D17-279726

Attention Sherry Hopkins

Dear Sherry

Please see enclosed letter to PPV.

Regards

Tom Allcott

with our compliments

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D17-279726

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1 September 2017

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Email: planning.panels@delwp.vic.gov.au.

Planning Panels Victoria
Attn: The Panel Coordinator
Level 5, 1 Spring Street,
Melbourne VIC 3000

Your reference: **Our reference:** 2849696

Dear Panel Coordinator

Monash Planning Scheme Amendment C129
Land: 1221-1249 Centre Road, Oakleigh South

We act for Sterling Global in relation to the above matter.

We refer to the Panel Directions letter dated 17 August 2017 and, in particular, the information requested to be provided by the Proponent, Sterling Global, in directions 6, 7 and 8. Our response to each of these directions is detailed below.

1 **Panel Direction 6 - The Proponent is to provide to the Planning Panels Office and other parties to the Hearing, hard copies of the Work Plan which accompanied the Work Authority for the sand extraction.**

1.1 A copy of the Work Plan which accompanied Work Authority 389 is enclosed with this letter.

1.2 We note that Work Authority 389 was varied on 20 December 2001 to excise the majority of the site from the Work Authority Area, with the exception of Zone 4. A copy of the variation of the Work Plan is also enclosed.

2 **Panel Direction 7 - The Proponent is to provide written definitions for Site Environmental Strategy Plan, Site Environmental Assessment and Site Remediation Plan.**

2.1 We provide written definitions for the terms 'Site Environmental Strategy Plan' (**SESP**) and 'Environmental Site Assessment' (**ESA**) below. We assume that the reference to 'Site Remediation Plan' in the Panel's directions is a reference to a 'Site Remediation Strategy Plan' (**SRSP**). As discussed below, the intended function of the SESP is the same as a SRSP, with minor differences.

Site Environmental Strategy Plan/Site Remediation Strategy Plan **(SESP/SRSP)**

2.2 The function of a SESP/SRSP is to demonstrate that, based on known issues and investigation techniques, a site is highly likely to be capable of being remediated so that it is suitable for the proposed use and/or development.

2.3 The *Potentially Contaminated Land Advisory Committee Report* (**AC Report**) considered that a SRSP was an appropriate means for planning authorities to satisfy themselves that contamination can be managed.

2.4 The AC Report provides a description of a SRSP as follows (at p 46):

> *'A Site Remediation Strategy Plan is a broad overview of the realistic options available and the preferred remedial approach to carry out clean up of the site to ensure suitability of use. It is usually based on site history and some preliminary site assessment.*
>
> *...*
>
> *The primary role of the Site Remediation Strategy Plan would be for a land owner to convince a council that a clean up of the site is feasible.*
>
> *A Site Remediation Strategy Plan should not be confused with a Clean Up Plan (otherwise known as a Remediation Action Plan), or an engineering design of remediation work. Such documents are much more detailed and provided specific contaminant treatment procedures, quantities of work, actions, schedules, clean up criteria and validation procedures. Such documents would usually be prepared at a later stage, closer to the time of site remediation work taking place.*
>
> *The Site Remediation Strategy Plan should attempt to demonstrate with a reasonable degree of confidence that the site is capable of being remediated. Such a conclusion would typically be based on the assumption that further site sampling, or health risk assessments, or feasibility studies of remediation processes need to be conducted at a later stage.*
>
> *An auditor would not be able to confirm prior to the remediation process that a statement or certificate will be issued following future remediation, only that it is likely.'*

2.5 The primary role of a SRSP is to give a Responsible Authority, or a Panel, a high level of surety that, in circumstances where an audit is deferred, clean-up of a site is feasible, having regard to the proposed uses. In the current circumstances, the SESP is intended to provide this surety at both the Planning Scheme Amendment stage and, as contemplated under the draft CDZ Schedule, before the issue of any planning permit for the use of the land.

2.6 The SESP has the same content and function (subject to a minor difference, discussed below) as an SRSP.

2.7 A SESP/SRSP is a strategy plan which is completed before an ESA is undertaken. The conclusions drawn in a SESP/SRSP are based on site history, preliminary site assessments and known remediation techniques and options, having regard to the proposed use.

2.8 Importantly, those conclusions are typically based on an assumption or understanding that further site sampling to satisfy the requirements of an audit will need to be conducted at a later stage.

2.9 The draft CDZ Schedule circulated to the Panel on Friday, 11 August 2017 contemplates that additional information provided and/or conclusions drawn as a result of the completion of an ESA may result in the need to update the SESP/SRSP. The CDZ Schedule provides for this by requiring an auditor to ensure that the SESP/SRSP and ESA are consistent before a permit for each stage can be granted.

2.10 The SESP that has been prepared for the site (the *Huntingdale Estate Site Environmental Strategy Plan*) is based on the content requirements of the SRSP for the Amcor site in Alphington. However, rather than including the options for remediation within the SRSP, as was the case for the Amcor site, a separate Remediation Options Report (**ROR**) was prepared for the Huntingdale site, a copy of which is enclosed. The strategy plan for the site was named a SESP, rather than an SRSP, in order to avoid confusion with the ROR. For the sake of completeness, a copy of Development Plan Overlay – Schedule 11 in the *Yarra Planning Scheme*, which applies to the Amcor site and which details the content requirements for the SRSP to be prepared for that site, is enclosed.

Environmental Site Assessment

2.11 The purpose of an Environmental Site Assessment (**ESA**) is to provide:

(1) the Responsible Authority with a completed assessment regarding the suitability of the site, or a part of the site, for a sensitive use, having regard to all investigation data required to satisfy the requirements of an audit; and

(2) the Environmental Auditor with information on the contamination status of the site, or a part of the site, and the consequent implications for the suitability of the site for its intended use. This will ultimately allow the Auditor to complete an Environmental Audit and issue a Statement or Certificate of Environmental Audit.

2.12 An ESA may apply to the entirety of a site, or to a portion of a site. There may be multiple ESAs performed, as each ESA may concentrate on a different aspect of contamination, for example groundwater, landfill gas etc.

2.13 In an ESA, assessment is made of the levels of contamination present, compared to criteria that are linked to possible site uses. ESAs are required to be undertaken in accordance with the '*National Environmental Protection [Assessment of Site Contamination] Measure*' (**NEPM**). The ESA may include advice on clean up or management requirements that could be implemented to make the site suitable for a range of uses.

2.14 While in the current circumstances it is intended that the SESP be a document that is updated iteratively following the completion of an ESA, it would not be appropriate for an ESA to be similarly updated on an iterative basis. Once an ESA report is completed, it will be submitted to the Environmental Auditor for review and assessment to enable the completion of the audit.

3 **Panel Direction 8 - The Proponent is to supply any plans referred to in the Oakleigh Planning Scheme Planning Permit, dated 1 May 1989**

3.1 Planning Permit No. 4731 dated 1 May 1989 refers to a 'Site Layout Plan'. A copy of the Site Layout Plan is enclosed.

3.2 Please contact Rory O'Connor on (03) 8686 6068 should you require any further information.

Yours faithfully

Rory O'Connor
Special Counsel
Norton Rose Fulbright Australia
Partner: Sally Macindoe

D17-279726

Primary School

ASHBROOK CT

KAYBROOK CT

REDPATH CL

HARDY CT

COONIL ST

ALVINA ST

120 M

130 M

95 M

STREET

SINCLAIR

RESIDENCE

TALBOT AVENUE

GATE (EXISTING)

Scouts

Workshop Operation

W/SHOP

W/SHOP

PLANT

FOUNDRY SAND PLANT

OFFICE W/BRIDGE

Foundry Operation

ZONING: PREVIOUS IL/HC

ZONING: FOS

Davies Reserve

X

X'

NEW BUND (SEE DETAIL)

ZONING: IN 1/2

Water Storage

ZONING: TP2/3

ZONING: IN1

Talbot Park (Reclaimed Land).

Rehabilitation

OCTOBER '93

- COMMENCE DRAINING
- COMMENCE CAPPING WITH CLEAN FILL TO ORIGINAL GROUND LEVELS
- SURFACE COVERED WITH 750mm SOIL INCL 100mm TOPSOIL LAYER.

Existing E.I.L. 44-1

EXISTING FENCE

Existing E.I.L. 1322

EXISTING GATES

ZONING: IN1

Extraction Complete 1993.

1993 TO 2014

- PROGRESSIVE BACKFILLING (SOUTH TOWARDS NORTH) WITH CLEAN FILL.

30 M

Existing E.I.L. 44-1

Existing Water Storage

- REMAINS FOR FOUNDRY OPERATION.
- SURFACE AREA INCREASED

Existing Water Storage

- PROGRESSIVELY BACKFILLED

Aged Centre

CENTRE ROAD

HUNTINGDALE ROAD

GATE (EXISTING)

ELDER ST

EULINGA RD

CRAWFORD RD

Primary School

NEW TREE

NEW TREE

EXISTING TREES TO REMAIN

GRASS TO MOWABLE FINISH

750mm SOIL INCL 100mm TOPSOIL SURFACE GRASS FINISH

NEW BUND (SEE DETAIL)

20 M

4 M

NEW CLEAN FILL (CURRENTLY IN PROGRESS)

CLEAN FILL CONTINUES

EXTRA FILL (IF APPROVED)

Section x-x'
East Boundary 1:100

LEGEND

- = EXISTING TREES BEYOND THE SUBJECT SITE
- = EXISTING TREES TO REMAIN
- = NEW TREES (INDIGENOUS SPECIES) TO BE PLANTED
- = EXISTING BUND (1.5 M H)
- = EXISTING WATER SPRAY JET
- = EXISTING 15 M BUFFER ZONE
- = REHABILITATION: FILL TO ACHIEVE ORIGINAL GROUND LEVELS & GRASSED (NO PLANT WORKS OR STOCKPILES). FINISH TO BE SLASHED MINIMUM 5 X PER YEAR.
- = CURRENT ZONING: CITY OF OAKLEIGH PLANNING SCHEME

PROPOSED WORKS
SAND OPERATION: OAKLEIGH
TALBOT AVE, SOUTH OAKLEIGH
PIONEER CONCRETE (VIC) P/L. PO BOX 2806 1183 TOORAK RD HAWTHORN 3123

Work Plan Approved
28 SEP 1998
Signed pursuant to Instrument of Delegation dated 1-7-1996

carol frank-mas & associates
Landscape Architects

DATE 11-93
DRAWN DC JE
SCALE 1:1000
DRAWING NO 1533/3

D17-279726

Extractive Industries Development Act 1995

VARIATION OF WORK AUTHORITY
(Section 22)

WORK AUTHORITY NUMBER: 389

HOLDER OF WORK AUTHORITY: Pioneer Construction Materials Pty Ltd

SUBJECT: Excision

LOCATION: Oakeigh, Ringwood Map Sheet

AREA: 6.58 Hectares

RESPONSIBLE AUTHORITY: City of Monash

RECOMMENDATION:

Extractive Industry Work Authority No. 389 is varied as shown in the attached plan.

Signed by

GEORGE BUCKLAND
Manager, Mineral and Extractive Tenements
Delegate of the Minister.

Date: 20/12/01

D17-279726

Natural Resources and Environment
AGRICULTURE
RESOURCES
CONSERVATION
LAND MANAGEMENT

EXTRACTIVE INDUSTRIES DEVELOPMENT ACT 1995

WORK AUTHORITY No. 389

PLAN OF AREA

ISSUED TO: Pioneer Construction Materials Pty Ltd

MUNICIPALITY OF Monash City
PARISH OF Mordialloc

TOTAL AREA ± 18.66 Hectares
NET AREA ± 6.58 Hectares

Excised Land

Private Land - Sold No Depth Restriction

ALL MEASUREMENTS ARE IN METRES

Checked Julie Prenc

Date 23/11/2001

Record plan Ringwood

D17-279726

REMEDIATION OPTIONS REPORT 1221 TO 1249 CENTRE ROAD, & 22 TALBOT AVENUE, OAKLEIGH SOUTH, VIC

Prepared for:

Talbot Road Finance Pty Ltd
c/- Sinclair Brook
Level 1, 460 Bourke Street
Melbourne, VIC 3000

Report Date: 27 May 2014

Project Ref: ENAUABTF00751AA

Written/Submitted by:

Nick Woodford
Risk Assessor

Written/Submitted by:

Stephen Cambridge
Senior Associate
Environmental Engineer

Reviewed/Approved by:

Phil Sinclair
Principal

RECORD OF DISTRIBUTION

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1	ENAUABTF00751_R04a.doc	Draft	13 September 2013	Coffey Environments Australia Pty Ltd	SC
1	ENAUABTF00751_R04.doc	Final	3 December 2013	Talbot Road Finance Pty Ltd c/o Sinclair Brook Pty Ltd	PM
1	ENAUABTF00751_R04.doc	Final	3 December 2013	Coffey Environments Australia Pty Ltd	PM

CONTENTS

LIST OF ATTACHMENTS

Tables in Report

Appendices

ABBREVIATIONS

AHD	Australian Height Datum
Bgs	below ground surface
BH	Borehole
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
ESA	Environmental Site Assessment
MW	Monitoring Well
NEHF	National Environmental Health Forum
NEPM	National Environment Protection Measure
NSW EPA	Environment Protection Authority of New South Wales
OCP	Organochlorine Pesticide
OPP	Organophosphorous Pesticide
PAH	Polycyclic Aromatic Hydrocarbon
ppmv	parts per million by volume
RL	Reduced Level
SB	Soil Bore
SOP	Standard Operating Procedures
SWL	Static Water Level
TDS	Total Dissolved Solid
TOC	Top of Casing

EXECUTIVE SUMMARY

Coffey Environments Australia Pty Ltd (Coffey) was engaged by Talbot Road Finance Pty Ltd (Talbot Road Finance) to prepare a Remediation Options Report for the land located at 1221 to 1249 Centre Road, Oakleigh South, Victoria (the site). The site location is shown on Figure 1 (Appendix A).

The site has been nominally divided into five separate zones; designated Zones 1 to 5, which we note generally represent various former quarry pits or operational areas. An additional quarry area is present off-site immediately to the south east in what is now Talbot Park and is owned by Monash City Council. The current site condition and features are shown on **Figure 2 (Appendix A).**

A Remediation Options Analysis has been undertaken, based on the site development objectives and landuse Masterplans 1 to 3 (**Appendix B**).

The following preferred remediation concept solutions are recommended for the site.

Soil Remediation Preferred Option:

1. Conduct soil sampling of existing stockpiles and assess geotechnical and environmental suitability for reuse as backfill in Zone 4 or elsewhere on site;
2. Conduct soil sampling across the site to fill in data gaps and assess suitability of soil to remain in current location, or alternatively for reuse in Zone 4. Soil sampling would be conducted to a depth 3 m beyond the final design surface level.
3. Where soil is not suitable for use in the top 3 m of soil at the site, or for reuse within the quarry void, the following remedial options would be assessed (based on the type and concentration of contamination present):
    a. Remediate soil on site and reuse. Options would include sieving out aesthetically unacceptable material (such as bricks, concrete etc); bioremediation of organic contamination, or fixation of inorganic contamination (such as metals).
    b. Dispose of unsuitable material off-site to a licensed landfill.

Landfill Gas Remediation Preferred Option:

1. Capping areas of gas producing waste with a 1m low permeability clay cap; and
2. Installation of boundary venting system consisting of either gravel filled vertical shafts and/or lineal gravel filled trenches around the perimeter of the areas of gas producing waste; and
3. Installation of gas protection membranes or venting voids beneath buildings constructed over gas producing waste; and
4. Construction of underground utility trenches (eg stormwater, sewers, communications, electrical, gas) within high permeability backfill material.

Groundwater Remediation Preferred Option:

1. Capping areas of gas producing waste with a 1m low permeability clay cap. This will limit the infiltration of surface waters into the landfill mass, and reduce the contaminant flux; and
2. Conduct mass flux modelling and calculate the assimilative capacity of the aquifer; and

3. Implement a monitored natural attenuation program including monitoring bore network, and contingency plans where action levels for groundwater contamination are exceeded (such as unacceptable levels of nitrate moving off-site in groundwater); and
4. Include contingency measures into the remedial solution, such as an interception trench and bores for conducting active remediation if required. Further consideration of appropriate remedial measures would be conducted as part of detailed design, however this may include utilising the geotechnical drainage layers for the Zone 4 quarry void.

Quarry Surface Water Remediation Preferred Option:

The quarry water in Zone 4 will need to be removed to allow backfilling. Options for disposal of this water include:

- Option 1: irrigation of Huntingdale Golf Course.
- Option 2: disposal to stormwater offsite.
- Option 3: disposal to sewer under a Trade Waste Agreement.
- Option 4: use as dust suppressant during earthworks onsite.

Each of these options is potentially viable, depending upon the quality of the water at the time of disposal. Surface water sampling conducted in July 2013 indicated that the surface water quality is suitable for irrigation purposes. Further assessment prior to, and during dewatering, would be required to determine the preferred disposal option(s).

Quarry Sediment Remediation Preferred Option:

The following Options are presented, subject to further assessment of sediment quality:

- Option 1: reuse on site as part of Zone 4 backfilling, providing the soil contaminants do not represent a risk to groundwater and meet the geotechnical requirements.
- Option 2: off-site disposal.
- Option 3: on-site remediation and reuse

Limited data is currently available on the sediment quality and quantity within the quarry void, therefore the preferred remedial solution cannot be presented at this time.

Post Development Considerations

Following implementation of the remedial measures and site development, there is likely to be requirements for various stakeholders to implement on-going management and maintenance. These post development considerations include defining roles and responsibilities, implementing maintenance and monitoring regimes, and executing binding agreements related to on-going responsibilities and mechanisms for future site infrastructure changes.

Recommendations

It is recommended that the remedial options presented are discussed with other stakeholders, designers, and the appointed Environmental Auditor, to ensure that the options meet the project objectives. Further site characterisation will then be required to address environmental data gaps across the site. Following this further characterisation works, a reassessment of the remedial options would be required to test the assumptions. Once the final remedial solutions are adopted, detailed design, in conjunction with the architectural, civil and geotechnical designers can be completed.

1 INTRODUCTION

1.1 Background

Coffey Environments Australia Pty Ltd (Coffey) was engaged by Talbot Road Finance Pty Ltd (Talbot Road Finance) to prepare a Remediation Options Report for the land located at 1221 to 1249 Centre Road, Oakleigh South, Victoria (the site). The site location is shown on **Figure 1** (**Appendix A**).

The site is located at Talbot Avenue, Oakleigh and was formerly used for a range of landuses including poultry, market gardens, sand quarrying in several pits, landfilling, foundry sand production, and concrete batching. Over the years all but one of the quarry pits has been backfilled with uncontrolled fill (including landfill) and/or soft clay slimes (silts left over from sand washing operations).

The site has been nominally divided into five separate zones; designated Zones 1 to 5, which we note generally represent various former quarry pits or operational areas. An additional quarry area is present off-site immediately to the south east in what is now Talbot Park and is owned by Monash City Council. The current site condition and features are shown on **Figure 2 (Appendix A).**

Coffey understand that the Landowner intends to redevelop the site as a master planned residential development, consisting predominantly of medium density dwellings, and that high density (apartments), retail and mixed use components will also be considered as part of the overall master plan. Concepts for the development master plan are shown in **Appendix B**.

The site is subject to an Environmental Audit Overlay and the investigations conducted by Coffey will be used to assess the potential for the rehabilitation and development of the site and to support a Certificate or Statement of Environmental Audit to be issued by a third party independent Auditor.

1.2 Objectives

The objectives of this report are to:

- Develop broad remedial goals based on the proposed site use, geotechnical limitations and regulatory requirements;
- Develop conceptual designs for one or more preferred remediation method(s).
- Conduct an initial feasibility screening of each remediation option, and present the benefits and limitations of each option.

The remediation options and conceptual designs are intended to be used as a basis for discussion with project stakeholders, such as EPA and Monash City Council, and as a platform for overall master-planning of the site redevelopment.

1.3 Scope of Works

Coffey has undertaken the following scope of works in preparing this report:

- Assessment of remediation options through the use of a screening matrix taking into consideration:
  - Probability of achieving the agreed end-point;
  - Timing/duration of works;
  - Likelihood of meeting operational and logistical goals;

  - Regulatory compliance;
  - Ongoing management/monitoring requirements;
  - Financial costs (capital, operating, ongoing);
- Assessment of the data in light of the preferred remediation option(s) to refine data gap analysis.

The works have been undertaken in accordance with Coffey proposal dated 24 May 2013.

2 SITE DESCRIPTION

A detailed site description, including a Conceptual Site Model is included in the Issues Summary Report (Coffey, 31 July 2013). A full description of the site condition, issues and data gaps is not included in this Remediation Options Report, however the following summary of the zones is provided in reference to the remediation options presented in this report:

2.1 Zone 1- (North western portion of the site)

Zone 1 comprises a former sand pit that has been used as landfill. Based on boreholes drilled in previous environmental investigations, the subsurface conditions within Zone 1 generally comprise uncontrolled fill and landfill materials extending to depths of up to 18m. The landfill appears to be capped with un-engineered fill between 1-5m in thickness.

Based on aerial photos of the site, landfilling was completed between 1970 and 1974. Information from EPA Victoria indicates that approximately 535,000 m^3 of solid inert and putrescible waste was accepted during its operation as a municipal landfill. Gas measurements taken within this area indicate that the landfill continues to produce some landfill gas; however, the generation rates are likely to be reduced somewhat, due to the landfill being in the later stages of its gas generation lifecycle. A preliminary risk assessment conducted by Coffey (Issues Summary Report, July 2013), resulted in a low gas risk classification for the site, due to low gas flow rates.

Leachate from the former landfill has the potential to impact upon the beneficial uses of groundwater beneath the site.

