Melbourne Water Corporation

Area 4C of Riverwalk Estate, Princes Highway, Werribee, Victoria

Environmental Audit

February 2014

ENVIRONMENT PROTECTION ACT 1970

Statement of Environmental Audit

I, Dr Fouad Abo of GHD Pty Ltd 180 Lonsdale Street Melbourne, a person appointed by the Environment Protection Authority ('the Authority') under the Environment Protection Act 1970 ('the Act') as an environmental auditor for the purposes of the Act, having:

1. been requested by Mr Timm Kurth of Melbourne Water Corporation to issue a certificate of environmental audit in relation to the site located at Riverwalk Estate, Princes Freeway, Werribee, located in the Wyndham City Council, comprising the land defined by part of Lot B on Plan of Subdivision 636839Q, derived from Certificate of Title Volume 11367, Folio 778, (the surveyed site boundary and the relevant boundary coordinates are defined on the attached Figure 3), owned/occupied by Melbourne Water Corporation.
2. had regard to, amongst other things,
    i. guidelines issued by the Authority for the purposes of Part IXD of the Act,
    ii. the beneficial uses that may be made of the site, and
    iii. relevant State environment protection policies/industrial waste management policies, namely: State environment protection policy (Prevention and Management of Contamination of Land) 2002, State environment protection policy (Groundwaters of Victoria) 1997, State environment protection policy (Waters of Victoria) 2003, and State environment protection policy (Air Quality Management) 2001.

    in making a total assessment of the nature and extent of any harm or detriment caused to, or the risk of any possible harm or detriment that may be caused to, any beneficial use made of the site by any industrial processes or activity, waste or substance (including any chemical substance), and
3. completed an environmental audit report in accordance with section 53X of the Act, a copy of which has been sent to the Authority and the relevant planning and responsible authority.

HEREBY STATE that I am of the opinion that:

The site is suitable for the beneficial uses associated with:

- Parks and Reserves; Agricultural; Sensitive use (i.e. high density, medium and single dwelling/low density residential use, child care centre, pre-school or primary school); Recreation/Open space; Commercial; and Industrial.

subject to the following conditions attached thereto:

1. Any fill or soil brought to the site as part of the site proposed development must be chemically tested soil or fill that classifies as "fill material" in accordance with relevant EPA guidelines.
2. The limited residual pieces of asbestos containing material (ACM) in the north part of the site (i.e. area of SP1, SP2, and SP3 shown in figure 11) must be removed and disposed of as part of the site development work. Such removal and disposal must be conducted in accordance with relevant regulations and guidelines.

The condition of the site is detrimental or potentially detrimental to any (one or more) beneficial uses of the site. Accordingly, I have not issued a Certificate of Environmental Audit for the site in its current condition, the reasons for which are presented in the environmental audit report. The terms and conditions that need to be complied with before a Certificate of Environmental Audit may be issued are set out as follows:

- The unsuitable material located on site as stated in condition 1 above must be removed in accordance with relevant EPA guidelines.

Other related information:

- Waste generated in the future as a result of the future development works should be dealt with in accordance with the relevant EPA guidelines.
- Asbestos containing materials were found on the site, particularly in the vicinity of the former buildings which were located in the northern part of the site (refer Figure 3 and 11), and have been removed as far as practicable. Small quantities of bonded asbestos containing material (ACM) fragments may remain on or within the soil and be uncovered during excavation works. These ACM fragments were not anticipated to represent a health risk; as discussed in the audit report to occupiers of the completed development. If encountered during future development or use of the site, any fragments should be handled and disposed of in accordance with the relevant regulations and guidelines.
- The groundwater monitoring well (MW-4 as listed in the attached Figure 6) present at the site should be decommissioned in accordance with the requirement of the most recent version of "Minimum Construction Requirements for Water Bores in Australia", published by the National Uniform Drillers Licensing Committee.
- There is a visible concrete manhole of the stormwater drainage pipe located adjacent to sampling points (4C/G14 and 4C/G15, shown in Figure 5).
- Waste generated in the future as a result of the future development works should be dealt with in accordance with relevant EPA guidelines.

This Statement forms part of the Environmental Audit Report: *Melbourne Water Corporation, Area 4C of Riverwalk Estate, Princes Highway, Werribee, Victoria, February 2014*. Further details regarding the condition of the site may be found in the Environmental Audit Report.

DATED: 21 February 2014

SIGNED: .....

DR FOUAD ABO
ENVIRONMENTAL AUDITOR
(Appointed Pursuant to the Environment Protection Act 1970)

Executive summary

Table 1 Summary of audit information

Summary Information Required	
EPA file reference no.	41460-5
Auditor	Dr Fouad Abo of GHD Pty Ltd
Auditor term of appointment	7 January 1997 to 26 July 2016
Name of person requesting audit	Mr Timm Kurth of Melbourne Water Corporation (Melbourne Water)
Relationship to premises / location	Property Sales Manager
Date of request	Melbourne Water first requested an audit of the Riverwalk Estate (Overall Audit Area), including area 4C on 15 March 2000. Due to the development timing requirements, Melbourne Water decided to request a separate audit for this Area (4C). The request for the audit of Area 4C was on 8 July 2009.
Date EPA notified of audit	The Riverwalk Estate was originally to be audited as one audit, hence the auditor notified EPA as such on 15 March 2000. As explained in Section 1.1 of this report, for ease of audit and to meet the development schedule, Melbourne Water later decided to divide the site into a number of "sub" Areas and requested an audit for each of these Areas separately. Accordingly, the Auditor notified EPA of the request to undertake an audit of Area 4C specifically on 13 July 2009.
Completion date of the audit	21 February 2014
Reason for audit	Due diligence associated with a proposed zoning change.
Current land use zoning	Residential 1 Zone (R1Z) under the Wyndham City Council Planning Scheme.
EPA region	West Metro.
Municipality	Wyndham City Council.
Dominant – Lot on plan	The site is defined as part of Lot B on Plan of Subdivision 636839Q, on Certificate of Title Volume 11367, Folio 778 (Appendix A). The surveyed site boundary and the relevant boundary coordinates are defined on the attached Figure 3.
Additional – Lot on plan	
Site/premises name	Riverwalk Estate
• Street/Lot – Lower No.	
• Street/Lot – Upper No.	
• Street Name	Princes
• Street type (road, court, etc.)	Highway

Summary Information Required	
• Street suffix (North, South etc.)	
• Suburb	Werribee
• Postcode	3030
GIS Coordinate of Site centroid	
• Longitude / Northing (GDA94)	Northing 5800725.33
• Latitude / Easting (GDA94)	Easting 293112.38
Site area (hectares)	4.417 ha
Members and categories of support team utilised	None.
Outcome of the audit	Statement of Environmental Audit
Further works or requirements	None
Nature and extent of continuing risk	None. The contamination condition of soil and groundwater are not expected to adversely impact site uses provided.

*NB – Leave cell blank if not applicable

Table 2 Physical site information

Summary Information Required	
Site aquifer formation	Newer Volcanics and Brighton Group Formations are located in the vicinity of the site. Wells at the site were installed within the Newer Volcanics aquifer.
Average depth to groundwater	11 m
Groundwater segment	Segment C
Groundwater flow direction	Groundwater flow is expected to be the east towards the Werribee River which flow approximately north-south and is located approximately 800 m to the east of the site. Regionally, the flow is expected to be to the south east toward Port Phillip Bay located approximately 6.4 km to the south east of the site.
Past use/site history	Dairy farming, stock grazing, vegetable growing, Melbourne Water Activities and RAAF occupation.
Surrounding land use	North: Area 4B (for which an Environmental Audit is currently underway). East: Area 4I (for which an Environmental Audit is currently underway) and Farm Road. South: Junction of Farm Road and New Farm Road. West: New Farm Road and Area 5 (for which an Environmental Audit is currently underway).
Proposed future use	The site is proposed to be used for a mixture of high, medium, and low residential use.

REGISTER SEARCH STATEMENT (Title Search) Transfer of Land Act 1958

VOLUME 11367 FOLIO 778 Security no : 124043522685M
Produced 17/10/2012 04:20 pm

LAND DESCRIPTION

Lot B on Plan of Subdivision 636839Q.
PARENT TITLE Volume 11309 Folio 105
Created by instrument PS636839Q 02/08/2012

REGISTERED PROPRIETOR

Estate Fee Simple
Sole Proprietor
MELBOURNE WATER CORPORATION of 990 LA TROBE STREET DOCKLANDS VIC 3008
PS636839Q 02/08/2012

ENCUMBRANCES, CAVEATS AND NOTICES

Any encumbrances created by Section 98 Transfer of Land Act 1958 or Section 24 Subdivision Act 1988 and any other encumbrances shown or entered on the plan set out under DIAGRAM LOCATION below.

NOTICE as to part Section 47(2) Heritage Act 1995
REGISTER NO. 1884
X234908X 29/12/2000

AGREEMENT Section 173 Planning and Environment Act 1987
AG017913K 08/08/2008

DIAGRAM LOCATION

SEE PS636839Q FOR FURTHER DETAILS AND BOUNDARIES

ACTIVITY IN THE LAST 125 DAYS

NUMBER		STATUS	DATE
PS636839Q (S)	PLAN OF SUBDIVISION	Registered	02/08/2012

DOCUMENT END

Delivered from the LANDATA® System by InfoTrack Pty Ltd.

Signed by Council: Wyndham City Council, Council Ref: WYP4474/10, WYS1815/11, Original Certification: 30/06/2011, Recertification: 04/06/2012, S.O.C.: 20/07/2012

PLAN OF SUBDIVISION

STAGE NO	LRS USE ONLY	PLAN NUMBER
———	EDITION 1	PS 636839Q

LOCATION OF LAND

PARISH: MAMBOURIN
TOWNSHIP: WERRIBEE
CROWN ALLOTMENTS: 22A (PART) & 10A (PART)

PARISH: MAMBOURIN
CROWN ALLOTMENTS: 4A, 5A, 6A, 7A, 8A & 9A
CROWN ALLOTMENTS: G (PT) & H (PT) SECTION 7
CROWN ALLOTMENT: 7 (PT) & 8 (PT) SECTION 8

LAST PLAN REF: PS 641301K LOT A
TITLE REFERENCE: VOL 11309 FOL 105

POSTAL ADDRESS: CNR PRINCES HIGHWAY & MALTBY BYPASS WERRIBEE 3030

MGA CO-ORDINATES: E 292 680
OF APPROX. CENTRE OF LAND IN PLAN N 5 800 580
ZONE 55

VESTING OF ROADS OR RESERVES

IDENTIFIER	COUNCIL/BODY/PERSON
R1 (ROAD)	WYNDHAM CITY COUNCIL
RESERVE No.1	POWERCOR AUSTRALIA LTD

COUNCIL CERTIFICATION AND ENDORSEMENT

COUNCIL NAME: WYNDHAM CITY COUNCIL REF:

(1) THIS PLAN IS CERTIFIED UNDER SECTION 6 OF THE SUBDIVISION ACT 1988.
(2) THIS PLAN IS CERTIFIED UNDER SEC. 11(7) OF THE SUBDIVISION ACT 1988. DATE OF ORIGINAL CERTIFICATION UNDER SECTION 6 / /
(3) THIS IS A STATEMENT OF COMPLIANCE ISSUED UNDER SECTION 21 OF THE SUBDIVISION ACT 1988

OPEN SPACE:
(A) A REQUIREMENT FOR PUBLIC OPEN SPACE UNDER SECTION 18 OF THE SUBDIVISION ACT 1988 HAS NOT BEEN MADE
(B) THE REQUIREMENT HAS BEEN SATISFIED
(C) THE REQUIREMENT IS TO BE SATISFIED IN STAGE:

COUNCIL DELEGATE
COUNCIL SEAL
SURVEYOR'S PLAN VERSION
DATE / /

RE-CERTIFIED UNDER SECTION 11(7) OF THE SUBDIVISION ACT 1988
COUNCIL DELEGATE
COUNCIL SEAL
SURVEYOR'S PLAN VERSION
DATE / /

NOTATIONS

DEPTH LIMITATION:
DOES NOT APPLY

THIS IS A SPEAR PLAN

STAGING:
THIS IS NOT A STAGED SUBDIVISION
PLANNING PERMIT NO: WYP4474/10

SURVEY:
THIS PLAN IS BASED ON SURVEY (PS 636838S)
THIS SURVEY HAS BEEN CONNECTED TO PERMANENT MARKS:
IN PROCLAIMED SURVEY AREA NUMBER:

OTHER PURPOSE OF PLAN:
TO REMOVE PART OF EASEMENT E-6 ON PS 641301K AND CREATED IN PS 636838S AND AFFECTING ROAD R1 ON THIS PLAN.

GROUNDS FOR EASEMENT REMOVAL:
WYNDHAM CITY COUNCIL
PLANNING PERMIT No. WYP4613/10

LOTS 1 TO 117 (BOTH INCLUSIVE) & LOT A HAVE BEEN OMITTED FROM THIS PLAN

RIVERWALK RELEASE 2

EASEMENT INFORMATION

LEGEND: A - APPURTENANT EASEMENT E - ENCUMBERING EASEMENT R - ENCUMBERING EASEMENT (ROAD)

EASEMENT REFERENCE	PURPOSE	WIDTH (METRES)	ORIGIN	LAND BENEFITED/IN FAVOUR OF
			SEE SHEET 2	

LRS USE ONLY

STATEMENT OF COMPLIANCE EXEMPTION STATEMENT
RECEIVED ☑
DATE 23/07/12

LRS USE ONLY
PLAN REGISTERED
TIME 11:17am
DATE 2/08/12
G Venn
ASSISTANT REGISTRAR OF TITLES

SHEET 1 OF 12 SHEETS

CHRIS RUNTING & ASSOCIATES PTY LTD
LAND SURVEYORS
TOWN PLANNERS
DEVELOPMENT CONSULTANTS
20 Hamilton Street
Mont Albert Vic 3127
Tel: 9890 0933
Fax: 9898 2543

LICENSED SURVEYOR: P.J.S. TYNKKYNEN
SIGNATURE: DIGITALLY SIGNED
REF: 3936PS2 VERSION: 23 (4.05.12)

DATE / /
COUNCIL DELEGATE SIGNATURE

ORIGINAL SHEET SIZE A3

Signed by: Paavo Jukka Tynkkynen (Chris Runting & Associates Pty Ltd) Surveyor's Plan Version (23 (4.05.12)) SPEAR Ref S011384A 07/05/2012

Signed by Council: Wyndham City Council, Council Ref: WYP4474/10, WYS1815/11, Original Certification: 30/06/2011, Recertification: 04/06/2012, S.O.C.: 20/07/2012

PLAN OF SUBDIVISION

STAGE NO ——

PLAN NUMBER **PS 636839Q**

EASEMENT INFORMATION

LEGEND: A - APPURTENANT EASEMENT E - ENCUMBERING EASEMENT R - ENCUMBERING EASEMENT (ROAD)

EASEMENT REFERENCE	PURPOSE	WIDTH (METRES)	ORIGIN	LAND BENEFITED/IN FAVOUR OF
E-1	SEWERAGE	3	PS412756U	CITY WEST WATER LIMITED
E-2	SEWERAGE	2.50	PS636838S	CITY WEST WATER LIMITED
E-3	DRAINAGE	3	PS641301K	WYNDHAM CITY COUNCIL
	SEWERAGE	3	PS641301K	CITY WEST WATER LIMITED
E-4	SEWERAGE	2	PS641301K	CITY WEST WATER LIMITED
E-5	DRAINAGE	2	PS641301K	WYNDHAM CITY COUNCIL
E-6	DRAINAGE	SEE PLAN	PS636838S	WYNDHAM CITY COUNCIL
	SEWERAGE	SEE PLAN	PS636838S	CITY WEST WATER LIMITED
E-7	DRAINAGE	SEE PLAN	PS636838S	WYNDHAM CITY COUNCIL
E-8	SEWERAGE	2	PS636838S	CITY WEST WATER LIMITED
E-9	DRAINAGE	2	PS636838S	WYNDHAM CITY COUNCIL
E-10	POWERLINE	SEE PLAN	PS636838S - SEC 88 ELECTRICITY INDUSTRY ACT 2000	POWERCOR AUSTRALIA LTD
E-11	DRAINAGE	2	THIS PLAN	WYNDHAM CITY COUNCIL
E-12	SEWERAGE	2	THIS PLAN	CITY WEST WATER LIMITED
E-13	DRAINAGE	3	THIS PLAN	WYNDHAM CITY COUNCIL
	SEWERAGE	3	THIS PLAN	CITY WEST WATER LIMITED
E-14	DRAINAGE	SEE PLAN	PS636838S	MELBOURNE WATER CORPORATION
E-15	SEWERAGE	2.50	PS636838S	CITY WEST WATER LIMITED
	DRAINAGE	2.50	PS636838S	MELBOURNE WATER CORPORATION
E-16	DRAINAGE	4	THIS PLAN	WYNDHAM CITY COUNCIL
E-17	SEWERAGE	2	THIS PLAN	CITY WEST WATER LIMITED
E-18	DRAINAGE	SEE PLAN	THIS PLAN	WYNDHAM CITY COUNCIL
	SEWERAGE	SEE PLAN	THIS PLAN	CITY WEST WATER LIMITED
E-19	DRAINAGE	SEE PLAN	PS636838S	MELBOURNE WATER CORPORATION
	SEWERAGE	SEE PLAN	THIS PLAN	CITY WEST WATER LIMITED
E-20	POWERLINE	1.50	THIS PLAN - SEC 88 ELECTRICITY INDUSTRY ACT 2000	POWERCOR AUSTRALIA LTD

RIVERWALK RELEASE 2

No of Lots: 51 (excluding Lot B) Release 2 Land Area: 3.248ha

SHEET 2

CHRIS RUNTING & ASSOCIATES PTY LTD
LAND SURVEYORS
TOWN PLANNERS
DEVELOPMENT CONSULTANTS
20 Hamilton Street
Mont Albert Vic 3127
Tel: 9890 0933
Fax: 9898 2543

LICENSED SURVEYOR: P.J.S. TYNKKYNEN

SIGNATURE ..... DATE / /

REF: 3936PS2 VERSION: 23 (4.05.12)

DATE / /

..... COUNCIL DELEGATE SIGNATURE

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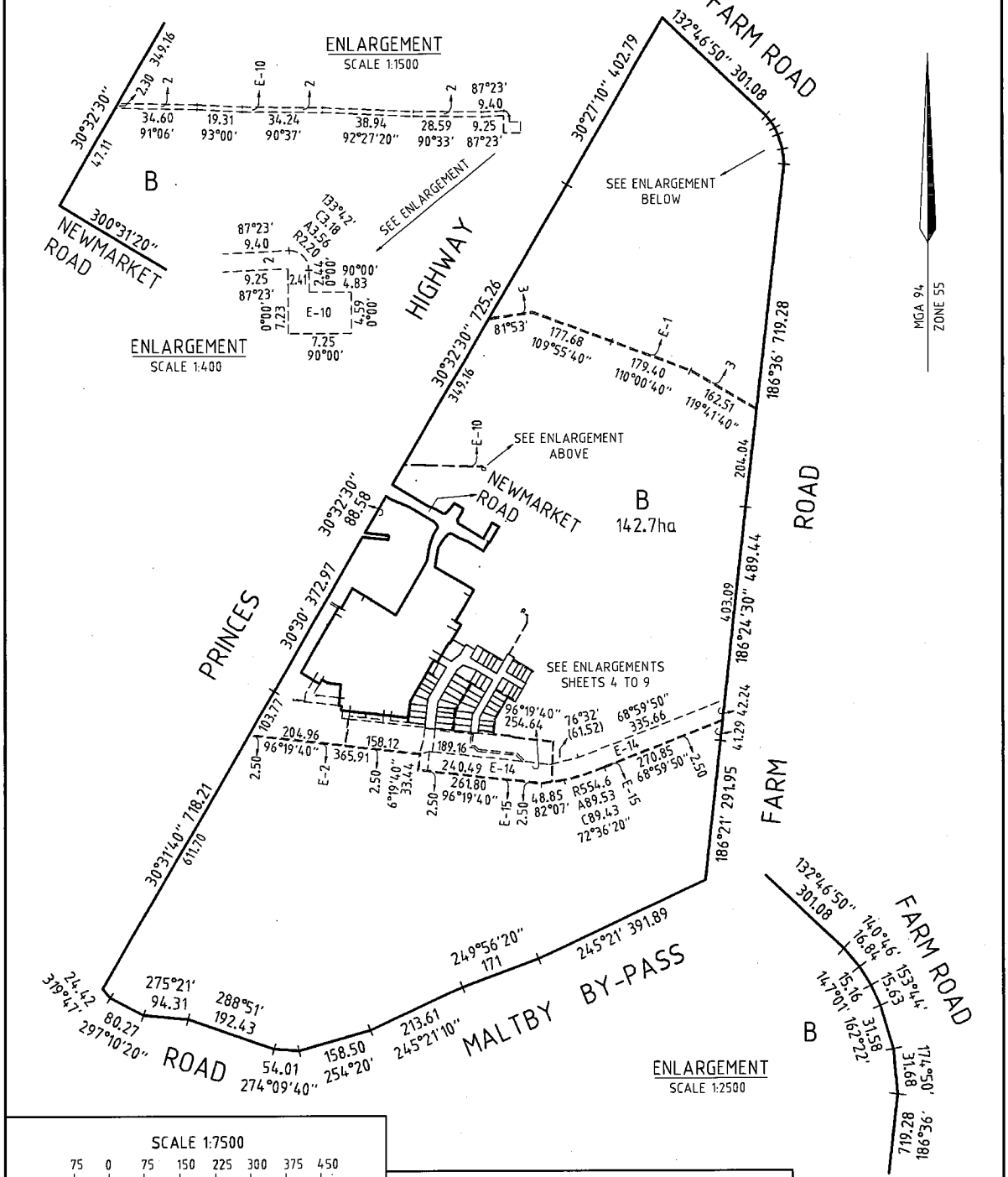
PLAN OF SUBDIVISION

STAGE NO —

PLAN NUMBER **PS 636839Q**



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LENGTHS ARE IN METRES

RIVERWALK RELEASE 2

No of Lots: 51 (excluding Lot B) Release 2 Land Area: 3.248ha

SHEET 3

CHRIS RUNTING & ASSOCIATES PTY LTD
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DATE / /

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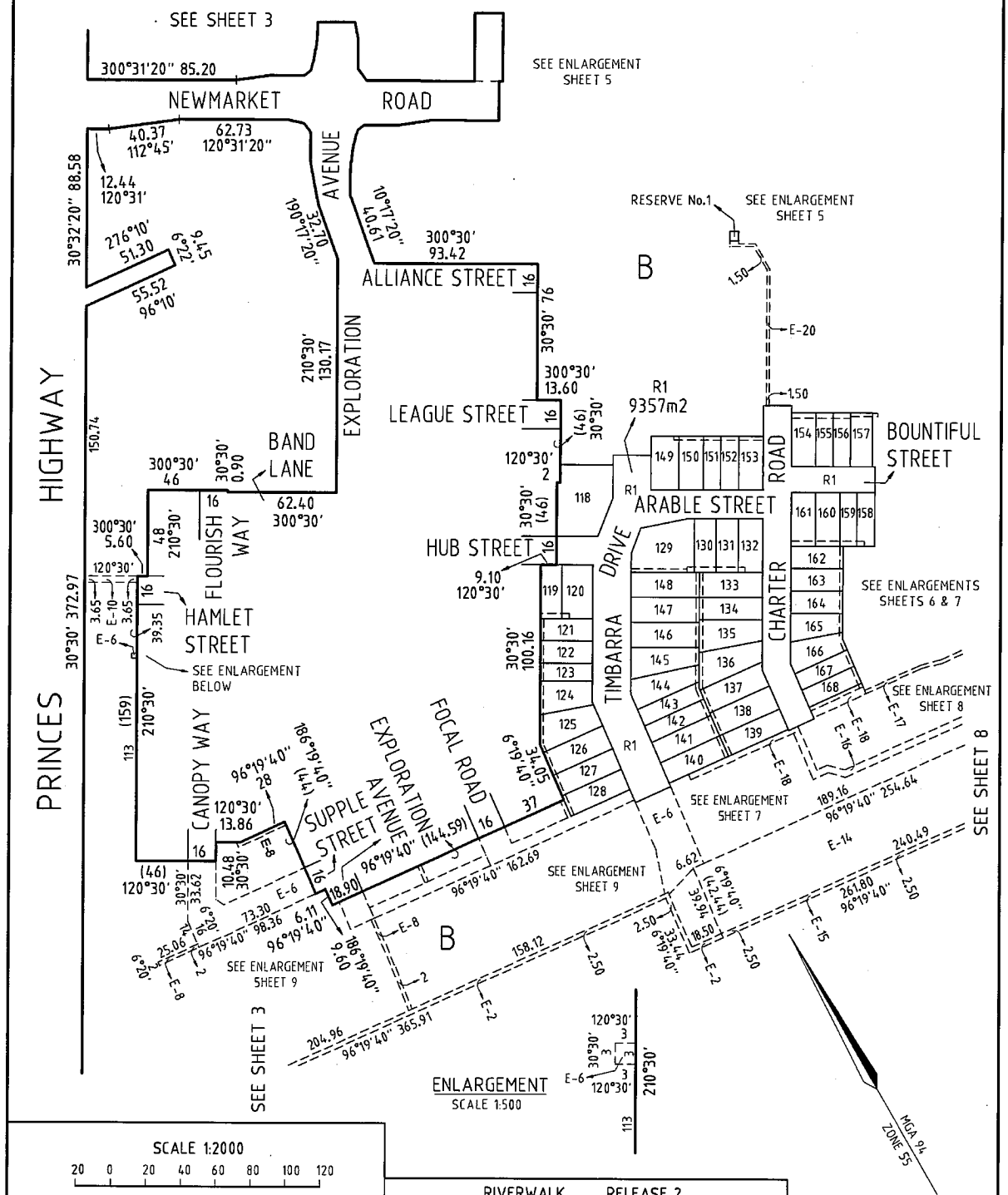
PLAN OF SUBDIVISION

