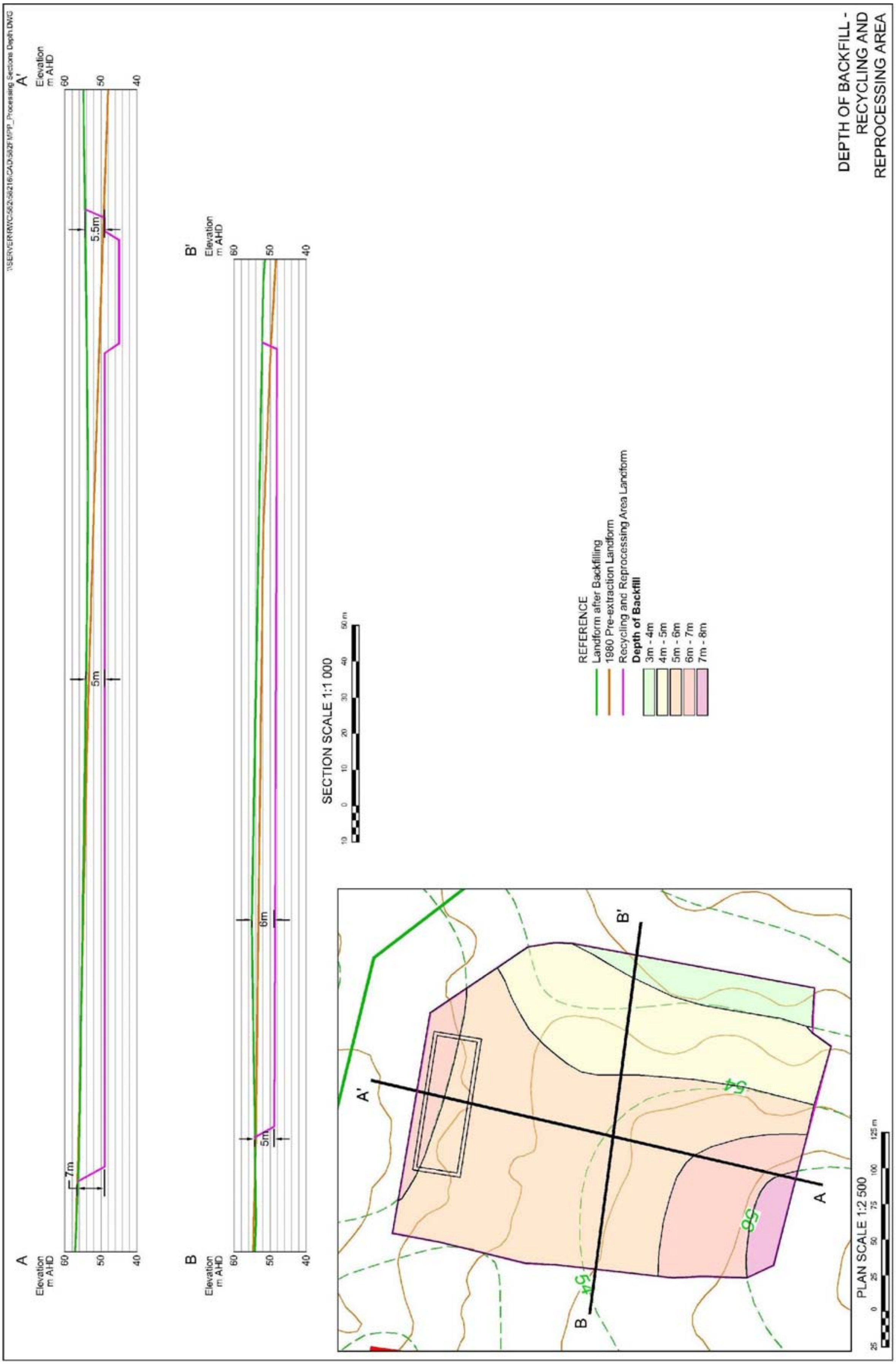
Appendix A

Additional figures not in the FMPPR


Elevation m AHD
1
Property Boundary
Existing Northern Bund Wall
2
Removed During Construction
5% Slope Created During Construction
Property Boundary
Placement of ENM to create 5% slope north of existing bund wall
Removal of material from northern side of bund wall
Placement of VENM/ENM on southern side of bund wall to raise the height of the Northern Face to 52mAHD
3
New Northern Face to 52mAHD
Excavated to 28m AHD
Property Boundary
Completed Northern Face to 52mAHD
Excavation of clay / shale to 28mAHD
4
Capping (placed with use of progressive 5m high earth mounds)
Void Filled with Waste
Property Boundary
Placement of waste in excavated void and capping of waste
5
Topsoil / Subsoil Delivered
Northern Face Removed
5% Slope
Excavation up to 1m below Final Level
Property Boundary
Removal of Northern Face from southern side using excavator and truck
Removal of final northern side of Northern Face using bobcat and truck
Topsoil / Subsoil delivered
6
Soil Placed (using Bobcat)
5% Slope
Property Boundary
Placement of Topsoil / Subsoil
7
Tree Thinning
5% Slope
Property Boundary
Final 5% landform across entire Northern Face
Tree thinning
100m
50m
0m
60
50
40
30
20
DECONSTRUCTION OF THE NORTHERN ACOUSTIC MOUND



FURTHER MODIFIED FINAL LANDFORM AND MPP PROPOSED FINAL LANDFORM COMPARISON


DEPTH OF BACKFILL - RECYCLING AND REPROCESSING AREA
REFERENCE
Landform after Backfilling
1980 Pre-extraction Landform
Recycling and Reprocessing Area Landform
Depth of Backfill
3m - 4m
4m - 5m
5m - 6m
6m - 7m
7m - 8m
SECTION SCALE 1:1 000
PLAN SCALE 1:2 500
A
A'
B
B'
Elevation m AHD
5.5m
5m
7m
6m
5m