2.2 Zone 4 (South western portion of site)

Zone 4 comprises an open former quarry pit understood to be about 15m deep. Backfilling was commenced in the north east portion of the pit using soil stockpiled in Zone 1; some existing bunds, clay slimes and water are also present within parts of the pit. Recent surface water quality testing, as detailed in the Issues Summary Report (Coffey, July 2013), indicated that the surface water is suitable for irrigation purposes, however further assessment is needed to determine its suitability for other disposal options. Previous investigations have identified some contamination issues with the sediment within this quarry void.

Dewatering of the pit occurred for several years with the water being used for irrigation on the neighbouring golf course. This has caused a groundwater depression in this area and although the dewatering activities have ceased, the groundwater depression remains. The quarry pit is proposed to be backfilled with engineered fill under Level 1 Geotechnical supervision, with soil quality required to meet the quality specified in the Site Backfill Protocol (Coffey, 12 August 2013).

Due to the boundaries of Zone 4 adjoining the boundaries of areas previously backfilled with putrescible waste (ie Talbot Park, Zone 1 and possibly Zone 2), consideration of gas protection measures for Zone 4 northern and eastern boundaries is required. In addition consideration of groundwater protection measures or remedial measures for the Zone 4 northern boundary is required due to the former landfill in Zone 1.

2.3 Zones 2, 3, and 5 - (Eastern portion of the site)

Zones 2 and 3 comprise former sand pits that have been backfilled with remnant slimes from the former sand mining operations. Slimes are a waste product generated when the fine sand, clay and silt fractions are washed from natural sands during sand mining operations. Typically, the slimes are stored in a saturated state in former quarry pits, and comprise very soft clays and silts and very loose sands. The slimes are highly compressible, with in-situ moisture contents higher than their liquid limit, giving the slimes fluid properties.

Based on previous investigations the subsurface conditions within Zones 2 and 3 generally comprise a 1m to 4m thick soil cover over slimes up to about 20m deep, but may extend deeper elsewhere.

It is noted that the western portion of Zone 5 formerly supported the plant used as part of the sand mining operations, and such mining operations and slimes are more limited in this area. Uncontrolled fill up to 9m thick does exist within the western portion of Zone 5.

Based on circumstantial evidence, including the presence of methane gas within the northern part of Zone 2, there is potential for methane generating waste to also be present in Zone 2, although it appears that it is likely to be more limited than in Zone 1 and Talbot Park.

2.4 Talbot Park (South of Zone 2)

Although Talbot Park is not part of the site boundaries, the ground conditions in Talbot Park are relevant to the development of the site due to historical landfill in this area. Talbot Park is located to the south of Zone 2, which is underlain by a former municipal landfill. Information from EPA Victoria indicates that approximately 136,000m^3 of solid inert and putrescible waste was accepted during its operation before it closed sometime between 1977 and 1978.

Previous landfill gas monitoring at Talbot Park in 2009 and 2010 indicate that the site was still producing methane. Similar to the landfill in Zone 1 the generation rates are likely to be reducing with the landfill being in the latter stage of its lifecycle.

Groundwater flow from Talbot Park is currently inferred to discharge to the quarry void in Zone 4, however it is predicted that following backfill of Zone 4, that groundwater flow is likely to resume a flow direction to the south or south-west, therefore leachate generated from Talbot Park would be unlikely to have a significant impact on the Zone 4 part of the site.

2.5 Proposed Development Plans

Three options for development of the site have prepared by the site architects. These proposed development plans are included in **Appendix B**. The options include a mixture of residential landuse with some retail space considered as part of Option 2 Masterplan. The residential landuse includes a mixture of single storey, terrace, townhouses and larger lots, with an allotment size range from 93 m^2 to 321 m^2. The Masterplan options also include layouts for roads, carparks and stormwater retention areas.

The soil quality criteria adopted for the site is dependent upon the type of final landuse implemented and is primarily related to the access to soil. For soil with minimal access (such as apartments) less stringent criteria to soil quality are applied.

3 ISSUES SUMMARY AND DATA GAPS

A full description of the environmental issues and data gaps is presented in the Issues Summary Report (Coffey, 31 July 2013). A summary of the key environmental issues is presented as follows.

- **Soil**: due to the historical placement of uncontrolled fill material across the site, including stockpiled materials, there is potential for that soil quality in all zones does not meet the site acceptance criteria. Surface soils (generally the top 2 m of soil), must be suitable for the proposed development in those areas, unless access to the soil is restricted (eg a carpark of apartment complex with no gardens). A further consideration with respect to soil contamination is whether the contamination represents a risk to other beneficial uses of the site, including groundwater. Presently, data gaps exist in the understanding of soil quality across the site.
- **Landfill Gas**: historical filling of Zone 1, Talbot Park (offsite) and potentially Zone 2 with putrescible wastes has result in the product of landfill gases, including methane and carbon dioxide. The presence and migration of this gas, and the future gas generating potential of the wastes, need to be considered as part of the site redevelopment for future occupiers and users of the site, and for adjacent land occupiers and receptors. A preliminary risk assessment conducted by Coffey (Issues Summary Report, July 2013), resulted in a low gas risk classification for the site, due to low gas flow rates which is likely to be due to the age of the waste mass. Data gaps exist in the understanding of the gas generation within the centre of Zone 1 (which cannot currently be accessed), and the source of the methane concentrations measured in Zone 2 (ie Talbot Park source of Zone 2 source).
- **Groundwater**: groundwater contamination is generally characterised by ammonia and nitrate, likely to be due to the landfilling activities in Zone 1 and Talbot Park. In addition TPH and benzene have been reported in groundwater in Zone 1 monitoring bores, and toluene in Zone 4 adjacent to Talbot Park. Ammonia and nitrate is also present in other areas of the site, which is likely to be due to lateral migration of contaminated groundwater into other zones of the site, although at lower concentrations. Concentrations of mercury above the adopted criteria for maintenance of ecosystems were also reported near the western boundary of Zone 2. Other metals, with the possible exception of lead and cadmium, are considered to be naturally occurring. The downgradient groundwater conditions are unknown at this time, due to groundwater from the site primarily discharging to the Zone 4 quarry void surface water, and the absence of downgradient groundwater bores.
- **Surface Water Conditions:** recent surface water sampling conducted in 2013 (Coffey) identified concentrations were below the adopted guidelines (ANZECC 2000 – Primary Industry - Irrigation). Earlier investigations by AMAL (2002) reported leachate flowing from the northern wall of the quarry (from Zone 1), therefore this may have previously impacted the surface water quality within the quarry water. Further assessment of the data is required to assess alternative off-site disposal options including discharge to stormwater or sewer.
- **Sediment**: sediments samples collected from the bottom of the quarry lake (AMAL, 2002), indicated the presence of mercury, arsenic and organo-chlorine pesticides. A comprehensive understanding of the sediment quality is not currently available.

A summary of the key environmental issues is included in **Table 3** below.

Table 1 – Summary of Environmental Issues

	Environmental Media	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Environmental Issues Identified	Soil	Assessment of suitability of existing surface soils (top 2 to 3 metres), and current stockpiles is required to determine suitability for future residential dwellings	As for Zone 1	As for Zone 1	Backfilling of quarry void required	As for Zone 1
	Landfill Gas	Landfill gas generation from Zone 1 former landfilled waste may affect future occupiers in Zone 1, Zone 3, Zone 4, and offsite receptors to the north and west	There is some circumstantial evidence that landfilling of Zone 2 with gas generating waste may have occurred. Therefore, landfill gas generation from Zone 2 may affect future occupiers in Zone 4, Zone 5 and receptors to the east. Talbot Park former landfill waste may be causing landfill gas to migrate from Talbot Park into Zone 2.	It does not appear that landfill gas is being generated from Zone 3, however landfill gas may migrate from the adjacent Zone 1 into Zone 3.	Landfill gas may migrate from Zone 1 into the northern part of Zone 4, or from Zone 2 and Talbot Park into the eastern side of Zone 4.	Landfill gas may migrate from Zone 1 into the western part of Zone 5, or from Zone 2 into the southern part of Zone 5.
	Groundwater	Groundwater contamination from the former landfill is present in Zone 1. Groundwater is currently discharging to the Zone 4 quarry lake, however once this quarry void is backfilled, groundwater is likely to move off-site to the south or south-west. A Clean Up To Extent Practical (CUTEP) submission is likely to be required for Zone 1 as a source area.	Groundwater contamination is present in Zone 2, which may be due to former filling of Zone 2 with uncontrolled fill. Groundwater is currently discharging to the Zone 4 quarry lake, however once this quarry void is backfilled, groundwater is likely to move off-site to the south or south-west. CUTEP may be required for Zone 2, if this is identified as a groundwater contamination source area.	Some relatively low level groundwater contamination is present in Zone 3, however based on current data; this Zone does not appear to be a source of significant groundwater contamination.	Once the current quarry void is backfilled, contaminated groundwater from Zone 1 may migrate in groundwater under Zone 4. Contaminated groundwater from Zone 2 and Talbot Park may also migrate in groundwater under Zone 4, once the quarry void is backfilled and groundwater levels stabilise.	Some relatively low level groundwater contamination is present in Zone 5, however based on current data; this Zone does not appear to be a source of significant groundwater contamination.
	Sediment and Surface Water	No current issues identified.	No current issues identified.	No current issues identified.	Surface water and sediment within the current quarry void would need to be removed to allow backfilling.	No current issues identified.

4 REMEDIATION OPTIONS ANALYSIS

This section presents the remediation goals and objectives, as well as a summary of the remediation options considered. A detailed analysis of each remediation options for landfill gas and groundwater is presented in **Appendix C**.

4.1 Remediation Goals

The broad remediation goals associated with the site development are summarised as follows:

- Provide a final soil quality that is suitable for the proposed landuse, and does not represent an ongoing risk to groundwater.
- Ensure that landfill gas remedial measures are protective of future occupiers of the site, such as residents, and future users of the site, such as subsurface maintenance workers, whilst also being protective of off-site receptors.
- Implement groundwater remedial measures that are protective of the likely beneficial uses of groundwater.
- Ensure sediment and surface water is of suitable quality to be retained/reused on site or disposed offsite in accordance with applicable regulations.
- All remediation options adopted need to be:
    - be protective of future occupants of the site into the future,
    - practical and cost effective to implement,
    - have low ongoing maintenance and operating requirements;
    - compliant with regulatory requirements.

4.2 Summary of Remediation Options

A summary of the remediation options considered is presented in **Table 4** below and **Figures 3 to 8** attached. The remedial options are presented on the figures as follows:

- **Figures 3 to 5**: these figures show the architectural Masterplan layouts with three different landuse development strategies. Coffey has overlaid the remediation options for landfill gas mitigation and for leachate remediation on to these figures, to show the spatial extent of the potential remedial options relevant to landfill gas and leachate from the Zone 1 landfill.
- **Figure 6A**: shows the conceptual design for Zone 1 for landfill gas remediation Option 1 (removal of landfill waste); and Option 2 (an area wide gas sub-surface gas barrier combined with a clay cap and boundary venting system).
- **Figure 6B**: shows the conceptual design for Zone 1 for landfill gas remediation Option 3 (gas barrier void beneath individual buildings combined with a clay cap and boundary venting system); and Option 4 (gas membrane and venting layer beneath individual buildings combined with a clay cap and boundary venting system).
- **Figure 7A**: shows the conceptual design for Zone 4 for landfill leachate remediation Option 1 (groundwater interception bores with extraction and treatment).

- **Figure 7B**: shows the conceptual design for Zone 4 for landfill leachate remediation Option 2 (groundwater reactive barrier).
- **Figure 8**: shows all of the conceptual design options for Zone 2 for landfill gas remediation.

The specific remediation options for soil remediation cannot be specifically shown on the Figures, however Figures 6A to 7B do show the requirement for the top 3 m (approximately) of soil to meet the soil quality criteria adopted for the site.

It should also be noted that the preferred groundwater (leachate) remedial option, as described in Section 4.3.3, of monitored natural attenuation with source control, is difficult to represent graphically, and hence is not shown on the figures.

Table 2 – Summary of Remedial Options

	Environmental Media	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Conceptual Remedial Solutions	Soil (Options not shown on Figures)	**Option 1**: Undertake a quantitative risk assessment to determine soil suitability to remain on site or to be disposed of off-site.	As for Zone 1	As for Zone 1	Backfilling of quarry void in Zone 4 to be conducted in accordance with the Backfill Protocol (Coffey, 2013). There may be opportunity for reuse of soils from other Zones (including stockpiles and insitu soils) in the Zone 4 quarry void at depths greater than 2 m, providing the soil contaminants do not represent a risk to groundwater and meet the geotechnical requirements.	As for Zone 1
		Option 2: Use as backfill at depth in Zone 4 and import suitable soil for Zone 1.				
		Option 3: Remediate or manage soils *insitu* (method depends on contaminant type)				
		Option 4: Dispose off-site and import suitable soil for Zone 1.				
	Landfill Gas	**Option 1 (see Figure 6A)**: Source removal of landfill waste from the former landfill (excavate and offsite disposal).	As for Zone 1. Boundary gas protection measures will also prevent the migration of landfill gas from Talbot Park into Zone 2.	Gas protection measures for Zone 1 would alleviate the need for gas protection in Zone 3	Gas protection measures for Zone 1, Zone 2 and Talbot Park western boundary would alleviate the need for gas protection in Zone 4	Gas protection measures for Zone 1 and Zone 2 would alleviate the need for gas protection in Zone 5
		Option 2 (see Figure 6A for Zone 1 and Figure 8 for Zone 2) • Installation of a clay cap and HDPE liner above the waste • Installation of a gas venting system below the liner with a water collection sump to ensure the venting layer does not become saturated • Installation of a boundary venting system to prevent off-site migration.				
		Option 3 (see Figure 6B for Zone 1 and Figure 8 for Zone 2) • Installation of a clay cap above the waste • Installation of a taped and sealed membrane and venting system consisting of a clear void with air brick vents beneath each building • Installation of a boundary venting system to prevent off-site migration.				
		Option 4 (see Figure 6B for Zone 1 and Figure 8 for Zone 2) • Installation of a clay cap above the waste • Installation of a proprietary gas resistant membrane and venting system consisting of a gravel layer with inlet and outlet risers beneath each building • Installation of a boundary venting system to prevent off-site migration.				

	Environmental Media	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Conceptual Remedial Solutions	Groundwater	**Option 1 Option 2 (See Figure 7A)**: Pump and treatment of contaminated groundwater. This could be conducted in the source zone of landfilled waste of Zone 1, or down-gradient of Zone 1. If conducted down-gradient of Zone 1, this could involve installation of groundwater extraction wells or sump(s) into the geotechnical drainage layer at the base of Zone 4 quarry void. The extracted groundwater may then need to be treated before disposing off-site or on-site, or reinjected into the ground. **Option 2 (See Figure 7B)**: Insitu remediation, such as installing a reactive permeable barrier between Zone 1 and 4 which would remediate the groundwater contamination as it moves through the vertical in-ground barrier. This would result in groundwater contamination remaining within Zone 1, however with treated groundwater exiting Zone 1, into Zone 4. **Option 3 (Not shown on Figures)**: Monitored natural attenuation. No active remediation implemented. This approach relies on natural processes to degrade contaminants and the implementation of an attenuation zone near the landfill source where groundwater contamination would remain.	As for Zone 1, however it is noted that Talbot Park is located down-gradient of Zone 2, therefore active remediation of groundwater in Zone 2 may have little net environmental benefit as it is likely to be re-contaminated as it passes under Talbot Park.	Based on the current data, remediation of groundwater is not required.	Once Zone 4 is backfilled, groundwater levels and flow directions are likely to stabilise over time. Pending remediation of groundwater in Zone 1, and stabilisation of groundwater flow directions across the site, no groundwater remediation would be required for Zone 4.	Based on the current data, remediation of groundwater is not required.
	Surface Water	No remediation required.	No remediation required.	No remediation required.	The following Options are presented for disposal of the existing quarry void water, subject to further assessment of water quality suitability: • Option 1: irrigation of Huntingdale Golf Course. • Option 2: disposal to stormwater offsite. • Option 3: disposal to sewer under a Trade Waste Agreement. • Option 4: use as dust suppressant during earthworks onsite.	No remediation required.
	Sediment	No remediation required.	No remediation required.	No remediation required.	The following Options are presented, subject to further assessment of sediment quality: • Option 1: reuse on site as part of Zone 4 backfilling, providing the soil contaminants do not represent a risk to groundwater and meet the geotechnical requirements. • Option 2: off-site disposal.	No remediation required.

	Environmental Media	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
					• Option 3: on-site remediation and reuse	

4.3 Preferred Remediation Options

4.3.1 Soil Remediation

Based on the current data available, the soil at the site does not appear to be significantly contaminated, however areas of contamination above the criteria applicable to the proposed landuses do exist and therefore soil remediation will be required. Other issues identified at this stage include the presence of materials that would be an aesthetic issue for standard residential development (such as bricks, concrete fragments, etc), and the data gaps which exist in the understanding of the soil quality across the site.

The specific remedial measures adopted will be dependent upon further soil sampling to be conducted, however based on the current understanding the following soil remedial approach is recommended:

1. Conduct soil sampling of existing stockpiles and assess geotechnical and environmental suitability for reuse as backfill in Zone 4 or elsewhere on site;
2. Conduct soil sampling across the site to fill in data gaps and assess suitability of soil to remain in current location, or alternatively for reuse in Zone 4. Soil sampling would be conducted to a depth 3 m beyond the final design surface level.
3. Where soil is not suitable for use in the top 3 m of soil at the site, or for reuse within the quarry void, the following remedial options would be assessed (based on the type and concentration of contamination present):
    a. Remediate soil on site and reuse. Options would include sieving out aesthetically unacceptable material (such as bricks, concrete etc); bioremediation of organic contamination, or fixation of inorganic contamination (such as metals).
    b. Dispose of unsuitable material off-site to a licensed landfill.

These options are predicated on the following assumptions:

- Unsuitable soils, including the gas producing landfilled waste (eg Zone 1 and potentially part of Zone 2), are only excavated if they are present in the uppermost 3 m of the final site profile, to meet geotechnical requirements and environmental requirements. Deeper soils will remain in their current location.
- Consideration will be need to be given to the proposed gas protection options (as detailed in Section 4.3.2 below), such as a 1m thick low permeability clay cap in areas of potential gas generation.

4.3.2 Landfill Waste and Gas Remediation

Landfill gas remediation and management options are generally broken up into four board categories including:

- removal of source material,
- installation of barriers,
- dilution and dispersion (i.e. venting of gas to atmosphere); and
- monitoring.

The installation of barriers and vents can occur either in-ground or at the building boundary and are often used in tandem to increase the efficiency and to provide some level of redundancy. Monitoring is a reactive management option and is usually limited to existing building where a hazard has been identified or in conjunction with other methods at high risk sites.

Coffey has reviewed the available remediation and management technologies and applied a technology screening matrix to the several applicable options. The review of available technologies and the screening matrix are presented in **Appendix C,** with the options presented graphically on **Figures 6A and 6B**. The preferred landfill gas mitigation measures are summarised below.

1. Capping areas of gas producing waste with a 1m low permeability clay cap; and
2. Installation of boundary venting system consisting of either gravel filled vertical shafts and/or lineal gravel filled trenches around the perimeter of the areas of gas producing waste; and
3. Installation of gas protection membranes or venting voids beneath buildings constructed over gas producing waste; and
4. Construction of underground utility trenches (eg stormwater, sewers, communications, electrical, gas) within high permeability backfill material.

The benefits of this combination of gas mitigation measures are considered to be:

- The measures are technically proven and feasible for this site, particularly when considering the likely low gas generation potential of the waste;
- The cost of implementation is reasonable when compared with excavation and off-site disposal of landfilled waste areas;
- There is a level of redundancy in the combined technology approach, with the clay cap acting as a primary barrier, directing landfill gas to a boundary venting system. The secondary layer of protection is gas protection measures (membranes and venting) for individual buildings.
- The measures are compatible with the geotechnical concept solutions proposed for the site, such as:
    - The clay capped areas could be subsequently penetrated with foundation piles (as opposed to a HDPE or LDPE membrane);
    - The measures would not be significantly affected by differential settlement.

4.3.3 Groundwater Remediation

Groundwater remediation options have been considered for leachate emanating from Zone 1 landfilled area. The remediation options for Options 1 and 2 are presented on Figures 7A and 7B, with each of Options 1 to 3 summarised as follows:

1. Interception of groundwater down-gradient (south) of Zone 1 in the direction of groundwater flow, including treatment of contaminants;
2. Installation of a groundwater treatment barrier down-gradient (south) of Zone 1 in the direction of groundwater flow,
3. Monitored natural attenuation.

The option of source removal, by excavation and off-site disposal of the formerly landfilled waste has previously been discounted from further consideration, based on the age and type of waste, feasibility of removal, and cost/benefit of removal from site.

Coffey has reviewed the available remediation and management technologies and applied a technology screening matrix to the several applicable options. The review of available technologies and the screening matrix are presented in **Appendix D**. The preferred groundwater remedial measures are summarised below.

1. Capping areas of gas producing waste with a 1m low permeability clay cap. This will limit the infiltration of surface waters into the landfill mass, and reduce the contaminant flux; and
2. Conduct mass flux modelling and calculate the assimilative capacity of the aquifer; and
3. Implement a monitored natural attenuation program including monitoring bore network, and contingency plans where action levels for groundwater contamination are exceeded (such as unacceptable levels of nitrate moving off-site in groundwater); and
4. Include contingency measures into the remedial solution, such as an interception trench and bores for conducting active remediation if required. Further consideration of appropriate remedial measures would be conducted as part of detailed design, however this may include utilising the geotechnical drainage layers for the Zone 4 quarry void, as presented in **Figure 7A**.

The benefits of this combination of groundwater remedial measures are considered to be:

- The measures are technically proven and feasible for this site, particularly when considering the likely low gas generation potential of the waste;
- The measures are commensurate with the degree of groundwater contamination present in Zone 1, particularly when considering the likely actual uses of groundwater on-site in future, and the adjacent landuses;
- The cost of implementation is reasonable when compared with active groundwater remediation;
- The measures involve minimal future intrusion into the site, post development. Post development site works would include ongoing groundwater monitoring and possible implementation of contingency measures;
- The measures are compatible with the geotechnical concept solutions proposed for the site.