STAGE NO	PLAN NUMBER
———	PS 636839Q



RIVERWALK RELEASE 2

No of Lots: 51 (excluding Lot B) Release 2 Land Area: 3.248ha

SHEET 4

CHRIS RUNTING & ASSOCIATES PTY LTD
LAND SURVEYORS
TOWN PLANNERS
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LICENSED SURVEYOR: P.J.S. TYNKKYNEN

SIGNATURE ..... DATE / /

REF: 3936PS2 VERSION: 23 (4.05.12)

DATE / /

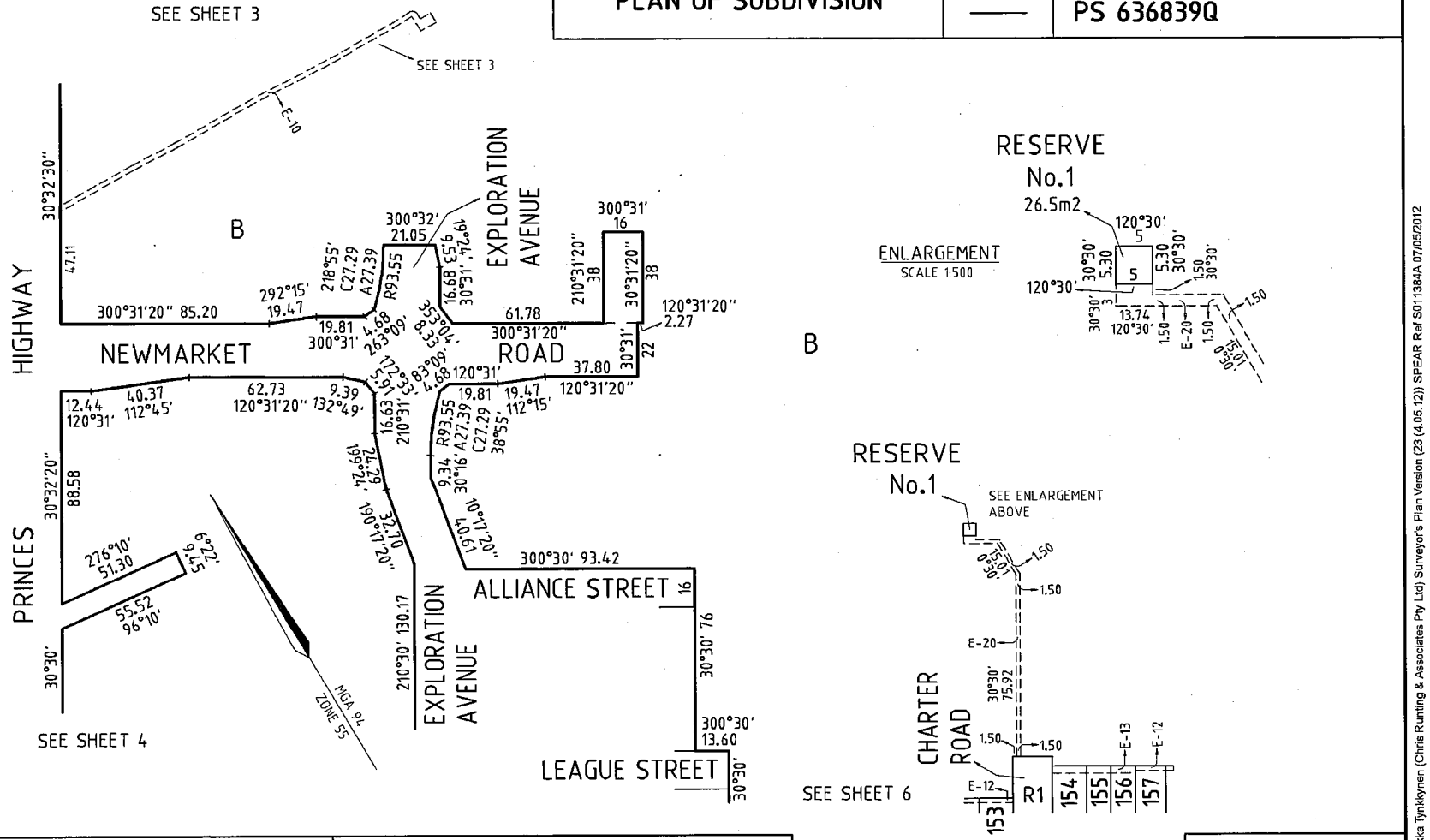
COUNCIL DELEGATE SIGNATURE

ORIGINAL SHEET SIZE A3

Signed by: Paavo Jukka Tynkkynen (Chris Runting & Associates Pty Ltd) Surveyor's Plan Version (23 (4.05.12)) SPEAR Ref S011384A 07/05/2012

PLAN OF SUBDIVISION

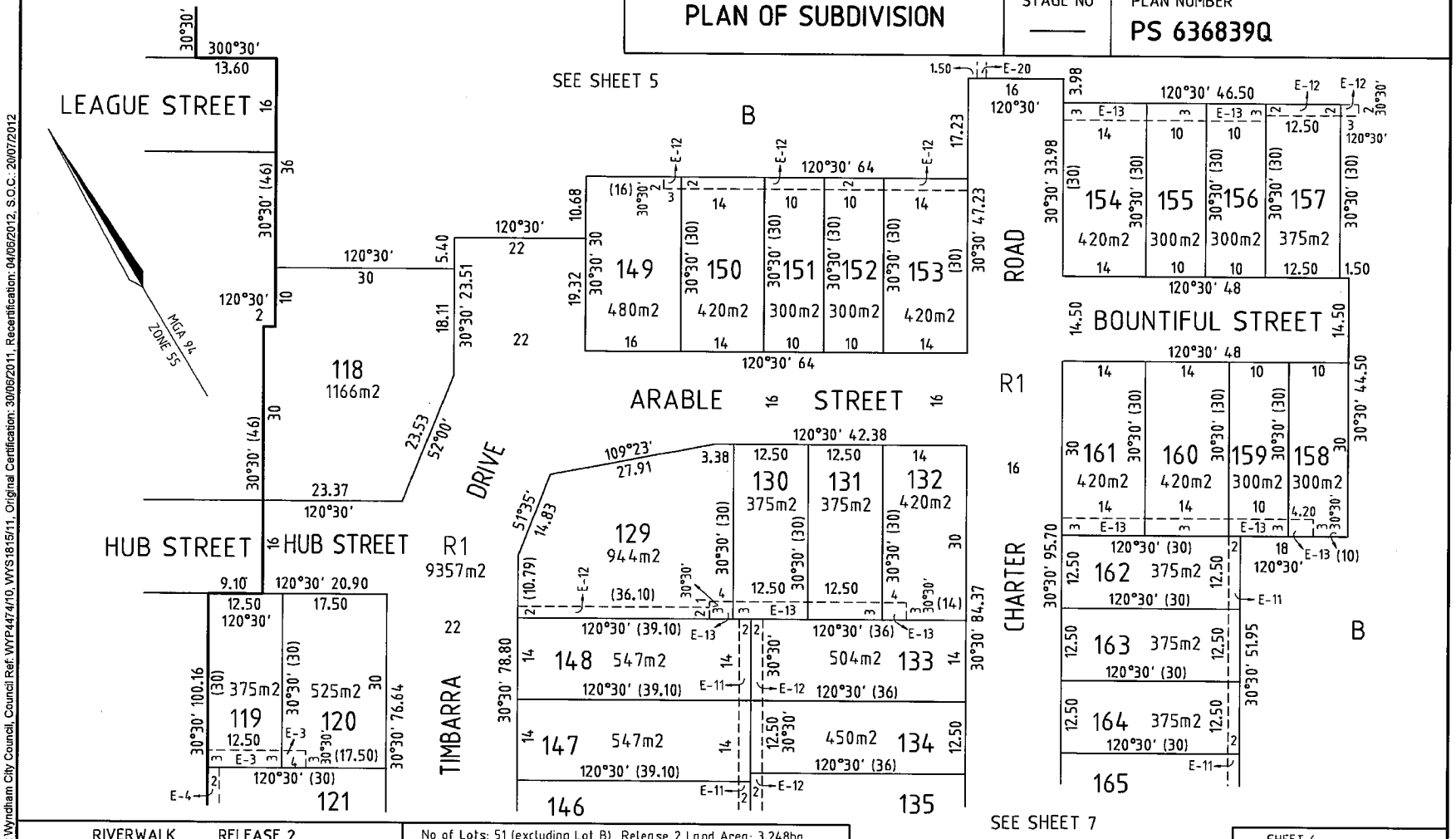
STAGE NO	PLAN NUMBER
——	PS 636839Q



RIVERWALK RELEASE 2	No of Lots: 51 (excluding Lot B) Release 2 Land Area: 3.248ha	SHEET 5
CHRIS RUNTING & ASSOCIATES PTY LTD LAND SURVEYORS TOWN PLANNERS DEVELOPMENT CONSULTANTS 20 Hamilton Street Mont Albert Vic 3127 Tel: 9890 0933 Fax: 9898 2543	SCALE 1:1500 15 0 15 30 45 60 75 90 LENGTHS ARE IN METRES	LICENSED SURVEYOR: P.J.S. TYNKKYNEN SIGNATURE ..... DATE / / REF: 3936PS2 VERSION: 23 (4.05.12)	DATE / / COUNCIL DELEGATE SIGNATURE ORIGINAL SHEET SIZE A3

PLAN OF SUBDIVISION

STAGE NO	PLAN NUMBER
——	PS 636839Q



RIVERWALK RELEASE 2	No of Lots: 51 (excluding Lot B) Release 2 Land Area: 3.248ha	SHEET 6

CHRIS RUNTING & ASSOCIATES PTY LTD
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TOWN PLANNERS
DEVELOPMENT CONSULTANTS
20 Hamilton Street
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Tel: 9890 0933
Fax: 9898 2543

SCALE 1:600
6 0 6 12 18 24 30 36
LENGTHS ARE IN METRES

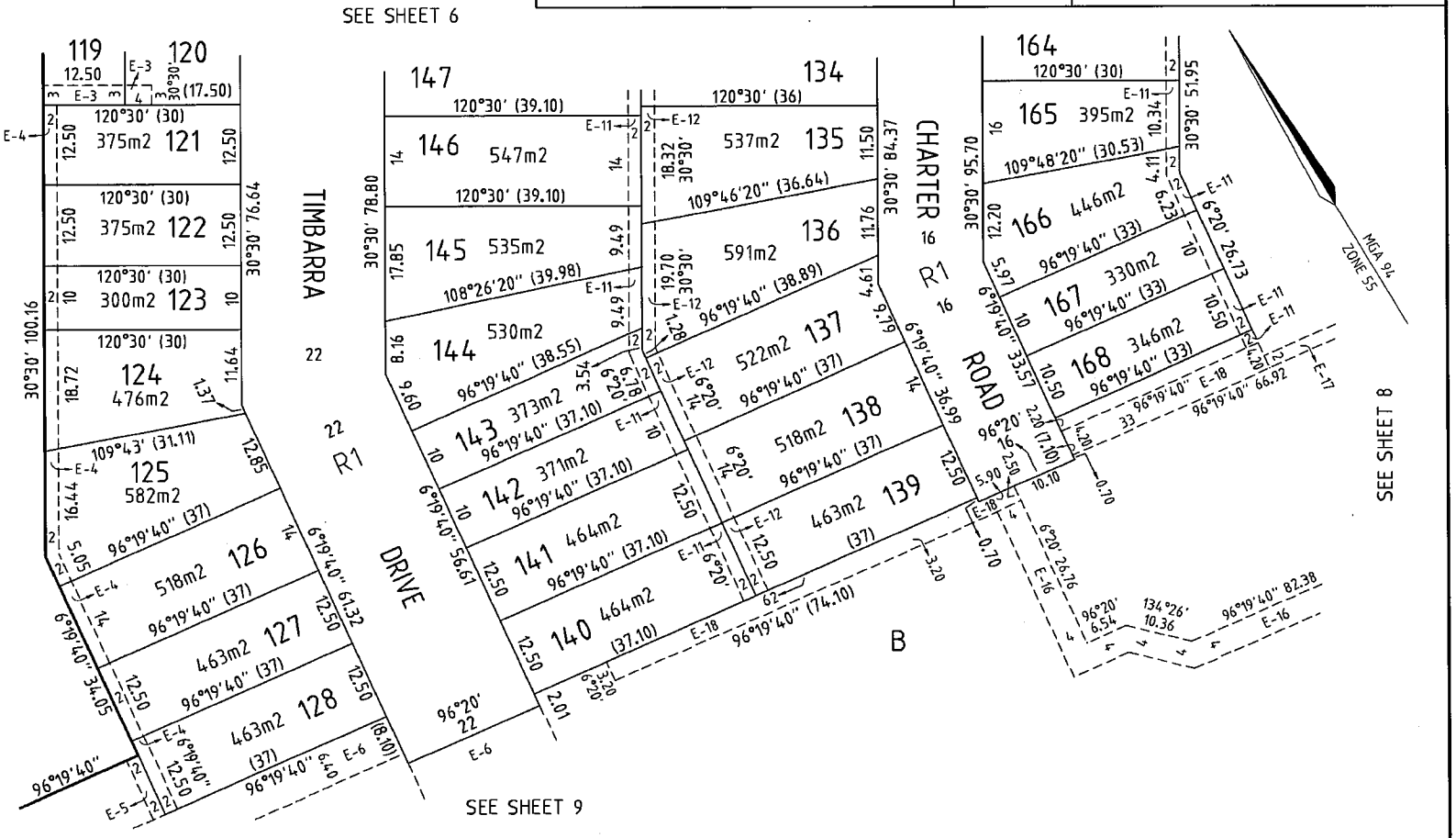
LICENSED SURVEYOR: P.J.S. TYNKKYNEN
SIGNATURE ..... DATE / /
REF: 3936PS2 VERSION: 23 (4.05.12)

DATE / /
COUNCIL DELEGATE SIGNATURE

ORIGINAL SHEET SIZE A3

PLAN OF SUBDIVISION

STAGE NO	PLAN NUMBER
———	PS 636839Q



RIVERWALK RELEASE 2

No of Lots: 51 (excluding Lot B) Release 2 Land Area: 3.248ha

SHEET 7

CHRIS RUNTING & ASSOCIATES PTY LTD
LAND SURVEYORS
TOWN PLANNERS
DEVELOPMENT CONSULTANTS
20 Hamilton Street
Mont Albert Vic 3127
Tel: 9890 0933
Fax: 9898 2543

SCALE 1:600

6 0 6 12 18 24 30 36

LENGTHS ARE IN METRES

LICENSED SURVEYOR: P.J.S. TYNKKYNEN

SIGNATURE ..... DATE / /

REF: 3936PS2 VERSION: 23 (4.05.12)

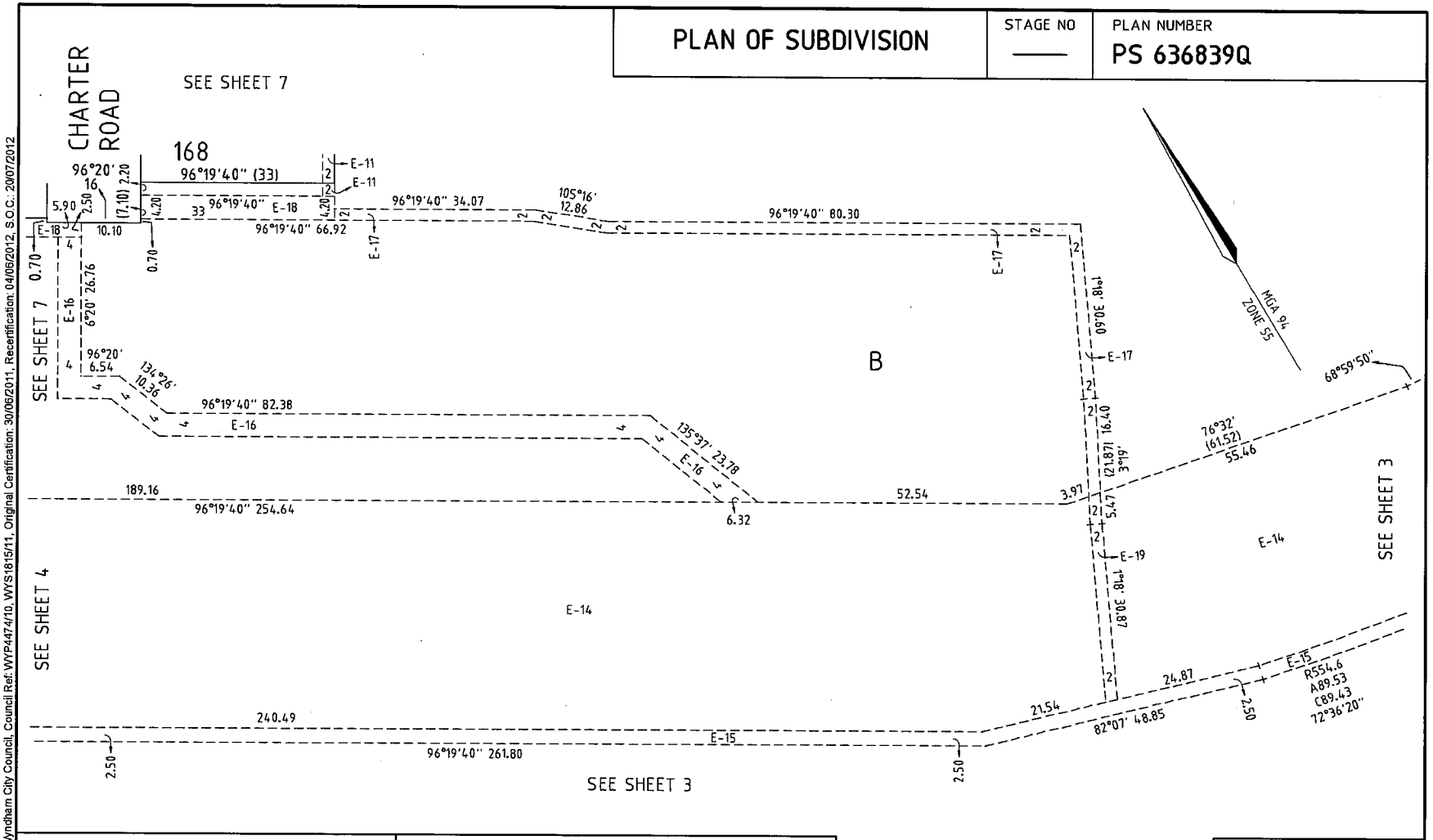
DATE / /

COUNCIL DELEGATE SIGNATURE

ORIGINAL SHEET SIZE A3

PLAN OF SUBDIVISION

STAGE NO	PLAN NUMBER
——	PS 636839Q



RIVERWALK RELEASE 2	No of Lots: 51 (excluding Lot B) Release 2 Land Area: 3.248ha	SHEET 8

CHRIS RUNTING & ASSOCIATES PTY LTD
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SCALE 1:600

6 0 6 12 18 24 30 36

LENGTHS ARE IN METRES

LICENSED SURVEYOR: P.J.S. TYNKKYNEN

SIGNATURE ..... DATE / /

REF: 3936PS2 VERSION: 23 (4.05.12)

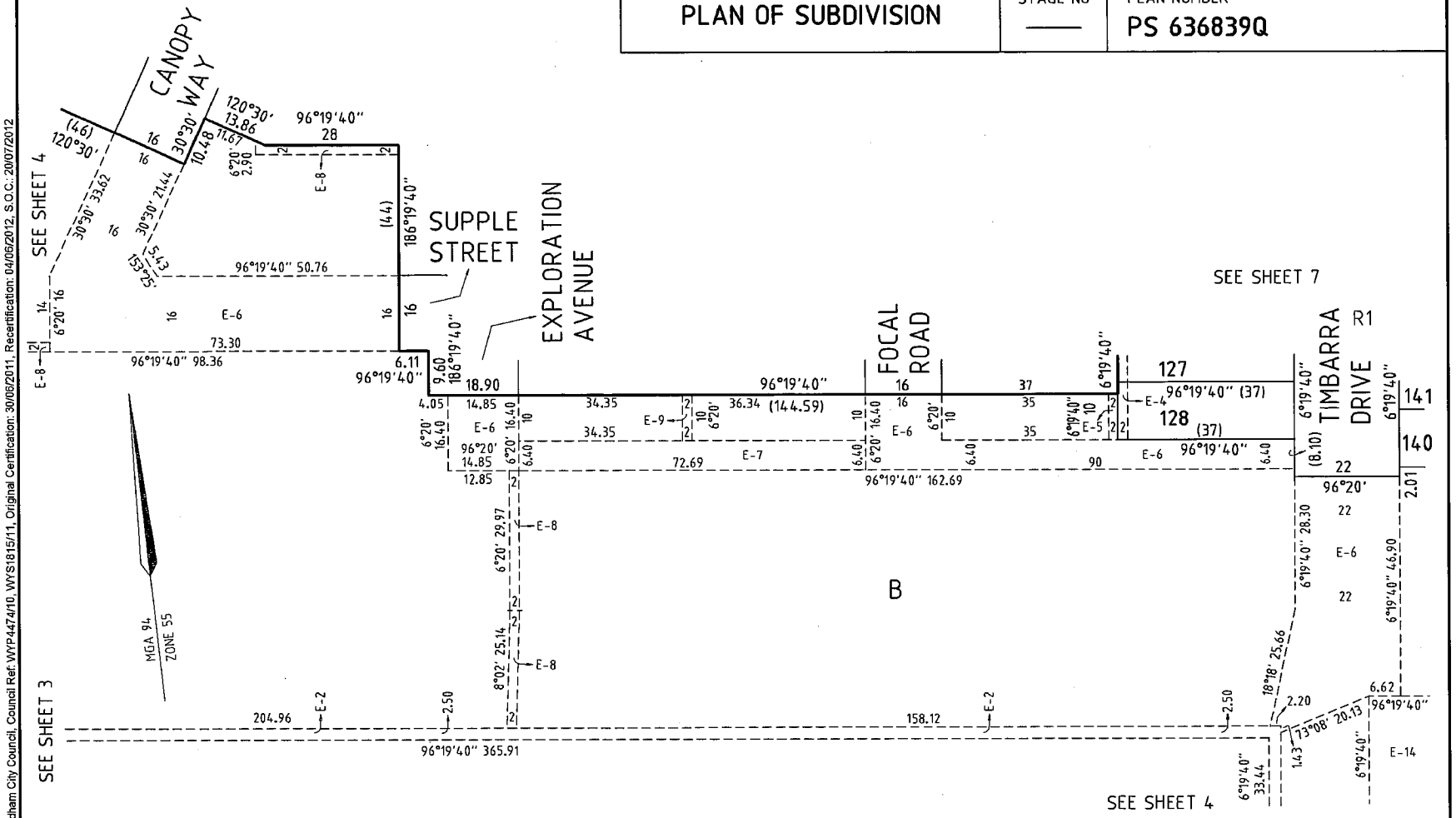
DATE / /

..... COUNCIL DELEGATE SIGNATURE

ORIGINAL SHEET SIZE A3

PLAN OF SUBDIVISION

STAGE NO	PLAN NUMBER
——	PS 636839Q



RIVERWALK RELEASE 2	No of Lots: 51 (excluding Lot B) Release 2 Land Area: 3.248ha	SHEET 9
CHRIS RUNTING & ASSOCIATES PTY LTD LAND SURVEYORS TOWN PLANNERS DEVELOPMENT CONSULTANTS 20 Hamilton Street Mont Albert Vic 3127 Tel: 9890 0933 Fax: 9898 2543	SCALE 1:750 7.5 0 7.5 15 22.5 30 37.5 45 LENGTHS ARE IN METRES	LICENSED SURVEYOR: P.J.S. TYNKKYNEN SIGNATURE ..... DATE / / REF: 3936PS2 VERSION: 23 (4.05.12)	DATE / / COUNCIL DELEGATE SIGNATURE ORIGINAL SHEET SIZE A3

Signed by Council: Wyndham City Council, Council Ref: WYP4474/10, WYS1815/11, Original Certification: 30/06/2011, Recertification: 04/06/2012, S.O.C.: 20/07/2012

	PLAN OF SUBDIVISION	STAGE NO	PLAN NUMBER
		———	PS 636839Q

CREATION OF RESTRICTION "A"

LAND BURDENED AND LAND BENEFITED: REFER TO TABLE 1

DESCRIPTION OF RESTRICTION

The registered proprietor or proprietors for the time being of any burdened lot on this plan to which this restriction applies shall not build or permit to be built or remain on the lot any building other than a building which has been constructed in accordance with endorsed memorandum of common provisions registered in dealing no AA2033 which memorandum of common provisions is incorporated into this plan.

This restriction shall cease to have affect 10 years after the date of registration of this plan.

CREATION OF RESTRICTION "B"

LAND BURDENED AND LAND BENEFITED: REFER TO TABLE 1

DESCRIPTION OF RESTRICTION

The registered proprietor or proprietors for the time being of any burdened lot must not:

B1 build or erect or permit to be built or erected or remain on the burdened lot or any part of it, any building or structure other than a building or structure which has been constructed in accordance with plans, drawings, designs and specifications which have first been approved in writing by Places Victoria ABN 61 868 774 623 in accordance with Places Victoria's Riverwalk Design Requirements and Controls as amended from time to time;

B2 erect or allow any signs to remain on the burdened lot other than the following:

- B2.1 where a dwelling constructed on the burdened lot has been completed and is offered for sale (but not if the burdened lot remains vacant or the dwelling is partly completed and is offered for sale) any real estate agent's "for sale" sign not exceeding 2.4 metres x 1.8 metres; or
- B2.2 during the period of construction of a dwelling on the burdened lot signs of builders and tradespersons who are carrying out construction work on the burdened lot;

B3 use the burdened lot or any part of it as a display home except with Places Victoria's prior written consent.

Restriction B shall cease to have affect 10 years after the date of registration of this plan.

RIVERWALK RELEASE 2 No of Lots: 51 (excluding Lot B) Release 2 Land Area: 3.248ha		SHEET 10
CHRIS RUNTING & ASSOCIATES PTY LTD LAND SURVEYDRS TOWN PLANNERS DEVELOPMENT CONSULTANTS 20 Hamilton Street Mont Albert Vic 3127 Tel: 9890 0933 Fax: 9898 2543	LICENSED SURVEYOR: P.J.S. TYNKKYNEN SIGNATURE ..... DATE / / REF: 3936PS2 VERSION: 23 (4.05.12)	DATE / / ..... COUNCIL DELEGATE SIGNATURE ORIGINAL SHEET SIZE A3

Signed by: Paavo Jukka Tynkkynen (Chris Runting & Associates Pty Ltd) Surveyor's Plan Version (23 (4.05.12)) SPEAR Ref S011384A 07/05/2012

	PLAN OF SUBDIVISION	STAGE NO	PLAN NUMBER
		——	PS 636839Q

CREATION OF RESTRICTION "C"

UPON REGISTRATION OF THIS PLAN OF SUBDIVISION THE FOLLOWING RESTRICTION IS CREATED

LAND BURDENED AND LAND BENEFITED:

LAND TO BE BURDENED:
Lots 118 to 168 (inclusive)

LAND TO BENEFIT:
Lot F on Plan of Subdivision number PS636838S

DESCRIPTION OF RESTRICTION
The registered proprietor or proprietors for the time being of a burdened lot:

1. shall not develop a burdened lot, permit a burdened lot to be developed or permit a burdened lot to remain developed, other than in accordance with the Places Victoria Fibre To The Home Building Guidelines; and
2. must not occupy a dwelling on a burdened lot and must not obtain or procure an Occupancy Permit under the Building Act 1993 (Vic) for a dwelling on a burdened lot, prior to Places Victoria issuing a Fibre To The Home compliance certificate in respect of the dwelling on the burdened lot.

This restriction applies for the period from the date of registration of this Plan of Subdivision until the date that is 10 years after the issuing of an Occupancy Permit under the Building Act 1993 (Vic) in respect of the dwelling on the burdened lot.

RIVERWALK RELEASE 2

No of Lots: 51 (excluding Lot 8)
Release 2 Land Area: 3.248ha

SHEET 11

CHRIS RUNTING & ASSOCIATES PTY LTD
LAND SURVEYORS
TOWN PLANNERS
DEVELOPMENT CONSULTANTS
20 Hamilton Street
Mont Albert Vic 3127
Tel: 9890 0933
Fax: 9898 2543

LICENSED SURVEYOR: P.J.S. TYNKKYNEN

SIGNATURE ..... DATE / /

REF: 3936PS2 VERSION: 23 (4.05.12)

DATE / /

..... COUNCIL DELEGATE SIGNATURE

ORIGINAL SHEET SIZE A3

Signed by Council: Wyndham City Council, Council Ref: WYP4474/10, WYS1815/11, Original Certification: 30/06/2011, Recertification: 04/06/2012, S.O.C.: 20/07/2012

	PLAN OF SUBDIVISION	STAGE NO	PLAN NUMBER
		———	PS 636839Q

TABLE 1

LAND BURDENED AND LAND BENEFITED – REFER RESTRICTIONS "A" AND "B"

CREATION OF RESTRICTION

BURDENED LOT No	BENEFITING LOTS
118	120, 129, 149
119	120, 121
120	119, 121
121	119, 120, 122
122	121, 123
123	122, 124
124	123, 125
125	124, 126
126	125, 127
127	126, 128
128	127
129	130, 148
130	129, 131, 133, 148
131	130, 132, 133
132	131, 133
133	130, 131, 132, 134, 148
134	133, 135, 147
135	134, 136, 145, 146, 147
136	135, 137, 143, 144, 145
137	136, 138, 142, 143
138	137, 139, 141, 142
139	138, 140
140	139, 141
141	138, 140, 142
142	137, 138, 141, 143
143	136, 137, 142, 144

BURDENED LOT No	BENEFITING LOTS
144	136, 143, 145
145	135, 136, 144, 146
146	135, 145, 147
147	134, 135, 146, 148
148	129, 130, 133, 147
149	150
150	149, 151
151	150, 152
152	151, 153
153	152
154	155
155	154, 156
156	155, 157
157	156
158	159
159	158, 160, 162
160	159, 161, 162
161	160, 162
162	159, 160, 161, 163
163	162, 164
164	163, 165
165	164, 166
166	165, 167
167	166, 168
168	167

RIVERWALK RELEASE 2

No of Lots: 51 (excluding Lot B)

Release 2 Land Area: 3.248ha

SHEET 12

CHRIS RUNTING & ASSOCIATES PTY LTD

LAND SURVEYORS
TOWN PLANNERS
DEVELOPMENT CONSULTANTS

20 Hamilton Street
Mont Albert Vic 3127
Tel: 9890 0933
Fax: 9898 2543

LICENSED SURVEYOR: P.J.S. TYNKKYNEN

SIGNATURE ..... DATE / /

REF: 3936PS2 VERSION: 23 (4.05.12)

DATE / /

..... COUNCIL DELEGATE SIGNATURE

ORIGINAL SHEET SIZE A3

Signed by: Paavo Jukka Tynkkynen (Chris Runting & Associates Pty Ltd) Surveyor's Plan Version (23 (4.05.12)) SPEAR Ref S011384A 07/05/2012

wyndham
city council

Plan of Subdivision PS636839Q
Certifying a New Version of an Existing Plan (Form 21)

SUBDIVISION (PROCEDURES) REGULATIONS 2000

SPEAR Reference Number: S011384A
Plan Number: PS636839Q
Responsible Authority Name: Wyndham City Council
Responsible Authority Reference Number 1: WYP4474/10
Responsible Authority Reference Number 2: WYS1815/11
Surveyor's Plan Version: 23 (4.05.12)

Certification

This plan is certified under section 11 (7) of the Subdivision Act 1988
Date of original certification under section 6: 30/06/2011
Date of previous recertifications under Section 11(7): 16/04/2012

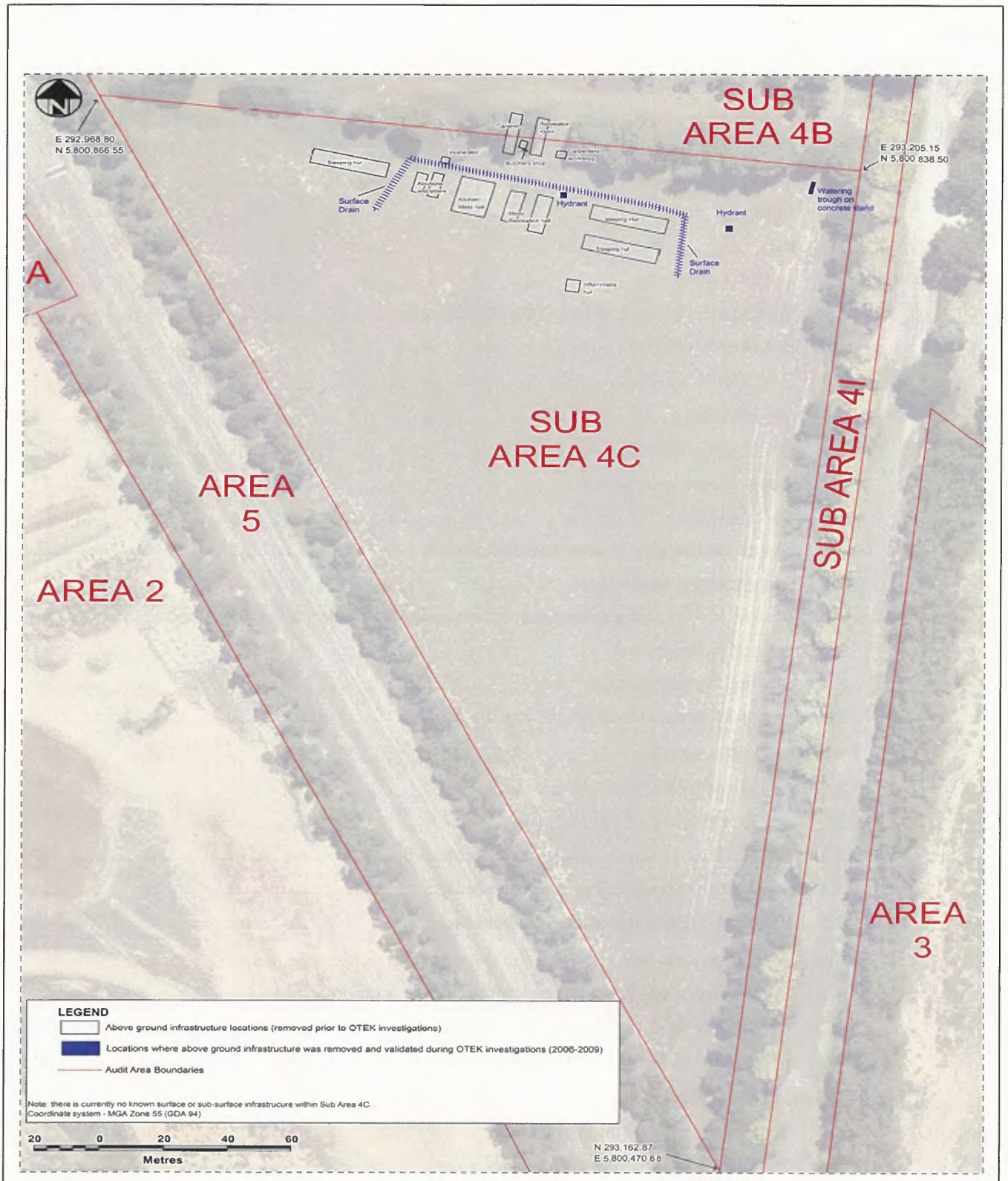
Public Open Space

A requirement for public open space under section 18 of the Subdivision Act 1988

Has not been made

Digitally signed by Council Delegate: Peter Van Til
Organisation: Wyndham City Council
Date: 04/06/2012

Signed by: Peter William Van Til (Wyndham City Council) 04/06/2012



This figure was originally prepared by OTEK for "Environmental Site Assessment, Riverwalk Sub-Area 4C, New Farm Road, Werribee, Victoria" (4C ESA Report). The image represented above is an extract from the 4C ESA Report and therefore the accuracy of the data displayed cannot be guaranteed by GHD.
GHD has not had access to the raw data used to produce this figure; GHD make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and / or costs (including indirect or consequential damage) which may be incurred by any party as a result of this map being inaccuate, incomplete or unsuitable in any way and for any reason.

Note: Image was extracted from OTEK ESA Report (above) and is not represented to scale.

Client: Melbourne Water
Project: Environmental Audit of Area 4C, Riverwalk Estate, Princes Highway, Werribee
Source: Environmental Site Assessment, Riverwalk Sub-Area 4C, New Farm Road, Werribee, Victoria (OTEK, 2013)

Job No. | 31 / 1157500
Report No. | 215722
Rev No. | B

Figure 3
Defined Audit Boundary and Historical Aboveground Infrastructure

scale: | Not to Scale | date: | 2 September 2013

Level 8, 180 Lonsdale Street, Melbourne VIC 3000 T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com.au

Table of contents

Table index

Figure index

Appendices

1. Introduction

1.1 Background

A large portion of Melbourne Water Corporation's Farm Road site, called the Riverwalk Estate is under Environmental Audit (herein referred to as the 'Overall Audit Area'). Melbourne Water voluntarily initiated an environmental assessment (undertaken by OTEK Pty Ltd (OTEK)) and environmental audit as a due diligence measure. The Overall Audit Area is roughly triangular in shape and comprises approximately 200 hectares. The current Melbourne Water operations office and Discovery Centre will remain onsite and are not subject to an audit. The locality of the Overall Audit Area is shown on Figure 1

In order to simplify the audit process and allow for areas with specific issues and development times to be considered separately, the Overall Audit Area was divided into the following 13 "Sub-Areas": 1, 2, 3, 4A, 4B, 4C, 4D, 4E, 4F, 4G, 4H, 4I, and 5 (herein referred to as 'Areas'). Audits for Areas 1, 2, 3, 4A, 4F and 5 have been completed. The remainder of the Areas were under audit at the time of reporting. Figure 2 shows the majority of the Overall Audit Area with the exception of the full extent of Area 2 and Area 3. Area 2 extends further to the south, while Area 3 is located to the east and south of Area 4C. The full extent of the Riverwalk Estate (including the full extent of the Overall Audit Area) is shown on the proposed development plan attached as Appendix B. This audit report pertains to Area 4C only, herein referred to as 'the site'. The total area of the site is 4.417 hectares. The site boundary is shown on Figure 3.

The site is part of the Riverwalk Estate which is proposed to be developed for residential purposes (with lot sizes between 300 m^2 and 600 m^2, which, in accordance with EPA (2007) is defined as 'Residential – single dwelling' and 'medium-density') and associated uses such as public open space and recreation areas.

1.2 Purpose

This Environmental Audit Report sets out the results of an Environmental Audit conducted for the Site in accordance with Part IXD of the Environment Protection Act, 1970. The report was completed in accordance with the guidelines issued by the EPA for environmental audit of contaminated sites in Victoria.

1.3 Audit methodology

The environmental assessment and subsequent remediation works were undertaken by OTEK Pty Ltd (OTEK).

The auditor was involved with the audit since its commencement in 2000 and has overseen the various phases of works including a specialised military site history review (given the site was used by Defence for a period during the WWII, see Section 2.8.2); a subsurface geophysical survey; and various intrusive sampling and remediation works. The auditor considered that the audit had followed a logical sequence which provided the auditor with confidence that the site issues were addressed and closed out – the details of which are the subject of later sections of this audit report.

1.4 Input to this report by auditor's support team

The GHD staff and support team members that assisted with this audit are provided in Table 3.

Table 3 Auditor's team assisting with audit

Name	Qualification/Role/ Experience area	Contribution to audit
Elvira Ryan	Auditor's assistant (GHD Staff)	Assisted in the auditing process and inspected the site.
Kate Fairway	Project Manager / Auditor's assistant (GHD Staff)	Assisted in the auditing process, assisted in preparation the draft environmental audit report and inspected the site.
Kirsty John	Auditor's Assistant (GHD Staff)	Assisted in reviewing the consultant's assessment report and the preparation of the draft environmental audit report.
Geoff Pettifer	Principal Geophysist	Assisted with geophysics survey results when Enterra conducted its geophysics survey and investigation

1.5 Documents reviewed

The following documents were reviewed as part of the audit process (refer to Appendix C).

- Sinclair Knight Merz Pty Ltd (SKM), 17 February 1993, *Report 5V3590001.rp1* (only incomplete report provided).
- Biosis Research Pty Ltd (Biosis), March 2000, *Werribee Field, Victoria: An Archaeological and Cultural Heritage Survey.*
- Milsearch Pty Ltd (Milsearch), April 2000, *A Review of World War II-ERA Military Activity at Werribee Fields.*
- Enterra Pty Ltd (Enterra), 31 May 2001, *Werribee Fields Development – Sub Surface Investigation.*

In addition, and where relevant, the auditor has referred to data pertaining to other audits being undertaken in the Overall Audit area. Where applicable the relevant assessment reports have been referenced.

The following reports were more directly related to Area 4C (the site) and hence were also reviewed and relied upon as part of the audit.

- OTEK, 10 October 2002, Phase One Report, Werribee Fields, Werribee, Victoria (Otek, 2002) (refer to Appendix D).
- OTEK, 15 February 2013, Environmental Site Assessment, Riverwalk Sub-Area 4C, New Farm Road, Victoria, (OTEK, 2013). This report was prepared specifically for this site (i.e. Area 4C) and hence was relied upon most for the preparation of this audit report (refer to Appendix E).

OTEK 2002 report also summarised information from the available historical reports prepared by Biosis Research, Milsearch and Enterra. These reports are discussed in more detail in Section 2.8.1.

The report detailing the intrusive investigation works undertaken at the site since 2006 (OTEK 2013) are discussed in more detail throughout this report.

Work plans were reviewed prior to intrusive works for the various phases of investigation undertaken during the audit, and comments provided to OTEK. Additionally there was ongoing communication between the auditor and OTEK during the course of the field works.

1.6 Disclaimers

This statutory environmental audit report *Area 4C of Riverwalk Estate, Princes Highway, Werribee, Victoria* ("Report") has been prepared in accordance with Part IXD of the Environment Protection Act 1970. The Report represents the auditor's opinion of the condition of the site in relation to the presence and impact of contamination at the site and its suitability for beneficial uses stated in the Statement of Environmental Audit at the date the Statement of Environmental Audit is signed. This Report:

1. has been prepared by Dr Fouad Abo and his team, of GHD as indicated in the appropriate sections of this Report for Melbourne Water Corporation;
2. may be used and relied on by Melbourne Water Corporation;
3. may be used by and provided to EPA for the purpose of meeting statutory obligations in accordance with the relevant sections of the Environment Protection Act 1970;
4. may be provided to other third parties but such third parties' use of or reliance on the Report is at their sole risk; and
5. may only be used for the purpose as stated in Section 1.2 of the Report (and must not be used for any other purpose).

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the Report are excluded unless they are expressly stated to apply in this Report.

The services undertaken by the auditor, his team and GHD in connection with preparing this Report were undertaken in accordance with current profession practice and by reference to relevant environmental regulatory authority and industry standards in accordance with Part IXD of the Environment Protection Act 1970.

The opinions, conclusions and any recommendations in this Report are based on assumptions made by the auditor when undertaking the audit and preparing the Report. The assumptions are specified throughout this Report.

In undertaking the audit and preparing this Report, the auditor is required to make judgments regarding the completeness, reliability and accuracy of the information, and the potential for contamination to impact human health and the environment. The auditor makes these judgments based on the information available, the potential impact of contaminants based on the current scientific understanding of the significance and behavior of contaminants, the specific characteristics of the contaminants matrices and current regulatory policy and legislation. The nature of contaminated site investigations is such that there is always some uncertainty in these matters; as new information can arise, the science underlying these matters can change, and regulatory policy and legislation can change. The auditor and his team have formed their opinion on the basis of the information available and their understanding of the current science and regulatory policy and legislation, applying processes and considerations in accordance with professional practice. It is possible that new information, a changed scientific understanding or changed regulatory policy and requirements will become available in the future that may lead to a different interpretation. The auditor and GHD expressly disclaim responsibility for changes that arise because of any such new information, changed science or changed regulatory policy or legislation.

The auditor and GHD have prepared this Report on the basis of information provided by Melbourne Water Corporation, assessment consultant and others who provided information to GHD (including Government authorities). The auditor and GHD have verified the information received to the extent practicable and within the scope specified in the Guidelines for Issue of Certificates and Statements of Environmental Audit (EPA Victoria, 2007). However, there may

be some information which the auditor and GHD cannot independently verify or check ("Unverified Information").

The auditor and GHD are not responsible for the Unverified Information, including (but not limited to) errors in, or omissions from, the Report, which were caused or contributed to by errors in, or omissions from, the Unverified Information.

This Report should be read in full and no excerpts are taken to be representative of the findings of this Report.

2. Site Characterisation

2.1 Site physical definition and description

The description and definition of the site are presented in Table 4.

Table 4 Site definition and description

Aspect	Comments	
Site Locality	The site is located in the Werribee Fields, which is proposed to be developed as part of the Riverwalk Estate development, and is located on Princes Highway, Werribee, Victoria. The site locality plan (provided by OTEK) is included as Figure 1 of this report.	
Certificate of Title	The site is located on part of Lot B on Plan of Subdivision 636839Q, on Certificate of Title Volume 11367, Folio 778 (Appendix A). The site boundary is defined by the coordinates below. The defined audit area and survey coordinates are shown on Figure 3.	
GIS coordinates defining the boundary of the site (MGA Zone 55).	Easting	Northing
	292,968.686	5,800,866.562
	293,205.453	5,800,838.757
	293,162.871	5,800,470.686
Area	The site encompasses an area of approximately 4.417 ha	
Surrounding Land Use	North: Area 4B. East: Area 4I and Farm Road. South: Junction of Farm Road and New Farm Road. West: New Farm Road and Area 5.	
Topography	The site and surrounding area is generally flat.	
Site Coverage / Vegetation	At the time of the audit completion, the site was vacant and grass covered. There were no structures on the site. The unsealed areas of the site (i.e. adjacent to the road) were vegetated with grass, shrubs and trees.	
Sampling Locations	The locations of soil and groundwater sampling undertaken by OTEK between April 2008 and October 2012 are shown on Figure 5 and Figure 6 respectively. The soil validation sampling locations are shown on Figure 7 and Figure 8.	

2.2 Geology and hydrogeology

The borelogs for soil and groundwater assessment works are included in Appendices C (test pits) and K (groundwater monitoring wells) of OTEK 2013, which is included in this audit report as Appendix E.

2.2.1 Soils

The assessor indicated that the soil profile on site generally consisted of:

- Grass surface underlain by brown, silty clay soil to approximately 0.1 metres below ground level (m bgl);

- Soils consisting of yellowish brown silt with occasional bands of soft, high plasticity clay to 0.5 m bgl; and
- Medium to high plasticity clayey soils of varying colour (i.e. yellow, red and brown) to approximately 12.0 m bgl (maximum depth of investigation).

Fill material consisting of gravel and clayey silt was noted at ten test pit locations in the northern portion of the site, where former RAAF infrastructure was located. The depth of fill was generally not more than 0.5 m bgl. However, test pit 4C/G8 was an exception, with gravel fill extending to a depth of approximately 1.9 m bgl (for details refer to Section 5.3.5).

2.2.2 Geology and aquifers

The 1:63 360 Melbourne Geological Map (Geological Survey of Victoria) indicates that the site is underlain by approximately 15 m of Quaternary Age 'Deutgam Silt' alluvial deposits of the Werribee Delta, comprising grey to grey-brown silt with abundant carbonate nodules and some gravel, and sand and silty sand in the lower part of the sequence. The Deutgam Silt (of the Werribee Delta Formation) overlies approximately 40 m of Quaternary Age Newer Volcanics Formation, which predominantly comprises dark to light grey olivine basalt. The Newer Volcanics are underlain by the Brighton Group Formation and the Newport Formation. Regional data indicates that the Werribee Delta alluvial deposits may also directly overlie Brighton Group sands in places.

Groundwater is likely to be present within the alluvium deposits and the basalt fractures within the Newer Volcanic Formation.

2.2.3 Groundwater flow system

The Newer Volcanic and Brighton Group Formations are the two primary aquifer systems in the vicinity of the site. Groundwater flow is expected to be towards the Werribee River, which is the nearest receiving surface water body and is located approximately 650 m to the east of the site (at its closest point). Regionally, the groundwater flow is expected to be on a south-eastern direction toward the Port Phillip Bay, which is located about 6 km to the south east of the site.

The Werribee Delta is an unconfined to semi-confined shoe-string aquifer located near the mouth of the Werribee River, where it discharges to Port Phillip Bay. The Deutgam Silt is not expected to constitute a significant aquifer system in the vicinity of the site. Well yields in the Werribee Delta Aquifer range up to 15 litres per second (L/s) but are generally less than 5 L/s. Groundwater quality ranges from 500 to 6000 mg/L total dissolved solids (TDS), with the lower TDS occurring within the coarser lenses.

The Newer Volcanics Formation is comprises fractured basalt with interbedded clay aquitards. The shallow parts of the aquifer are unconfined, while the deeper parts range from semi-confined to confined. Water occurs in fractures and vesicular voids. Hydraulic properties vary widely depending on the condition of the basalt. Well yields in the Newer Volcanics Aquifer range up to 40 L/s but are generally less than 1.2 L/s. Groundwater quality in this aquifer ranges from 100 to 6000 mg/L TDS with the chemistry largely dependent on the state of weathering of the surrounding basalt. This aquifer, along with the underlying Brighton Formation aquifer, is identified as a primary aquifer in the region.

Groundwater monitoring well MW-04 is located within area 4C. The well log for MW-04 (refer to Appendix K of OTEK 2013, attached as Appendix E of this report) indicates the well was installed within the Newer Volcanics aquifer.

2.2.4 Groundwater database and groundwater quality

Groundwater database

OTEK did not undertake a search of the Victorian Groundwater Management System (managed by DSE); therefore the auditor undertook a search and review. The search identified 10 wells within a 1 km radius of the site, as tabulated and shown on a plan in Appendix F (note several of the wells plot in the same location due to the scale of the plan). The well locations shown in Appendix F are approximate only. The information available was considered sufficient to determine the approximate location of wells relative to the site, and hence was adequate for the purposes of the audit. The wells are listed as being used for domestic, stock and investigation purposes, with the use of several wells listed as not known. Groundwater chemistry data was not available. The majority of groundwater wells were located cross or up gradient of the site and are considered unlikely to be in the flow path of groundwater from the site.