4.3.4 Quarry Water Remediation

The quarry water in Zone 4 will need to be removed to allow backfilling. Options for disposal of this water include:

- Option 1: irrigation of Huntingdale Golf Course.
- Option 2: disposal to stormwater offsite.
- Option 3: disposal to sewer under a Trade Waste Agreement.
- Option 4: use as dust suppressant during earthworks onsite.

Each of these options is potentially viable, depending upon the quality and quantity of the water at the time of disposal. Surface water sampling conducted in July 2013 indicated that the surface water quality is suitable for irrigation purposes. Further assessment prior to, and during dewatering, would be required to determine the preferred disposal option(s).

4.3.5 Quarry Sediment Remediation Options

The following Options are presented, subject to further assessment of sediment quality:

- Option 1: reuse on site as part of Zone 4 backfilling, providing the soil contaminants do not represent a risk to groundwater and meet the geotechnical requirements.
- Option 2: off-site disposal.
- Option 3: on-site remediation and reuse

Limited data is currently available on the sediment quality and quantity within the quarry void, therefore we cannot recommend a preferred remedial solution at this time.

4.4 Post Development Considerations

The following post-development considerations should be considered in the assessment of the preferred remedial options:

- Roles and responsibilities: for any remedial measures implemented, a clear and enforceable mechanism for ongoing operation, maintenance and monitoring would be required. Responsible parties may include:
  - Body Corporates for common areas (eg gas barriers under apartments);
  - Monash City Council for remediation infrastructure in Council land (eg a gas venting barrier along road verges);
  - Individual Owners: (eg gas barriers under dwellings).
  - Site Developer: ongoing maintenance or management of remedial infrastructure, and ongoing monitoring requirements.
- Maintenance: environmental infrastructure including barriers, vents, extraction bores and monitoring bores would require ongoing maintenance to ensure performance criteria are met, and the infrastructure remains operational.
- Reconfiguration of buildings/other site development: a mechanism to require future alterations or additions to the site development to upgrade or amend remedial infrastructure would need to be in place post-development. Such mechanisms may include Section 173 Agreements under the *Planning and Environment Act 1987*.
- Monitoring and validation: ongoing monitoring and validation of the remedial measures would be required to be implemented. This would typically be the responsibility of the Site Developer, and would be implemented under Management Plans stipulated as conditions of a Statement of Environmental Audit (Contaminated Land).

5 CONCLUSIONS AND RECOMMENDATIONS

Coffey Environments Australia Pty Ltd (Coffey) was engaged by Talbot Road Finance Pty Ltd (Talbot Road Finance) to prepare a Remediation Options Report for the land located at 1221 to 1249 Centre Road, Oakleigh South, Victoria (the site). The site location is shown on **Figure 1** (**Appendix A**).

The site has been nominally divided into five separate zones; designated Zones 1 to 5, which we note generally represent various former quarry pits or operational areas. An additional quarry area is present off-site immediately to the south east in what is now Talbot Park and is owned by Monash City Council. The current site condition and features are shown on **Figure 2 (Appendix A).**

A Remediation Options Analysis has been undertaken, based on the site development objectives and landuse Masterplans 1 to 3 (**Appendix B**).

The following preferred remediation concept solutions are recommended for the site.

Soil Remediation Preferred Option:

- Conduct soil sampling of existing stockpiles and assess geotechnical and environmental suitability for reuse as backfill in Zone 4 or elsewhere on site; AND
- Conduct soil sampling across the site to fill in data gaps and assess suitability of soil to remain in current location, or alternatively for reuse in Zone 4. Soil sampling would be conducted to a depth 3 m beyond the final design surface level, AND
- Where soil is not suitable for use in the top 3 m of soil at the site, or for reuse within the quarry void, the following remedial options would be assessed (based on the type and concentration of contamination present):
    - Remediate soil on site and reuse. Options would include sieving out aesthetically unacceptable material (such as bricks, concrete etc); bioremediation of organic contamination, or fixation of inorganic contamination (such as metals).
    - Dispose of unsuitable material off-site to a licensed landfill.

Landfill Gas Remediation Preferred Option:

- Capping areas of gas producing waste with a 1m low permeability clay cap; AND
- Installation of boundary venting system consisting of either gravel filled vertical shafts and/or lineal gravel filled trenches around the perimeter of the areas of gas producing waste; AND
- Installation of gas protection membranes or venting voids beneath buildings constructed over gas producing waste; AND
- Construction of underground utility trenches (eg stormwater, sewers, communications, electrical, gas) within high permeability backfill material.

Groundwater Remediation Preferred Option:

- Capping areas of gas producing waste with a 1m low permeability clay cap. This will limit the infiltration of surface waters into the landfill mass, and reduce the contaminant flux; AND
- Conduct mass flux modelling and calculate the assimilative capacity of the aquifer; AND
- Implement a monitored natural attenuation program including monitoring bore network, and contingency plans where action levels for groundwater contamination are exceeded (such as unacceptable levels of nitrate moving off-site in groundwater); AND

- Include contingency measures into the remedial solution, such as an interception trench and bores for conducting active remediation if required. Further consideration of appropriate remedial measures would be conducted as part of detailed design, however this may include utilising the geotechnical drainage layers for the Zone 4 quarry void.

Quarry Surface Water Remediation Preferred Option:

The quarry water in Zone 4 will need to be removed to allow backfilling. Options for disposal of this water include:

- Option 1: irrigation of Huntingdale Golf Course.
- Option 2: disposal to stormwater offsite.
- Option 3: disposal to sewer under a Trade Waste Agreement.
- Option 4: use as dust suppressant during earthworks onsite.

Each of these options is potentially viable, depending upon the quality and quantity of the water at the time of disposal. Surface water sampling conducted in July 2013 indicated that the surface water quality is suitable for irrigation purposes. Further assessment prior to, and during dewatering, would be required to determine the preferred disposal option(s).

Quarry Sediment Remediation Preferred Option:

The following Options are presented, subject to further assessment of sediment quality:

- Option 1: reuse on site as part of Zone 4 backfilling, providing the soil contaminants do not represent a risk to groundwater and meet the geotechnical requirements.
- Option 2: off-site disposal.
- Option 3: on-site remediation and reuse

Limited data is currently available on the sediment quality and quantity within the quarry void, therefore we cannot recommend a preferred remedial solution at this time.

Post Development Considerations

Following implementation of the remedial measures and site development, there is likely to be requirements for various stakeholders to implement on-going management and maintenance. These post development considerations include defining roles and responsibilities, implementing maintenance and monitoring regimes, and executing binding agreements related to on-going responsibilities and mechanisms for future site infrastructure changes.

Recommendations

It is recommended that the remedial options presented are discussed with other stakeholders, designers, and the appointed Environmental Auditor, to ensure that the options meet the project objectives. Further site characterisation will then be required to address environmental data gaps across the site. Following this further characterisation works, a reassessment of the remedial options would be required to test the assumptions. Once the final remedial solutions are adopted, detailed design, in conjunction with the architectural, civil and geotechnical designers can be completed.

6 REFERENCES

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coffey

Important information about your **Coffey** Environmental Report

Introduction

This report has been prepared by Coffey for you, as Coffey's client, in accordance with our agreed purpose, scope, schedule and budget.

The report has been prepared using accepted procedures and practices of the consulting profession at the time it was prepared, and the opinions, recommendations and conclusions set out in the report are made in accordance with generally accepted principles and practices of that profession.

The report is based on information gained from environmental conditions (including assessment of some or all of soil, groundwater, vapour and surface water) and supplemented by reported data of the local area and professional experience. Assessment has been scoped with consideration to industry standards, regulations, guidelines and your specific requirements, including budget and timing. The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry practice,

This interpretation is not a complete description of all material on or in the vicinity of the site, due to the inherent variation in spatial and temporal patterns of contaminant presence and impact in the natural environment. Coffey may have also relied on data and other information provided by you and other qualified individuals in preparing this report. Coffey has not verified the accuracy or completeness of such data or information except as otherwise stated in the report. For these reasons the report must be regarded as interpretative, in accordance with industry standards and practice, rather than being a definitive record.

Your report has been written for a specific purpose

Your report has been developed for a specific purpose as agreed by us and applies only to the site or area investigated. Unless otherwise stated in the report, this report cannot be applied to an adjacent site or area, nor can it be used when the nature of the specific purpose changes from that which we agreed.

For each purpose, a tailored approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible quantify, risks that both recognised and potential contamination pose in the context of the agreed purpose. Such risks may be financial (for example, clean up costs or constraints on site use) and/or physical (for example, potential health risks to users of the site or the general public).

Limitations of the Report

The work was conducted, and the report has been prepared, in response to an agreed purpose and scope, within time and budgetary constraints, and in reliance on certain data and information made available to Coffey.

The analyses, evaluations, opinions and conclusions presented in this report are based on that purpose and scope, requirements, data or information, and they could change if such requirements or data are inaccurate or incomplete.

This report is valid as of the date of preparation. The condition of the site (including subsurface conditions) and extent or nature of contamination or other environmental hazards can change over time, as a result of either natural processes or human influence. Coffey should be kept appraised of any such events and should be consulted for further investigations if any changes are noted, particularly during construction activities where excavations often reveal subsurface conditions.

In addition, advancements in professional practice regarding contaminated land and changes in applicable statues and/or guidelines may affect the validity of this report. Consequently, the currency of conclusions and recommendations in this report should be verified if you propose to use this report more than 6 months after its date of issue.

The report does not include the evaluation or assessment of potential geotechnical engineering constraints of the site.

Interpretation of factual data

Environmental site assessments identify actual conditions only at those points where samples are taken and on the date collected. Data derived from indirect field measurements, and sometimes other reports on the site, are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions.

Variations in soil and groundwater conditions may occur between test or sample locations and actual conditions may differ from those inferred to exist. No environmental assessment program, no matter how comprehensive, can reveal all subsurface details and anomalies. Similarly, no professional, no matter how well qualified, can reveal what is hidden by earth, rock or changed through time.

The actual interface between different materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but

steps can be taken to reduce the impact of unexpected conditions.

For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of a suitably qualified and experienced environmental consultant through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other unrecognised features encountered on site. Coffey would be pleased to assist with any investigation or advice in such circumstances.

Recommendations in this report

This report assumes, in accordance with industry practice, that the site conditions recognised through discrete sampling are representative of actual conditions throughout the investigation area. Recommendations are based on the resulting interpretation.

Should further data be obtained that differs from the data on which the report recommendations are based (such as through excavation or other additional assessment), then the recommendations would need to be reviewed and may need to be revised.

Report for benefit of client

Unless otherwise agreed between us, the report has been prepared for your benefit and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendation and should make their own enquiries and obtain independent advice in relation to such matters.

Coffey assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report.

To avoid misuse of the information presented in your report, we recommend that Coffey be consulted before the report is provided to another party who may not be familiar with the background and the purpose of the report. In particular, an environmental disclosure report for a property vendor may not be suitable for satisfying the needs of that property's purchaser. This report should not be applied for any purpose other than that stated in the report.

Interpretation by other professionals

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, a suitably qualified and experienced environmental consultant should be retained to explain the implications of the report to other professionals referring to the report and then review plans and specifications produced to see how other professionals have incorporated the report findings.

Given Coffey prepared the report and has familiarity with the site, Coffey is well placed to provide such assistance. If another party is engaged to interpret the recommendations of the report, there is a risk that the contents of the report may be misinterpreted and Coffey disowns any responsibility for such misinterpretation.

Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists or engineers based on their interpretation of field logs, field testing and laboratory evaluation of samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

This report should be reproduced in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

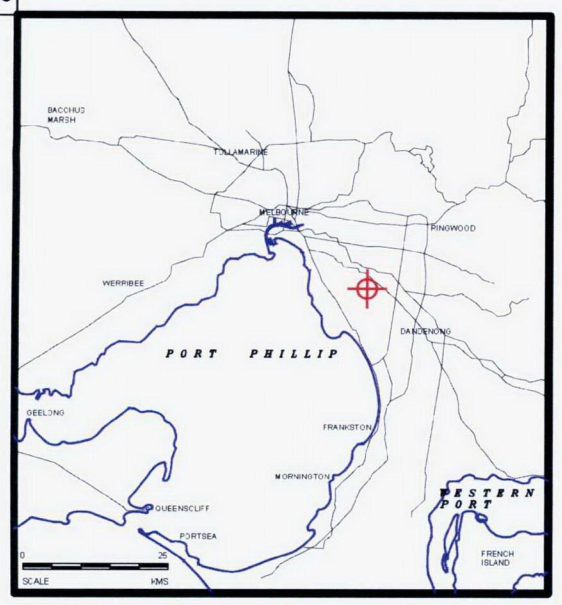
Responsibility

Environmental reporting relies on interpretation of factual information using professional judgement and opinion and has a level of uncertainty attached to it, which is much less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. As noted earlier, the recommendations and findings set out in this report should only be regarded as interpretive and should not be taken as accurate and complete information about all environmental media at all depths and locations across the site.

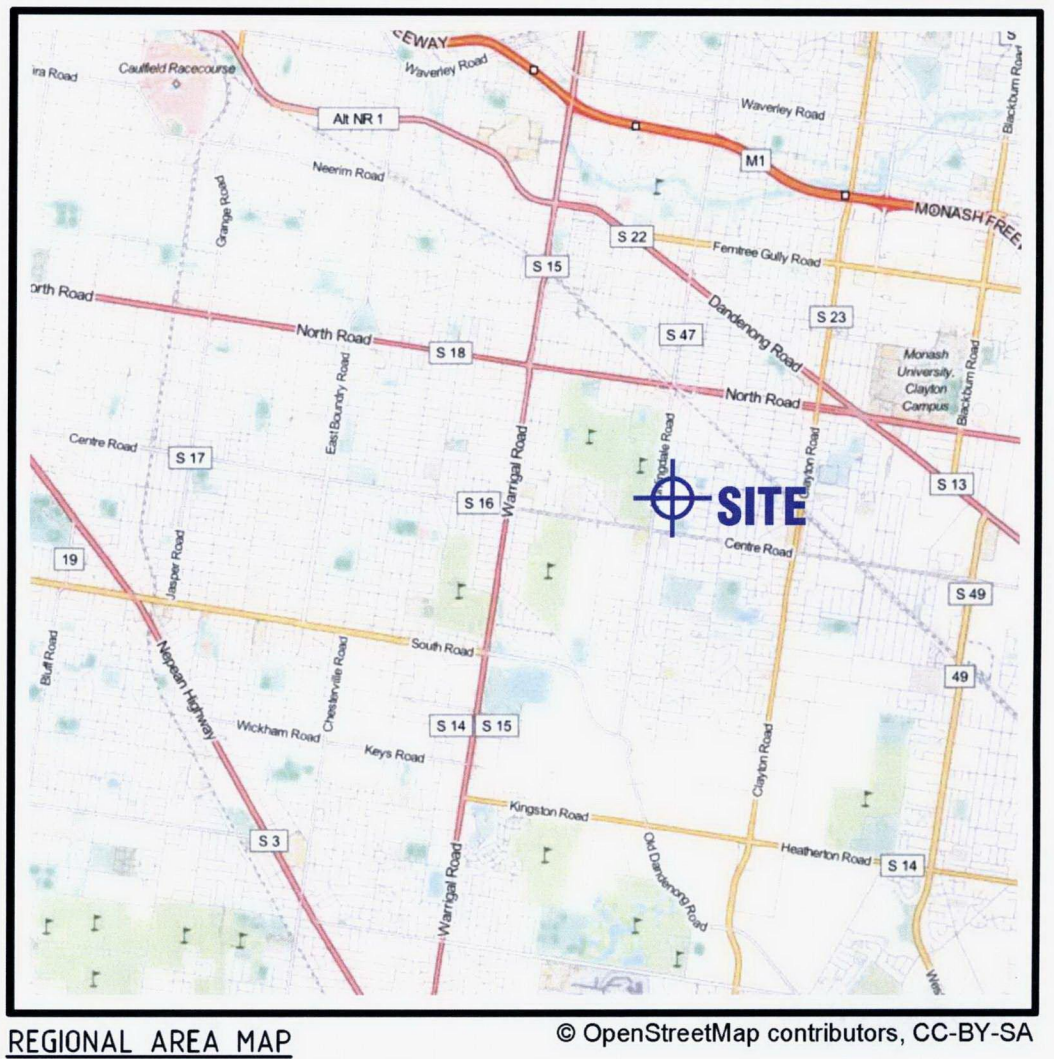
Appendix A
Figures

Remediation Options Report
1129 to 1149 Centre Road, & 22 Talbot Avenue, Oakleigh South, VIC

A3



GENERAL AREA MAP



REGIONAL AREA MAP

0 1 2 3 4 5
SCALE 1:100000 (A3) KILOMETRES

0 150 300 450 600 750
SCALE 1:15000 (A3) METRES

coffey — 126 Trenerry Crescent, Abbotsford VIC 3067, Ph: (03) 9473 1400, Fax: (03) 9473 1450	Client: TALBOT ROAD FINANCE PTY LTD	Project: REMEDIATION OPTIONS REPORT	Drawing Title: **SITE LOCALITY PLAN**
Rev: A; Date: 09.09.13; Revision Details: ISSUE; Drn: LZ		Location: 1221-1249 CENTRE ROAD OAKLEIGH SOUTH, VICTORIA	Drawn: LZ; Date: 09.09.13; Project - Drawing No.: ENAUABTF00751AA-D05; Figure No.: 1; Rev.: A

D17-279726

A3

LEGEND

- TITLE PEG
- T.B.M.
- CAMERA LOCATION & PHOTO NUMBER
- SINGLE TREE
- GATE
- STAY FOR POLE
- TELECOMMUNICATIONS PIT
- VENT POLE
- FIRE HYDRANT
- S.B. SETBACK FROM FENCELINE

- TITLE
- DCMB LINEWORK
- FENCE
- TOP OF BANK
- TOE OF BANK
- CONCRETE KERB AND CHANNEL
- DRAINAGE INVERT
- PLANNING ZONE BOUNDARY

- AREAS NOT SAFE TO SURVEY
- CONCRETE
- BITUMEN
- GROUP OF TREES
- BUILDINGS
- DAM
- HABITABLE WINDOW
- SOIL EMBANKMENTS
- SOIL STOCKPILE
- FILL PLATFORM

- S SEWERAGE
- D DRAINAGE
- T TELECOMMUNICATIONS
- G GAS
- W WATER
- E ELECTRICITY
- OVERHEAD ELECTRICITY

SOURCE: TAYLORS DETAIL SURVEY PLAN (REF 1808/5, REV A, 12/06/13)

coffey
126 Trenerry Crescent
Abbotsford VIC 3067
Ph: (03) 9473 1400
Fax: (03) 9473 1450

Client: TALBOT ROAD FINANCE PTY LTD

Project: REMEDIATION OPTIONS REPORT

Drawing Title: **SITE ZONES & KEY FEATURES**

Rev	Date	Revision Details	Drn
A	09.09.13	ISSUE	LZ

0 25 50 75 100 125
SCALE 1:2500 (A3) METRES

Location: 1221-1249 CENTRE ROAD OAKLEIGH SOUTH, VICTORIA

Drawn: LZ

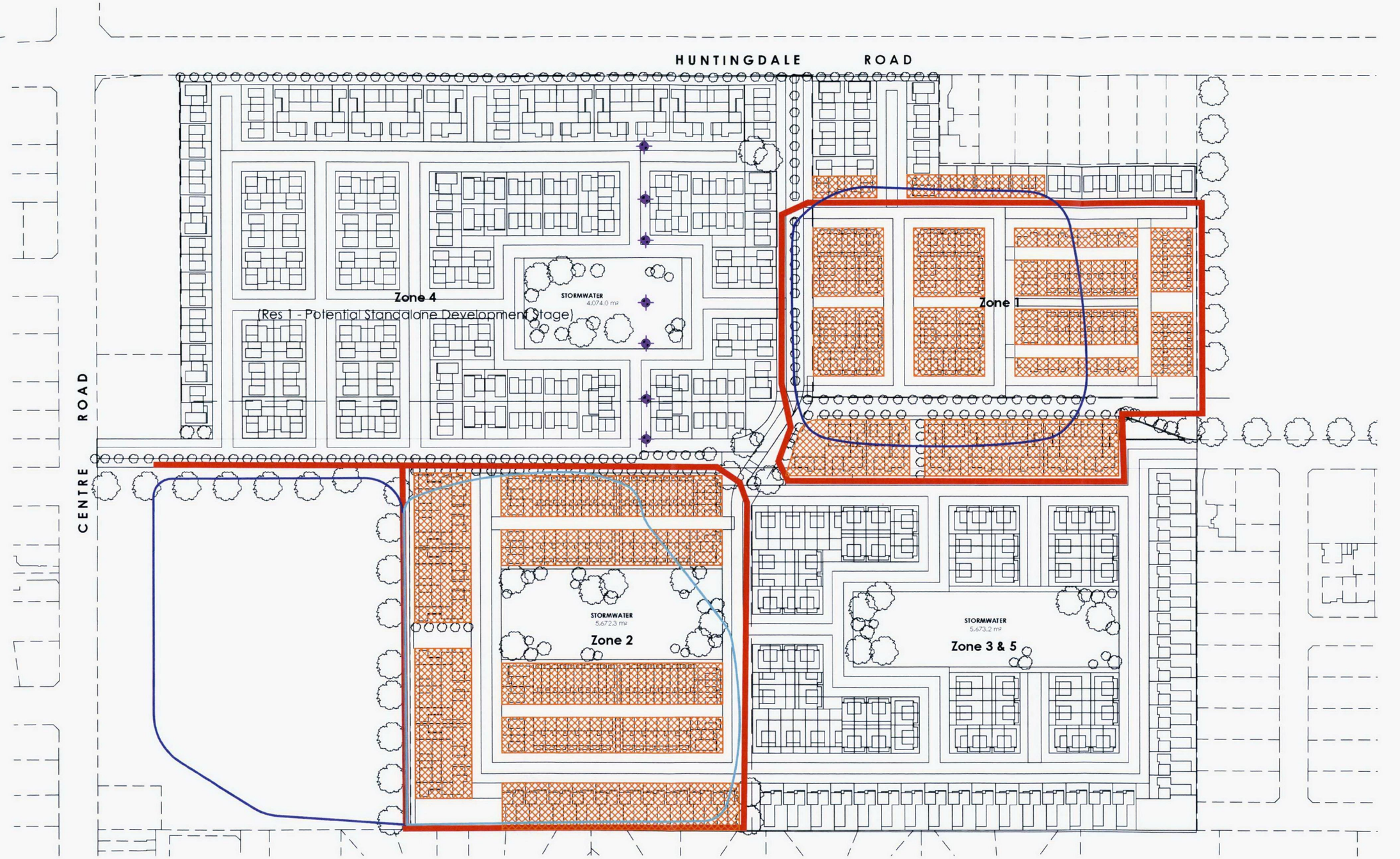
Date: 09.09.13

Project - Drawing No.: ENAUABTF00751AA-D05

Figure No.: 2

Rev.: A

D17-279726



LEGEND

- APPROXIMATE EXTENT OF LANDFILL WASTE (EXTENT UNCONFIRMED)
- APPROXIMATE EXTENT OF POTENTIALLY LANDFILLED AREA (EXTENT UNCONFIRMED)
- GAS PROTECTION MEASURES FOR BUILDINGS
- VERTICAL GAS VENTING SYSTEM
- LEACHATE TREATMENT WELLS

coffey
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Rev	Date	Revision Details	Drn
A	09.09.13	ISSUE	LZ

Client: TALBOT ROAD FINANCE PTY LTD

Project: REMEDIATION OPTIONS REPORT

Location: 1221-1249 CENTRE ROAD OAKLEIGH SOUTH, VICTORIA

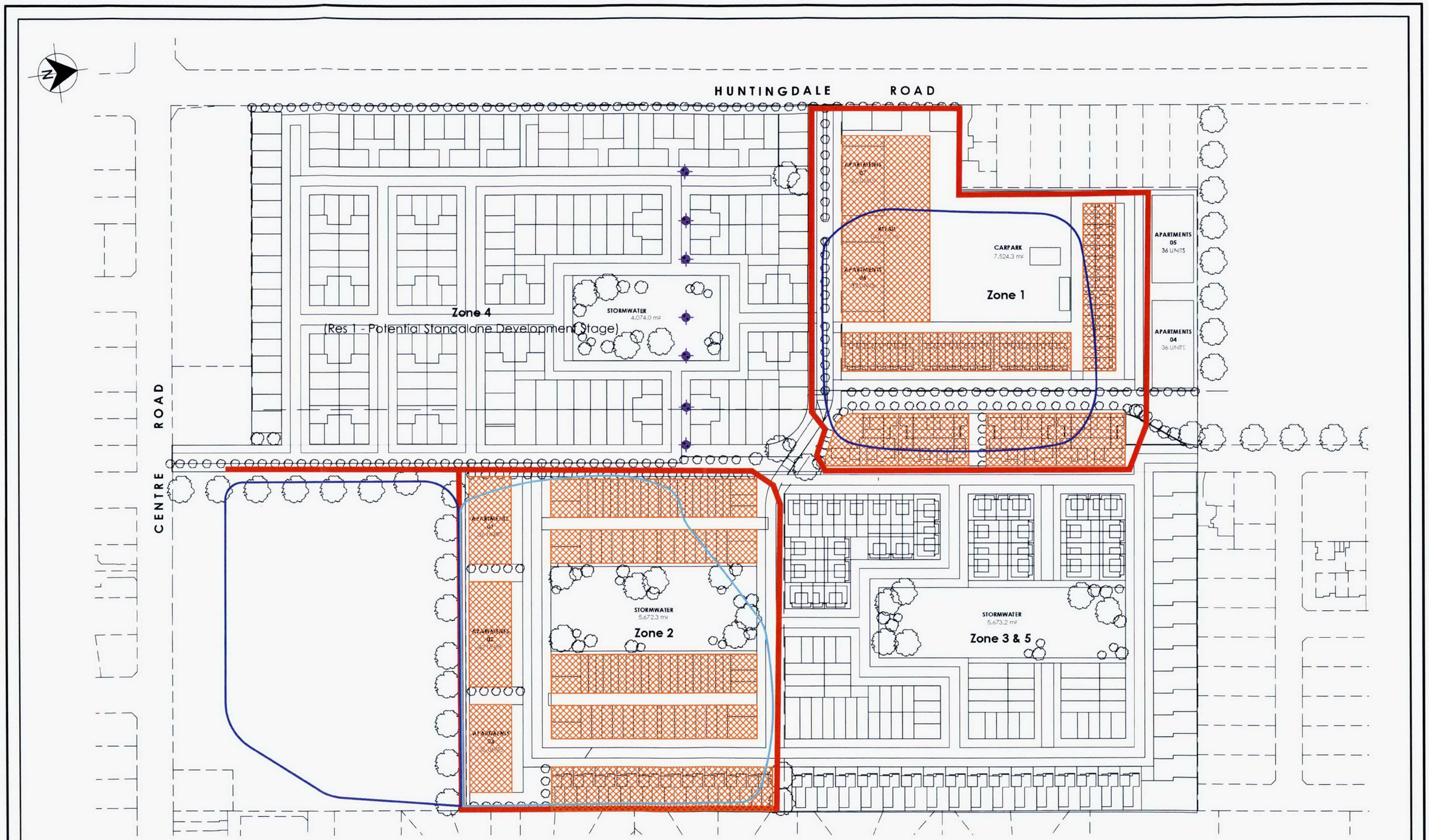
0 20 40 60 80 100
SCALE 1:2000 (A3) METRES

Drawing Title: **REMEDIAL OPTIONS FOR MASTERPLAN - OPTION 1**

Drawn	Date
LZ	09.09.13

Project - Drawing No.	Figure No.	Rev.
ENAUABTF00751AA-D05	3	A

D17-279726



LEGEND

- APPROXIMATE EXTENT OF LANDFILL WASTE (EXTENT UNCONFIRMED)
- APPROXIMATE EXTENT OF POTENTIALLY LANDFILLED AREA (EXTENT UNCONFIRMED)
- GAS PROTECTION MEASURES FOR BUILDINGS
- VERTICAL GAS VENTING SYSTEM
- LEACHATE TREATMENT WELLS

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Rev.	Date	Revision Details	Drn
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Client: TALBOT ROAD FINANCE PTY LTD

Project: REMEDIATION OPTIONS REPORT

Location: 1221-1249 CENTRE ROAD OAKLEIGH SOUTH, VICTORIA

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SCALE 1:2000 (A3) METRES

Drawing Title: **REMEDIAL OPTIONS FOR MASTERPLAN - OPTION 2**

Drawn	Date
LZ	09.09.13

Project - Drawing No.	Figure No.	Rev.
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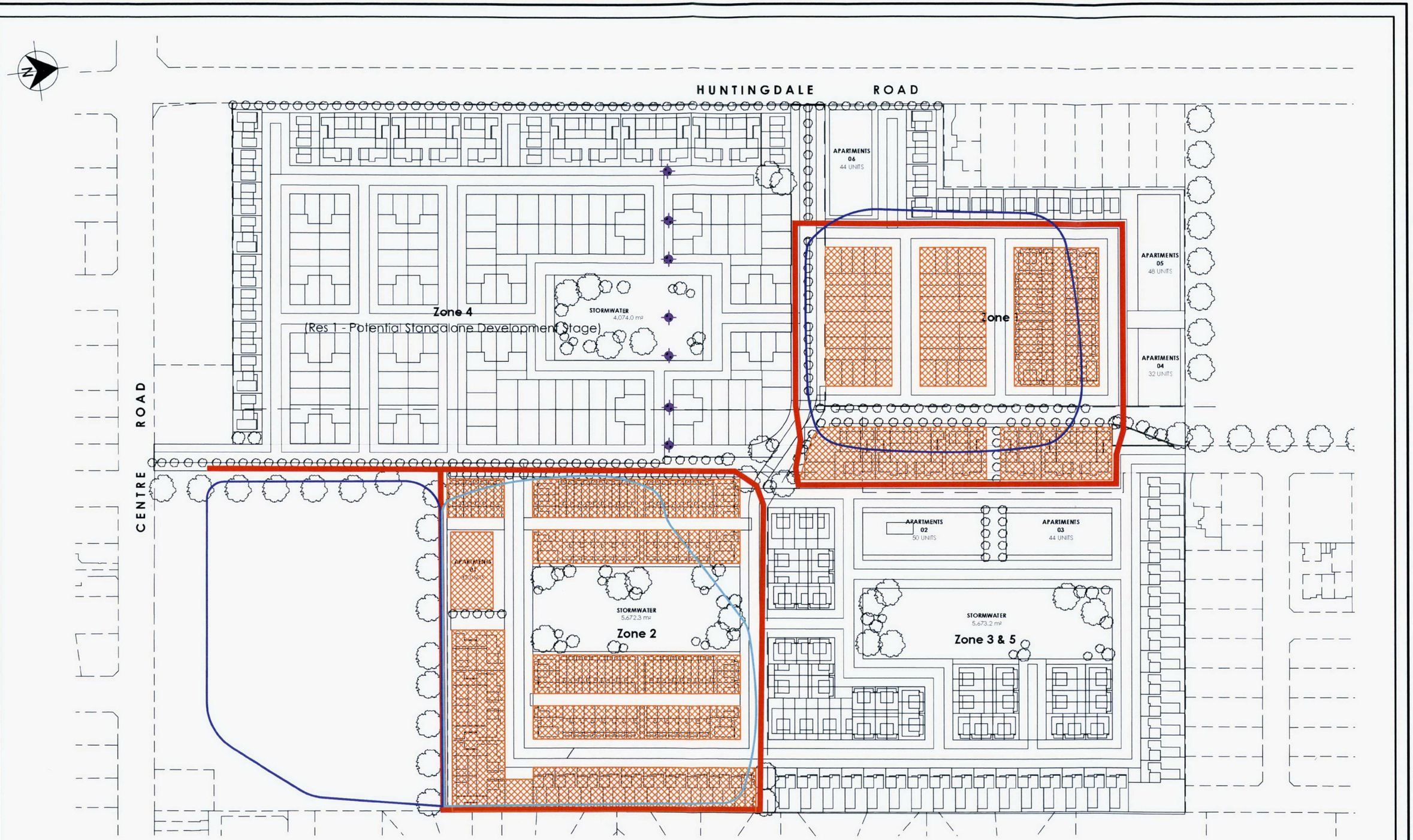
D17-279726



LEGEND

- APPROXIMATE EXTENT OF LANDFILL WASTE (EXTENT UNCONFIRMED)
- APPROXIMATE EXTENT OF POTENTIALLY LANDFILLED AREA (EXTENT UNCONFIRMED)
- GAS PROTECTION MEASURES FOR BUILDINGS
- VERTICAL GAS VENTING SYSTEM
- LEACHATE TREATMENT WELLS

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A	09.09.13	ISSUE	LZ

Client: TALBOT ROAD FINANCE PTY LTD

Project: REMEDIATION OPTIONS REPORT

Location: 1221-1249 CENTRE ROAD OAKLEIGH SOUTH, VICTORIA

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SCALE 1:2000 (A3) METRES

Drawing Title: **REMEDIAL OPTIONS FOR MASTERPLAN - OPTION 3**

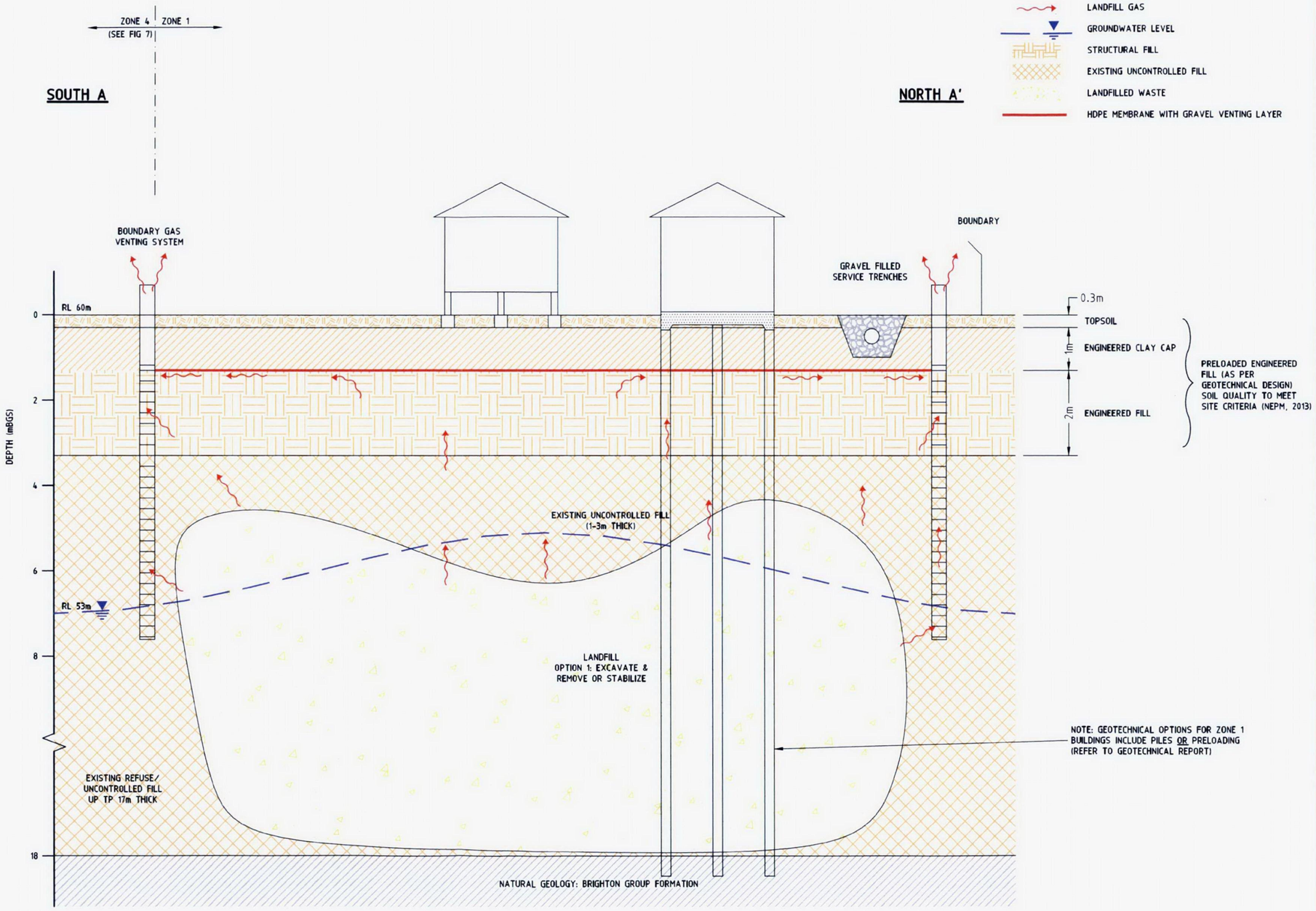
Drawn	Date
LZ	09.09.13

Project - Drawing No.	Figure No.	Rev.
ENAUABTF00751AA-D05	5	A

D17-279726

LANDFILL GAS TREATMENT OPTIONS:

1. REMOVE LANDFILL WASTE FROM SITE
2. AREA-WIDE GAS BARRIER AND BOUNDARY VENTING
3. VOID VENTING BENEATH BUILDINGS WITH BOUNDARY VENTING
4. GAS MEMBRANE BENEATH BUILDINGS WITH BOUNDARY VENTING



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Rev	Date	Revision Details	Drn
A	09.09.13	ISSUE	LZ

Client: TALBOT ROAD FINANCE PTY LTD

Project: REMEDIATION OPTIONS REPORT

Location: 1221-1249 CENTRE ROAD OAKLEIGH SOUTH, VICTORIA

Drawing Title: **ZONE 1 CONCEPTUAL DESIGN GAS MITIGATION OPTIONS 1 & 2**

Drawn: LZ

Date: 09.09.13

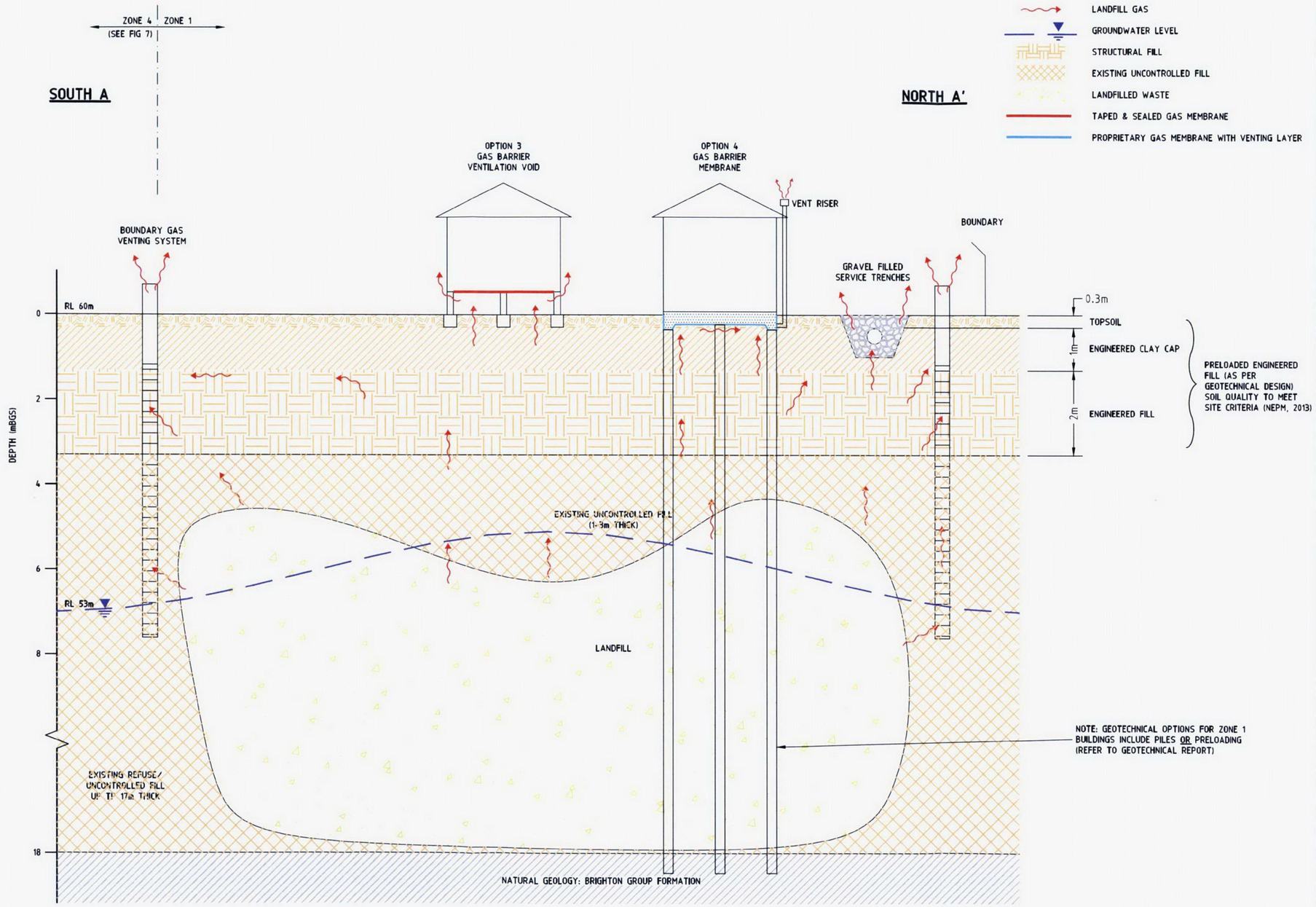
Project - Drawing No.: ENAUABTF00751AA-D05

Figure No.: 6A

Rev.: A

D17-279726

LANDFILL GAS TREATMENT OPTIONS:
1. REMOVE LANDFILL WASTE FROM SITE
2. AREA-WIDE GAS BARRIER AND BOUNDARY VENTING
3. VOID VENTING BENEATH BUILDINGS WITH BOUNDARY VENTING
4. GAS MEMBRANE BENEATH BUILDINGS WITH BOUNDARY VENTING



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Rev	Date	Revision Details	Drn
A	09.09.13	ISSUE	LZ