Groundwater quality

Based on groundwater data from the Overall Audit Area including this site, information from nearby audits and published references, and as discussed further in Section 6.2 of this report; groundwater in the region was found to have elevated concentrations of some inorganics and nitrate. This was considered to be attributed to naturally occurring concentrations in the Newer Volcanics Aquifer, and to widespread regional agricultural land use.

2.3 Surface water

The Werribee River is located approximately 800 m to the east of the site (at its nearest point) and flows in a southerly direction towards Port Phillip Bay located about 6 km south of the site.

No surface water bodies are located on the site.

2.4 Site physical status at audit commencement

The site was used by the RAAF during World War II. During this time (1942 to 1945), a number of structures were erected. Most structures in the Area 4C were removed during the RAAF withdrawal in 1952, with the remaining removed at later stage as per Table 5 below. A summary of the structures and the year of removal are provided in Table 5.

Table 5 Onsite infrastructure and status

Infrastructure	Status
Several RAAF buildings including a mess hall, recreation hall, a canteen, a kitchen/mess hall, a recreation room, and three sleeping huts.	Removed in 1952
Three RAAF structures including a paint shop, a carpenter's workshop, and a butcher's shop.	Removed in 1952
Two RAAF buildings / structures (ablutions and latrines).	Removed in 1952
Inflammable hut	Removed in 1952
Incinerator	Removed in 1952
Petrol UST	40,000 litre (L) tank removed from the site circa 1959 (Milsearch, 2000)

Infrastructure	Status
Septic tank	Removed from the site in July 2009 (OTEK Fieldworks).
Underground piping	Asbestos and terracotta piping removed from the site in 2008/2009 (OTEK Fieldworks).
Above ground concrete surface drain.	Removed from the site 2008/2009 (OTEK Fieldworks).
Animal watering trough	Removed from the site in 2009 by OTEK.

Plans showing the location of former above and underground infrastructure are provided in Figure 3 and Figure 4 respectively of this audit report. At the time of audit completion, no above ground infrastructure was present on site.

Further discussion regarding the investigation activities undertaken during the infrastructure removal is provided in Section 5.3 of this report.

2.5 Proposed site development

The site is part of the Riverwalk Estate which is proposed to be developed for residential development (with lot sizes between 300 m^2 and 600 m^2) and associated uses such as public open space and recreation areas.

As per the development plan and in accordance with the Environmental Auditor (Contaminated Land) Guidelines for Issue of Certificates and Statements of Environmental Audit (EPA Publication 759.1) (EPA 2007) the lot sizes would be defined as 'residential – single dwelling' (300 m^2 to 4000 m^2 and 'medium density' (one dwelling between 200 m^2 and 300 m^2).

The proposed development plans and planning scheme information are included in Appendix B of this report.

2.6 Review of EPA Notices, Register, Licences and/or Trade Waste Agreements

There were no EPA licences or trade waste agreements relevant to Area 4C.

The auditor's file search indicated that Area 4C was not subject to overlays related to contaminated land, was not on the EPA Priority Sites register, and was not subject to an EPA clean-up or pollution abatement notice. Melbourne Water initiated this audit and environmental assessment as part of its own due diligence measures.

2.7 Off-site investigations

At the time of the audit, investigations on the areas of the Overall Audit Area surrounding the site were being finalised. Some of the assessment information from the surrounding sites was used in this audit due to a number of similarities (e.g. history, geology, hydrogeology, etc.). Such information provided further confidence in the auditor's understanding of the background conditions (where appropriate).

2.8 Site and surrounding site history

2.8.1 Summary of historical reports for the overall audit area

Various historical reports were reviewed to provide information on the site history and potential contaminants of concern. Information from the historical reports undertaken between 1993 and 2001 was detailed in OTEK (2002), included as Appendix C of this audit report. The following historical reports have been considered. The first two were not relied upon for the purposes of the audit as they were out-dated and were superseded by more recent site history report, geophysical report, and detailed assessments, as discussed in this report.

SKM Pty Ltd (1993)

SKM (1993) conducted a preliminary site investigation for the Audit Site prior to the commencement of the Environmental Audit. A total of 52 samples were collected from 26 locations across the Overall Audit Area. One borehole (borehole 14) was located within Area 4C. A sample from this borehole '14A' was combined to form a three-part composite 'Comp 5' and analysed for inorganics, OCPs and pH. No exceedances were observed.

Biosis Pty Ltd (March, 2000)

Biosis conducted an archaeological and cultural survey to identify any areas of archaeological and cultural heritage that may be impacted by the proposed site investigation and development across the Overall Audit Area. The survey included research of background information relating to the Overall Audit Area, site inspections and a systematic ground survey. Liaison was also made with the Wathaurong Aboriginal Cooperative Ltd and the South West Region Cultural Heritage Group. The report has not identified any heritage or cultural issues at the site. The Biosis report is attached as Appendix C of this report.

Milsearch Pty Ltd (April, 2000)

Milsearch undertook a specialist review of the site history during the World War II era to determine the potential for the presence of residual munitions and other material burials or contaminants at the site.

A Works Service drawing No. 47/48/147 located in the Australian Archives revealed a UST of 10,000 gallon (40,000 L) capacity close to the Farm Road and near Hanger 5. In addition, the building complex south of Hanger 5 included a paint shop, incinerator, septic tank, and inflammables hut. Both the UST and building complex are inferred to be located within Area 4C. The Milsearch report is attached as Appendix C of this report.

Enterra Pty Ltd (May, 2001)

In response to the findings of the Milsearch report, a subsurface geophysical investigation was conducted by Enterra between November 2000 and February 2001 to locate the 10,000 gallon UST within Area 4C. The investigation was undertaken using various geophysical techniques including the use of a digital magnetometer and electromagnetic detection equipment.

No UST was identified within Area 4C, however, Enterra identified nine (9) geophysical anomalies that were investigated further by OTEK (refer to Section 5.3). These anomalies are summarised in Table 6.

Table 6 Geophysical anomalies identified within Area 4C

Anomaly Number	Depth (m bgs)	Initial Enterra Interpretation (May 2001)	Actual
1	2.0	Sewer pipe	
2	2.2	Sewer pipe	Ceramic pipe, steel pipe, junction box associated with former latrine removed by OTEK (refer to Section 5.3.10).
3	3.4	Water pipe	
4	3.6	Sewer pipe	
5	1.0	Hydrant	Hydrant. Removed with the asbestos/metal pipe by OTEK (refer to Section 5.3.3).
6	1.8	Foundation	Part of the septic and soak pit. Removed by OTEK (refer to Section 5.3.7).
7	1.1	Foundation	
8	2.1	Hydrant	Hydrant. Removed with the asbestos/metal pipe by OTEK. (refer to Section 5.3.3).
9	1.1	Reinforced concrete base	Former UST pit with buried concrete and steel pieces. Removed by OTEK (refer to Section 5.3.1).

The Enterra report is attached as Appendix C of this report).

2.8.2 Summary of available site history information

OTEK undertook a history review for the Overall Audit Area (OTEK 2002), including a review of the historical reports by SKM (1993), Geo-Eng (1997), Biosis (2000), and Milsearch (2000), review of Melbourne Water historical property files, Sands and McDougall records and historical title records, personnel interviews, and an aerial photograph search (site photographs were not available prior to 1945). OTEK also provided a summary of the site history findings relevant to the site in OTEK 2013.

- The Overall Audit Area and land in the general vicinity was used for dairy farming, stock grazing, and vegetable growing during 1880-1900.
- According to Biosis (2000), circa 1900, the Board of Works ceased leasing the land (approximately 10,000 hectares) and used it for waste water irrigation in winter and sheep grazing in summer. Further information indicated that wastewater irrigation practices were undertaken on a small portion of off-the Overall Audit Area land located beyond the south west of Area 2 (Environmental Audit was completed for Area 2 in 2004). This was practiced until 1958, when the Maltby Bypass was constructed adjacent to the southern boundary of the overall audit site. The Caltex Service Station and the Freeway Access Ramp now occupy this area, which is not part of the Overall Audit Area. The available information indicated that the Overall Audit Area has not been irrigated using wastewater.
- Melbourne Water Corporation acquired the Overall Audit Area in the 1920s.
- The Overall Audit Area was occupied by the RAAF from circa 1940 to 1952.
- From the early 1950s to the late 1970s the site was used primarily for agriculture, and then in the late 1970s Melbourne Water began operating at the site.
- During World War II, sections of Area 4 were temporarily occupied by the Royal Australian Air Force (RAAF) during which a number of structures were erected, and then

subsequently removed during the RAAF withdrawal from the site in 1952. The location of former above ground and subsurface infrastructure is shown in Figure 3 and Figure 4 respectively. Structures erected within Area 4C are detailed in Table 5.

As noted in Section 2.8.1, the geophysical survey completed by Enterra between November 2000 and February 2001 identified nine (9) underground anomalies believed to be associated with the former RAAF occupation of the site. These anomalies are discussed further in Section 5.3 and summarised in Table 6.

2.9 Identified contaminants of potential concern

OTEK provided information on the contaminants of potential concern (CoPC) in Section 5.1 of OTEK 2013 report, which was based on the site infrastructure and historical site use. A summary of the previous site uses and the associated CoPC identified are summarised in Table 7, along with specific observations related to each potential source.

Table 7 Potential sources and associated contaminants of potential concern

Site activity / Potential source	Contaminants of Potential Concern (CoPC)	Location	Comments
Onsite			
RAAF infrastructure: • Paint shop; • Carpenter's shop; • Butcher's shop; • Kitchen/mess hall; • Recreation/mess hall; • Sleeping huts; • Septic and soak pit; • Latrines and ablutions; • Incinerator; • Inflammables hut; • Asbestos/metal pipe; and • Petrol UST.	Inorganics, organochlorine pesticides (OCPs), organophosphate pesticides (OPPs), total petroleum hydrocarbons (TPHs), benzene, toluene, ethylbenzene and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), semi-volatile organic compounds (SVOCs), dioxins, cyanide, fluoride, ammonia, nitrates, nitrites, asbestos, *E.Coli,* and pH.	Northern portion of Area 4C. Refer to Figure 3 and Figure 4.	Status of infrastructure above and below ground at time of audit: Most above-ground RAAF infrastructure including the paint shop, carpenter's shop, butcher's shop, kitchen/mess hall, recreation/mess hall, sleeping huts, latrines and ablutions, incinerator, and inflammables hut was removed from the site in 1952. Septic and soak pit – both underground structures, comprised of buried blue stone cobbles/boulders, were excavated and removed from the site by OTEK during the audit (Refer to Section 5.3.7). Incinerator – removed from the site in 1952. An associated subsurface layer of ash was later removed by OTEK during the audit (Refer to Section 5.3.6). Asbestos/metal pipe – removed by OTEK during the audit (Refer to Section 5.3.3). Petrol UST – Removed from the site circa 1959. Tankpit backfill material contained concrete anchors and other debris, which were removed by OTEK and validated during the audit (Refer to Section 5.3.1). A potential for scattered debris and non-friable asbestos fragments in Area 4C from buildings constructed from ACM which were present at the site (refer to section 5.4).
Stockpile	Potential for a wide range of potential contaminants as listed above	Northern portion of Area 4C	In 2008, a small stockpile (of unknown origins) was found on site by OTEK during its site investigations and disposed offsite (Refer to Section 5.3.4).
Buried Debris	Potential for a wide range of potential contaminants as listed above	Northeast portion of Area 4C	Discovered by OTEK in 2006 during site investigation works. Buried material described as 'minor domestic rubbish' consisting of a small amount of plastic, glass, and concrete (Refer to Section 5.3.5).

Site activity / Potential source	Contaminants of Potential Concern (CoPC)	Location	Comments
Agriculture (farming and grazing), and watering trough on concrete stand.	Inorganics, OCPs/OPPs, asbestos, pH, nitrate, nitrite, and ammonia.	Entire Area 4C (watering trough located in northeast corner of Area 4C).	Potential for broad application of pesticides and herbicides across the site.
Offsite			
Agriculture (farming and grazing)	Inorganics, OCPs/OPPs, asbestos, pH, nitrate, nitrite, and ammonia.	Surrounding Areas: 4B (North), Area-2 (Southwest), Area-3 (East), and Area-5 (West)	Potential for broad application of pesticides across the overall audit area.
RAAF infrastructure in Areas 4B and 4F (aircraft hangers and septic tanks).	Asbestos, inorganics, fluoride, E.Coli, ammonia, nitrate, nitrite, and pH.	Potential for broad contamination from runoff from areas north (Area 4B and 4F) of the site.	A hydrogeological assessment of the overall audit area found that Area 4B is located hydraulically up-gradient of the site, and hence there is potential for contamination (if any identified) to migrate from this area via groundwater to the site. OTEK did not comment on the possibility of windborne contamination or surface runoff. Cross contamination through dust migration and/or surface runoff is possible, albeit minimal given Area 4B is located immediately adjacent to the site.

Auditor's opinion on site history assessment

When the site history information from various sources was reviewed in its entirety, it provided a comprehensive understanding of potentially contaminating activities that may have occurred at the site. Based on the site history review, the majority of the site was considered likely to be green field land, with a low potential for contamination.

The auditor was satisfied that the site history review of the site and Overall Audit Area provided sufficient information to allow an appropriate sampling and analysis program to be developed and then implemented as discussed in this report.

3. Assessment guidelines

Environmental protection in Victoria is legislated under the *Environment Protection Act 1970* (EP Act). Sub-ordinate legislation within the EP Act includes State environment protection policies (SEPPs) that prescribe beneficial uses and objectives that are to be met to protect the various segments of the environment.

3.1 Beneficial uses of the land to be protected

For the land segment, the *State environment protection policy (Prevention and Management of Contamination of Land)*, 2002 applies. Commonly referred to as the 'Land SEPP', the policy provides the beneficial uses to be protected under a number of different land use scenarios, and provides indicators and objectives for protection of land. The SEPP was varied on 26 September 2013. The SEPP and the variation to the SEPP should be read in conjunction.

The land use categories of possible relevance to any site according to the Land SEPP are:

- Parks and Reserves;
- Agricultural;
- Sensitive Use including child care centre, pre-school, primary school and residential, any of which may take place in:
  - A high density area (where there is minimal access to soil) - Sensitive Use (High Density).
  - A lower density area (where there is generally substantial access to soil) - Sensitive Use (Other).
- Recreation/Open Space;
- Commercial; and
- Industrial.

The Policy defines protected beneficial uses for land as being:

- Maintenance of natural ecosystems, modified ecosystems and highly modified ecosystems;
- Human health;
- Buildings and structures;
- Aesthetics; and
- Production of food, flora and fibre.

The protected beneficial uses for each of the respective land uses are shown in Table 1 of the Land SEPP. This table is reproduced in Table 8 below.

Table 8 Protected Beneficial Uses of Land

Beneficial Use	Land Use						
	Parks & Reserves	Agricultural	Sensitive Use (High Density)	Sensitive Use (Other)	Recreation / Open space	Commercial	Industrial
Maintenance of Ecosystems							
Natural Ecosystems	✓						
Modified Ecosystems	✓	✓		✓	✓		
Highly Modified Ecosystems		✓	✓	✓	✓	✓	✓
Human Health	✓	✓	✓	✓	✓	✓	✓
Buildings & Structures	✓	✓	✓	✓	✓	✓	✓
Aesthetics	✓		✓	✓	✓	✓	
Production of Food, Flora & Fibre	✓	✓		✓			

The site is proposed to be developed for residential uses including residential-single dwelling and medium-density residential use and as such the beneficial uses under the sensitive use (other) land use category apply as per the Land SEPP. The relevant beneficial uses of land to be protected under the sensitive use (other) category are:

- Modified Ecosystems;
- Highly Modified Ecosystem;
- Human Health;
- Buildings & Structures;
- Aesthetics; and
- Production of Food, Flora and Fibre.

3.2 Adopted investigation levels – land

The Land SEPP refers to the National Environment Protection (Assessment of Site Contamination) Measure in December 1999 (often referred to as "the NEPM") which was formulated by the National Environment Protection Council (NEPC), under the *National Environment Protection Council Act 1994.* NEPM 1999 was amended in May 2013 and is now referenced as NEPM (1999 as amended 2013). All of the assessment work for this audit was undertaken from 2006 to 2012, which was well before the amended NEPM was released. The EPA has indicated that a 12 month transition process from May 2013 applies to the implementation of the NEPM 1999 (as amended 2013) and as such the auditor considered that use of the NEPM 1999 was appropriate in this instance. All the States and Territories of Australia were signatories to the making of the NEPM, including Victoria under the *National Environment Protection Council (Victoria) Act 1995.*

The NEPM provides investigation levels for soil and groundwater in the assessment of site contamination including Ecological Investigation Levels (EILs) and Health Investigation Levels

(HILs) in Schedule B(1). The NEPM EILs and HILs are referred to in the Land SEPP as the principal objectives to be met to protect the beneficial uses of land.

3.2.1 Ecological protection

NEPM EILs (Interim Urban) (NEPC, 1999) were adopted as the initial screening level to assess potential impacts of soil contaminants on the environment (i.e. to consider impacts to the beneficial use 'Maintenance of Ecosystems'). EILs are set for urban land use (comprising city, suburban, and industrial areas). Where no EIL exists for an analyte, the following hierarchy of criteria were used by the auditor to assess potential ecological impact:

- Threshold concentrations for sensitive land use - soils (Table 3) from the NSW EPA (1994) *Guidelines for Assessment of Service Station Sites*;
- The Environmental Investigation "B" levels presented in the ANZECC & NHMRC (1992) *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*; and
- The Dutch Target and Intervention Values provided in MHSPE (2009).

Where composite sampling occurred during the initial investigations at this site, modified investigation levels were adopted for these samples (i.e. ecological investigation criteria were divided by the number of a samples making up the composite sample).

3.2.2 Human health protection

NEPM HIL A criteria were adopted as the initial screening level to assess impacts of soil contaminants on human health at the site. NEPM HIL A criteria are applicable for protection of human health in standard residential land uses with gardens / accessible soil (home grown produce contributing less than 10% fruit and vegetable intake; no poultry) and includes children's day care centres, preschools, and primary schools.

Where concentrations were below NEPM HIL A, it was generally considered that contamination would not adversely affect human health under any of the exposure scenarios (NEPM 1999). Where contaminant concentrations exceeded NEPM HIL A, results were then compared to HIL D to F to determine the land use scenarios under which human health would be protected. Such evaluation would typically include the nature and degree of the exceedance and a consideration of any proposed site use, human health risks or other impacts on the nominated beneficial use.

Where no HIL exists for an analyte, the following hierarchy of criteria were used by the auditor to assess potential human health impact.

- Threshold concentrations for sensitive land use - soils (Table 3) from the NSW EPA (1994) *Guidelines for Assessment of Service Station Sites*;
- The Environmental Investigation "B" levels presented in the ANZECC & NHMRC (1992) *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*; and
- The Dutch Target and Intervention Values provided in MHSPE (2009).

Where composite sampling occurred during the initial investigations at this site, modified investigation levels were adopted for these samples (i.e. human health criteria were divided by the number of a samples making up the composite sample).

3.2.3 Aesthetics

There are no published criteria specific to assessment of aesthetic impact. However, the Land SEPP includes the aesthetic as a protected beneficial use of the land and also states (Table 2 of the SEPP) "contamination must not cause the land to be offensive to the senses of human beings". The NEPM (1999) also specifies the fundamental principle that the soils should not be discoloured, malodorous (including when dug over or wet) nor be of abnormal consistency.

3.2.4 Buildings and structures

The Land SEPP requires that "Contamination must not cause the land to be corrosive to or adversely affect the integrity of structures or building materials". The Land SEPP specifies pH, sulphate, redox potential, salinity or any chemical substances or waste that may have a detrimental impact on the structural integrity of buildings and/or other structures as indicators.

3.2.5 Production of food, flora and fauna

The Land SEPP requires that "Contamination of land must not:

(i) adversely affect produce quality or yield; and

(ii) affect the level of any indicator in food, flora and fibre produced at the site (or that may be produced) such that the level of that indicator is greater than that specified by the *Australia, New Zealand Food Authority, Food Standards Code*".

The SEPP specifies any chemical substance or waste including those in the National Environmental Protection (Assessment of Site Contamination) Measure, Schedule B(2), Appendix 1.

In the absence of officially adopted investigation levels specifically for protection of food, flora, and fibre; NEPM EILs have been considered for the purpose of this audit. It is noted that OTEK adopted NEPM A HILs as investigation levels for this beneficial use. The auditor considered the EILs should also be considered as they are, also appropriate for assessing potential adversity to produce quality or yield.

3.3 Beneficial uses of groundwater to be protected

The Victorian Environment Protection Authority (the Authority) will determine the segment to which groundwater in an aquifer belongs. The beneficial uses to be protected for each of the groundwater segments are defined in Table 2 of the *State environment protection policy Groundwaters of Victoria 1997*, herein referred to as the Groundwater SEPP. Water of higher quality (lower salinity) has more beneficial uses than low quality (more saline) groundwater.

The protected beneficial uses for each segment are shown in Table 2 of the Groundwater SEPP. This table is reproduced in Table 9 below.

Table 9 Protected beneficial uses of groundwater segments

Beneficial Uses	Segments (mg/L TDS)				
	A1 (0-500)	A2 (501-1000)	B (1001-3500)	C (3501-13,000)	D (greater than 13,000)
Maintenance of ecosystems	✓	✓	✓	✓	✓
Potable water supply					
Desirable	✓				
Acceptable		✓			

Beneficial Uses	Segments (mg/L TDS)				
	A1 (0-500)	A2 (501-1000)	B (1001-3500)	C (3501-13,000)	D (greater than 13,000)
Potable mineral water supply	✓	✓	✓		
Agriculture, parks & gardens	✓	✓	✓		
Stock watering	✓	✓	✓	✓	
Industrial water use	✓	✓	✓	✓	✓
Primary contact recreation (e.g. Bathing, swimming)	✓	✓	✓	✓	
Buildings and structures	✓	✓	✓	✓	✓

As per clause 9(2) of the SEPP, the Authority may also determine that a beneficial use specified in Table 9 above does not apply to groundwater where:

- there is insufficient aquifer yield to sustain the beneficial use;
- the background level of a water quality indicator other than TDS precludes a beneficial use;
- the soil characteristics preclude a beneficial use; or
- a groundwater quality restricted use zone has been declared.

Clause 5. (1) of the Groundwater SEPP also states that "The goal of the policy is to maintain and where necessary improve groundwater quality sufficient to protect existing and potential beneficial uses of groundwater throughout Victoria."

EPAV (2007) *Publication 759.1, Environmental Auditor (Contaminated Land) Guidelines for Issue of Certificates and Statement of Environmental Audit* provides further explanation:

- Section 9.3 (last paragraph, Explanatory Note) states: "Any assessment of the likelihood of particular beneficial uses of groundwater being realised should be based on an evaluation of whether an owner/occupier of the site or in the vicinity of the site may reasonably expect to use or be able to use groundwater for those purposes".
- Section 13.4 states: "Beneficial uses of groundwater may be considered 'relevant' for the purpose of determining whether to issue a Certificate in the following circumstances:
  - Where the beneficial use is 'existing' in the vicinity of the site. A beneficial use may be considered 'existing' where an existing receptor (bore, spring, creek) is or could plausibly be impacted by the pollution or reasonably foreseeable conditions (including altered groundwater flow resulting from abstraction, injection or other means).
  - Where the beneficial use is 'likely' to be realised in the vicinity of the site. A beneficial use may be considered 'likely' in circumstances including but not limited to, the following,
    (i) groundwater is used in the same hydrogeological setting nearby or elsewhere in Victoria, and
    (ii) the existing and likely future land uses both at the site and in the vicinity of the site are compatible with the beneficial use".

In this case the groundwater protected beneficial uses have been determined on the basis of the Groundwater SEPP for the purposes of this report.

TDS measured in the groundwater at the site ranged from 3780 mg/L (MW-4 in 2011) to 3920 mg/L (MW-4 in 2009) (OTEK 2013). Therefore, under the Groundwater SEPP, groundwater at the site would be classified as Segment C. Accordingly, the relevant beneficial uses of groundwater to be protected are:

- Maintenance of Ecosystems;
- Stock watering;
- Industrial water use;
- Primary contact recreation (e.g. Bathing, swimming); and
- Buildings and structures.

3.4 Adopted investigation levels – groundwater

Table 3 of the Groundwater SEPP specifies the water quality investigation indicators required to protect beneficial uses. These investigation levels are specified in Table 10 below. In its 2012 assessment report, OTEK adopted ANZECC 1992 guidelines for comparison purposes. The auditor requested OTEK consider the more recent ANZECC 2000 and NHMRC 2008 guidelines. The auditor considered the most recent guidelines, as summarised in Table 10 below. The adoption of these more recent guidelines does not; in this instance alter the conclusions OTEK reached based on its consideration of ANZECC 1992.