Client: TALBOT ROAD FINANCE PTY LTD

Project: REMEDIATION OPTIONS REPORT

Location: 1221-1249 CENTRE ROAD OAKLEIGH SOUTH, VICTORIA

Drawing Title: **ZONE 1 CONCEPTUAL DESIGN GAS MITIGATION OPTIONS 3 & 4**

Drawn: LZ

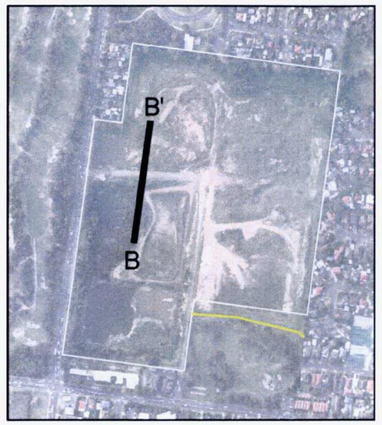
Date: 09.09.13

Project - Drawing No.: ENAUABTF00751AA-D05

Figure No.: 6B

Rev.: A

D17-279726



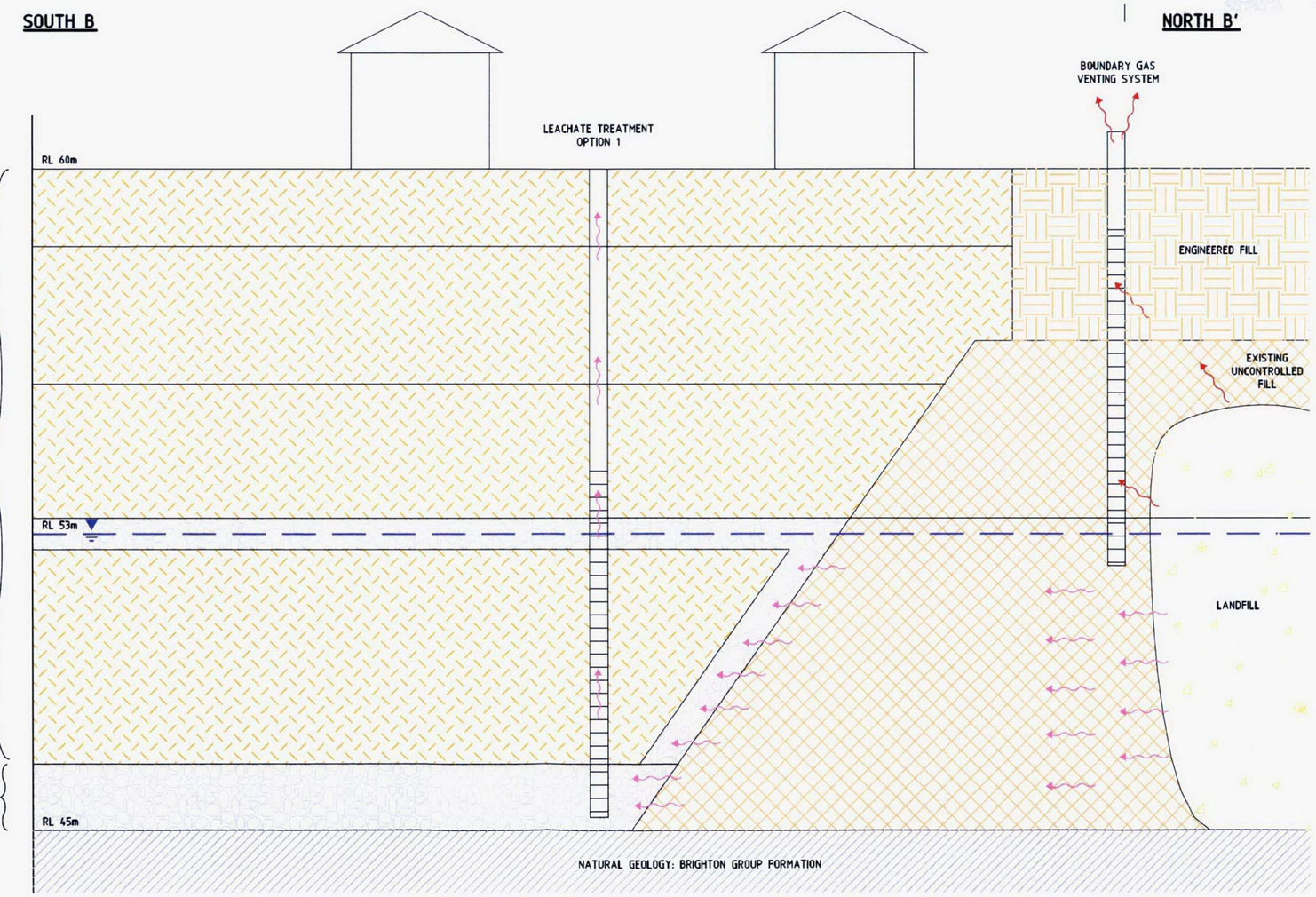
LEACHATE TREATMENT OPTIONS:
1. PUMP & TREAT FROM INTERCEPTION BORES OR TRENCH
2. LEACHATE BARRIER
3. NATURAL ATTENUATION

LEGEND

- LANDFILL LEACHATE
- LANDFILL GAS
- 'CLEAN' GROUNDWATER
- STABILIZED GROUNDWATER LEVEL
- STRUCTURAL FILL
- EXISTING UNCONTROLLED FILL
- LANDFILLED WASTE
- ENGINEERED BACKFILL
- DRAINAGE LAYER

ZONE 4 | ZONE 1

SOUTH B — **NORTH B'**



ENGINEERING BACKFILL OF ZONE 4 QUARRY VOID (REFER TO GEOTECHNICAL CONCEPT DESIGN)
SOIL QUALITY TO MEET SITE CRITERIA AS DETAILED IN BACKFILL PROTOCOL (COFFEY, 2013)

DRAINAGE LAYER (REFER TO GEOTECHNICAL CONCEPT DESIGN)

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Rev	Date	Revision Details	Drn
A	09.09.13	ISSUE	LZ

Client: TALBOT ROAD FINANCE PTY LTD

Project: REMEDIATION OPTIONS REPORT

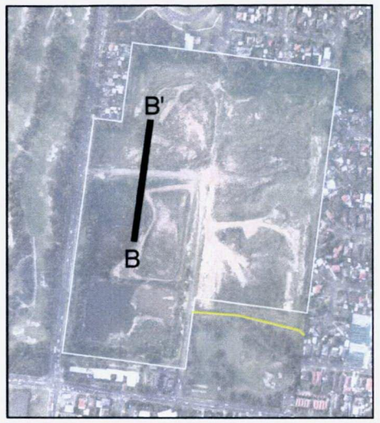
Location: 1221-1249 CENTRE ROAD OAKLEIGH SOUTH, VICTORIA

Drawing Title: **ZONE 4 CONCEPTUAL DESIGN LEACHATE TREATMENT OPTION 1**

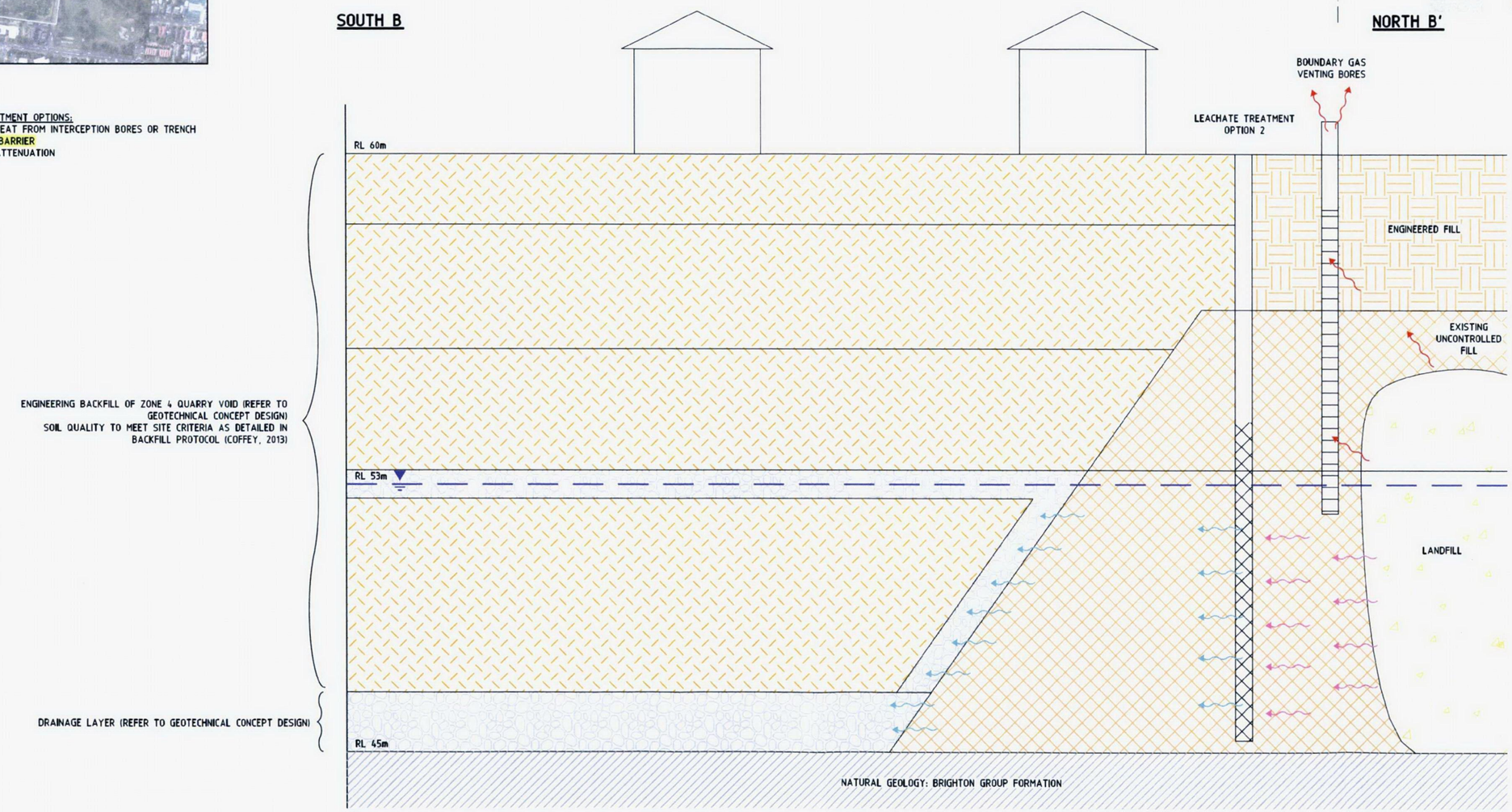
Drawn	Date
LZ	09.09.13

Project - Drawing No.	Figure No.	Rev.
ENAUABTF00751AA-D05	7A	A

D17-279726



LEACHATE TREATMENT OPTIONS:
1. PUMP & TREAT FROM INTERCEPTION BORES OR TRENCH
2. LEACHATE BARRIER
3. NATURAL ATTENUATION



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Rev	Date	Revision Details	Drn
A	09.09.13	ISSUE	LZ

Client: TALBOT ROAD FINANCE PTY LTD

Project: REMEDIATION OPTIONS REPORT

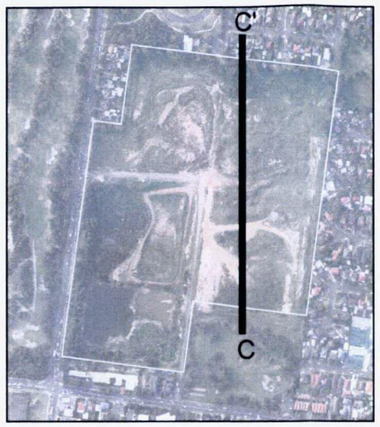
Location: 1221-1249 CENTRE ROAD OAKLEIGH SOUTH, VICTORIA

Drawing Title: **ZONE 4 CONCEPTUAL DESIGN LEACHATE TREATMENT OPTION 2**

Drawn	Date
LZ	09.09.13

Project - Drawing No.	Figure No.	Rev.
ENAUABTF00751AA-D05	7B	A

D17-279726



SOUTH C

NORTH C'

ZONE 2 | ZONE 5 | ZONE 3

SITE BOUNDARY GAS VENTING SYSTEM

OPTION 3 GAS BARRIER VENTILATION VOID

OPTION 4 GAS BARRIER MEMBRANE

OPTION 2

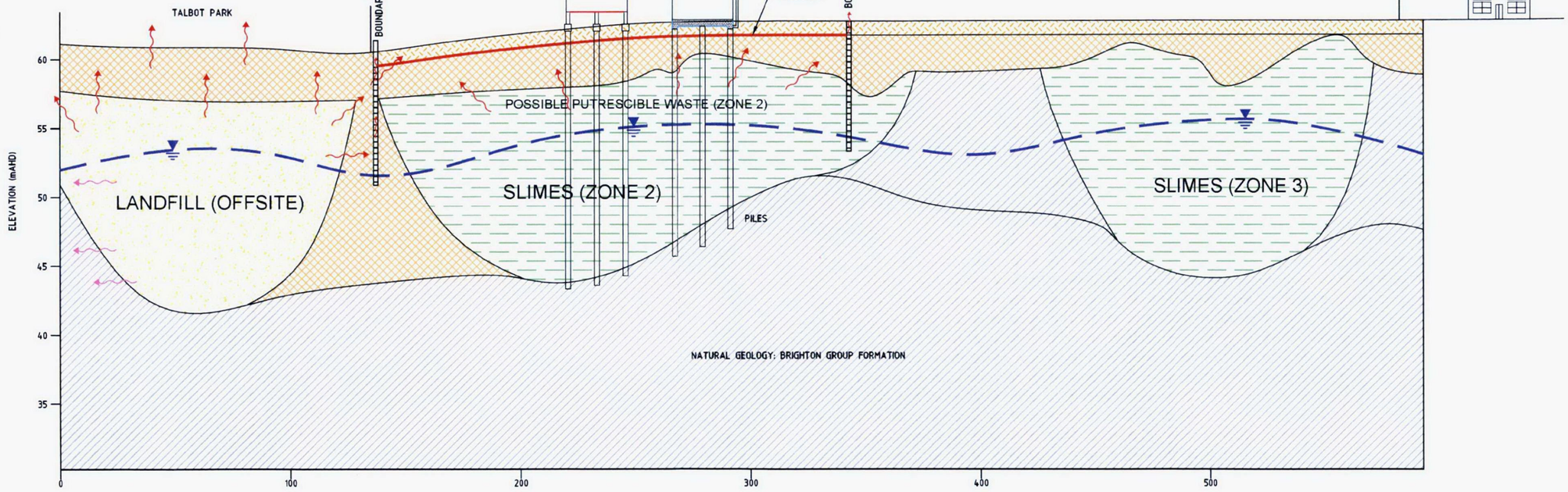
BOUNDARY GAS VENTING SYSTEM

SITE BOUNDARY

RESIDENTIAL

TALBOT PARK

LANDFILL GAS TREATMENT OPTIONS:
1. REMOVE LANDFILL WASTE FROM SITE
2. AREA-WIDE GAS BARRIER AND BOUNDARY VENTING
3. VOID VENTING BENEATH BUILDINGS WITH BOUNDARY VENTING
4. GAS MEMBRANE BENEATH BUILDINGS WITH BOUNDARY VENTING



LEGEND

- ENGINEERED BACKFILL
- EXISTING UNCONTROLLED FILL
- LANDFILLED WASTE
- SLIMES
- GROUNDWATER LEVELS
- POTENTIAL LANDFILL GAS MOVEMENT
- POTENTIAL LEACHATE MOVEMENT

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Rev	Date	Revision Details	Drn
A	09.09.13	ISSUE	LZ

Client: TALBOT ROAD FINANCE PTY LTD

Project: REMEDIATION OPTIONS REPORT

Location: 1221-1249 CENTRE ROAD OAKLEIGH SOUTH, VICTORIA

Drawing Title: **ZONES 2, 3 & 5 CONCEPTUAL DESIGN GAS MITIGATION**

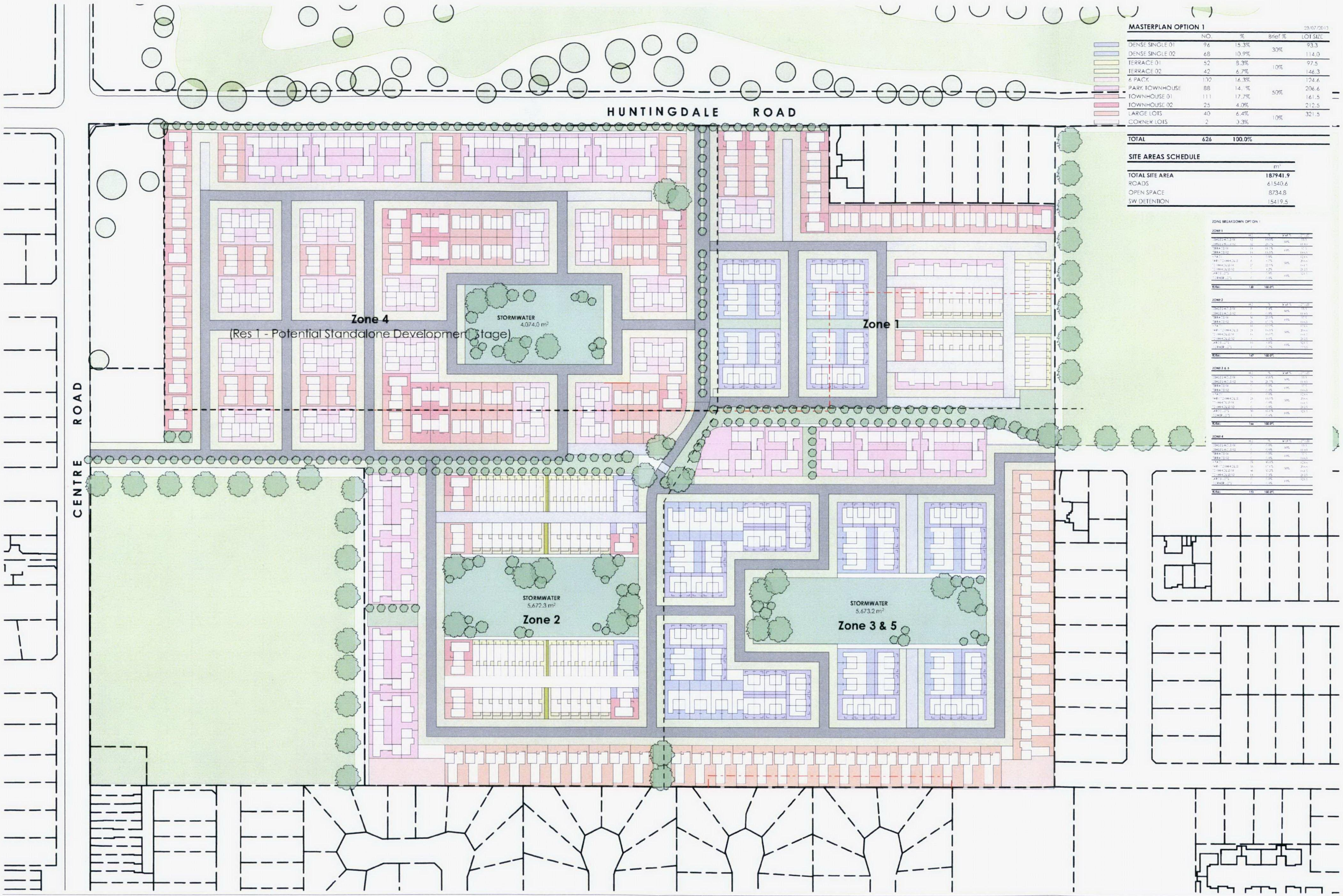
Drawn: LZ | Date: 09.09.13

Project - Drawing No.: ENAUABTF00751AA-D05 | Figure No.: 8 | Rev.: A

Appendix B
Site Master Plans

Remediation Options Report
1129 to 1149 Centre Road, & 22 Talbot Avenue, Oakleigh South, VIC

D17-279726



MASTERPLAN OPTION 1

23/07/2013

	NO.	%	Brief %	LOT SIZE
DENSE SINGLE 01	96	15.3%	30%	93.3
DENSE SINGLE 02	68	10.9%		114.0
TERRACE 01	52	8.3%	10%	97.5
TERRACE 02	42	6.7%		146.3
6 PACK	102	16.3%	50%	124.6
PARK TOWNHOUSE	88	14.1%		206.6
TOWNHOUSE 01	111	17.7%		161.5
TOWNHOUSE 02	25	4.0%		212.5
LARGE LOTS	40	6.4%	10%	321.5
CORNER LOTS	2	0.3%		
TOTAL	**626**	**100.0%**		

SITE AREAS SCHEDULE

	m²
TOTAL SITE AREA	**187941.9**
ROADS	61540.6
OPEN SPACE	8734.8
SW DETENTION	15419.5

ZONE BREAKDOWN OPTION 1

Architect
dKO architecture (Vic) pty ltd
Shop 118, Level 1, 439 Docklands Drive, Docklands, VIC, 3008, AUS
T +61 3 8601 6000 / F +61 3 8601 6099
www.dko.com.au / info@dko.com.au

Client Details
Sterling Global

Project
Centre Road Oakleigh South

Project Number
10831

Drawing
Masterplan Option 1

Scale 1:1000 @ A1
Date 23/07/2013

A001

D17-279726

HUNTINGDALE ROAD

CENTRE ROAD

Zone 4
(Res 1 - Potential Standalone Development Stage)

STORMWATER
4,074.0 m²

APARTMENTS
07
32 UNITS

RETAIL
5,012.0 m²

APARTMENTS
06
32 UNITS

CARPARK
7,524.3 m²

Zone 1

APARTMENTS
05
36 UNITS

APARTMENTS
04
36 UNITS

APARTMENTS
01
36 UNITS

APARTMENTS
02
42 UNITS

APARTMENTS
03
36 UNITS

STORMWATER
5,672.3 m²
Zone 2

STORMWATER
5,673.2 m²
Zone 3 & 5

MASTERPLAN OPTION 2 23/07/2017

	NO.	%	Brief %	LOT SIZE
DENSE SINGLE 01	84	15.8%	30%	93.3
DENSE SINGLE 02	43	8.1%		114.0
TERRACE 01	65	12.3%	10%	97.5
TERRACE 02	41	7.7%		146.3
6 PACK	96	18. 1%	50%	124.6
PARK TOWNHOUSE	56	10.6%		206.6
TOWNHOUSE 01	84	15.8%		161.5
TOWNHOUSE 02	20	3.8%		212.5
LARGE LOTS	40	7.5%	10%	321.5
CORNER LOTS	1	0.2%		
SUB-TOTAL	**530**	**100.0%**		
APARTMENT	250			
TOTAL	**780**			

SITE AREAS SCHEDULE

	m²
TOTAL SITE AREA	**187941.9**
ROADS	57319.5
OPEN SPACE	7668.4
SW DETENTION	15419.5
RETAIL AREA	
SITE AREA	**12695**
GLAR ANCHOR	4300
GLAR SPECIALITIES	1300
# CARS	250
CARPARK AREA	7500

ZONE BREAKDOWN OPTION 2

ZONE 1

	NO.	%	Brief %	LOT SIZE
DENSE SINGLE 01	0	0%	30%	0.0
DENSE SINGLE 02	0	0%		0.0
TERRACE 01	0	0%	10%	0.0
TERRACE 02	0	0%		0.0
6 PACK	0	0%	50%	0.0
PARK TOWNHOUSE	0	0%		0.0
TOWNHOUSE 01	0	0%		0.0
TOWNHOUSE 02	0	0%		0.0
LARGE LOTS	0	0%	10%	0.0
CORNER LOTS	0	0%		0.0
TOTAL	0	0%		

ZONE 2

	NO.	%	Brief %	LOT SIZE
DENSE SINGLE 01	0	0%	30%	0.0
DENSE SINGLE 02	0	0%		0.0
TERRACE 01	0	0%	10%	0.0
TERRACE 02	0	0%		0.0
6 PACK	0	0%	50%	0.0
PARK TOWNHOUSE	0	0%		0.0
TOWNHOUSE 01	0	0%		0.0
TOWNHOUSE 02	0	0%		0.0
LARGE LOTS	0	0%	10%	0.0
CORNER LOTS	0	0%		0.0
TOTAL	0	0%		

ZONE 3 & 5

	NO.	%	Brief %	LOT SIZE
DENSE SINGLE 01	0	0%	30%	0.0
DENSE SINGLE 02	0	0%		0.0
TERRACE 01	0	0%	10%	0.0
TERRACE 02	0	0%		0.0
6 PACK	0	0%	50%	0.0
PARK TOWNHOUSE	0	0%		0.0
TOWNHOUSE 01	0	0%		0.0
TOWNHOUSE 02	0	0%		0.0
LARGE LOTS	0	0%	10%	0.0
CORNER LOTS	0	0%		0.0
TOTAL	0	0%		

ZONE 4

	NO.	%	Brief %	LOT SIZE
DENSE SINGLE 01	0	0%	30%	0.0
DENSE SINGLE 02	0	0%		0.0
TERRACE 01	0	0%	10%	0.0
TERRACE 02	0	0%		0.0
6 PACK	0	0%	50%	0.0
PARK TOWNHOUSE	0	0%		0.0
TOWNHOUSE 01	0	0%		0.0
TOWNHOUSE 02	0	0%		0.0
LARGE LOTS	0	0%	10%	0.0
CORNER LOTS	0	0%		0.0
TOTAL	0	0%		

APARTMENTS OPTION 2

APARTMENT 1

# AREA	1 BED	2 BED + STUDY	2 BED + 2 STUDY	TOTAL
# APARTMENTS	0	0	0	0
# APARTMENTS AREA	0	0	0	0

APARTMENT 2

# AREA	1 BED	2 BED + STUDY	2 BED + 2 STUDY	TOTAL
# APARTMENTS	0	0	0	0
# APARTMENTS AREA	0	0	0	0

APARTMENT 3

# AREA	1 BED	2 BED + STUDY	2 BED + 2 STUDY	TOTAL
# APARTMENTS	0	0	0	0
# APARTMENTS AREA	0	0	0	0

APARTMENT 4

# AREA	1 BED	2 BED + STUDY	2 BED + 2 STUDY	TOTAL
# APARTMENTS	0	0	0	0
# APARTMENTS AREA	0	0	0	0

APARTMENT 5

# AREA	1 BED	2 BED + STUDY	2 BED + 2 STUDY	TOTAL
# APARTMENTS	0	0	0	0
# APARTMENTS AREA	0	0	0	0

APARTMENT 6

# AREA	1 BED	2 BED + STUDY	2 BED + 2 STUDY	TOTAL
# APARTMENTS	0	0	0	0
# APARTMENTS AREA	0	0	0	0

APARTMENT 7

# AREA	1 BED	2 BED + STUDY	2 BED + 2 STUDY	TOTAL
# APARTMENTS	0	0	0	0
# APARTMENTS AREA	0	0	0	0

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Docklands, VIC, 3008, AUS
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www.dko.com.au / info@dko.com.au

Client Details
Sterling Global

Project
Centre Road
Oakleigh South

Project Number
10831

Drawing
Masterplan Option 2

Scale: 1:1000 @ A1
Date: 23/07/2017

A002

D17-279726

HUNTINGDALE ROAD

CENTRE ROAD

Zone 4
(Res 1 - Potential Standalone Development Stage)

STORMWATER
4,074.0 m²

APARTMENTS
06
44 UNITS

Zone 1

APARTMENTS
05
48 UNITS

APARTMENTS
04
32 UNITS

APARTMENTS
01
32 UNITS

STORMWATER
5,672.3 m²
Zone 2

APARTMENTS
02
50 UNITS

APARTMENTS
03
44 UNITS

STORMWATER
5,673.2 m²
Zone 3 & 5

MASTERPLAN OPTION 3 23/07/2015

	NO.	%	Req'd %	LOT SIZE
DENSE SINGLE 01	94	17.1%	30%	93.3
DENSE SINGLE 02	38	6.9%		114.0
TERRACE 01	55	10.0%	10%	97.5
TERRACE 02	32	5.8%		146.3
6 PACK	96	17.5%	50%	124.6
PARK TOWNHOUSE	70	12.7%		206.6
TOWNHOUSE 01	99	18.0%		161.5
TOWNHOUSE 02	24	4.4%		212.5
LARGE LOTS	40	7.3%	10%	321.5
CORNER LOTS	2	0.4%		
SUB-TOTAL	550	100.0%		
APARTMENT	250			
TOTAL	800			

SITE AREAS SCHEDULE

	m²
TOTAL SITE AREA	187941.9
ROADS	62069.3
OPEN SPACE	8117.2
SW DETENTION	15419.5

ZONE BREAKDOWN OPTION 3

APARTMENTS OPTION 3

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Client Details: Sterling Global

Project: Centre Road Oakleigh South

Project Number: 10831

Drawing: Masterplan Option 3

Scale: 1:1000 @ A1
Date: 23/07/2015

A003

Appendix C
Remediation Options Analysis – Landfill Gas

Remediation Options Report
1129 to 1149 Centre Road, & 22 Talbot Avenue, Oakleigh South, VIC

LANDFILL WASTE AND GAS REMEDIATION SCREENING ASSESSMENT

Available Technologies

Source Removal

Effectiveness: Source removal is considered to be the most effective remediation option in terms of the mitigation of risks to the potential future receptors at the site. Source removal also has advantages in that there would be a significant reduction in the on-going management requirements of the site including reduced monitoring requirements, no maintenance requirements and no mechanism for failure in the future.

Technical Limitations: Source removal would require a high level of site characterisation and assessment to ensure delineation of the waste area prior to excavations, classification of the excavated material for disposal and validation of the excavated area after waste is removed. Sorting of excavated material may also be necessary. There are likely to be geotechnical issues associated with waste mass being located at depths of up to 20 mbgs including dewatering and access for mobile plant and trucks.

Source removal would have significant costs associated with the technical limitations and requirements above as well as disposal costs for potentially up to 500,000m^3 of waste in Zone 1, and an as yet undefined volume of waste in Zone 2 (although likely to be significantly less than Zone 1). This may be partially off-set by lower on-going costs.

Community and Environmental Impact: Source removal may also have a negative impact on the surrounding community and the environment. Dust and odour emissions have the potential to affect local residences in the surrounding area and health and safety concerns would need to be managed for personnel involved in the excavations. Transport of waste will also impact on traffic in the area.

Feasibility: Source removal could be implemented at the site; however given the potential volume of waste in the Zone 1 landfill area, the technical limitations and the availability and cost of off-site disposal may make this option impractical. Furthermore, due to the age of the waste (40 years old), the type of waste (solid inert and putrescible), and the calculated low gas potential and risk, it is considered that there is less net environmental benefit in removing the waste from the site than for other options.

Source removal may be more feasible for small pockets of waste, such as those suspected to be located in Zone 2.

Source removal would not be possible for off-site sources (i.e. the Talbot Park landfill).

In-Ground Barriers and Venting

Horizontal Barriers and Venting

Effectiveness: Horizontal barriers can provide a reduction or a complete break in the vertical migration of gases from the landfill waste. Horizontal barriers are typically comprised of clay or engineered clay cap, or an impermeable geomembrane or a liner, such as HDPE or LDPE. Barriers may be installed with a high permeability layer beneath them to provide a pathway for gas to be vented to atmosphere.

The installation of barriers, such as a cap, can also serve to reduce landfill gas generation in the unsaturated zone through a reduction in rainfall infiltration and reduced leachate generation as well as to physically isolate the waste to reduce direct contact risks and aesthetic impacts.

Venting layers on a large scale are typically constructed of a crushed rock or gravel layer with horizontal pipes or void formers connected to inlet and outlet risers to promote the flow of gas through the system. Active ventilation can be applied to increase the effectiveness of the ventilation layer.

Technical Limitations: Clay caps would be required to be engineered with a high degree of compaction to achieve the optimal reduction in permeability; this may also serve to improve the geotechnical stability of the area over the landfill. Liners such a HDPE or LDPE required a high level of construction quality control to ensure adequate sealing along lapped seams and around any penetrations, such as piles or monitoring wells and to prevent damage during installation. Both caps and liners would be susceptible to damage due to subsidence.

Adequate drainage would be required for venting layers beneath a cap or liner to ensure the system does not become inundated with groundwater or leachate. Groundwater or leachate from the drainage system may require treatment prior to disposal.

Community and Environmental Impact: The installation of capping and venting systems may produce local impacts such as dust noise and additional traffic for the importation of clay and gravel. Impacts may be more severe if waste is exposed.

Feasibility: The implementation of a clay or engineered clay cap in Zone 1 is considered to be a suitable control measure to reduce the vertical migration of gases in this area and gives the additional advantages of reducing infiltration and increasing the stability of the site. As this would not create a complete break in the migration pathway, additional control measures would be required to protect individual buildings above the cap.

The installation of an impermeable liner across the whole landfill area is not considered to be practical given that the use of building piles would be required for the proposed development and the delicate nature of the liners. The same effect can be achieved through the implementation of gas resistant membranes in individual buildings and this would reduce the total area of barrier that would need to be installed.

The implementation of a horizontal venting layer in addition to a barrier may not be required to manage the risks; this option may be more applicable if groundwater remediation is found to be necessary and requires the installation of a sump. An active landfill gas ventilation system would greatly increases on-going maintenance requirements and would have a greater potential for failure than a passive system.

The installation of a horizontal barrier above small pockets of waste, such as those suspected to be located in Zone 2 is considered to be inefficient.

Vertical Barriers and Venting

Effectiveness: Vertical barriers can provide a reduction or a complete break in the lateral migration of gases from the landfill waste and could be used to prevent migration of gases between sites or zones. As with horizontal barriers, a venting system may also be installed in tandem with a vertical barrier to provide a preferential pathway for gas release. In areas where the gas migration potential is relatively low, a venting system on its own may be a sufficient landfill gas control measure. Vertical barriers and venting could also be applied around the outside of a cap or liner to mitigate the potential for increases in lateral migration.

Vertical barriers or 'cut-off' walls can be created using a number different techniques, the most common approaches include:

- Synthetic geomembranes;
- Bentonite slurry walls; and
- Sealed sheet piles;

Vertical venting systems could be installed to complement a barrier or as a standalone mitigation measure. Typical venting methods include gravel filled boreholes or trenches or drive-in geocomposite void formers. Vertical risers are usually employed to promote flow and vent gas at controlled points. A combination of deep boreholes and shallow trenches may also be employed to facilitate deep venting requirements or share vent risers between multiple boreholes.

Where venting is used without a barrier system, trenches will provide a more complete break in the migration pathway. Where the installation of trenches is limited, the density of the boreholes and vents would need to be increased to adequately mitigate the expected gas flow.

Active venting may also be employed to increase the efficiency of the venting system in areas where the installation of a cut-off wall is not practical and a high level of mitigation is required.

Technical Limitations: There are practical limitations to the depth to which geomembranes can be installed, with a key consideration being the depth to groundwater. It is considered unlikely however that the depth to groundwater would represent a significant concern for installing a vapour barrier in the top 2m of this site. The installation of geomembranes would require the excavation of trenches (and potentially waste) and dewatering may be required to enable installation.

The installation of slurry walls would also require the excavation of trenches; however installation can be achieved without dewatering. Slurry walls can be installed to much greater depths than geomembranes. Slurry walls may be degraded when in contact with leachate and an assessment of their durability in the presence of leachate from the site may be required, prior to adopting this as a remediation measure.

Sheet piling is also depth-limited; however, as with geomembranes, it is likely that sheet piles could be installed to the depth necessary for effective landfill gas control at the site.

Community and Environmental Impact: The installation of trenches and boreholes may produce local impacts such as dust, odour, noise and vibration. In some circumstances, vibration may cause damage to adjacent structures and become a significant issue. Impacts due to dust and odour may be more severe if waste is exposed.

Feasibility: As a minimum, control measures will be required to mitigate off-site migration of gases. Currently, off-site migration has only been identified along the northern boundary of Zone 1. However,

as development over Zone 1 progresses, it is expected that vertical migration will become limited and lateral migration may increase, necessitating control measures around additional boundaries.

The implementation of a vertical barriers and / or venting around the internal boundaries of the Zone 1 landfill would reduce the requirements of control measures in other parts of the site.

Further characterisation of the Zone 1 landfill would be required to determine the most suitable type of barrier (if any) and venting system that would be required.

Any active venting system would increase on-going maintenance requirements and would have a greater potential for failure than a passive system.

Building Specific Engineering Controls

Robust methodology exists for the installation of gas mitigation measures for building on gas affected ground. Coffey recommends the implementation of the British Standard BS8485 (2007) *Code of Practice for the Characterization and Remediation from Ground Gas in Affected Developments*, (the 'Standard'), which identifies a range of gas protection measures that may be required. To help decide which suite of gas protection measure may apply, the Standard includes a classification called the 'Adopted Characteristic Situation', which is based on the Gas Screening Values.

Effectiveness: The protection measures are assigned a relative score for each measure, with the aggregate of the scores for each protection measure implemented required to meet a minimum rating, based on the type of building present on the site, or likely to be built. The following measures can be implemented in order to meet the minimum aggregate score for gas protection:

- Passive sub-floor ventilation. Score 1 to 2.5 pending performance.
- Active sub-floor ventilation. Score 2.5.
- Ventilated Carpark (basement or undercroft beneath all enclosed or habitable spaces). Score 4.
- Reinforced concrete slab. Score 0.5 to 1.5 pending design.
- Fully tanked basement. Score 2.
- Membrane. Score 0.5 to 2 pending material, design, quality control and validation.

Passive sub-floor ventilation can be achieved through the use of a clear void (or crawlspace) beneath the building ventilated by air bricks or by using gravels, geocomposite or polystyrene void formers connected to inlet and outlet vents.

Active sub-floor ventilation can be achieved through a similar setup as the passive system with the addition of mechanical extraction of gas at the outlet or via positive pressurisation of the sub-floor area.

Technical Limitations: Depending on the design, venting systems may be damaged or become blocked and may require regular inspections. Low level inlet vents, such as air bricks, are particularly susceptible to being blocked or obstructed (i.e. through vegetation growth etc.). In addition, active systems should be designed with a level of redundancy built-in, in case of failure. Active systems can be designed to operate as passive systems and should be installed together with membrane barriers.

Where ventilated carparks are used as gas protection measures, controls need to be in place to ensure any mechanical ventilation systems run continuously. Where basement carparks do not extend under the full area of the overlying building or where low ventilation areas may exist within the carpark, additional gas protection measures are required.

As Australian and British construction techniques vary, a suitably qualified engineer should review the use of a building slab or fully tanked basement as a gas mitigation measure against the British Standard. In particular, the use of 'water bars' (refer BS8485:2007) is not common practice in Australia.

The installation of membranes requires all seams, joins and penetrations to be sealed. Membranes are often delicate and can be easily pierced during construction. Membrane installation needs to be completed in line with current best practice. To achieve compliance, membrane installation must occur under a construction quality assurance plan (CQAP) with independent validation and (potentially) integrity testing. The number of proprietary membranes available in Australia is limited.

Community and Environmental Impact: Impact to the local community and environment is expected to be minimal; i.e. similar to construction sites of similar scale that do not require these measures. Vent risers may cause an aesthetic impact.

The implementation of an adequate CQAP may cause disruption to the standard construction process resulting in delays.

Feasibility: As part of the preliminary site characterisation, Gas Screening Values were calculated from the concentrations and flow rates available for gas bores at the site. Based on the Gas Screening Values, the site was classified as having an Adopted Characteristic Situation of 2, which represents a low risk with respect to human health hazard. Uncertainties were noted with respect to the landfill waste area in the centre of Zone 1, due to no bores being available to sample Therefore, the characteristic gas situation in this area remains unknown; i.e. Coffey is not able to recommend what landfill gas mitigation measures would be required for Zone 1.

In accordance with the Standard, the aggregate score required for the site is 3, based on a land use scenario of 'Non-Managed Property' or 'Public Building'. Non-Managed Property is defined in the Standard as including private residential housing and Public Buildings. The category may also include managed apartments.

Based on further site characterisation, an Adopted Characteristic Situation could be calculated for each Zone, and there is potential that this could result in a rating of 1 in some areas; i.e. a very low risk to human health and if this were found to be the case, would not require mitigation measures to be installed in buildings. This is likely the case in Zone 4 once filling is completed.

Technology Screening Matrix

As multiple remediation or management technologies are likely to be required at the site, a technology screening matrix has been applied on a number of complete options for each area of interest.

Zone 1

Option 1:

- Source removal of waste from the former landfill.

Option 2:

- Installation of an engineered clay cap and HDPE liner above the waste
- Installation of a gas venting system below the liner with a leachate collection sump to ensure the venting layer does not become saturated
- Installation of a boundary venting system to prevent off-site migration of landfill gas.

Option 3:

- Installation of an engineered clay cap above the waste
- Installation of a taped and sealed membrane and venting system consisting of a clear void with air brick vents beneath each building
- Installation of a boundary venting system to prevent off-site migration of landfill gas.

Option 4:

- Installation of an engineered clay cap above the waste
- Installation of a proprietary gas resistant membrane and venting system consisting of a gravel layer with inlet and outlet risers beneath each building
- Installation of a boundary venting system to prevent off-site migration of landfill gas.

Zone 1 Remediation Technology Screening Matrix (Landfill Gas)

Option	Discussion		Ratings *(Higher rating more likely to meet project objectives)*							
			Probability of achieving Remediation Goals (G)	Likelihood of achieving operational and logistical goals (L)	Regulatory Compliance (R)	Financial costs (capital, operating, ongoing) (C)	Timing / Duration of Works (T)	Ongoing management requirements (M)	Community / Environmental and Health and Safety Impacts (I)	Rating Summation
	Advantage	Disadvantage	0 1 2 3 4 5	0 1 2 3	0 1 2 3	High$ 1 2 3 4 5 Low$	1 2 3 4	1 2 3 4	1 2 3 4	G*(L+R+C)*(T+M+I)
Option 1: Source removal of waste from the former landfill.	• Most effective risk mitigation • Limited on-going monitoring • No on-going maintenance or associated maintenance cost • Certainty - no chance of future failure	• High capital cost • Significant time requirements and logistics • Additional characterisation required • Dewatering required • Community impact • Environmental impact • Health and safety impact	5	2	2	**1**	1	**4**	1	150
Option 2: Clay cap with HDPE line, horizontal venting layer and boundary venting	• Complete barrier for vertical migration of LFG • Reduction in lateral migration • Reduced infiltration to waste would generate less LFG than would otherwise occur	• Chance of failure • High on-going maintenance cost • On-going extraction of leachate could be expensive • Environmental impact • Not compatible with geotechnical piles to support buildings	3	2	3	2	3	1	2	126
Option 3: Clay cap with building membranes/venting void and boundary venting	• Reduction in vertical migration • Reduction in lateral migration • Some reduction of infiltration to waste generating less LFG than would otherwise occur • Lower impact to community and environment • Lower cost	• Environmental impact • On-going maintenance cost	3	3	3	4	2	2	3	210
Option 4: Clay cap with building membranes/venting layer and boundary venting	• Reduction in vertical migration • Reduction in lateral migration • Some reduction of infiltration to waste generating less LFG than would otherwise occur • Lower impact to community and environment	• Environmental impact • On-going maintenance cost • Increased installation requirements and costs	4	3	3	3	2	2	3	252

Probability of achieving Remediation Goals (G)	Likelihood of achieving operational and logistical goals (L)	Regulatory Compliance (R)	Financial costs (capital, operating, ongoing) (C)	Timing / Duration of Works (T)	Ongoing management requirements (M)	Community / Environmental and Health and Safety Impacts (I)
0 = not applicable	0 = not applicable	0 = Not Permissible	1 = Very High	1 = Very Long	1 = High	1 = High
1 = unlikely to be achieve goals	1 = unlikely to be achieve goals	1 = Probably not Permissible	2 = High	2 = Long	2 = Medium	2 = Medium
2 = possible to be achieve goals	2 = possible to be achieve goals	2 = Probably Permissible	3 = Moderate	3 = Moderate	3 = Low	3 = Low
3 = likely to be achieve goals	3 = likely to be achieve goals	3 = No Permitting Problems	4 = Low	4 = Short	4 = Nil	4 = Nil
4 = highly likely to be achieve goals			5 = Very Low			
5 = source removal						

Zone 2 and Talbot Park Boundaries

Option 1:

- Source removal of waste (extent assumed to be limited to diffuse areas of waste in uncontrolled fill above slimes).

Option 2:

- Not considered for Zone 2 – ruled out based on inferred limited waste extent.