Table 10 Groundwater quality indicators

Beneficial Use Category	Water Quality Indicators
Maintenance of Ecosystem	Those specified in the relevant SEPP for surface waters as this beneficial use applies at the point of discharge of groundwater to a receiving surface water body. This site is located within the "Cleared Hills & Coastal Plains" segment covered by the SEPP Waters of Victoria (June 2003). The environmental quality objectives specified for this segment are those values in the ANZECC 2000 guidelines, and the level of ecosystem protection for this Segment is generally 95% for slightly to moderately modified aquatic ecosystems.
Potable Water Supply (Desirable and acceptable)	ANZECC (2000) Australian Water Quality Guidelines for Fresh and Marine Waters, refers to the Australian NHMRC and ARMCANZ (1996) Australian Drinking Water Guidelines. The NHMRC and ARMCANZ (2004) Australian Drinking Water Guidelines supersede these guidelines.
Potable Mineral Water	Australian Food Standards Code (1987) – Standard 08 Mineral Water, criteria for potable mineral water supply.
Agriculture, Parks & Gardens	ANZECC (2000) Australian Water Quality Guidelines for Fresh and Marine Waters, investigation levels for Primary Industries.
Stock Watering	ANZECC (2000) Australian Water Quality Guidelines for Fresh and Marine Waters, investigation levels for Primary Industries.
Industrial Water use	ANZECC (2000) Australian Water Quality Guidelines for Fresh and Marine Waters do not provide specific guidance for industrial water use, because industrial water requirements are so varied (both within and between industries) and sources of water for industry have other coincidental environmental values that tend to drive management of the resource. Industrial water use has been considered through regard for other environmental values.

Beneficial Use Category	Water Quality Indicators
Primary Contact Recreation	The ANZECC (2000) Australian Water Quality Guidelines for Fresh and Marine Waters, Guidelines for Recreation Water Quality and Aesthetics which supersede these guidelines refers to the NHMRC (2008) Guidelines for Managing Risks in Recreational Water.
Buildings & Structures	Introduced contaminants shall not cause groundwater to be corrosive to structures or building materials (pH, sulphate, redox potential). Investigation levels are not specified and reference has been made to AS2159-2009 Piling – Design and installation.

3.5 Beneficial uses of the air environment

The State environment protection policy *(Air Quality Management)* (AQM SEPP) dated 21 December 2001 stated that the following beneficial uses are protected in the ambient (outdoor) air environment throughout the State of Victoria:

a. life, health and well-being of humans;

b. life, health and well-being of other forms of life, including the protection of ecosystems and biodiversity;

c. local amenity and aesthetic enjoyment;

d. visibility;

e. the useful life and aesthetic appearance of buildings, structures, property and materials; and

f. climate systems that are consistent with human development, the life, health and well-being of humans, the protection of ecosystems and biodiversity.

Table 11 below outlines the likely impact scenarios and provides a screening analysis of the beneficial uses of air for further consideration (if any), as relevant to this site:

Table 11 Relevance of beneficial uses of air

Beneficial Use	Possible Exposure Scenarios	Requires Further Consideration?
Life, health and well-being of humans	Volatile contaminants were not reported during assessment works at the site.	No
Life, health and well-being of other forms of life, including the protection of ecosystems and biodiversity	Volatile contaminants were not reported during assessment works at the site.	No
Local amenity and aesthetic enjoyment	Odours were not reported during assessment works at the site.	No
Visibility	Given the site coverage at the completion of the audit, it is unlikely that significant dust would result in impact to this beneficial use.	No
Useful life and aesthetic appearance of buildings, structures, property and materials	Volatile contaminants and odours were not reported during assessment works at the site.	No
Climate systems that are consistent with human development, the life, health and well-being of humans, the protection of ecosystems and biodiversity	Volatile contaminants were not reported during assessment works at the site.	No

4. Site investigation activities

4.1 Chronology of site activities relevant to the environmental audit

The chronology of site activities and a description of the soil and groundwater works undertaken relevant to the environmental audit is presented in Table 12. The auditor's opinion of the adequacy of the assessment results and a consideration of risks to human health and the environment is discussed in Section 5 (soil) and Section 6 (groundwater).

Table 12 Sequence of site activities

Date of Investigation	Site Activity and Objective	Relevant Section of Audit Report
1993 - 2001	Various historical reports were prepared for the Overall Audit Area.	Section 2.8.1
2002	OTEK undertook a site and surrounding site history investigation (OTEK, 2002) to determine if infrastructure and former activities may have resulted in contamination.	Section 2.8.1
April to May 2006	OTEK undertook a soil investigation, including collection of samples from 56 grid-based test pits and 19 targeted locations.	Section 5.2
May 2006	OTEK supervised the removal of 820 m^3 of material from the backfilled UST pit and collected validation samples from the walls and base of the excavation. 5.9 tonnes of concrete and steel pieces were removed from the soil and disposed of offsite.	Section 5.3.1
19 July 2006	Groundwater monitoring well MW-4 was installed down-gradient from Area 4C former UST to assess the potential for groundwater hydrocarbon impacts.	Section 6.1
March 2007	OTEK supervised the removal of a small amount of ash from the small burner/incinerator by undertaking a surface scrape of soil over an area of approximately 40 m^2 to a depth of approximately 0.6 m.	Section 5.3.6
	OTEK completed a visual inspection to demarcate the extent of surface asbestos containing material, delineating an area of approximately 5405 m^2 across the northern portion of Area 4C.	Section 5.2.3
24 August 2007	OTEK conducted a groundwater monitoring event across Overall Audit Area, including MW-4.	Section 6.5
15 November 2007	OTEK conducted a groundwater monitoring event across Overall Audit Area, including MW-4.	Section 6.5
4 February 2008	OTEK conducted a groundwater monitoring event across Overall Audit Area, including MW-4.	Section 6.5
April 2008	OTEK undertook inorganics delineation sampling in response to zinc exceedances observed at locations 4C/T6 and 4C/G5.	Section 5.3.2
September 2008	OTEK supervised the removal of 250 m of asbestos and metal pipes and collected validation samples from the walls and base of the excavated trench.	Section 5.3.3
	OTEK identified 12 m^3 of illegally dumped stockpile material. Stockpile samples were collected and the soil was classified as Category B material and disposed offsite.	Section 5.3.4

Date of Investigation	Site Activity and Objective	Relevant Section of Audit Report
May 2009	OTEK supervised removal and offsite disposal of an animal watering trough and underlying concrete stand.	Section 5.3.9
June 2009	OTEK supervised the removal of the septic and soak pit fill material and undertook validation sampling of the underlying soils.	Section 5.3.7
	OTEK supervised the removal of buried debris (plastic, glass concrete) previously identified in test pit 4C/G8.	Section 5.3.5
	OTEK excavated a 40 m^2 area to 0.6 m bgl in vicinity of former incinerator to remove all visible ash.	Section 5.3.6
July 2009	OTEK removed pieces of concrete from former surface drain and disposed offsite.	Section 5.3.8
	OTEK removed asbestos fragments, identified in the vicinity of former surface drain, in several stages; including handpicking and surface soil tilling.	Section 5.4.1
August 2009	OTEK supervised removal of pieces of concrete and ceramic pipe identified in vicinity of former kitchen.	Section 5.3.7
September 2009	OTEK completed further delineation sampling in response to zinc exceedances observed at locations 4C/T6 and 4C/G5.	Section 5.3.2
	OTEK supervised the removal and offsite disposal of ceramic and steel piping and a junction box.	Section 5.3.10
25 November 2009	OTEK conducted a groundwater monitoring event across Overall Audit Area, including MW-4.	Section 6.5
November 2010	OTEK commenced handpicking exercise as part of asbestos remedial action plan in demarcated area within Area 4C. Handpicking was ceased after 3 days due to poor weather.	Section 5.4.2
February 2011	OTEK resumed handpicking exercise across Area 4C until no visual asbestos was identified.	Section 5.4.2
	OTEK scraped surface soil across three 10 m x 10 m areas (1 area targeted, 2 areas chosen randomly) within asbestos remediation area. Visually identified asbestos was removed and surface validation samples were collected. Scraped soil was stockpiled and visually inspected and/or sampled for asbestos.	Section 5.4.2
8 December 2011	OTEK conducted a groundwater monitoring event across Overall Audit Area, including MW-4.	Section 6.5

4.2 Field sampling and laboratory testing program

The field sampling and laboratory testing programs were designed by the assessor to identify contamination in the natural soils, any fill materials on site, and the groundwater beneath the site. The auditor reviewed various Sampling and Analysis Plans (SAPs) prepared by the assessor for various phases of work and provided feedback to OTEK.

Analysis of soil samples was undertaken by the following laboratories:

- Primary Laboratory: ALS and Labmark Laboratories Pty Ltd (Labmark); and
- Secondary (split sample) testing: ALS, Leeder Consulting, Labmark, and Groundswell Laboratories (Groundswell).

The assessor indicated these laboratories were NATA accredited for the testing undertaken. The auditor noted the laboratory reports received were NATA stamped and signed by NATA signatories.

4.3 Review of the quality of the site assessment

The auditor undertook a detailed review of the Quality Assurance and Quality Control (QA/QC) documentation presented by the assessors, and reviewed OTEK's field procedures to verify the integrity and the reliability of the data presented. This review is provided in Appendix G, and indicated the following:

- Overall the frequency of QC samples, specifically field duplicate and field split samples was adequate, with the exception of the tank pit validation works where duplicates and split samples were not collected. An insufficient analytical suite was analysed as part of the grid and validation sampling works. Based on the following, the auditor is satisfied that sufficient information was available to assess the integrity and the reliability of the data set:
  - Consistency of results when compared to the Overall Audit Area;
  - OTEK followed correct field sampling procedures, and samples were stored and handled appropriately;
  - Laboratory analytical results were consistent with site observations and site history review, and with findings from the Overall Audit Area; and
  - Results for QA/QC samples that were analysed indicated good field and laboratory accuracy and precision.
- The RPDs were generally acceptable, except a limited number of results that were above the recommended range for calculated RPDs for soil and groundwater results. These were considered minor in the context of the entire data set. It was also considered that at least partly this would be due to the inherent soil heterogeneity.
- The majority of rinsate and trip blank sample results were below the laboratory detection limit for the analytes tested. Some inorganics were reported above the reporting limit, however, this was considered to be due to deionised water which was impacted with inorganics given it was reported in both the rinsate and trip blank sample. Laboratory correspondence (Appendix R of OTEK 2013) supported this conclusion. Trip blank samples were not always analysed for volatile contaminants (as is standard practice) this is not considered a significant issue given that volatile contaminants were not detected in soil or groundwater. Additionally and based on historical activities at the site, volatiles were not considered COPC.
- Sample holding times were generally acceptable. Where holding times were occasionally exceeded, the auditor was satisfied that analytical results were unlikely to have been compromised given correct handling and storage of samples, and low likelihood of the specific contaminants being identified.
- Laboratory internal QA/QC results were generally acceptable. Minor exceedances were noted on the laboratory reports and discussed by OTEK.
- As discussed in Section 5.1.1, composite samples were analysed for pH and semi-volatile analytes (PAHs, OCPs/OPPs), which is not in accordance with Australian Standard 4482.1. Given a reasonable number of individual samples were analysed for pH, PAHs and OCPs/OPPs across the site (refer Table 14) and the results were consistent with the individual sample data as well as those from the Overall Audit Area, this error in methodology is not considered to an issue of concern.

Auditor verification activities

The Auditor and/or his representative observed the field investigations across the Overall Audit Area and area 4C on numerous occasions. Works were frequently undertaken both on the site

and other audit areas during the same sampling event. Of particular relevance to the site were the following:

- **17 October 2005**: The auditor inspected the whole of the site focussing on areas of environmental importance (timber treatment, hangers, incinerator, and UST).
- **7 April 2006**: The auditor's assistant visited Area 4C and observed excavation and delineation works associated with the former UST pit and concrete spoon drain. Observations included asbestos cement pipe near former septic tank and incinerator, an ash layer to the east of the former incinerator, a concrete spoon drain near the former sleeping huts, with concrete pieces and asbestos fragments observed at the surface.
- **19 April 2006**: The auditor's assistant visited Areas 4C, 4F and 4G to observe field works concurrently being undertaken in these areas. Observations included pipework throughout the northern section of Area 4C and identification of a septic tank. Metal and concrete footings were also observed at the base of the former UST pit.
- **28 April 2006**: The Auditor inspected the site as well as 4D, 4F, and 4G. The Auditor discussed soil sampling across the tree-lined parcel of land to the east of these areas (now identified as Area 4I). The Auditor also observed asbestos in the soil within Area 4I.
- **15 May 2006**: The Auditor inspected the site as well as areas 4B and 4D. The concrete tank anchors from the former UST pit had been removed and the pit was being excavated to stabilise the hole. The fill excavated from the tank pit and natural soils were being stockpiled separately.
- **8 December 2008**: Accompanied by OTEK's field staff, the auditor's assistant undertook an inspection of Area 4 to gain an appreciation of the works being undertaken across the Overall Audit Area. With respect to Area 4C, Transfield were removing the asbestos as well as the hangers (not located on Area 4C) and OTEK was supervising these works. The auditor's assistant noted that standard field procedures were followed.
- **14 January 2009**: The auditor's assistant completed a walkover over Area 4 (including Area 4C) and inspected the UST removal in Area 1.
- **10 March 2010:** The auditor and auditor's assistants conducted a site visit to consider asbestos issue and if needed the potential for asbestos disposal areas (i.e. inspected Ryan's tip and East tanks within Melbourne Water property).
- **7 and 9 February 2011:** The auditor and auditor's assistant visited the site to observe asbestos works in Areas 4C and 4H. Refer to Section 5.4 of this report for details regarding the asbestos remediation and validation works completed in Area 4C.
- **4 February 2014:** The auditor undertook the final site inspection. The site was covered by long and dense grass. The auditor scraped the surface at a number of locations where asbestos had previously been observed at the site and remediated, asbestos fragments were not observed. The stormwater drain and well W4 remained present onsite.

Conclusions on QA/QC

Overall the laboratory results were considered to be consistent with the site history review and field observations made during the assessment of Area 4C. The Auditor was satisfied that the sampling undertaken was adequate and the laboratory results reported were representative of the condition of soil and groundwater on site at the time of the assessments.

See Appendix G for a detailed review.

5. Assessment of soil quality

A summary of the location of key information within the Assessor's report (OTEK, 2013) is provided in Table 13 below.

Table 13 Assessor's site assessment information - soil

Assessment Details	Section in Assessor's Report (OTEK 2013, attached as Appendix E of this report)
Site History	Section 3
Details of soil sampling (including for the assessment, remediation, and validation) and laboratory analysis	Sections 6.1, 7, 10.1, 11.1, 11.2, and 11.3
Field Observations	Sections 2.1, 2.2, 5.1.2, 4.1, 7, and 8
Borelogs	Appendix C
Site Plans	Figures 1 to 9A
Analytical Results (Summary Tables)	Tables 1 to 79

5.1 Soil sampling and analytical program

To assess soil quality at the site, OTEK collected soil samples from grid based and targeted locations. OTEK summarised the soil investigation activities in Table E of OTEK 2013 (attached as Appendix E of this report).

5.1.1 Grid samples

A total of 56 grid-based soil sampling locations (i.e. test pits) were advanced at the site in April 2006 and that a total of 175 samples were collected from the 56 grid-based test pits. Of these, 35 three-part composite samples were formed and sent to the laboratory for analysis and 53 individual grid-based samples were sent to the laboratory for analysis.

The Auditor noted that samples collected from test pit numbers 36, 37, 38, and 56 were not analysed at the time of sampling (i.e. April 2006). Samples collected from these test pits were composited as sample numbers C17 and C18 and analysed later (i.e. in March 2007[1]). Samples collected from test pit 56 were not analysed. On this basis, samples were analysed from 52 (not 56) grid-based locations, providing a sampling density of 11.6 locations per hectare across the 4.417 ha site, which meets the number of recommended sampling points specified in Australian Standard (AS4482.1).

Table 14 below provides a summary of the grid and composite analytical schedule (derived from Tables 1 through 9 in OTEK 2013).

Table 14 Grid-based sample analytical schedule

Analyte	No. of individual samples analysed	No. of composite samples analysed
Inorganics[1]	18	35
Manganese and Vanadium only	9	-

[1] Comparison of the test pit logs and laboratory reports indicate that samples C17 and C18 were composited and sent to the laboratory approximately one year out of holding time for the nominated analyses, hence these samples are not considered further by the auditor.

Analyte	No. of individual samples analysed	No. of composite samples analysed
OCPs	16	35
OPPs	17	14
PCBs	16	30
Asbestos	34	-
pH	16	33
EPA screen [2]	1	-
Phenols	16	30
BTEX and TPHs (C_6-C_9)	2	-
TPHs (C_{10}-C_{40})	19	-
PAHs	16	30
VCHs [3]	1	-
Fluoride and cyanide	15	28

NOTES:
[1] 18 Inorganics: Sb, As, Ba, Be, B, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, V, Zn, and Hg.
[2] EPA screen: Inorganics (i.e. As, Cd, Cr^{6+}, cyanide, fluoride), and organics (i.e. phenols, BTEX, TPHs, MAHs, OCPs, PCBs, chlorinated hydrocarbons).
[3] Volatile chlorinated hydrocarbons

It is considered that based on the site history the samples were analysed for the appropriate CoPC.

It is noted that the 2008 Sampling and Analysis Plan was developed prior to the 2009 *Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in WA (DOH, 2009)* asbestos guidelines. The Auditor has reviewed OTEK's methodology for identifying and assessing asbestos at the site and noted that OTEK's approach was consistent with the principles outlined in the DOH (2009) guidelines; including the completion of a site history review and visual site inspection. Further details regarding the results of these investigations and OTEK's subsequent development of a 'Remedial Action Plan' for asbestos in soil are provided in Section 5.2.3.

Composite samples were analysed for pH and semi-volatile analytes (i.e. PAHs, OCPs/OPPs), which is not in accordance with Australian Standard 4482.1, and is not standard industry practice. The Auditor followed up with OTEK, and OTEK acknowledged that this practice was not appropriate, but considered that composite results still provided information regarding the condition of soils at the site. The Auditor considered the composite results in his assessment of the site condition in comparison with the results from individual samples. The Auditor noted they were consistent with results from individual sample analyses from the site. Given a reasonable number of individual samples were analysed for pH, PAHs and OCPs/OPPs across the site (refer to Table 14) and results were consistent with data from the Overall Audit Area, this error in methodology is not considered to affect the outcome of the audit.

5.1.2 Target samples

A total of 19 targeted test pit locations were advanced at the site in April and May 2006 to assess potential contamination sources that were identified as part of the site history review (as discussed in Section 2.9). Works undertaken are summarised in Table 15.

Table 15 Targeted samples analytical schedule

Potential Contamination Source	Date/s	No. of Target Sampling Locations	No. Samples Collected	No. Samples Analysed	Analytes
Carpenter's shop	10 Apr 06	1 (4C/T1)	3	2	Inorganics [1], TPHs (C_{10}-C_{40}), PAHs, Phenols, SVCHCs, OCPs, OPPs, pH
Paint Worksop	10 Apr 06	2 (4C/T2 & 4C/T3)	6	4	Inorganics [1], BTEX & TPHs (C_6-C_9), TPH (C_{10}-C_{40}), PAHs, Phenols, SVCHCs, OCPs, OPPs, pH
				2	Asbestos
Incinerator	10 Apr 06	1 (4C/T4)	3	2	Inorganics [1], TPHs (C_{10}-C_{40}), PAHs, OCPs, pH
				1	Dioxins and Furans
				1	Asbestos
Latrines	10 Apr 06	2 (4C/T5 & 4C/T6)	6	4	Inorganics [1], TPHs (C_{10}-C_{40}), PAHs, OCPs, Ammonia, Nitrate and Nitrite, E.Coli
Septic / soak pit	10 Apr 06	1 (4C/T7)	4	2	Inorganics [1], TPHs (C_{10}-C_{40}), PAHs, OCPs, Ammonia, Nitrate and Nitrite, E.Coli
Ablutions	10 Apr 06	2 (4C/T8 & 4C/T9)	8	2[2]	Inorganics [1], TPHs (C_{10}-C_{40}), PAHs, OCPs, Ammonia, Nitrate and Nitrite, E.Coli
Inflammables hut	10 Apr 06	1 (4C/T14)	3	2	Inorganics [1], BTEX & TPHs (C_6-C_9), PAHs, Phenols, SVCHCs, OCPs, OPPs, pH, Ammonia
UST	7 Apr 06	1 (4C/T15)	2	2	BTEX & TPHs (C_6-C_9), TPHs (C_{10}-C_{40}), pH
Surface drain	16 May 06	8 (4C/T18 to 4CT25)	8	8	E.Coli

NOTES: [1] 18 Inorganics: Sb, As, Ba, Be, B, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Sn, V, Zn, Hg
[2] No samples collected at location 4C/T9 were analysed

A total of 43 target samples were collected at sampling depths ranging from 0.25 to 3.0 m bgs. Twenty-eight (28) of these samples were sent to the laboratory for analysis. Targeted sampling locations are shown on Figure 6. The laboratory analytical schedule is summarised in Table 15.

Infrastructure removal and validation sampling

Infrastructure including fill material in the former UST pit and septic/soak pits, asbestos and metal pipes, buried debris, and a former concrete surface drain were removed. During theValidation stage, OTEK collected samples to assess the potential for contamination from the removed infrastructure; this is discussed further in Section 5.3.

5.1.3 Auditor's opinion on adequacy of soil assessment program

The auditor and his team assessed the information available. It was considered that overall the grid-based and targeted sampling locations and analytical program provided adequate coverage to allow determination of the potential risk from potentially contaminating sources at the site. This is based on the following lines of evidence:

- The auditor, based on the site history information and his field visit reviewed and provided feedback on the sampling and analysis plans prior to commencement of work;
- The sampling program was based on a thorough understanding of potential sources and activities, which might have resulted in contamination of soil at the site;
- The analytical program sufficiently addressed all identified CoPC;
- Samples were collected using appropriate methodologies; and
- The auditor and his assistant undertook multiple site visits during the assessment of the site, and of the Overall Audit Area.

5.2 Summary of soil assessment results

5.2.1 Inorganics

A total of 25 individual soil samples contained concentrations of one or more of barium, vanadium and zinc above the EILs. Additionally, multiple *composite* samples contained concentrations of one or more of arsenic, barium, copper, manganese, nickel and vanadium above the modified EILs. Concentrations of all other CoPC were below the EILs.

Concentrations of all CoPC analysed, for individual and targeted soil samples, were below the HILs.

A summary of maximum concentrations of each contaminant identified above the adopted investigation levels in fill and/or natural soil during the assessment works is provided in Table 16 below. The table shows only individual samples containing contaminants at concentrations exceeding the adopted investigation levels (i.e. samples with concentrations below the investigation levels have not been included), and does not include composite samples, which are discussed further below.

A full summary of soil analytical results is presented in Tables 1 to 38 of OTEK 2013, attached as Appendix E of this report.

Table 16 Summary of contaminant exceedances in soil (individual samples)

Analyte	NEPM or Adopted Investigation Level (mg/kg)		Sample Type	Concentration (mg/kg)	Fill/ Natural	Samples exceeding adopted investigation level
	NEPM EIL	NEPM HIL A				
Barium	300	-	Grid	580	Natural	4C/G52/0.25
			Target	320	Natural	4C/T8/1.0
			Target	430	Natural	4C/T14/0.5
Vanadium	50		Grid	53	Fill	4C/G6/0.5
			Grid	59	Fill	4C/G8/2.0
			Grid	50	Natural	4C/G10/0.5
			Grid	55	Natural	4C/G14/0.25

Analyte	NEPM or Adopted Investigation Level (mg/kg)		Sample Type	Concentration (mg/kg)	Fill/ Natural	Samples exceeding adopted investigation level
	NEPM EIL	NEPM HIL A				
			Grid	53	Natural	4C/G25/0.25
			Grid	57	Natural	4C/G34/0.5
			Grid	52	Natural	4C/G35/0.5
			Grid	57	Natural	4C/G40/0.5
			Grid	58	Natural	4C/G42/0.5
			Grid	54	Natural	4C/G43/0.25
			Grid	58	Natural	4C/G46/0.5
			Grid	59	Natural	4C/G47/0.5
			Grid	61	Natural	4C/G50/0.25
			Grid	52	Natural	4C/G52/0.25
			Grid	52	Natural	4C/G52/0.5
			Target	53	Natural	4C/T1/0.5
			Target	57	Fill	4C/T4/0.5
			Target	53	Natural	4C/T5/0.25
Zinc	200	*7000*	Grid	330	Fill	4C/G5/0.7
			Target	228	Fill	4C/T6/0.25

NOTES:
Underlined: result higher than NEPM EIL investigation levels
Italics: result higher than NEPM A investigation levels

The following provides a discussion of each analyte where concentrations exceeded the EIL. Also, as OTEK did not refer to any investigation levels in OTEK 2013 for the results of nutrient (i.e. nitrate, nitrite, and ammonia) analyses, the Auditor also discussed these as they were considered CoPC.

Arsenic, Barium, Copper, Manganese, Nickel, and Vanadium

Multiple composite samples contained concentrations of the following contaminants above the modified ecological investigation levels (as per the AS4482.1 the investigation levels were divided by number of samples in composite).

- Arsenic: 23 composites.
- Barium: 19 composites.
- Copper: 2 composites.
- Manganese: 33 composites.
- Nickel: 28 composites.
- Vanadium: 35 (all) composites.

OTEK did not analyse any individual samples from composites containing concentrations above the modified investigation levels, due to an oversight. However 27 other individual samples from

across the site were analysed for inorganics (including arsenic, barium, copper manganese, nickel and vanadium), with the following results (as summarised in Table 15), it is also noted that the modified investigation level is a conservative measure due to dividing the investigation level by the number of samples making up the composite sample (i.e. 3 in this case):

- Arsenic: Concentrations of arsenic were below the EILs for all individual samples. On this basis, and considering the comparability of results with the Overall Audit Area, and the absence of a specific source for arsenic, the arsenic detected in composite samples was considered naturally occurring and is not discussed as an exceedance henceforth;
- Barium: Three individual samples reported concentrations of barium above the EIL, however, all concentrations were less than 250% of the EIL. The results were also consistent with concentrations detected across the Overall Audit Area (as detailed in Table R of OTEK 2013).
- Copper: A total of 22 individual samples were analysed for copper and none exceeded the EIL of 100 mg/kg. On this basis, and the absence of a specific source for copper, the copper detected in composite samples was considered to be naturally occurring;
- Manganese: Concentrations of manganese were below the EIL for all individual samples. The results were also consistent with concentrations detected across the Overall Audit Area (as detailed in Table R of OTEK 2013) and were, therefore considered to be naturally occurring;
- Nickel: A total of 25 individual samples were analysed for nickel and none exceeded the EIL of 60 mg/kg. The results were also consistent with concentrations detected across the Overall Audit Area (as detailed in Table R of OTEK 2013). On this basis, and the absence of a specific source for nickel, the nickel detected in composite samples was considered to be naturally occurring and is not discussed as an exceedance henceforth;
- Vanadium: Concentrations of vanadium exceeding the EIL were reported in 17 grid-based and targeted samples in both fill and natural soil: however, all concentrations were less than 250% of the EIL. The results were also consistent with concentrations detected across the Overall Audit Area (as detailed in Table R of OTEK 2013); and
- Zinc: Of a total of 37 grid-based and target samples analysed, only two samples reported concentrations of zinc above the EIL; however, both concentrations were less than 250% of the EIL. On this basis, and considering the comparability of results with the Overall Audit Area, and the absence of a specific source for zinc, the zinc detected was considered to be naturally occurring.

The concentrations of barium, vanadium and zinc detected in individual samples during the soil assessment works are considered to be naturally occurring, based on the following:

- The majority (83%) of samples reporting exceedances for vanadium and all samples reporting exceedances for barium, were collected from natural soils;
- Results for barium and vanadium were consistent with concentrations detected across the Overall Audit Area (as detailed in Section 10.1.1.1, Table R of OTEK 2013);
- There were no identified potential sources of these contaminants; and
- Concentrations were all within NEPM background ranges.

It is acknowledged that where sample compositing is undertaken and investigation level exceedances occur, individual samples should subsequently be analysed. The auditor communicated this to OTEK, who indicated the omission was an oversight. In this instance the auditor did not consider the oversight to be significant, given the generally low concentrations of inorganics detected and the above lines of evidence. The auditor considered sufficient data

were available to indicate that concentrations of barium, vanadium and zinc are unlikely to pose a risk to beneficial users of the land.

Nitrate, Nitrite and Ammonia

Target samples were also analysed for nitrate, nitrite and ammonia (as detailed in Table 15). Nitrate results were generally low (all concentrations were below 0.7 mg/kg) with the exception of sample 4C/T7/1.0, that was targeting the septic/soak pit and reported a concentration of 13.8 mg/kg. A minor concentration of nitrite of 0.2 mg/kg was also detected in this sample. Soil was removed from this location during the excavation of the former septic and soak pit and is discussed in Section 5.3.7. The remaining nitrate concentrations were within the range of those detected across the Overall Audit Area (as detailed in Section 13.1.3, Table Y of OTEK 2013). No other nitrite concentrations were detected.

Of the 10 samples analysed for ammonia, two samples reported concentrations above the LOR of 1.1 mg/kg and 8.2 mg/kg. Both samples were located at targeted sample location 4C/T14 (former inflammables hut). Soil from this location was removed during the excavation of the former UST pit and is discussed in Section 5.3.1.

5.2.2 Organics

All concentrations of all organic analytes tested were below the investigation levels, and predominantly below the laboratory limits of reporting. The Auditor noted however, that OTEK had recorded several higher PID readings (above 25 ppm) during the grid sampling. A review of these readings and the auditor's comments are provided in Table 17.

Table 17 Summary of elevated PID readings

Grid Location	Depth (m bgl)	PID Reading ppm	Auditor Comments
4C/G38	1.0	336	Laboratory analysis for TPH (C_6-C_{36}), BTEX and VCHs reported concentrations below laboratory detection limits. Review of the bore log shows there was no odours, debris or evidence of staining in the soil.
4C/G43	0.5	106	Laboratory analysis for TPH (C_6-C_{36}) and PAHs reported concentrations below laboratory detection limits.
	1.0	115	No laboratory analysis undertaken for volatiles. Review of the bore log shows there was no odours, debris or evidence of staining in the soil. OTEK (2013) noted that a second PID reading taken at this depth reported a concentration of 5.4 ppm.
4C/G36	1.0	54.3	No laboratory analysis undertaken for this sample, however a shallower sample from same test pit, 4C/G36_0.25 was analysed for BTEX and TPH (C_6-C_{36}) and reported concentrations below laboratory detection limits. Review of the bore log shows there was no odours, debris or evidence of staining in the soil.
4C/G54	0.25	29.1	No laboratory analysis undertaken for these samples. Review of the bore log shows there was no odours, debris or evidence of staining in the soil.
	0.5	31.3	
	1.0	27.5	

Dioxins and furans

Dioxins are a known by-product of municipal waste incineration, and therefore were a potential CoPC at the former incinerator location in Area 4C. As there are currently no screening guidelines for dioxin concentrations in soil in Australia, OTEK adopted the human health risk

assessment criteria developed by URS Auditor (2001) for dioxin management at the Melbourne Water's Dandenong Treatment Plant (DTP) audit. The risk based soil concentrations, derived in accordance with the general framework presented in the NEPM (1999 as amended) and a tolerable daily intake (TDI9) set by the World Health Organisation (WHO) in 1998 was used to determine the risk based soil concentration for Dioxin. The WHO allowable range set in 1998 was 1-4 pg/kg/day and based on this, URS derived a site-specific risk based soil criterion for low density residential (HIL-B) of 100 ng/kg.

This risk assessment was revised by URS in 2003 to take into account recent updates available for toxicity information, potential background exposures and refinement of the exposure parameters. Accordingly, the RBSC criterion for low density residential was reduced to 64 ng/kg in soil. The relevant reports are provided in Appendices L and M of the Assessor's ESA 2013 final Report (Appendix E of this report).

Six targeted test pit locations were selected across the Overall Audit Area for dioxin analysis. Each location was selected based on site history to target the most likely occurrence of dioxins (predominantly ash material likely associated with two small scale incinerators), one of which was formerly located within Area 4C.

The incinerator in Area 4C was targeted at test pit location 4C/T4. OTEK (provided the following information in relation to this incinerator in their letter *'Riverwalk Project – Area 4 Dioxin Sample Locations'* dated 14 August, 2007):

"The incinerator was likely to have been used extensively between 1943 and 1946 when the hangar complex was occupied by 1 Central Recovery Depot (Milsearch, 2000, pg. 10). The Milsearch report does not discuss the use of this particular incinerator beyond 1946. No known records exist of the type of incinerator that existed at this location and none of the incinerator structure was located during the investigation works. The incinerator was located in close proximity to sleeping huts, a kitchen and mess, canteen, a butchers shop, a carpenters shop and a paint shop. Therefore it is likely that the majority of material burnt within the incinerator was domestic type wastes (e.g. kitchen/butchers wastes, off cuts from the carpenters shop and possibly used paint containers). The soil profile observed in test pit 4C/T4 consisted of disturbed silty-clay mixed with ash to a depth of 0.6 m bgs underlain by natural silty clay to the test pit termination depth of 1.1 m bgs. The ash material was targeted in this case".

The auditor reviewed the results of the laboratory analysis for dioxins and noted the reported maximum concentration for sample 4C/T4/0.25 of 26.70 ng/kg[2], was below the adjusted RBSC criterion of 64 ng/kg in soil (for low density residential). The auditor observed and noted that the ash identified in the vicinity of the former incinerator was removed as part of the remediation and validation works and is discussed further in Section 5.3.6.

5.2.3 Asbestos

During the grid sampling works at the site, asbestos fragments[3] were identified at the surface in test pits 4C/G4, 4C/G13, 4C/G14 and 4C/G15 (see Figure 5). Broken asbestos sheeting was also observed at 0.5 m in test pit 4C/G5. A total of 34 samples were collected from the grid based test pits (including the aforementioned test pits where asbestos was identified) and sent to the laboratory for asbestos analysis. No asbestos was detected in any of these samples.

A Remedial Action Plan (Asbestos in Soil), herein referred to as the Asbestos RAP, was developed by OTEK for the Overall Audit Area (OTEK, 2010). This report noted that historical infrastructure (WWII-era structures) across Area 4 included ablutions, latrines, butchers shops,

[2] International Toxic Equivalency Factor (I-TEF). Note also that laboratory results are reported in pc/g which is equivalent to ng/kg.

[3] Asbestos fragments were described interchangeably by OTEK as "asbestos sheeting" or "asbestos fragments" throughout their ESA report (OTEK, 2013).

canteens, incinerators, aircraft hangars, mess rooms, kitchens and recreation huts. Some of these structures, including the 5 aircraft hangars, incorporated roofs or walls cladded in bonded asbestos cement sheeting. The WWII-era structures containing bonded asbestos cement sheeting were located in areas 4B, 4C, 4E, 4F, 4G, and 4H. Demolition of WWII-era infrastructure in Area 4C, E and H was undertaken during the 1950s which resulted in these three areas being impacted by mostly residual bonded asbestos sheeting.

This report identified approximately 21 individual fragments of "ACM" (asbestos containing material) located within a defined area concentrated in the northern quarter of Area 4C (as summarised in Table 18 below). Where asbestos is noted at a test pit location (but not recorded in the relevant test pit log) it has been assumed that the asbestos was observed in the vicinity of the test pit.

The asbestos identified during the grid sampling works was remediated and validated and is discussed further in Section 5.4.

Table 18 Summary of asbestos fragments observed during grid sampling

Location ofAsbestos	No. asbestos pieces	Analysed for Asbestos	Results	Location of Asbestos	No. of asbestos pieces	Analysed for Asbestos	Results
4C/G3	1	Yes	Not detected	4C/G14	>5	Yes	Not detected
4C/G5	1	Yes	Not detected	4C/G16	1	Yes	Not detected
4C/G8	1	Yes	Not detected	4C/G18	1	Yes	Not detected
4C/G9	1	Yes	Not detected	4C/G19[1]	1	No	-
4C/G10	1	Yes	Not detected	4C/G23	1	Yes	Not detected
4C/G12	1	Yes	Not detected	4C/G25	1	Yes	Not detected
4C/G13	>5	Yes	Not detected				

NOTES:

[1] Although a sample was not analysed for asbestos at this location during the grid sampling, test pit location 4C/G19 was included within the asbestos remediation zone as described in Section 5.4.

Three samples collected at targeted locations 4C/T2, 4C/T3 and 4C/T4, located in the vicinity of the former paint workshop and incinerator, were also analysed for asbestos. No asbestos was detected in these soil samples.

Auditor's opinion on the soil assessment results

The auditor concluded that the information obtained during the soil assessment, including field observations and analytical results, indicated that the identified potential contamination sources and activities historically undertaken at the site have not resulted in soil contamination. Concentrations of several inorganics above the investigation levels for maintenance of ecosystems were considered to be naturally occurring, based on NEPM background ranges, data from the Overall Audit area, and no evidence of potential sources as discussed in details above.

5.3 Infrastructure removal, remediation and validation

During the course of the soil assessment works (discussed in Sections 5.1 and 5.2) remains of former RAAF infrastructure; including a septic/soak pit, a backfilled UST pit, a concrete surface drain and underground metal/asbestos pipe, were removed from the site by Enviropacific Services Pty Ltd and the underlying soils validated by OTEK. Figure 3 and Figure 4 of this audit report show the location of former RAAF infrastructure (including structures removed prior to the commencement of the audit). The resultant excavations and validation sampling locations are

shown in Figure 6, Figure 7 and Figure 8. Details of works undertaken are summarised in Table 19 below.

Table 19 Assessment and removal of infrastructure and validation sampling

Works Undertaken	Date of Works	Validation Samples Collected	Analysis [1]	Sample(s) exceeding adopted investigation level	Comments
Former UST pit					
820 m^3 of fill excavated from former tank pit and stockpiled.	May 2006	4C/T10 to 4C/T12, 4C/T15 to 4C/T17, 4C/T26 and 4C/T27.	Lead, BTEX, TPHs(C_6-C_{36}), PAHs, phenols	None	Backfilled with combination of excavated material (refer to stockpile validation below) and imported fill material. Refer to Section 5.3.1.
Stockpile Validation	May to June 2006	4C/SP-1/1 to 4C/SP-6/2	EPA Screen (448.1)[2], inorganics, BTEX, PAHs, TPHs(C_6-C_{36}), phenols, pH, asbestos	None	Prior to sampling, 5.9 tonnes of steel and concrete pieces were separated from the stockpile soil and exported offsite.
					Validated stockpile soil was reinstated into former UST tank pit. Refer to Section 5.3.1.
Test-pitting	Not provided	4C/UST/NW, NE, SE and SW	None	Not applicable	Visually inspected only – no signs of hydrocarbon or other contamination identified.
Inorganics (Metals) Delineation Sampling					
Delineation sampling around former test pit 4C/T7	April 2008	4 test pits stepped out 1,2,3 and 4 m north, south, east and west from 4C/T7.	32 samples analysed for copper and total chromium	4C/T7/S3/0.25 and QS-18	EIL exceedances for copper of 109 mg/kg (4C/T7/S3/0.25) and 103 mg/kg (QS-18).
Delineation sampling around former test pit locations 4C/T6 and 4C/G5	Sep 2009	4 test pits stepped out 1, 2, 3 and 4 m north, south, east and west from 4C/T6 and 4C/G5.	20 samples analysed for zinc	4C/T6/N1/0.5	EIL exceedance for zinc of 300 mg/kg.
			Samples 4C/T6/N2/0.25 and 0.5 analysed for zinc	None	No further delineation sampling required. Refer to Section 5.3.2.
Removal of Asbestos/Metal Pipe and Hydrants					
Excavation of hydrants and 250 m underground asbestos/metal pipe.	Sep 2008 to Feb 2009	4C/VS-1/1,2 and 3 to 4C/VS-8/1,2 and 3.	15 samples for inorganics	4C/VS-3/1	EIL exceedance for manganese (541 mg/kg) and vanadium (51 mg/kg).
			12 samples for asbestos	None	Excavated material was stockpiled.
Three additional validation samples were collected around location 4C/VS-3	6 Nov 2008	4C/VS-3/4, 5 and 6	Inorganics	None	Measured concentrations of vanadium and manganese at the site have been attributed to background concentrations. Refer to Section 5.2.1.

Works Undertaken	Date of Works	Validation Samples Collected	Analysis [1]	Sample(s) exceeding adopted investigation level	Comments
Excavated soil stockpiled into 2 stockpiles – 4C/SP2 (350 m^3) and 4C/SP6 (58 m^3) and validation samples collected	Sep 2008	4C/SP-2/1, 4C/SP-2/2, 4C/SP-2/3	IWRG EPA Screen[2]	4C/SP-2/2	Fill Material exceedances for cadmium (5 mg/kg), copper (115 mg/kg), mercury (1.2 mg/kg) and zinc (385 mg/kg).
	Nov 2008	4C/SP-2/4, 4C/SP-2/5	IWRG EPA Screen[2]	4C/SP-2/5	Fill material exceedance for mercury (1.1 mg/kg). Stockpile material disposed offsite as Category C waste.
	Sep 2009	4C/SP-6/1 4C/SP-6/2 4C/SP-6/3	IWRG EPA Screen[2] or pH, inorganics and leachable inorganics	None	Soil classified as "Fill Material" and used to backfill asbestos/metal pipe trench.
Dumped Stockpile					
Stockpile validation for dumped stockpile (~12 m^3)	Sep 2008	4C/SP-1/1 4C/SP-1/2 4C/SP-1/3	IWRG EPA Screen[2] and asbestos	4C/SP-1/1 4C/SP-1/2 4C/SP-1/3	Fill material exceedances for arsenic (24 mg/kg), lead (319-648 mg/kg), zinc (411-3310 mg/kg), total PAHs (37-106 mg/kg), and B(a)P (1.8-5 mg/kg).
Three additional stockpile samples collected.	Oct 2008	4C/SP-1/1 4C/SP-1/2 4C/SP-1/3	Arsenic, lead, B(a)P, leachable arsenic, lead, and B(a)P	4C/SP-1/1 4C/SP-1/2 4C/SP-1/3	Fill material exceedances for arsenic (22 mg/kg), lead (415 mg/kg), B(a)P (1.8 – 17.2 mg/kg). Material classified as Category B based on B(a)P concentration.
Surface validation sample collected from stockpile footprint	Feb 2009	4C/SP-1/SS-1	Arsenic, lead, zinc, and PAHs.	4C/SP-1/SS-1	B(a)P concentration of 1.1 mg/kg slightly exceeds NEPM HIL-A criteria of 1 mg/kg. Total PAHs below fill material criteria of 20 mg/kg
					Stockpile disposed offsite. OTEK (2013) noted that waste tracking documentation was not available; however EPA docket numbers and vehicle IDs were provided and show 9.2 tonnes of Category B material was disposed offsite.
Buried Debris, Fill Removal and Soil Validation					
Debris identified in test pit 4C/G8 during grid sampling	May 2006	4C/G8/0.25 4C/G8/0.5	Inorganics, TPHs, PAHs, OCPs, OPPs, PCBs, VOCs, phenols, pH, total cyanide, fluoride	4C/G8/2.0	Minor EIL exceedance for vanadium (59 mg/kg).
Test pit excavated to 2.0 m bgs and debris removed	17 June 2009	4C/G8/VS-1 to 4C/G8/VS-8	Asbestos, pH, sulphate, inorganics, TPHs, BTEX,	None	Removed debris comprised of a small amount of plastic and glass and a piece of

Works Undertaken	Date of Works	Validation Samples Collected	Analysis [1]	Sample(s) exceeding adopted investigation level	Comments
			PAHs, PCBs, phenols, and VOCs		concrete. Excavated soil then used to backfill test pit.
Incinerator Ash Removal and Soil Validation					
Excavator used to complete a surface scrape around test pit 4C/T4 to delineate extent of ash.	March 2007	None			Area of approximately 40 m^2 identified.
40 m^2 area excavated to 0.6 m bgl and Test pit 4C/G5 excavated to 0.7 m bgl until all visible ash had been removed.	17-18 June 2009	4C/G5/VS-1 to 4C/G5/VS-5	Asbestos, pH, TPHs, PAHs, VOCs, PCBs, phenols, and inorganics	None	Scraped and excavated material was stockpiled with septic and soak pit stockpile (refer below). Excavation was backfilled with imported fill material. Refer to Section 5.3.6.
Removal of Watering Trough					
Animal watering trough and underlying concrete stand removed and disposed offsite	May 2009	4C/T28	pH, sulphate, inorganics, nitrate, nitrite, faecal coliforms, and E.Coli.	None.	Refer to Section 5.3.9.
Septic and Soak Pit Removal and Soil Validation					
Removal of basalt boulders and cobbles from former soak pit.	19-22 June 2009	4C/VS-9 to 4C/VS-13	*E.coli*, faecal coliform, inorganics, TPH and OCPs.	4C/VS-9 4C/VS-11	Minor EIL exceedance for vanadium (62 mg/kg) EIL exceedance for barium (530 mg/kg).
Removal of basalt boulders and cobbles from former septic	23 June 2009	4C/T7/VS-1 to 4C/T7/VS-5	Asbestos, pH, *E.coli*, faecal coliform, ammonia, nitrate, nitrite, inorganics, TPHs, PAHs and OCPs.	None	Excavated material was stockpiled.
57 m^3 of excavated material (predominantly basalt cobbles with some soil) stockpiled.	26 June 2009	4C/SP-3/1, 4C/SP-4/1, 4C/SP-5/1	Inorganics, E.coli, nitrate, nitrite, faecal coliforms, ammonia, asbestos, pH, OCPs, TPHs, and PAHs.	None	Material classified as fill and disposed offsite. Refer to Section 5.3.7.
Removal of Concrete Surface Drain					
OTEK removed small pieces of concrete from former surface drain and disposed offsite.	July 2009	4C/T18 to 4C/T25	*E.Coli*	None	Removed concrete pieces were disposed offsite. Refer to Section 5.3.8. Visible asbestos fragments were observed in vicinity of former concrete pipe, refer to Section 5.4.1.

Works Undertaken	Date of Works	Validation Samples Collected	Analysis [1]	Sample(s) exceeding adopted investigation level	Comments
Removal of Concrete Pieces and Ceramic Pipe					
Excavator used to remove pieces of concrete and ceramic pipe identified in vicinity of former kitchen.	August 2009	4C/VS-28 to 4C/VS-34	pH, *E.Coli*, faecal coliform, nitrate, nitrite, and inorganics.	None	Excavated material disposed offsite. Refer to Section 5.3.7.
Removal of Ceramic and Steel Piping and Junction Box					
Ceramic and steel piping and junction box removed and disposed offsite.	Sep 2009	4C/VS-35 to 4C/VS-40	Inorganics, OCPs, TPHs, E.Coli, faecal coliforms.	None	Refer to Section 5.3.10.

NOTES:

[1] Samples analysed for one or more of listed analytes (i.e. not all samples analysed for all analytes)

[2] EPA Screen (448.1) – Inorganics (As, Cd, Cu, Pb, Mo, Ni, Se, Ag, Sn, Zn, Cr6+, Hg), total cyanide, fluoride, polychlorinated biphenyls (PCBs), monocyclic aromatic hydrocarbons (MAHs), volatile halogenated compounds (VHCs), phenols, polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs), total petroleum hydrocarbons (TPHs).

OTEK confirmed all validation samples were collected from natural soils, which were consistent with natural soils observed across the remainder of the site (refer Section 2.2). PID readings taken during the validation of the former UST pit were negligible in all samples (0.0 to 8.5 ppm), and OTEK indicated there were no visual or olfactory observations of hydrocarbons or other volatiles.

5.3.1 Former UST excavation and tankpit validation

Tankpit excavation

As noted in Section 2.8.1, Milsearch undertook a review of the site history during the World War II era to determine the potential for the presence of residual munitions and other material burials or contaminants at the site. This review identified a UST of 40,000 L capacity, inferred to be located within Area 4C. In response to these findings, a subsurface geophysical investigation was conducted by Enterra between November 2000 and February 2001 to locate the UST within Area 4C.

No UST was identified within Area 4C, however, Enterra identified several geophysical anomalies in the area, one of which was described as a 'reinforced concrete base' (refer to Table 6). In May 2006, OTEK removed approximately 820 m^3 of material comprised of concrete anchors, steel, and concrete pieces at this location, which was, based on available information, believed to be a backfilled pit of the removed former UST (OTEK, 2013).

The excavation extended to a depth of 6 m bgl and OTEK noted that all material was removed until only natural soil remained. Field screening was undertaken with PID results ranging from 0.0 to 8.5 ppm.

Validation samples were collected from the walls and base of the excavation at eight locations. A total of 17 samples were analysed for lead, BTEX and TPH (C_6-C_{36}), while two samples were analysed each for PAHs and phenolic compounds. Results for BTEX, TPH (C_6-C_{36}), PAHs and phenols were below the laboratory detection limits, and lead concentrations were below the adopted NEPM HIL-A and EIL criteria.

Tankpit stockpiles

The excavated material with an approximate volume of 820 m^3 was held temporarily onsite in six stockpiles 4C/SP-1 to 4C/SP-6. An excavator sieve bucket was used to separate the soil from the large debris. Approximately 5.9 tonnes of steel and concrete was separated from the soil and transferred to Simms Metal in Brooklyn (OTEK, 2013).

OTEK did not provide a volume for the remaining stockpile material after the steel and concrete pieces were removed. A total of 20 samples were collected from this stockpile material and of these, 15 were analysed.

The Auditor reviewed the analytical results for the 15 stockpile samples. All results for BTEX, TPHs (C_6-C_{36}), PAHs, phenols, OCPs, OPPs, VOCs, and PCBs were below laboratory LORs, while inorganics concentrations were below the upper limits for Fill Material, and therefore, based on the IWRG 702, it was not necessary to calculate a 95% UCL average. The Auditor also noted that as this material was reinstated into the UST excavation; reported inorganics concentrations were below NEPM EIL.

Tankpit backfilling

In June 2006, the validated stockpile material was backfilled and compacted into the UST excavation by John Holland Group. OTEK (2013) reported that the material was compacted to 95% of the maximum dry density under Level 1 geotechnical supervision provided by Coffey International Limited and that approximately 500 m^3 of fill material was imported to complete the backfilling to surface level. OTEK (2013) noted that where backfilling was required in Area 4C, the material was sourced from Cemex Werribee Quarry (refer to Section 5.4.1 below).

Additional test-pits

The assessor stated that four additional test pits (4C/UST/NW, NE, SE and SW) were advanced around the former UST to investigate if other UST associated infrastructure was present. OTEK (2013) noted that the test pits showed only natural soil and that no other infrastructure, or signs of hydrocarbon impact, was identified. OTEK has advised that no samples were collected during this test-pitting and that logs are not available. The Auditor noted that although it would have been good practice to record test pit logs and collect some validation samples, the fact OTEK did not, is unlikely to impact the audit conclusions based on the following:

- No infrastructure associated with the former UST was identified,
- No signs of hydrocarbon impact (staining or odours) were identified; and
- Results of all validation samples collected from the walls and floor of the former UST pit showed no indications of hydrocarbon impact.

5.3.2 Inorganics delineation sampling

During the grid and targeted sampling, concentrations of zinc exceeding the EIL of 200 mg/kg and the typical upper range of 300 mg/kg for background concentrations were identified in samples 4C/T6/0.25 and 4C/G5/0.7. The following sections provide details on the delineation works undertaken to delineate the extent of the zinc concentrations at the site.