Option 3:

- Installation of a clay layer above the waste
- Installation of a taped and sealed membrane and venting system consisting of a clear void with air brick vents beneath each building
- Installation of a boundary venting system to prevent off-site migration of landfill gas.

Option 4:

- Installation of a clay cap above the waste
- Installation of a proprietary gas resistant membrane and venting system consisting of a gravel layer with inlet and outlet risers beneath each building
- Installation of a boundary venting system to prevent off-site migration of landfill gas.

Zone 2 Remediation Technology Screening Matrix (Landfill Gas)

Option	Discussion		Ratings *(Higher rating more likely to meet project objectives)*							
			Probability of achieving Remediation Goals (G)	Likelihood of achieving operational and logistical goals (L)	Regulatory Compliance (R)	Financial costs (capital, operating, ongoing) (C)	Timing / Duration of Works (T)	Ongoing management requirements (M)	Community / Environmental and Health and Safety Impacts (I)	Rating Summation
	Advantage	Disadvantage	0 1 2 3 4 5	0 1 2 3	0 1 2 3	High$ 1 2 3 4 5 Low$	1 2 3 4	1 2 3 4	1 2 3 4	G*(L+R+C)*(T +M+I)
Option 1: Source removal of waste from the former landfill.	• Most effective risk mitigation • Limited on-going monitoring • No on-going maintenance • No chance of future failure	• Additional characterisation required • Dewatering required • Community impact • Environmental impact • Health and safety impact	5	3	2	2	2	4	1	245
Option 2 – Not considered										
Option 3: Clay cap with building membranes/venting void and boundary venting	• Reduction in vertical migration • Reduction in lateral migration • Some reduction of infiltration to waste • Low impact to community and environment • Low cost	• Environmental impact • On-going maintenance cost	3	3	3	4	2	2	3	240
Option 4: Clay cap with building membranes/venting layer and boundary venting	• Reduction in vertical migration • Reduction in lateral migration • Some reduction of infiltration to waste • Low impact to community and environment	• Environmental impact • On-going maintenance cost • Increased installation requirements and costs	4	3	3	3	2	2	3	252

Probability of achieving Remediation Goals (G)	Likelihood of achieving operational and logistical goals (L)	Regulatory Compliance (R)	Financial costs (capital, operating, ongoing) (C)	Timing / Duration of Works (T)	Ongoing management requirements (M)	Community / Environmental and Health and Safety Impacts (I)
0 = not applicable	0 = not applicable	0 = Not Permissible	1 = Very High	1 = Very Long	1 = High	1 = High
1 = unlikely to be achieve goals	1 = unlikely to be achieve goals	1 = Probably not Permissible	2 = High	2 = Long	2 = Medium	2 = Medium
2 = possible to be achieve goals	2 = possible to be achieve goals	2 = Probably Permissible	3 = Moderate	3 = Moderate	3 = Low	3 = Low
3 = likely to be achieve goals	3 = likely to be achieve goals	3 = No Permitting Problems	4 = Low	4 = Short	4 = Nil	4 = Nil
4 = highly likely to be achieve goals			5 = Very Low			
5 = source removal						

Preferred Options

Zone 1

The preferred option for Zone 1 involves the placement of a clay capping layer above the former landfill, the installation of a boundary gas mitigation system around the former landfill and the installation of a gas resistant membrane and venting system for buildings constructed above the landfill gas affected area.

The installation of an engineered clay cap above the waste would assist in reducing the upwards migration landfill gas, providing limited protection for any development that occurs in this area. Although the cap would not completely break the vertical migration pathway, it would also serve to reduce landfill gas generation in the unsaturated zone through a reduction in rainfall infiltration and subsequently reduce leachate generation.

The application of a capping layer over the putrescible waste would alter the rate of lateral migration of landfill gas. The reduction in the vertical flow path would mean that landfill gas that was previously being emitted to atmosphere through site surface would be forced to migrate laterally through the subsurface beneath the capping layer resulting in potential impacts to the surrounding land. A gas venting system surrounding that capped area would be able to provide a preferential pathway for gas migrating laterally through the sub-surface; the system would vent the gas to atmosphere in a safe and controlled manner. It is noted that in some areas (i.e. on the northern boundary) off-site gas migration is already occurring and mitigation measures would be required regardless of any potential increase in lateral migration due to the placement of a cap or the development of the site.

Further characterisation of the extent and gas generation rates of the landfill are would be required to determine the type and position of the boundary venting system. However, based on the current understanding of the gas regime, it is unlikely to require the inclusion of an impermeable barrier and would most likely consist of a series of gravel filled bores and / or trenches with vent risers.

Buildings would be further protected with the inclusion of a gas resistant membrane and venting system. As a minimum, this would comprise a proprietary gas resistant membrane installed under independent inspection and with integrity testing and passive sub-floor venting system incorporating a gravel layer connected to vent risers to promote air flow. The system be assessed using the British Standard 8485:2007 and should have an aggregate gas protection score of at least 3.

It is noted that there are uncertainties relating to the gas regime in the area of the landfill. Should further characterisation of the site result in an increase in risk, the aggregate gas protection score required would need to be increased appropriately; i.e. more complex gas protection measures could be required. Conversely, further characterisation of the site might result in a decrease in risk meaning less complex gas protection measures may be sufficient in some parts of the site.

Zone 2

The nature and extent of putrescible waste in Zone 2 is not well defined and is based on circumstantial evidence in previous reports and indirect evidence such as bores with high landfill gas concentrations. As such, the extent of remediation and management measures could vary.

The preferred option for Zone 2 is based on the assumption that the extent of waste is limited to diffuse areas in the uncontrolled fill above slimes.

Although the placement of an engineered clay cap is likely to have less effect that in Zone 1, some physical separation between the waste and the surface would be required. The placement of either an engineered fill platform or capping layer as recommended in the Geotechnical Conceptual Site Model (Coffey September 2013) would be sufficient.

A boundary venting system would also be required to reduce lateral migration of gases off-site or into other zones. Gas migration rates are expected to be considerably lower than in Zone 1 and this should result in system with less venting capacity than Zone 1 being suitable (i.e. vent bores and risers could be spaced further apart).

Building protection measures would also be required above gas affected areas. Based on the landfill gas monitoring conducted at the site, the gas protection system should have an aggregate gas protection score of at least 3 (as per British Standard 8485:2007).

Should waste be identified in shallow (<4 mbgs) discrete pockets of putrescible material surrounded by inert fill, it may be feasible to remove this material from Zone 2, lessening the gas protection measures required.

Zone 3, 4 and 5

Based on the current understanding of the site, landfill gas is not being generated in these zones and mitigation measures applied in other zones would also protect future development in these areas.

Appendix D
Groundwater Remediation Options Analysis

Remediation Options Report
1129 to 1149 Centre Road, & 22 Talbot Avenue, Oakleigh South, VIC

GROUNDWATER REMEDIATION SCREENING ASSESSMENT

Available Technologies

Option 1 - Monitored Natural Attenuation

Effectiveness: Monitored natural attenuation would not include any active remediation works rather it allows natural attenuation processes such as biodegradation, sorption, dilution and dispersion. The primary contaminants of concern identified at the site include ammonia and nitrate from fill material with BTEX, TPH and heavy metals also being present above criteria.

Sorption would be expected to contribute most to ammonia attenuation at the site. Ammonia will sorb to soil with high clay or organic carbon content. Clean fill material being used to re-instate the Zone 4 excavation are expected to act as a sink for ammonia moving away from the Zone 1 waste area.

Groundwater flowing out of the waste area is also expected to have low dissolved oxygen content and redox potential producing conditions favourable to de-nitrification of nitrate through microbial reactions. This process would require an electron donor, typically supplied by organic carbon; initially organic chemical in the groundwater such as BTEX or TPH would be expected to act as an electron donor; however, a higher mass of organic carbon would be required for complete de-nitrification of all nitrate.

Primary chemicals of concern and indicator chemicals would be monitored to ensure the groundwater geochemistry continues to be suitable for MNA.

Technical Limitations: Although the waste in Zone 1 is quite old (40 plus years), the mass is considerable and could act as an ongoing source for an extended period of time.

Groundwater levels in Zone 1 would be expected to rise following the filling of Zone 4. An increase in groundwater level will saturate waste currently in the vadose zone and this could lead to an increase in chemical concentrations in groundwater leaving Zone 1.

Channelling groundwater through gravel draining layers will limit the ability of soils in Zone 4 to act as a sink for ammonia; however, the natural soils of the Brighton Group would also be expected sorb ammonia.

As fresh groundwater enters Zone 1 or as impacted groundwater mixes with fresh groundwater further down-gradient the dissolved oxygen and redox potential would be expected to increase and this would limit de-nitrification of nitrate.

A contingency plan would be recommended to be put in place should on-going monitoring indicate that natural attenuation is not having the required effect.

Community and Environmental Impact: An area of impacted groundwater would persist at the site and potentially down-gradient of the site, this could impact on beneficial uses of groundwater and a Groundwater Restricted Use Zone (GRUZ) may be required.

Applicability: Given the current understanding of the groundwater geochemistry an MNA approach is considered to be feasible; however the ongoing cost of groundwater monitoring should be considered.

Option 2 - In-Situ Remediation

Effectiveness: There are a wide range of in-situ remediation technologies available. The most applicable method to applying an in-situ remediation technology to groundwater in Zone 1 would be to implement one or more Permeable Reactive Barriers (PRB).

A typical PRB would consist of a gravel or sand filled trench / excavation which could be treated with the addition of an amendment to elicit a desirable effect on the groundwater. The amendment may be an electron donor or acceptor to promote chemical or microbial treatment of groundwater or a media to which a contaminant may adsorb to. Groundwater would be treated as it flows through the barrier with the aim to reduce contaminant concentration to acceptable levels as it exits Zone 1 into Zone 4.

Technical Limitations: Due to the complexity of the of the groundwater chemistry, several barriers or treatment zones may be required to effectively treat all the contaminants of concern and their by-products.

The reactive elements of a PRB would need to be replenished on a regular basis to allow for groundwater treatment to occur over a long period of time.

A comprehensive groundwater model that incorporated flow and geochemistry would be required to the successfully implement a PRB system.

Community and Environmental Impact: The installation of a PRB may produce local impacts such as dust and noise. Replenishment of amendment could be done using a series of in-situ pipework to distribute the amendment throughout the barrier.

Impacts are likely to be low.

Applicability: The implementation of several PRBs to treat all the contaminants of concern may not be possible in the limited space available between the landfill waste and Zone 4. Given the mass of waste at the site the cost and frequency of replenishing the amendment may be prohibitively high.

Option 3 – Pump and Treat

Effectiveness: The pump and treat option would involve the installation of a sump to groundwater extraction wells within the waste area in Zone 1 or down-gradient of the source zone, potentially being combined into the geotechnical drainage layers in Zone 4.

Ex-situ treatment options could vary significantly from a treatment plant utilising chemical or thermal treatment, to implementing a small wetlands system for bioremediation (either on-site in the stormwater retention area, or off-site, such as Huntingdale Golf Course). The degree to which the groundwater is treated would be linked to the method of disposal (i.e. disposal to sewer or reinjection into the aquifer).

The extraction of groundwater on-site would also assist in altering the flow of groundwater in the area and could be utilised to help reduce the amount of untreated impact leaving the site.

Technical Limitations: As with the in-situ remediation options several different treatment technologies may need to be implemented to target all the contaminants of concern.

Routine testing would be required to ensure the end criteria are being met and waste water is suitable for reinjection or off-site disposal.

The pump and treat system would require on-going management and maintenance.

Community and Environmental Impact: Depending on the design there is potential that a water treatment plant could aesthetically impact the community and could have a negative environmental footprint (i.e. power consumption). If a wetlands treatment system were constructed onsite, there may be potential (perceived or real) community impact from treating leachate in a community area.

Applicability: Depending on the design and scale required, the construction and a water treatment facility could require a significant capital investment.

Permits would be required to enable the disposal of treated water to sewer or for offsite reuse.

Technology Screening Matrix

A technology screening matrix has been applied for the conceptual options described above.

D17-279726

Zone 1 Remediation Technology Screening Matrix (Landfill Gas)

Option	Discussion		Ratings							
			Probability of achieving Remediation Goals (G)	Likelihood of achieving operational and logistical goals (L)	Regulatory Compliance (R)	Financial costs (capital, operating, ongoing) (C)	Timing / Duration of Works (T)	Ongoing management requirements (M)	Community / Environmental and Health and Safety Impacts (I)	Rating Summation
	Advantage	Disadvantage	0 1 2 3 4 5	0 1 2 3	0 1 2 3	High$ 1 2 3 4 5 Low$	1 2 3 4	1 2 3 4	1 2 3 4	G*(L+R+C)*(T+M+I)
Option 1: Monitored Natural Attenuation	• Low capital expenditure required • Minimal above ground impact	• Long time frame for on-going monitoring and management • Area affected by impacted groundwater may require a GRUZ • May not be effective for all contaminants • Contingency Plan may be required	3	3	2	**4**	2	**4**	2	216
Option 2: Insitu Groundwater Remediation (ie Permeable Reactive Barrier)	• Treats groundwater as it exists Zone 1	• Technology not widely implemented to treat leachate • May not be effective for all contaminants • May require multiple treatment zones • High on-going maintenance	3	1	2	2	2	2	3	105
Option 3: Pump and Treat (Groundwater Extraction and Treatment)	• Groundwater level depression to help contain groundwater on-site • Likely to treat most contaminants	• Permit required to for disposal to sewer • High capital cost • High on-going maintenance	4	2	2	1	2	2	2	120

Probability of achieving Remediation Goals (G)	Likelihood of achieving operational and logistical goals (L)	Regulatory Compliance (R)	Financial costs (capital, operating, ongoing) (C)	Timing / Duration of Works (T)	Ongoing management requirements (M)	Community / Environmental and Health and Safety Impacts (I)
0 = not applicable	0 = not applicable	0 = Not Permissible	1 = Very High	1 = Very Long	1 = High	1 = High
1 = unlikely to be achieve goals	1 = unlikely to be achieve goals	1 = Probably not Permissible	2 = High	2 = Long	2 = Medium	2 = Medium
2 = possible to be achieve goals	2 = possible to be achieve goals	2 = Probably Permissible	3 = Moderate	3 = Moderate	3 = Low	3 = Low
3 = likely to be achieve goals	3 = likely to be achieve goals	3 = No Permitting Problems	4 = Low	4 = Short	4 = Nil	4 = Nil
4 = highly likely to be achieve goals			5 = Very Low			
5 = source removal						

Preferred Options

Zone 1

Monitored natural attenuation is the preferred approach to groundwater remediation in Zone 1. Coffey consider that this approach is commensurate with the risk profile associated with the groundwater contamination from Zone 1 and the likely uses of groundwater in the vicinity of Zone 1. A groundwater model will need to be developed prior to the implementation of MNA. The groundwater model will need to include a detailed geochemical assessment of groundwater at the site, including the source zone area and in the surrounding aquifer. The effect of filling in Zone 4 will need to be considered, both in terms of alterations to the groundwater flow and the potential for further saturation of waste currently above the groundwater levels in Zone 1.

The current network of groundwater monitoring wells would need to be extended to allow for the monitoring of contaminants and natural attenuation parameter through the plume. Typically this would be done using a series of groundwater bores running from up-gradient to down-gradient with several bores across gradient. Consideration should be given to a suitable layout of bores during the next phases of site characterisation.

A groundwater quality management plan (GQMP) will need to be developed and implemented to ensure the natural attenuation process are having the desired affect and that the assimilative capacity of the aquifer is appropriate for the mass of contaminants moving out of the waste area. The GQMP should contain a sampling and analysis plan for ongoing monitoring. In addition the GQMP should include trigger values and a decision matrix to enable a contingency plan to be enacted should the MNA approach be found to be not as effective as predicted, as well as allowing for a staged reduction in the frequency and an eventual cessation of monitoring.

The contingency plan will need to be developed along with the GQMP and if required it may be beneficial to have any infrastructure necessary for its implementation in place prior to the development of the site being complete. A contingency plan may include injection or extraction wells into the Zone 4 drainage layer, whereby organic carbon rich material could be injected for the treatment of groundwater, or groundwater extracted for subsequent treatment. These options should be further refined in the detailed design stage, in consultation with the Auditor.

As an area of impacted groundwater would persist at the site and potentially down-gradient of the site, the implementation of a Groundwater Restricted Use Zone (GRUZ) may be necessary. The enactment of a GRUZ would require the developer to show that Clean Up To the Extent Practical (CUTEP) has been achieved. The CUTEP submission would be conducted as part of the 53X Environmental Audit process.

The clay and organic carbon content of material being imported into Zone 4 could alter the effectiveness of this approach. Consideration should be given as the how fill material is selected and re-instated within the quarry void and how the drainage channels will affect the ability for this material to act as a 'sink'.

Zone 2

As for Zone 1.

Zone 4

Once Zone 4 is backfilled, groundwater levels and flow directions are likely to stabilise over time. Pending remediation of groundwater in Zone 1, and stabilisation of groundwater flow directions across the site, no groundwater remediation would be required for Zone 4.

Zone 3 and Zone 5

Based on the current data, remediation of groundwater is not required.

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SCHEDULE 11 TO THE DEVELOPMENT PLAN OVERLAY

Shown on the planning scheme map as **DPO11**.

AMCOR SITE, HEIDELBERG ROAD, ALPHINGTON

This schedule applies to the Amcor site which is bounded by Heidelberg Road, Parkview Road (including No 28 Parkview Road) Chandler Highway and the Yarra River.

1.0 Requirements before a permit is granted

18/07/2013
C200

A permit may be granted before a development plan has been approved for the following:

- Earthworks and site preparation works provided the works are carried out in accordance with a Construction Management Plan prepared in accordance with this Schedule;
- The removal or demolition of any building provided the demolition or works are carried out in accordance with a Construction Management Plan prepared in accordance with this Schedule;
- The construction of minor buildings or works provided the buildings or works are carried out in accordance with a Construction Management Plan prepared in accordance with this Schedule;
- Consolidation or subdivision of land; and
- Removal or creation of easements or restrictions.

Before granting a permit the responsible authority must be satisfied that the permit will not prejudice the future use and development of the land in an integrated manner and will contribute to the vision for the Amcor site.

The land may be developed in stages.

2.0 Conditions and requirements for permits

18/07/2013
C200

Except for a permit issued as provided for under Clause 1.0, a permit must contain conditions or requirements which give effect to the provisions and requirements of the approved Development Plan.

Before granting any permit in accordance with an approved development plan, the owner/s of the land must enter into an agreement with the responsible authority under Section 173 of the Planning and Environment Act 1987 which must provide, to the satisfaction of the responsible authority that the owners will:

- Provide 5% of the total number of dwellings for the purpose of affordable housing developed in association with an accredited housing association;
- Provide the first 30 metres of land from the Yarra River, measured from the edge of the river bank, to maintain ongoing public access, protect riparian vegetation and maintain landscape values along the Yarra River; and
- Construct a pedestrian and bicycle path along the Yarra River frontage of the site connecting with existing pedestrian and bicycle accessways.

The cost of preparing and lodging the agreement, including any Land Titles Office registration fees, must be paid for in full by the owner(s).

Prior to the commencement of any permitted demolition, buildings or works, a detailed Construction Management Plan as relevant demolition or those buildings or works must be prepared to the satisfaction of the responsible authority. In considering the Construction

Management Plan, the responsible authority must take into account any comments received from VicRoads and Public Transport Victoria within 21 days of the date of referral of the Construction Management Plan to the relevant authorities. The Construction Management Plan must include, but is not limited to, the following:

- Staging of construction;
- Protection of heritage fabric consistent with any conditions attached to any permit or exemption issued for the relevant demolition, subdivision, buildings or works;
- Protection of identified significant vegetation;
- Management of public access and linkages around the site during construction;
- Site access, parking and traffic management;
- Any works within the Heidelberg Road, Chandler Highway, LaTrobe Avenue, Lugton Street or Parkview Road road reserve;
- Sediment control and site drainage;
- Hours of construction;
- Control of noise, dust and soiling of roadways;
- Discharge of polluted waters;
- Demolition & excavation;
- Storage of construction materials;
- Location of site offices, & cranes;
- Public safety;
- Management of potentially contaminated materials;
- Collection and disposal of building and construction waste;
- Methodology for responding to complaints associated with the construction works; and
- Site manager contact details.

All development must be carried out in accordance with the approved Construction Management Plan to the satisfaction of the responsible authority.

3.0 Requirements for development plan

18/07/2013
C200

A development plan must be generally in accordance with the *Indicative Framework Plan* as shown in Figure 1 to the satisfaction of the responsible authority.

The development plan must be consistent with the following vision for the site:

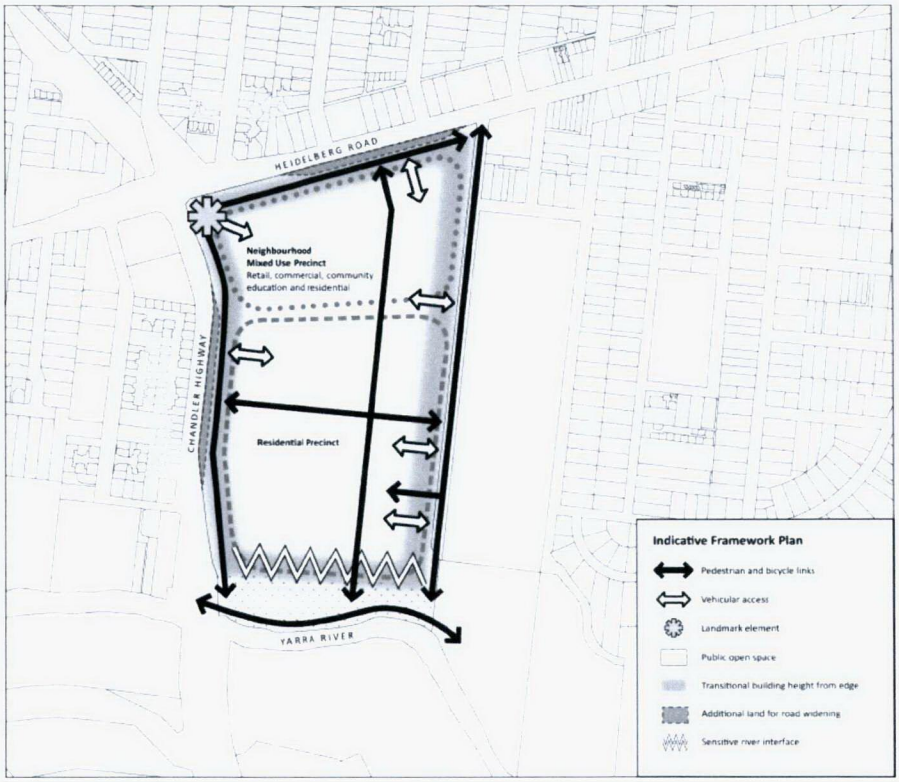
Vision

- The Amcor site will become a sustainable, predominantly residential community.
- The Amcor site will be redeveloped to provide a predominantly medium to higher density residential development, providing homes for a diversity of households including affordable housing, supported by convenience retailing services and community facilities, with employment opportunities in offices and showrooms along the Heidelberg Road frontage.
- The development will provide a transition in the scale of buildings from Heidelberg Road and Chandler Highway stepping down to the Yarra River in the south and Parkview Road as appropriate.

- The development will demonstrate a high quality architectural response, implement innovative ESD features, provide opportunities for best practice in environmental management, and provide a high standard of internal amenity.
- The development will protect and enhance the Yarra River environs.
- The development will create a cohesive community across south Alphington and south Fairfield.
- The development will retain some links to the site's industrial past.

The development plan may be prepared in stages.

Figure 1 Indicative Framework Plan



The development plan must include the following documents, reports, guidelines and plans, prepared to the satisfaction of the responsible authority:

Planning Report

A planning report that includes:

- A site analysis that identifies the key attributes of the land, its context, the surrounding area and its relationship with existing or proposed uses on adjoining land;
- A context analysis identifying the surrounding area, existing or proposed uses on adjoining land, and other neighbourhood features such as public transport, neighbourhood centres, walking and cycling connections;
- Identification of important views to be protected and enhanced, including views of the site and views from the site;
- Details of any known contamination (a certificate or statement of environmental audit for the land covered by the Environmental Audit Overlay will be required to be prepared by a suitably qualified environmental auditor before any construction associated with a sensitive use can commence);

- Demonstrates how the recommendations of the Conservation Management Plan, Housing Diversity Report, Community Infrastructure Report, ESD Strategy, and Site Remediation Strategy have been incorporated into the proposed development of the land; and
- An assessment of any air emissions and odour buffer requirements affecting the site.

Site Master Plan

A site master plan must be provided that includes, but is not limited to:

- The proposed uses of each building and estimated floor area for each use;
- An indication of the approximate residential yield for the site, comprising a range of residential development densities and dwelling types as identified in the Housing Diversity Report. and including affordable housing;
- The location of a neighbourhood based community hub consisting of a range community uses including meeting rooms and community spaces and facilities;
- The location of neighbourhood retail facilities to service new and existing residents, and small offices/commercial development to generate employment opportunities;
- An interface with the Yarra River that:
  - Enhances the bushland character of the river corridor;
  - Protects significant stands of remnant and native vegetation present in various locations abutting the site; and
  - Integrates with planting along the Yarra River wetlands;
- The location of open space and recreation facilities to be provided on the site, including areas available to the public; and.
- The location of heritage buildings and significant vegetation.

Design Guidelines

Design guidelines and principles for the site (or part of the site) must include, but are not limited to:

- Development concept plans including indicative:
  - Building heights and setbacks;
  - Elevations and cross sections;
  - Building materials, treatments, including reflectivity details, and architectural styles throughout the site;
  - Siting and orientation of buildings having regard to passive energy efficiency techniques and spacing between buildings;
  - Treatments for key interface areas – between open space areas and proposed development, within existing streetscapes, and between residential and non-residential land uses and the proposed development; and
  - Viewlines from the Yarra River (north side from the portion of the path in Willsmere Park opposite the Amcor Site), Chandler Highway, Heidelberg Road and Parkview Road.
- Shadow diagrams internal and external to the site for the equinox between 11.00am and 2.00pm based on the building envelopes or arrangement shown in the proposed Development Plan;
- Indicative waste storage and collection points;
- Interfaces between the site and adjacent sites and streets;

- Any particular and relevant design measures recommended by the Activity Centre Design Guidelines (DSE 2005), the Design Guidelines for Higher Density Residential Development (DSE 2004) and Safer Design Guidelines for Victoria (Crime Prevention Victoria and DSE 2005); and
- Any particular and relevant design measure recommended by the Heritage Plan, ESD Strategy, Transport Management Plan and the Site Remediation Strategy, as appropriate.

The Guidelines must be consistent with the Vision for the site and the following objectives:

- To promote urban legibility and public access to and through the site;
- To ensure new buildings are well spaced and offset to distribute access to outlook and sunlight between built forms and manage overlooking between habitable room windows where possible;
- To provide for diverse built form;
- To demonstrate high quality built form outcomes that contribute to the built form character of the neighbourhood and its surrounds;
- To ensure that building heights consider and respond to the over shadowing effects within the site and on adjoining land;
- To ensure that building heights provide an appropriate transition to site interfaces;
- To incorporate a landmark building element which displays design excellence to mark the Heidelberg Road and Chandler Highway intersection;
- To ensure street level interface treatments contribute to high levels of pedestrian amenity and safety;
- To provide wind climate design to ameliorate adverse wind conditions at street level, public spaces, balconies and adjoining properties;
- To provide acoustic design treatments that addresses the impact of existing and potential noise particularly from road traffic;
- To collectively form a coherent and identifiable precinct;
- To provide for safe and convenient vehicular and pedestrian access;
- To minimise, where practical, the impact of vehicles on public space;
- To ensure that above ground parking is suitably concealed by appropriate building features such as active podium frontages or within buildings that display a high level of architectural resolution;
- To improve the amenity of and accessibility to the Yarra River frontage of the site; and
- To incorporate recognised and proven ESD measures to aid in the reduction of energy and water consumption, the generation of waste and greenhouse emissions.

The following requirements must be reflected in the design guidelines:

- Building heights for new buildings must not exceed the maximum building heights specified in the Building Heights Plan (Figure 2) and the AMCOR Building heights (Table 1);

Figure 2 Building Heights Plan

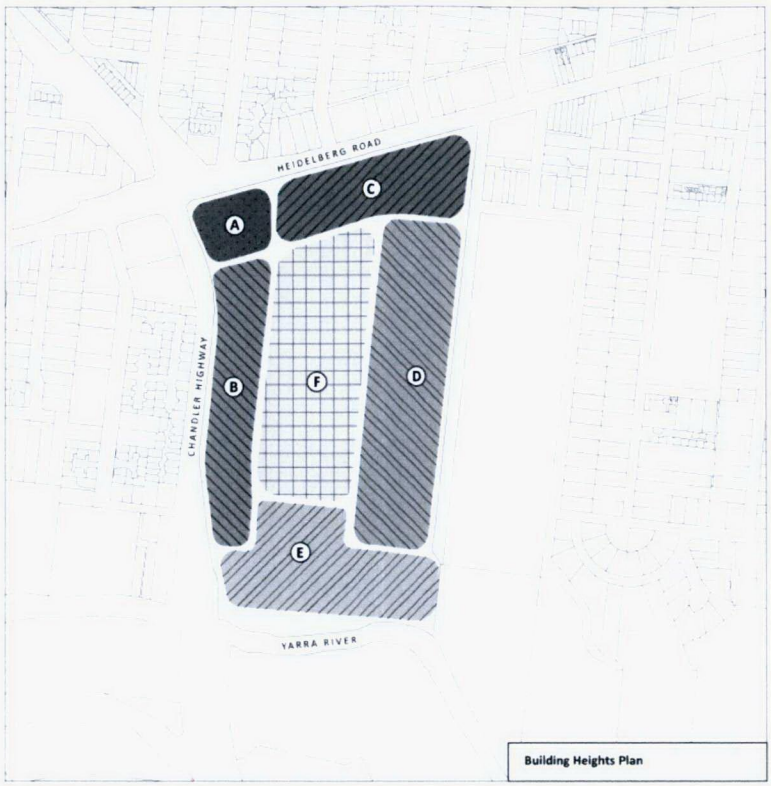


Table 1 AMCOR Building Heights

Precinct	Maximum building height	Preferred building heights	Street wall
A		14 storeys	3 storeys
B		5 storeys	3 storeys
C		6 -8 storeys	6 storeys
D	4 storeys		3 storeys, setback from Parkview Road
E	3 storeys		2 storey river interface, setback from crest line of the Yarra River
F	4 storeys		2-3 storeys

- Buildings along major roads to be generally of medium height as appropriate, stepping down to a lower height along the Yarra River interface and Parkview Road;
- Development should generally not extend above the tree line when viewed from the path in Willsmere-Chandler Park and the Yarra River;
- Built form and articulation should avoid long and continuous facades;
- Building setbacks along Parkview Road should be a minimum of 3 metres;
- Development in the residential precinct at the southern edge of the site near the Yarra River should be appropriately sited and designed and in particular:

- Visually dominant buildings must be avoided through the use of discontinuous forms, well articulated facades, and natural or recessive materials;
- Buildings must be set within a landscaped garden setting which allows for visual connections to the river corridor;
- Buildings must be oriented to front the Yarra River to provide visually interesting facades to and passive surveillance of the open space corridor and
- Buildings must be setback 10 metres from the river crest line to provide protection of the tree canopy and reduce the visual impact of the buildings;
- Treatment of the interface with the Yarra River and environs must demonstrate:
  - Maintenance and enhancement of the natural landscape and native vegetation along the river edge; and
  - Continuation of the public linear parkland and walking and cycling linkages along the river corridor.

Heritage Conservation Management and Interpretation

A Heritage Assessment Report must assess the cultural heritage of the site and identify any sites, buildings or structures of significance. The plan must include consideration of aboriginal heritage.

A Conservation Management Plan, including a Heritage Interpretation Plan must:

- Identify sites, buildings or structures which have been assessed as significant;
- Assess the extent to which a significant site, building or structure can be incorporated in the site's redevelopment;
- Identify how the site's industrial heritage is interpreted in the future development of the site; and
- Provide guidance on the on-going maintenance and management of the heritage places to be retained.

Landscape Concept Plan

A Landscape Concept Plan must be prepared for the site that includes:

- An assessment of existing vegetation on the land by a suitably qualified arborist;
- opportunities to retain mature trees with adequate setbacks to development;
- Appropriate treatment of the interface with the Yarra River;
- Opportunities for revegetation of the river bank and interface with the development;
- Typical street cross-sections;
- An overall landscape master plan for the site that complements the neighbourhood character and is in accordance with the proposed staging plan in the Development Plan;
- The management of landscaped areas, including sustainable irrigation treatments such as water sensitive urban design opportunities; and
- Details of how the Landscape Concept Plan responds to any requirements of the site remediation strategy for the land.

Economic Assessment Report

An Economic Assessment Report must be prepared which identifies viable employment generating uses for the site and assesses the value to the local economy of these proposed uses.

The report must also provide an economic assessment of proposed land uses for the site, and the viability of a neighbourhood activity centre on the site.

Housing Diversity Report

A Housing Diversity Report must be prepared explaining the mix of housing on the site including how it is proposed to provide 5% of the overall housing stock as affordable housing. The report must also include criteria for determining affordable housing stock.

Community Infrastructure Report

A Community Facilities Audit and Analysis must be prepared which identifies the following:

- Existing and planned services in the surrounding area and the impact the development of the site will have on these services.
- The need to provide additional community facilities on site or whether any existing community facilities in the local area should be upgraded or extended;
- The location of any new community facilities on site or in the surrounding area:
- Funding and implementation mechanisms for the provision of appropriate community infrastructure including developer contributions (monetary or building) towards the upgrading or extension of existing community facilities; or provision of new facilities in the surrounding local area; and
- Timing of the provision of any required community facilities coordinated with the overall development of the site.

Ecologically Sustainable Development (ESD) Strategy

An Ecologically Sustainable Design Strategy (ESD Strategy) must be prepared which considers and responds to the major components of the proposed development and construction processes and:

- Demonstrates the incorporation of recognised technologies and best practice;
- Demonstrates how compliance with all relevant statutory obligations in environmental sustainability is achieved;
- Identifies and nominates the level of sustainability performance standards to be adopted;
- Assesses options by which the agreed level of sustainable performance standards will be achieved.

The ESD Strategy must be based upon the following principles:

- Energy conservation with the objective of contributing to industry standards of national and international efforts to reduce energy usage and greenhouse gas emissions;
- Water conservation, ensuring that water resources are managed in a sustainable way;
- Water sensitive urban design and options ensuring the reduction of the impacts of stormwater on bays and catchments;
- Transport planning with the aim of encouraging walking, cycling and use of public transport;
- Land use and transport planning and infrastructure provision to contribute where practical to improved air quality;
- Options to reduce the amount of waste generated and encourage increased reuse and recycling of waste materials;
- Building materials conservation;

- Sustainability options in demolition and construction practices;
- Landscaping considering the provision of habitat, green spaces, and climate control as appropriate; and
- Indoor environmental quality.

The ESD Strategy must have regard to the following:

- Whether it is appropriate for individual plans to be prepared dealing with different aspects of the use and development;
- The need to clearly identify responsibilities for implementation, review, monitoring and maintenance;
- New resident awareness and education to promote the objectives of sustainability.

Site Remediation Strategy

Unless a Certificate or Statement of Environmental Audit has been issued, a Site Remediation Strategy must be prepared to the satisfaction of the responsible authority.

The Site Remediation Strategy must address and make recommendations in relation to:

- Potential impacts of any land or ground water contamination(including the potential for vapour intrusion or gas migration) on the proposed land use, the arrangement of land use across the land and any particular design requirement the development may be subject to;
- Heritage issues relevant to the remediation strategy;
- Options and a preferred approach to the testing and remediation of soil and groundwater;
- Proposed pattern of land uses across the site;
- Targeted condition of the site as required and specified by the Auditor to suit the proposed range of land uses or development;
- An indicative site map showing locations across the site of any identified contamination and any proposed c lean up work;
- Options for remediation technologies taking into account logistics, technology options currently available and likely effectiveness;
- A schedule of proposed remediation activities;
- Expected pattern/staging and indicative timeframes for signed Certificates or Statements of Environmental Audit across the site following the clean up of the site;
- Indicative site management and monitoring controls that will be necessary following each clean up activity; and
- Identifying the parties responsible for key activities and for subsequent site management and monitoring.

The Site Remediation Strategy may be prepared in stages where the development plan is prepared in stages.

The Site Remediation Strategy will be amended as required to reflect the recommendation or requirement of the Certificate or Statement of Environment Audit.

Traffic Management Plan

A Traffic Management Plan (TMP) must be prepared which provides the following details:

- The likely traffic generation by residents, staff and visitors, and for deliveries and service vehicles to the site;

- The likely traffic impacts of the proposed development on the land and the broader road network;
- A road safety audit of the design and proposed traffic management measures and incorporating the recommendations;
- Road layouts, widths and reserves and site access;
- The design of the footpaths, bicycle paths and shared pathways network;
- Traffic management measures and signalisation;
- Public transport routes and stops within the site and surrounds;
- Recommended car parking and bicycle parking rates and the location of on-site car and bicycle parking; and
- Loading bays.

Integrated Transport Plan

An Integrated Transport Plan (ITP) must be prepared based on the transport analysis and impact assessment which includes appropriate measures to address the transport, traffic, pedestrian and bicycle access needs of the development, and impacts on the existing road network, in particular:

- An indicative hierarchy of internal local roads proposed for the site that:
  - Complements the form and structure of the surrounding network;
  - Recognises the primacy of pedestrian and bicycle access within the site;
  - Provides a high level of amenity and connectivity, whilst managing the movement of vehicles travelling between Heidelberg Road and Chandler Highway through the site;
  - Allows for appropriate levels of manoeuvrability for emergency and service vehicles; and
  - Are of sufficient width to accommodate wide footpaths, new trees and bicycle lanes;
- The provision of a network of safe and convenient pedestrian and bicycle accessways through the site and connecting with the surrounding area, and encouraging the use of sustainable travel modes to local amenities;
- The location and layout of all car and bicycle parking areas and access to and from them;
- Opportunities for the provision of a car share system;
- Provision for loading and unloading of vehicles and means of access to them, including waste collection and delivery vehicles;
- Green Travel Plan initiatives, including a new resident awareness and education program;
- Tthe means proposed to address the impacts of traffic generated by the development on the surrounding road network including any required upgrades or modifications, including road widening, parking restrictions, traffic and pedestrian signals and public transport improvements; and
- Opportunities for providing improved public transport services and facilities.

Acoustic Report

An Acoustic Report is required to be prepared by a suitably qualified person(s) to the satisfaction of the Responsible Authority after seeking and considering the views of the Environment Protection Authority and VicRoads. The report must identify:

- Whether the proposed use and development of the site is likely to be affected by noise from nearby uses or abutting roads;
- The likely effect of non-residential uses on the site on the amenity of nearby residential uses; and
- Methods to address the issues identified.

Services and Engineering Infrastructure Report

The Services and Engineering Infrastructure Report must be prepared and include:

- An assessment of the existing engineering infrastructure servicing the site and its capacity to service the proposed development;
- A description of the proposed provision of all appropriate utility services to development parcels;
- Preparation of a stormwater drainage master plan, including measures to ensure appropriate protection of the Yarra River adjacent to the land; and
- The identification of the location of any on-site drainage retention facilities.

Development Staging

A Staging Plan to provide an indication of the likely staging and anticipated timing of the development of the land, specifically:

- The proposed sequencing of development;
- Vehicle access points, road infrastructure works and traffic management for each stage of development; and
- Interface / access treatments.

Community Engagement Strategy

A Community Engagement Strategy which establishes the mechanisms by which the community will be provided with information and opportunities for feedback in relation to the prepared development plan.

The development plan shall be available for public inspection for 28 days prior to its consideration by the responsible authority.

4.0 Decision guidelines

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Before deciding on a request to approve or amend a Development Plan, the responsible authority must consider as appropriate:

- any written comments received in response to the display of the development plan;
- any views of Public Transport Victoria;
- any views of VicRoads;
- any views of the Department of Education and Early Childhood Development;
- any views of Parks Victoria;
- any views of Melbourne Water; and
- any views of the Cities of Banyule, Boroondara and Darebin;

that are received by the responsible authority.

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Primary School.

ASHBROOK CT.

KAYBROOK CT.

REDPATH CT.

HARDY CT.

COONIL ST.

ALVINA ST.

20 M

110 M

STREET

SINCLAIR

RESIDENCE

TALBOT AVENUE

Scouts

75 M

Davies Reserve

HUNTINGDALE ROAD

Existing Water Storage

NEW BUND 1991 SEE DETAIL

Rehabilitation

* CONTINOUS DEWATERING OF CLAY SILT CONCENTRATION

Existing EIL 44-1

Talbot Park (Reclaimed Land).

ROAD

Existing EIL 1322

EXISTING FENCE

EXISTING GATES

Stockpiles:

- DUST CONTROLLED BY AUTOMATIC SPRAYS
- MAX HT OF STOCKPILE = 3M

W/SHOP

PLANT

FOUNDRY SAND PLANT

OFFICE W/BRIDGE

CALCRETE SAND PLANT

PROPOSED LIMIT OF OPERATION

ZONING PREVIOUS IN 1.2

ZONING IN 1.2

ZONING I.2 & 3

ZONING I.1

ZONING P.S.

On.going Extraction.

(Until October 1993)

30 M

Existing EIL 44-1

Existing Water Storage

Existing Water Storage

Aged Centre

CENTRE

ELDER ST

EULINGA RD

CRAWFORD RD

Primary School

NEW TREES

EXISTING TREES TO REMAIN

GRASS TO AVAILABLE FINISH

NEW BUND 3.2M HT

4M

20 M

EXISTING TI WATER LEVEL

WATER

NEW CLEAN FILL (CURRENTLY IN PROGRESS)

EXISTING EXTRACTION LIMIT (APPROX)

PROGRESSIVELY REHABILITATING CLAY SILT

Section x-x¹
East Boundary 1:100

LEGEND

- = EXISTING TREES (BEYOND THE SUBJECT SITE).
- = EXISTING TREES TO REMAIN
- = NEW TREES (INDIGENOUS SPECIES) TO BE PLANTED
- = EXISTING BUND (APPX 3.2M)
- = EXISTING WATER STORAGE
- = EXISTING 15 M BUFFER ZONE
- = REHABILITATION - FILL TO ACHIEVE ORIGINAL GROUND LEVELS & GRASSED (NO PLANT WORKS AT STOCKPILES). FINISH TO BE SLASHED MINIMUM 5 X PER YEAR
- = CURRENT ZONING: CITY OF OAKLEIGH PLANNING SCHEME.

REVISIONS
A 28.5.90 UPDATE
C 27.7.90 UPDATE
D 8.11.90 UPDATE, ADD ZONING
E 9.7.91 UPDATE

Title: EXISTING CONDITIONS 9/91
Project: SAND OPERATION: OAKLEIGH
TALBOT AVE, SOUTH OAKLEIGH
Client: PIONEER CONCRETE (VIC) P/L ph 805 2805
183 TOORAK RD HARTWELL 3125

Work Plan Approved
28 SEP 1998
Signed pursuant to instrument of Delegation dated 1-7-1996

carol frankmas & associates
Landscape Architects
526 Hawthorn Road
Caulfield South 3162
Phone 596 2817
Fax 596 1443

Date 5.4.90
Drawn D.C.
Scale 1:1000
Revision A 28.5.90 UPDATE
Drawing No. 1533/1 E