First round

In April 2008, OTEK undertook step-out delineation sampling to further investigate these zinc concentrations, however, due to errors in the Sampling and Analysis plan, the step out sampling was completed around the wrong test pit (4C/T7) and the samples collected were analysed for copper and total chromium, rather than zinc. For completeness however, the Auditor has considered the results.

This round of sampling included the excavation of four test pits located 1 m, 2 m, 3 m and 4 m to the north, south, east and west of location 4C/T7, totalling 16 test pits. At each location, soil was collected from 0.25, 0.5 and 1.0 m bgs. A total of 48 samples were collected and 32 samples were sent to the laboratory and analysed for copper and total chromium.

One sample (4C/T7/S3/0.25) and one quality control sample (QS-18[4]) reported copper concentrations of 109 mg/kg and 103 mg/kg respectively, marginally exceeding the EIL of 100 mg/kg. No further metals delineation sampling was undertaken at this location.

Second round

In September 2009, OTEK completed the zinc delineation around the correct test pit locations (i.e. 4C/T6/0.25 and 4C/G5/0.7), using the same approach adopted during the first round described above. At each of the thirty-two (32) test pit locations, soil was collected at 0.25 and 0.5 m bgs, with some additional samples collected at 1.0 m bgs. A total of 80 samples were collected.

Samples were analysed using a staged approach, whereby only samples from the first step out in each direction were analysed pending laboratory results. One zinc concentration of 300 mg/kg from sample 4C/T6/N1/0.5 prompted the analysis of two additional samples (4C/T6/N2/0.25 and 0.5) to the north. Both samples reported zinc concentrations below the EIL of 200 mg/kg. In total, twenty-two (22) samples were sent to the laboratory and analysed for zinc.

OTEK (2013) noted excavation works carried out in the vicinity of test pit 4C/G5 (associated with removal of the former incinerator ash, refer to Section 5.3.6) were undertaken in June 2009, prior to the metals delineation sampling in September 2009; and therefore the original elevated zinc concentrations may have already been removed.

Delineation sampling locations are shown in Figure 7 of this audit report and associated test pit logs are included in Appendix C of the Assessor's Report (Appendix E).

5.3.3 Asbestos/metal pipe and hydrant removal and soil validation

Pipe removal

Between September 2008 and February 2009, during the removal of the hydrants identified during the geophysical survey (refer Section 2.8.1), approximately 250 m of underground pipe comprised of alternating metal and asbestos was identified. An excavator was used to remove both the hydrants and the pipe, after which it was transported to Western Land Reclamation in Brooklyn for disposal.

In October 2008, validation samples were taken at eight locations (4C/VS-1 to 4C/VS-8) along the excavated trench. Three samples were collected at each location, one from each trench wall and one from the base (1.2 m bgs). A total of 24 samples were collected and of these 15 were analysed for metals and 12 samples were analysed for asbestos.

No asbestos was reported in any of the 12 samples analysed. A single sample, 4C/VS-3/1, reported minor NEPM EIL exceedances for manganese and vanadium. Subsequently, three additional validation samples were taken at this location, but no further exceedances were detected.

Stockpile validation

The excavated soil was stored on-site in two stockpiles, 4C/SP-2 and 4C/SP-6, with volumes of 350 m^3 and 58 m^3 respectively. In September 2008, three samples (4C/SP-2/1, 4C/SP-2/2,

[4] Split duplicate of sample 4C/T7/W4/0.25

4C/SP-2/3) were collected from stockpile 4C/SP-2 and analysed for an IWRG[5] EPA Screen. Fill material criteria for cadmium, copper, mercury, and zinc were exceeded in sample 4C/SP-2/2. In November 2008, two additional samples (4C/SP-2/4 and 4C/SP-2/5) were taken from this stockpile and also analysed for an IWRG EPA Screen. The results showed the fill material criteria were exceeded for mercury and subsequently the stockpile was disposed off-site as Category C waste.

With regard to stockpile 4C/SP-2, the IWRG Guidelines for Soil Sampling state the minimum number of samples required for a stockpile of volume 350 m^3 would be 14 samples (i.e. 1 sample per 25 m^3) or a minimum of 10 samples to calculate a 95% $UCL_{average}$, however, only five samples were collected and analysed.

The Auditor noted that although the sampling interval was not in accordance with the recommended guidelines, disposal of the stockpile material as Category C waste was appropriate given the following:

- The median concentrations of cadmium, copper, mercury, and zinc all comply with the more conservative Fill Material criteria;
- The mean concentrations for cadmium, copper and mercury also comply with the Fill Material criteria;
- The maximum concentrations of mercury (1.2 mg/kg) and zinc (385 mg/kg) only marginally exceeded their respective Fill Material criteria of 1 mg/kg and 200 mg/kg respectively; and
- The stockpiled soil was excavated from natural soils (with naturally occurring elevated concentrations of some inorganics) and hence it was not expected to vary in nature.

In September 2009, three samples were taken from the remaining stockpile, 4C/SP-6. One sample, 4C/SP-6/1 was analysed for an IWRG EPA Screen, the remaining two samples were analysed for pH, inorganics, and leachable inorganics. Based on the results, the material was classified as 'Fill Material' and re-used on site to backfill the trench.

With regard to stockpile 4C/SP-6, although three samples were collected (which complies with the minimum requirements as outlined in the IWRG Guidelines for Soil Sampling), only one sample was analysed for the IWRG EPA Screen, while the remaining two were only analysed for pH, inorganics, and leachable inorganics. Given that the measured concentrations of inorganics were all well within the Fill Material criteria, all leachability results were below Category C material limits, and results for organics, chlorinated hydrocarbons and pesticides were below laboratory detection limits. Therefore, the Auditor concurs that the material was suitable to reuse to backfill the trench.

5.3.4 Stockpile removal and soil validation

Stockpile validation

During the pipe removal works described in Section 5.3.3, a stockpile of unknown origin, approximately 12 m^3 in volume, was identified near the work area. This stockpile was deemed to be illegally dumped. In September 2008, three samples, 4C/SP-1/1 to 4C/SP-1/3 were collected and sent to the laboratory for an IWRG EPA Screen. The results showed concentrations of arsenic, lead, zinc, benzo(a)pyrene and total PAHs in excess of Fill Material[6] criteria.

[5] Industrial Waste Resource Guidelines
[6] Publication IWRG621 – June 2009.

Three additional samples, 4C/SP-1/1 to 4C/SP-1/3, with the same sample names as those collected in September 2008, were collected from this stockpile in October 2008 and analysed for arsenic, lead, benzo(a)pyrene and leachable arsenic, lead and benzo(a)pyrene. Concentrations of arsenic, lead, and benzo(a)pyrene exceeded their Fill Material criteria and based on the highest concentration of benzo(a)pyrene of 17.2 mg/kg, the stockpile soil was categorised as Category B material. OTEK (2013) reported that the stockpile material was disposed offsite in February 2009, however, copies of the waste-tracking documentation were not provided. OTEK did provide EPA docket numbers and vehicle IDs in Appendix I of the Assessor's report (attached as Appendix E of this report). The documentation shows that a total of 9.2 tonnes of Category B soil was disposed offsite.

Surface validation

OTEK (2013) noted that two surface validation samples (4C/SP-1/SS-1 and 4C/SP-5/SS-1) were collected from the stockpile footprint in February 2009. One sample (4C/SP-1/SS-1) was analysed for arsenic, lead, zinc, and PAHs. This sample reported a benzo(a)pyrene concentration of 1.1 mg/kg, marginally exceeding the NEPM HIL-A of 1 mg/kg.

The other sample was analysed for manganese and vanadium, with results below both the NEPM HIL-A and EIL.

The Auditor considered that the exceedance for benzo(a)pyrene was not significant and would be most unlikely to pose a risk to the beneficial uses of the land, given that the source of the benzo(a)pyrene (i.e. the former stockpile) had been removed and disposed offsite, and the exceedance was marginal (0.1 mg/kg).

5.3.5 Buried debris and fill removal and soil validation

During the grid sampling, OTEK identified a small amount of debris in test pit 4C/G8, located near the northern site boundary (see Figure 5). The material was described in the test pit log as *"minor domestic rubbish"* at around 0.25 m bgs and a *"large block of concrete"* (800 x 550 x 200 mm) at approximately 0.5 bgs. Samples from this test pit were analysed for inorganics, TPHs, VOCs, PAHs, phenols, OCPs, OPPs, PCBs, pH, total cyanide, and fluoride. Results for organics were all below the laboratory detection limits. Results for inorganics were below NEPM EIL, with the exception of a single sample 4C/G8/2.0, which reported a vanadium concentration of 59 mg/kg. The Auditor did not consider this exceedance was significant and would be unlikely to pose any significant risk to the beneficial uses of the land. Further discussion on vanadium is provided in Section 5.2.1.

In June 2009, this test pit was excavated to 2.0 m bgs to remove the debris. OTEK (2013) noted that only *"a small amount of plastic and glass and a piece of concrete was identified"*. A total of 8 validation samples (4C/G8/VS-1 to 4C/G8/VS-8) were collected from the walls and floor of the excavation and analysed for asbestos, inorganics, TPHs, BTEX, PAHs, PCBs, VOCs, phenols, and pH.

Samples 4C/G8/VS-1, 4C/G8/VS-5 and 4C/G8/VS-7 reported minor concentrations of TPHs (C_{15}-C_{28}) of 23 to 24 mg/kg and TPHs (C_{29}-C_{36}) of 27 to 33 mg/kg. These concentrations are well below the NSW Service Station criteria for sensitive land use of 1000 mg/kg for TPHs (C_{10}-C_{40}). All other results for organics were below the laboratory LORs and inorganic concentrations did not exceed NEPM EIL.

Based on the results of the test pit and validation samples, the excavated soil was used to the backfill the test pit.

5.3.6 Incinerator ash removal and soil validation

During the grid sampling, OTEK identified a layer of ash (likely to be associated with the former incinerator) between 0.1 and 0.7 m bgl in grid test pit location 4C/G5 and targeted test pit locations 4C/T4 and 4C/T7. The ash identified in test pit 4C/T7 was remediated as part of the septic and soak pit removal described in Section 5.3.7 below.

In March 2007, an excavator was used to scrape of the surface around test pit 4C/T4 and identify the extent of ash. An area of approximately 40 m^2 was identified.

On the 17 and 18 June 2009, this 40 m^2 area was excavated to a depth of approximately 0.6 m bgl. OTEK noted that ash was not identified in a continuous layer over the surface scraped area, and where it was identified, it was a few centimetres in thickness. All visible ash was removed. At the same time the surface scrape around test pit 4C/T4 was being completed, test pit location 4C/G5 was also excavated to a depth of 0.7 m bgl. OTEK noted that a small amount of ash was identified and removed from the excavated test pit.

No surface validation samples were collected across the scraped area; however, OTEK did collect five validation samples (4C/G5/VS-1 to VS-5) from the walls and floor of the 4C/G5 test pit excavation. These samples were analysed for asbestos[7], TPHs (C_6-C_{36}), PAHs, VOCs, PCBs, phenols, pH, and inorganics. Results for VOCs, PCBs, PAHs, phenols and TPHs were below laboratory detection limits, and inorganic concentrations were below NEPM EIL.

The scraped and excavated soil was stockpiled with the septic and soak pit material (refer to Section 5.3.7 below). The excavated trench was backfilled with imported fill from Cemex Werribee Quarry (refer Section 5.4.1).

5.3.7 Septic and soak pit removal and soil validation

Excavation of septic and soak pit

From the 19 to the 23 June 2009, the remains of the former RAAF septic system were removed by OTEK. The system consisted of an underground septic pit and connecting soak pit, comprised of buried bluestone cobbles and boulders which were removed using an excavator.

A total of five validation samples were collected from the floors and walls of the soak pit (4C/VS-9 to 4C/VS-13); and analysed for *E.coli*, faecal coliforms, inorganics, TPHs, and OCPs. A single exceedance of the barium EIL of 300 mg/kg was reported in sample 4C/VS-11 (location shown on Figure 8) while sample 4C/VS-9 reported a vanadium concentration of 62 mg/kg also exceeding the EIL (50 mg/kg). The Auditor did not consider these exceedances were significant and would be unlikely to pose a risk to the beneficial uses of the land. Further discussion on barium and vanadium is provided in Section 5.2.1.

Five validation samples (4C/VS-1 to 4C/VS-5) were also collected from the floors and walls of the septic pit and analysed for asbestos, pH, *E.coli*, faecal coliforms, ammonia, nitrate, nitrite, inorganics, TPHs, PAHs, and OCPs. No exceedances were detected.

Stockpile validation

Approximately 57 m^3 of excavated material was stockpiled on site. As noted in Section 5.3.6, the stockpile materials consisted of approximately 24 m^3 of ash-impacted soil and the remaining 33 m^3 of boulders, cobbles and soil from the septic and soak pits.

[7] Asbestos was noted in test pit 4C/G5 during the grid sampling in 2006, however, OTEK noted that no asbestos was observed during the excavation of this test pit in June 2009. In addition, the auditor notes that two of the validation samples were analysed for asbestos and were both non-detect.

On 26 June 2009, three samples (4C/SP-3/1, 4C/SP-4/1 and 4C/SP-5/1) were collected from the stockpile and analysed for inorganics, ammonia, nitrate, nitrite, OCPs, PAHs, TPHs, *E.coli,* and faecal coliforms. No exceedances were detected.

OTEK (2013) noted that the stockpile material was disposed offsite as fill material. The auditor has reviewed the stockpile data and noted that the IWRG Soil Sampling guidelines specify a minimum of 3 samples for a stockpile of volume 57 m^3. Although the minimum three samples were collected and analysed, none of them were analysed for the full IWRG EPA Screen[8], with only one sample being analysed for PAHs and no samples being analysed for cyanide, fluoride, phenols, MAHs, chlorinated hydrocarbons or PCBs. In light of the absence of the recommended analyses, the auditor has reviewed the results and noted the following:

- Samples were analysed for potential contaminants consistent with a former septic and soak pit (e.g. ammonia, nitrate, nitrite, E.coli, and faecal coliforms). Results were predominantly below detection limits with no exceedances detected.
- Samples were also analysed for potential contaminants consistent with ash associated with the former incinerator (i.e. TPHs and PAHs).
- Results for TPHs, PAHs, and OCPs were all below laboratory detection limits, while all inorganics concentrations were within 'Fill Material' criteria.
- The stockpile material was not analysed for phenols, chlorinated hydrocarbons, cyanide, and PCBs. The auditor noted that these were generally not considered contaminants of concern for a former septic system or incinerator ash. For completeness, however, the auditor reviewed the results from the surface validation samples taken from test pit 4C/G5 (where incinerator ash had been identified). These five samples (4C/G5/VS-1 to VS-5) were analysed for VOCs, PCBs and phenols, with all results below laboratory detection limits.
- The visual appearance of the stockpile material did not indicate any likelihood of the material being imported and was considered likely to be local disturbed soil.

Therefore, on balance, the auditor considered the risk of the contaminants not analysed for being present in the stockpile material at concentrations exceeding fill material criteria, was negligible.

Removal of concrete pieces and ceramic pipe

During the septic and soak pit removal works, OTEK identified pieces of concrete and ceramic pipe in the vicinity of the former kitchen. In August 2009, an excavator was used to remove this material, which was then disposed offsite.

Six validation samples (4C/VS-28 to 4C/VS-34 (see Figure 8) were collected from the walls and base of the excavation and analysed for pH, E.coli, faecal coliform, nitrate, nitrite, and inorganics. Results for E.Coli and faecal coliform were below laboratory detection limits and no inorganic exceedances were detected. Nitrite concentrations were generally low, with concentrations ranging from 0.67 mg/kg (4C/VS-32) to 5.5 mg/kg (4C/VS-34), while nitrate concentrations ranged from 28.7 mg/kg (4C/VS/QS-5) to 74.4 mg/kg (4C/VS-29)[9]. As noted in Section 5.2.1, nitrate concentrations were within the range of those detected across the Overall Audit Area (as detailed in Section 13.1.3, Table Y of OTEK 2013).

[8] Industrial Waste Resource Guidelines (IWRG621) *"Soil Hazard Categorisation and Management"*
[9] The auditor converted the nitrate and nitrite concentrations from nitrate-N and nitrite-N as provided in the laboratory reports, by applying the relevant conversion factors (4.43 for nitrate and 3.29 for nitrite).

5.3.8 Surface drain removal

In July 2009, OTEK noted that small pieces of concrete (the remains of a former surface drain), were picked up by hand and disposed offsite. OTEK stated that validation sampling was not undertaken for the drain as targeted soil sampling had already been completed. The auditor confirmed that 8 samples (4C/T18 to 4C/T25, refer Table 15 above) were collected along the path of the surface drain and analysed for E.coli, with all results below laboratory detection limits.

5.3.9 Trough removal and soil validation

In May 2009, an animal watering trough and associated concrete stand, located in the northeast corner of the site, was removed and disposed offsite by OTEK (OTEK, 2013). OTEK collected a single surface validation sample (i.e. 4C/T28) from the underlying soil and analysed it for pH, sulphate, inorganics, nitrate, nitrite, faecal coliforms, and E.Coli. No exceedances were reported.

5.3.10 Steep pipe, ceramic pipe and junction box removal and validation

When undertaking the inorganics delineation works around test pit location 4C/T6 (refer to Section 5.3.2), OTEK identified ceramic and steel piping and a junction box. In September 2009, OTEK removed this material and disposed it offsite.

Four validation samples, 4C/VS-35 to 4C/VS-38 (Figure 8) were collected from the natural soil beneath the ceramic pipe and the junction box and analysed for inorganics, OCPs, TPHs, E.Coli, and faecal coliforms. No exceedances were reported. OTEK also collected two samples, 4C/VS-39 to 4C/VS-40 from the natural soil beneath the steel pipe and analysed for inorganics. No exceedances were observed.

5.3.11 Hangar 5 – Area 4B

On 14 January 2009, OTEK undertook surface soil sampling in Area 4B, which is located immediately to the north of Area 4C. The purpose of this sampling was to assess potential asbestos impacts associated with Hanger 5. After the sampling was completed and the locations surveyed, OTEK found that five of the samples (4B/VS-1/SS-1 to 4B/VS-5/SS-1) were actually located within Area 4C (along the northern boundary, refer to Figure 8).

The samples were analysed for asbestos, with no detections being reported by the laboratory.

5.4 Asbestos remediation

5.4.1 Prior to implementation of the RAP

OTEK undertook remediation activities related to asbestos removal at the site both prior to implementation of the asbestos Remedial Action Plan (RAP), and as part of the RAP. These activities are described below and summarised in Table 20 below.

Asbestos/metal pipe

As discussed in Section 5.3.3, OTEK identified approximately 250 m of underground pipe, comprised of metal and asbestos during the removal of hydrants (previously identified during the geophysical survey, refer Section 2.8). OTEK disposed of the pipe offsite and collected validation samples along the excavated trench and analysed for inorganics and asbestos. No asbestos was reported in any of the 12 samples analysed. Concentrations of manganese and vanadium were reported above the NEPM EIL in one sample (4C/VS-3/1) and subsequently, three additional samples (4C/VS-3/4, 4C/VS-3/5 and 4C/VS-3/6) were collected and analysed for inorganics. No exceedances were reported. Furthermore, it has been noted that the

observed concentrations of vanadium and manganese were considered naturally occurring (as discussed in Section 5.2.1).

Surface drain removal

In July 2009, during the removal of the surface drain (refer Section 5.3.8), OTEK identified asbestos containing material (ACM). This ACM was removed by OTEK in several stages. Initially, a hand-pick was conducted to remove any visible pieces. Following this, an excavator bucket was used to disturb the top 5 to 10 cm of soil across the 70 m^2 area in which the ACM had been identified. Another hand-pick was then undertaken to remove any additional ACM pieces. OTEK then collected 14 surface validation samples (4C/VS-14 to 4C/VS-27 (see Figure 8) which were analysed for asbestos.

A single sample (4C/VS-14) reported the presence of chrysotile fibres and fragments of chrysotile fibre cement. Subsequently, OTEK scraped an additional 10 cm of soil from this location and collected another surface validation sample (i.e. 4C/VS-14/1). No asbestos was detected in this sample.

OTEK noted that the scraped soil was stockpiled with the material excavated during the removal of the asbestos/metal pipe, refer to Section 5.3.3, and was disposed off-site as Category C waste.

This entire area was remediated for asbestos again during the ACM removal works in February 2011, as detailed in Section 5.4.2 below.

5.4.2 Remedial action plan – asbestos in soil

An asbestos remediation plan *"Remedial Action Plan – Asbestos in Soil"* was completed by OTEK in December 2010 to address remaining ACM in Area 4.

As discussed in Section 5.2.3, asbestos fragments were visually identified at the surface during the grid sampling works. OTEK noted that no buried asbestos was identified. In March 2007, the results of this visual investigation were used to define an area of approximately 5405 m^2 as containing surface ACM. During the preparation of the asbestos RAP and following a closer review of the data, this area was refined to 4750 m^2 (Figure 9 and Figure 10 of this audit report).

Asbestos remediation works commenced in November 2010 and were undertaken in several stages, starting with a handpick exercise, involving a site walkover in 'lanes' and the removal of visible asbestos fragments on the surface. However, works were discontinued after 3 days due to poor weather. The hand-picking exercise recommenced in February 2011 and was considered complete after three passes had been made across the area and no visible asbestos remained. OTEK noted a total of 1.97 kg of ACM was collected, triple bagged and disposed offsite.

In accordance with the RAP, three 10 m x 10 m validation areas were selected (C1/1, C1/2 and C1/3) for further investigation (Figure 11 of this audit report). One target area (i.e. C1/1) was selected from where a higher density of ACM had been removed during the handpicking exercise, while the other two areas (i.e. C1/2 and C1/3) were chosen randomly.

OTEK then used an excavator bucket to scrape the top 0.15 m of soil from each validation area. The scraped soil from each area was stockpiled separately, with each validation area having 3 separate stockpiles. Each scraped area was then inspected and any visual ACM was removed.

Validation Area C1/1

Following the scraping of the top 0.15 m of soil from area C1/1, the auditor inspected the area on 7 February 2011 and observed further ACM. Consequently, the auditor requested that additional clean up and validation works be undertaken. Subsequently OTEK commenced

trenching around the north, east, and south sides of the C1/1 area to locate any buried ACM (see Figure 12 of this audit report). No asbestos was identified.

The surface of the validation area was then extended to the west and south by using the teeth of the excavator to disturb the top 0.15 m of soil over an area of approximately 920 m^2. This area was then handpicked in lanes, until no visible asbestos remained, resulting in the removal of a further 0.7 kg of ACM. On 9 February 2011, four validation samples C1/VS-1 to C1/VS-4 (see Figure 12 of this audit report for sampling locations) were collected from the surface of the disturbed area and sent to the laboratory for analysis. OTEK reported that asbestos was not detected in the laboratory samples, however, the relevant laboratory report was not provided.

The scraped soil (estimated volume of 153 m^3[10]) was stockpiled into three stockpiles (i.e. SP-1, SP-2, and SP-3, see Figure 11 of this audit report) OTEK visually inspected each stockpile and removed an additional 1.2 kg of ACM from stockpile C1/SP-1. Three validation samples were collected from each stockpile (a total of 9 samples) and sent to the laboratory for analysis. The Auditor noted that this sampling density complies with the IWRG Soil Sampling guidelines that specify a minimum of 6 samples for a single stockpile of 150 m^3 (or a minimum of 3 samples for three stockpiles of 50 m^3). OTEK noted that an ACM fibre bundle was reported in stockpile sample C1/SP-1/3, while no asbestos was detected in the other samples. The auditor noted that the relevant laboratory report for this analysis was not provided by OTEK. The stockpiled soil was used to backfill the scraped area.

Validation Areas C1/2 and C1/3

In February 2011, Validation Areas C1/2 and C1/3 were also scraped to a depth of 0.15 m and the soil from each validation area (approximately 15 m^3 for each validation area) was stockpiled into three stockpiles (based on a total scraped volume of 15 m^3 for each validation area, the auditor assumed that each stockpile would have had an approximate volume 5 m^3. Each validation area and stockpile was visually inspected. OTEK noted that no additional ACM was identified across validation areas C1/2 or C1/3 or the associated stockpiles, and therefore no additional sampling was conducted. The stockpiled soil was used to backfill the scraped areas.

Compliance with guidelines

OTEK noted that the volume of soil inspected, compared with the amount of ACM identified was below the applicable guideline of 0.01% weight/weight (DOH, 2009). The auditor has reviewed OTEK's calculations by recalculating the % W/W using DOH, 2009 method and concurs that they comply with the adopted guidelines.

The percentage soil asbestos calculation described in Table 4.1.7 of DOH (2009) is presented below:

$$\% \text{ Soil Asbestos} = \frac{\% \text{ Asbestos Content } (0.15) \times \text{ACM (kg) } (1.9)}{\text{Soil Volume (L) } (138{,}000+15{,}000) \times \text{Soil Density (kg/L) } (1.7)}$$

$$= 1.1 \times 10^{-6}$$

Where it is assumed that

% Asbestos Content (within asbestos cement materials) = 15%

Soil Density = 1.70 kg/L (silty clay soils)

[10] Auditor's volume estimate based on initial area of C1/1 excavation: 10 x 10 m (100 m^2) and extended area of 920 m^2 totalling 1020 m^2 x excavation depth of 0.15 m, equates to approximately 153 m^3.

Table 20 Summary of identification and removal of asbestos in Area 4C

Description of Works	Location	Action Taken	Date	Validation Samples	Summary of Results
Asbestos removal activities prior to implementation of Asbestos Remediation Action Plan					
Grid sampling	4C/G3, 4C/G4, 4C/G5, 4C/G8, 4C/G9, 4C/G10, 4C/G12, 4C/G13, 4C/G14, 4C/G15, 4C/G16, 4C/G18, 4C/G19, 4C/23, 4C/25	Soil samples collected from test pits analysed for asbestos. Samples taken from 4C/G19 were not analysed for asbestos[1].	April 2006	4C/G3/0.25, 4C/G4/0.25, 4C/G5/0.25, 4C/G8/0.25, 4C/G9/0.25, 4C/G10/0.25, 4C/G12/0.25, 4C/G13/0.25, 4C/G14/0.25, 4C/G15/0.25, 4C/G16/0.25, 4C/G18/0.25, 4C/G23/0.25, 4C/G25/0.25.	No asbestos detected. Refer to Section 5.2.3.
Asbestos/ metal pipe and hydrant removal	Part of underground pipe.	Pipe removed and disposed offsite to Western Land Reclamation Brooklyn	Sep 2008 to Feb 2009	4 validation sample locations along trench: 4C/VS-1/1,2,3, 4C/VS-2/1,2,3, 4C/VS-5/1,2,3 and 4C/VS-8/1,2,3	12 samples analysed for asbestos. No asbestos detected.
Concrete surface drain removal	ACM identified during removal of concrete surface drain across 70 m^2 area.	Handpick (aka emu bob) conducted to remove visible pieces. Bucket excavator used to disturb top 5 to 10 cm soil across area, followed by a hand pick up of any additional ACM pieces.	July 2009	14 surface validation samples collected: 4C/VS-14 to 4C/VS-27.	1 sample detected asbestos cement fragment (chrysotile). No asbestos detected in remaining samples.
		Further 0.1 m topsoil scraped over area where asbestos detected (4C/VS-14) and remaining soil sampled. Scraped soil was disposed offsite.	Aug 2009	4C/VS-14/1	No asbestos detected.
Asbestos removal activities as part of the Asbestos Remediation Action Plan					
ACM removal and validation	Visual inspection completed to demarcate the extent of surface ACM	Handpick exercise commenced, stopped after 3 days due to bad weather.	25 Nov 2010	Not applicable	
		Handpick exercise continued. Three passes completed and no visible asbestos remaining.	Feb 2011	Not applicable	1.97 kg of ACM, collected, triple bagged and disposed offsite.

Description of Works	Location	Action Taken	Date	Validation Samples	Summary of Results
	Three 10 x 10 m areas defined as follows;	Areas scraped to 0.15 m bgs using an excavator.	4 Feb 2011		
	C1/1 – higher proportion of ACM identified in this area during handpick.	Scraped area visually inspected and material stockpiled, SP-1.	4 Feb 2011	C1/SP-1/1, C1/SP-1/2, C1/SP-1/3.	1.2 kg of ACM was removed from stockpile C1/SP-1. Validation sample C1/SP-1/3 identified an ACM fibre bundle (amosite). The other 2 stockpile samples were non-detect for asbestos. OTEK reinstated stockpile on site.
		An investigation trench was extended along north, east and south sides of C1/1 area to 0.3 m bgs to locate any buried ACM..	7 Feb 2011	Not applicable	No ACM identified in trenches.
		This validation area was extended to the east and south to till the top 0.15 m of soil. This area was then handpicked in lanes until no visible ACM remained. Refer Figure 12.	9 Feb 2011	Four validation samples collected from surface of tilled area, C1/VS-1 to C1/VS-4	0.7 kg of ACM removed during handpicking. No asbestos detected in surface validation samples.
	C1/2 – area selected randomly	Area C1/2 – scraped area visually inspected and material stockpiled SP-2.	4 Feb 2011	C1/SP-2/1, C1/SP-2/2, C1/SP-2/3.	No asbestos detected.
	C1/3 – area selected randomly	Area C1/3 – scraped area visually inspected and material stockpiled, SP-3.	4 Feb 2011	C1/SP-3/1, C1/SP-3/2, C1/SP-3/3.	No asbestos detected.

NOTES

[1] Although a sample was not analysed for asbestos at location 4C/G19 during the grid sampling, this test pit location was included within the asbestos remediation zone as described in Section 5.4.

5.4.1 Backfill material

Imported fill material, sourced from Cemex Werribee Quarry (formerly Werribee Quarry), located at Wests Road, Werribee was used to backfill the former UST pit, excavation in the vicinity of the former incinerator and septic/soak pit. This material was formerly classified as suitable for use as backfill material across the Overall Audit Area. Details of sampling and analysis were provided under separate covers, which the auditor reviewed and provided comment on (attached as Appendix H). The fill material was found to contain concentrations of barium, manganese, nickel and vanadium above the EILs but within NEPM background levels. The concentrations were consistent with those detected at the site (as discussed in Section 5.2.1) and across the Overall Audit Area, and were considered to be naturally occurring given the basaltic origin of the material. The auditor was satisfied the material used to backfill excavations was of suitable quality for the proposed residential use of the site.

For ease of reporting, a summary of the final condition of soil at the site is presented in Section 5.6 below.

Auditor's opinion on infrastructure removal and validation sampling

From a review of the information provided by OTEK, including the description of infrastructure removed, validation sampling methodology, analytical suite and analytical results, the auditor considered the potential contaminating structures were adequately removed from the site, and the underlying soils appropriately validated.

5.5 Consistency with clean-up regulations

OTEK indicated that all soil excavated, sampled and removed from site was done so in accordance with EPA Industrial Waste Resource Guidelines (IWRG). Excavated soil was disposed offsite by appropriately licenced contractors, and where applicable to EPA licensed facilities. The auditor noted that OTEK 2013 referenced the appropriate waste guidelines for the duration of the works, and stated that works were undertaken in accordance with these guidelines.

5.6 Summary of final soil conditions and protected beneficial uses of land

As discussed above, the remediation works involved the removal of potentially contaminating infrastructure followed by validation sampling and analysis. There was no requirement to conduct soil clean up, as contamination of concern was not detected in the validation analytical results.

Following completion of the assessment, infrastructure removal, and validation works; only one concentration of benzo(a)pyrene (marginally above the EIL of 1 mg/kg) remained onsite where the illegally dumped stockpile was formerly located (4C/SP-1/SS-1 with a concentration of 1.1 mg/kg). Additionally, several minor concentrations of barium, copper, manganese, vanadium and zinc, above the EILs remained on the site, which were considered to be representative of background levels and not likely to pose a risk to ecological or human health (as discussed in Sections 5.3.2, 5.3.3 and 5.3.7) and summarised in Table 21 below.

Table 21 Summary of contaminant exceedances remaining in soil after remediation

Analyte	NEPM or Adopted Investigation Level (mg/kg)		Validation Sample Location	Concentration (mg/kg)	Samples exceeding adopted investigation level
	NEPM EIL	NEPM HIL A			
Barium	300	-	Former septic/soak pit	530	4C/VS-11
Copper	100	*1000*	Metals delineation	109	4C/T7/S3/0.25
				103	QS-18[1]
Manganese	500	*1500*	Asbestos/metal pipe removal	541	4C/VS-3/1
Vanadium	50	-	Asbestos/metal pipe removal	51	4C/VS-3/1
			Former septic/soak pit	62	4C/VS-9
Zinc	200	*7000*	Metals delineation	300	4C/T6/N1/0.5
Benzo(a)pyrene	-	*1*	Illegally dumped stockpile	*1.1*	4C/SP-1/SS-1

NOTES:
Underlined: result higher than NEPM EIL investigation levels
Italics: result higher than NEPM A investigation levels
[1] QS-18 is the field split for the other sample 4C/T7/S3/0.25

As discussed in Section 5.2.1 above, the analytical suite for soil validation samples included nitrate, nitrite, and ammonia. Ammonia was not detected in any validation samples analysed. Nitrite concentrations[11] were generally low, with concentrations ranging from 0.67 mg/kg to 5.5 mg/kg reported in vicinity of former ceramic pipe and concrete pieces (see Section 5.3.7 for details).

Nitrate concentrations were reported in validation samples collected from the septic/soak pit (19.9 mg/kg in 4C/T7/VS-1 and VS-5), the former animal watering trough (96.1 mg/kg in 4C/T28) and the former ceramic piping (74.4 mg/kg in 4C/VS-29) located during the septic/soak pit excavation (refer Section 5.3.7). OTEK did not compare the concentrations to any guidelines values, but indicated the nitrate and nitrite results at the site were well within the range of concentrations observed across the Overall Audit area (refer Table Y in OTEK 2013). Given the concentrations were within the identified range, the site was not considered to have been adversely impacted by nitrate from potential onsite sources.

The potential for any ecological and human health risk from the remaining concentrations of benzo(a)pyrene and metals are discussed below.

5.6.1 Maintenance of ecosystems

Concentrations of barium, copper, manganese, vanadium, and zinc above the EILs remained on the site, refer to Table 21. As discussed in Section 5.2.1, these concentrations were all detected in natural soils and are considered representative of background conditions.

Additionally, the range of pH (5.2 to 9.4) encountered at the site is not expected to adversely impact the beneficial use maintenance of ecosystems, as it is naturally occurring and there was no visual effect on site vegetation.

[11] The auditor converted the nitrate and nitrite concentrations from nitrate-N and nitrite-N as provided in the laboratory reports, by applying the relevant conversion factors (4.43 for nitrate and 3.29 for nitrite).

5.6.2 Human health

All concentrations of all analytes tested were below the investigation levels for protection of human health (HIL A), with the exception of a single concentration of benzo(a)pyrene detected in the former footprint of the illegally dumped stockpile. The auditor did not consider that this single benzo(a)pyrene concentration posed an unacceptable level of risk to human health based on the following lines of evidence:

- The source of the benzo(a)pyrene was an illegally dumped stockpile that was removed and disposed offsite in February 2009; and
- The reported concentration of 1.1 mg/kg, only marginally exceeded the NEPM HIL-A criteria of 1.0 mg/kg.

5.6.3 Buildings and structures

The pH in soils across all assessment and validation samples was ranging from slightly acidic to alkaline soils (5.2 to 9.4). OTEK did not comment on the cause of pH variability.

The pH range observed was consistent with that observed in similar natural soils across the Overall Audit Area and was consistent with the nature of the soil developed from the parent materials described in this report (i.e. Section 2.2). Given the distribution of the pH results observed across the site, and given there were no identified potential sources that might have attributed to altering soil pH, the pH range observed is considered naturally occurring and unlikely to be associated with onsite anthropogenic source. The soil pH range observed was not expected to adversely impact the integrity of future concrete buildings and structures on site.

Additionally, OTEK compared soil sulphate concentrations and pH levels with the exposure classification for concrete piles in Australian Standard AS2159-2009. OTEK concluded soil at the site would not impact the integrity of structures or buildings, the auditor concurred with this conclusion.

Acid sulphate soils were not encountered or expected at the site given the geological conditions and location of the site.

5.6.4 Aesthetics

OTEK reported (in OTEK 2013) there were no offensive odours noted during field works, and the site was free of debris. The auditor, during his final site inspection on 4 February, observed the site surface was predominantly covered with long and dense grass. The auditor confirmed there was no visual evidence of changes in the physical appearance of the site from what was described in OTEK's report (2013).

5.6.5 Production of food, flora and fibre

The objectives of this beneficial use were discussed in Section 3.2.5, and are generally applicable in an agricultural setting for which produce may be available for consumption.

As noted in Section 3.2.5, OTEK adopted HIL A investigation levels when assessing this beneficial use. The auditor considers the EILs should also be taken into account. On this basis the concentrations of barium, copper, manganese, vanadium, and zinc, in a limited number of samples exceeded the EIL. As discussed previously (Section 5.2 and 5.3), the auditor was of the opinion that these exceedances were considered to be naturally occurring, and were unlikely to pose an adverse impact to ecological receptors and hence nor to the beneficial use production of food, flora or fibre.

5.7 Off-site soil contamination

Based on the available information for the Overall Audit Area, there was no evidence that any activities undertaken on the site have resulted in contamination of soil at the surrounding sites.

5.8 Consistency of the proposed development with the condition of the site

As per the proposed development plan provided in Appendix B, the site was part of the Riverwalk Estate which was proposed to be developed for residential 'single-dwelling' and 'medium-density' development and associated uses such as public open space and recreation areas.

Based on all the data available as discussed in this report, the auditor was of the opinion that the site was currently suitable for the proposed sensitive land use, as it was considered the relevant beneficial uses of the land were protected.

6. Assessment of groundwater quality

OTEK undertook a groundwater assessment across the Overall Audit Area, including the installation of 11 groundwater monitoring wells (MW-1 through MW-11) across the Overall Audit Area between June 2006 and October 2009. One monitoring well, MW-4 was installed within Area 4C.

The OTEK findings of the groundwater investigation relevant to Area 4C (i.e. results for MW-4) were reported in OTEK 2013. The findings of the overall groundwater assessment were reported under separate cover as a draft document (OTEK, 2010). The auditor referred to OTEK 2010 for background information.

OTEK provided a discussion on groundwater at the site in OTEK 2013. A summary of the key information is provided in Table 22 below.

Table 22 Assessor's site assessment information – groundwater (OTEK 2013)

Assessment Details	Section in assessor's report (OTEK 2013, Appendix E of this report)
Details of Groundwater Sampling and Analysis	Section 8
Field Observations	Appendix H
Monitoring Well Logs	Appendix K
Field Measurements (Groundwater)	Appendix K
Site Plans	Figure 5
Analytical Results (Summary Tables)	Section 10: Table T and Table U; Appendix P

6.1 Adequacy of the groundwater assessment program

OTEK installed 11 groundwater monitoring wells (MW-1 through MW-11) across Area 4 of the Overall Audit Area between June 2006 and October 2009 to assess groundwater quality and the potential for adverse impact from possible sources identified. One of these groundwater monitoring well was installed on Area 4C (see Table 23 below).

Table 23 Monitoring well details

Monitoring Well ID	Potential Source Targeted	Total Well Depth (m bgl)	Aquifer	SWL (m TOC)	Top of screen (m bgl)
MW-4	Former UST	12	Werribee Delta	11.5[1]	8

NOTES:
m bgl – metres below ground surface / level
m TOC – metres below top of casing
[1] Measured from most recent groundwater monitoring round (December 2011)

Groundwater at the site and across the Overall Audit Area was inferred to flow towards the east (refer to Figure 13), which is consistent with the expected flow direction towards the Werribee River, located approximately 1 km to east north east of the Overall Audit Area (at its closest point), and approximately 800 m east of Area 4C. Regionally, the groundwater is expected to

flow to the south east toward Port Phillip Bay located approximately 7 km to the south east of the site.

Monitoring well MW-4 was installed on 19 July 2006, down gradient of the removed UST, formerly located in the central northern portion of Area 4C. The main purpose of the installation of monitoring well MW-4 was to assess whether this UST had resulted in an impact on the groundwater quality hydraulically down gradient, and also to provide information about the groundwater quality in Area 4C.

This well was installed using a combination of hollow and solid stem augers to the maximum depth of 12 m bgl. The screen was constructed above the measured standing water level, so that the potential for non-aqueous phase liquids (NAPL) and hydrocarbons (if any) could be adequately assessed if present. A sand pack was installed from the base of the well to at least 1.0 m above the screen and a bentonite seal of 1.0 m was installed above the sand pack, followed by grout to surface.

MW-4 was developed by injecting compressed air into the well to cause a surging, followed by pumping of the water to remove fines. OTEK was not able to provide any further details for the development of this well, and indicated that the well development records were not available. In the absence of the well development record, the auditor reviewed the groundwater data and based on the number of sampling events, consistency of results across sampling events and the elapsed time between development and sampling (more than 7 days), concurs with OTEK that the well had been sufficiently developed.

Five rounds of groundwater sampling were undertaken of MW-4 (as part of sampling event of the Overall Audit Area), as summarised in Table 24.

Table 24 Summary of area 4C groundwater sampling events and analysis

Monitoring Event	Date	Laboratories	Analysis Undertaken
GME 1	24 August 2007	Primary: Labmark Secondary: ALS	BTEX, TPHs (C_6-C_{36}), Inorganics[1], PAHs, alkalinity, TDS, Major Cations (Ca, Mg, K, Na), chloride, nitrate, nitrite, sulphate and pH.
GME 2	15 November 2007	Primary: Labmark Secondary: ALS	BTEX, TPHs (C_6-C_{36}), Inorganics[1, 2], PAHs.
GME 3	5 February 2008	Primary: Labmark Secondary: ALS	BTEX, TPHs (C_6-C_{36}), Inorganics [1, 2], PAHs.
GME 4	25 November 2009	Primary: ALS Secondary: Labmark	BTEX, TPHs (C_6-C_{36}), Inorganics [1, 3], PAHs, alkalinity, TDS, Major Cations (Ca, Mg, K, Na), chloride.
GME 5	8 December 2011	Primary: ALS Secondary: Groundswell	BTEX, TPHs (C_6-C_{36}), Inorganics [1, 3], alkalinity, TDS, Major Cations (Ca, Mg, K, Na), chloride.

NOTES:
[1] As, Ba, Be, B, Cd, Cr, Co, Cu, Pb, Mn, Hg, Mo, Ni, Se, Sn, Va, Zn
[2] Cr(VI) and/or Fe^{2+}
[3] Sb

Groundwater samples were collected using low flow micro-purge to reduce the potential loss of volatiles. Purging continued until stabilisation of the groundwater's physical and chemical parameters had occurred. Groundwater quality parameters for monitoring well MW-4 for all five GMEs were included in Appendix K of OTEK 2013. OTEK reported that samples were collected

in laboratory-prepared sampling containers with the headspace minimised to reduce the potential loss of volatile contaminants during transport and storage. The sampling methodologies employed were considered appropriate.

Table 24 outlines what laboratories were used for both the primary and secondary analyses of groundwater samples during each GME. All laboratories were NATA accredited for the analysis undertaken. Laboratory reports received were NATA stamped and signed by a NATA signatory.

Based on available relevant guidelines and current industry practice, the groundwater characterisation works completed by OTEK were considered adequate for the purposes of assessing the groundwater quality beneath the site. In summary:

- The number of monitoring wells installed across the Overall Audit Area enabled groundwater flow direction to be inferred;
- The data from the Overall Audit Area allowed for an assessment of regional groundwater conditions and provided further indication on the groundwater quality beneath the site;
- The monitoring wells were placed appropriately to assess groundwater quality from potential sources;
- Appropriate construction methods were generally adopted for the monitoring wells, with MW-4 screened across the standing water level;
- The analytical schedule and field measurements were adequate; and
- The low flow sampling methodology adopted was considered appropriate.

6.1.1 Auditor's opinion on the adequacy of the groundwater assessment program

In summary, the monitoring wells were appropriately located down / cross gradient from potential sources, and were correctly constructed to allow assessment of contamination. An adequate number of sampling events were undertaken with an appropriate analytical suite to address all CoPC, given that soil and groundwater analytical results did not indicate contamination at levels considered to adversely impact the relevant beneficial uses (following soil remediation), and no potential ongoing sources of groundwater contamination were identified within the site.

6.2 Beneficial uses of groundwater to be protected

The assessor's groundwater field investigations indicated the TDS of groundwater at the site ranged from 3780 mg/L (MW-4, December 2011) to 3920 mg/L (MW-4, November 2009). Therefore, groundwater at the site was classified as Segment C of the protected beneficial categories of the groundwater environment (*Groundwater SEPP*, 1997). Based on the salinity of the groundwater, the beneficial uses protected under the *Groundwater SEPP* were:

- Maintenance of Ecosystems;
- Stock watering;
- Industrial water use;
- Primary contact recreation (e.g. bathing, swimming); and
- Buildings and structures.

In addition to these beneficial uses, groundwater contamination should not be present at concentrations that would adversely affect the use of land at the site. Given that volatile contaminants were not encountered in groundwater at the site, it was not considered that groundwater conditions would have any adverse impact on the beneficial uses of land.

6.3 Regional groundwater quality

In order to gain a comprehensive understanding of regional groundwater quality, the auditor undertook a review of groundwater data across the Overall Audit Area (i.e. data from Areas 1, 2, 3 and 4). This review found that elevated concentrations of various inorganics in groundwater (e.g. boron, copper, manganese, nickel, selenium, zinc, and nitrate) above the investigation levels (predominantly for maintenance of ecosystems) were widespread across the region.

Typical concentrations of inorganics, considered to be naturally occurring and/or regionally representative in groundwater across the Overall Audit Area are summarised in Table 25, and discussed further below. It was noted that much of the data were collected over a number of years, but as the site activities had not changed, the data were still considered valid to provide a good indication of groundwater quality across the region. Additionally, as noted below, two previous audits conducted of nearby sites found groundwater quality of a similar nature.

Table 25 Regional groundwater quality

Analyte	Investigation Level Maintenance of Ecosystems [1]	Audit Area and Sampling Dates			
		Area 1 *Mar 2003*	Area 2 Oct 2003	Area 3 May 2005 to Sep 2005 3 monitoring events	Area 4 Aug 2007 to Dec 2011 6 monitoring events
	(mg/L)	Concentration Range (mg/L)			
Boron	0.37	0.18 – 0.42	0.29 - 0.71	0.16 – 0.23	0.16 – 0.45
Copper	0.0014	<0.001 – 0.008	0.005 – 0.011	0.002 – 0.021	0.004 – 0.158[2]
Manganese	1.9	0.017 – 0.068	0.018 – 0.13	0.15 – 2.3	<0.001 – 0.861[3]
Nickel	0.011	<0.001 – 0.006	0.006 – 0.01	0.011 – 0.26	0.002 – 0.100
Selenium	0.011	0.028 – 0.051	0.038 – 0.072	<0.005 – 0.031	<0.01 - <0.02
Zinc	0.008	0.015 – 0.019	0.009 – 0.014	0.01 – 0.047	0.01 – 0.331[4]
Nitrate-N	0.7	12.4[5]	5.3 – 6.7	2.3 – 9.8	1.25 – 5.82

NOTES:

[1] ANZECC (2000), 95% level of protection (slightly to moderately disturbed ecosystems) for freshwater guidelines.

[2] isolated results in MW6 Area 4, November 2007, all other results for Area 4 wells ≤0.011 mg/L.

[3] Results from November 2009 for Manganese were an order of magnitude greater than all other manganese results for Area 4, and considered anomalous.

[4] isolated result in MW6 Area 4, November 2007, all other results for Area 4 wells ≤0.066 mg/L.

[5] converted from Nitrate-NO_3 (55 mg/L).

Data sources: Refer Section 8 References OTEK 2010 and OTEK 2012.

6.3.1 Boron, Copper, Manganese, Nickel, Selenium and Zinc

Detected concentrations of boron, copper, manganese, nickel, selenium, and zinc were considered to be generally naturally occurring and representative of regional groundwater conditions in the Werribee Area, rather than attributed to point source contamination arising from historical uses of the Overall Audit Area. This was based on the following lines of evidence.

- Concentrations of inorganics were generally consistent across all audit Areas (i.e. Areas 1,2,3 and 4), in both up and down gradient monitoring wells;

- The concentrations of these analytes in soils were typically low, with few exceedances of soil investigation levels across the whole data set. In addition, the depth to groundwater, the nature of the soil as discussed in this report including the low permeability of soils, and the low concentrations in groundwater indicated migration from surface soil concentrations is unlikely to have occurred to any significant extent across the Overall Audit Area;
- There were no specific point sources of these inorganics identified in the vicinity of the Overall Audit Area or the site itself;
- A review of nearby audits undertaken during the audit of Area 3 (GHD 2003) found that groundwater at two sites located approximately 5 km north east (Dames and Moore Pty Ltd, 2000, Statutory Environmental Audit, 200-208 Derrimut Road, Hoppers Crossing, Victoria) and 6 km north east (HLA Envirosciences Pty Ltd, 2002, Statutory Environmental Audit, 60 Warringa Crescent) of the Overall Audit Area contained concentrations of chromium, selenium, zinc, nickel and copper above the investigation levels. It was concluded in these audits that the concentrations were considered naturally occurring in the Newer Volcanics Aquifer.
- A review of nearby audits undertaken in 2014 found that groundwater at one site (1-3 Stawell Street, Werribee, Victoria) located approximately 2 km north of the Overall Audit Area reported concentrations of copper, chromium, lead, manganese and zinc above the investigation levels. The report concluded that the concentrations were associated with an off-site source.

6.3.2 Nitrate

Similarly, groundwater in the vicinity of the Overall Audit Area was also found to contain 'elevated' concentrations of nitrate, with concentrations in groundwater across all audit Areas (Areas 1,2,3 and 4) exceeding the maintenance of ecosystems guidelines. It was noted that ANZECC issued an errata in June 2005 stating that all nitrate trigger values should be deleted and replaced with "under review". Therefore, the investigation level has been retained for general guidance only. The concentrations of nitrate observed across the Overall Audit Area were considered either naturally occurring or representative of the regional land use, based on the following lines of evidence.

- Although septics and associated infrastructure located in Areas 4A, 4B, 4C, 4D, 4E, 4F, 4I and 4G were identified as potential point sources of nitrate in the Overall Audit Area, the distribution of nitrate concentrations in groundwater did not indicate contamination from point sources (i.e. no elevated concentrations of nitrate were detected close to potential sources). The concentrations of nitrate observed across the Overall Audit Area were reasonably consistent (refer Table 25 above), with up gradient (i.e. background) wells containing similar concentrations to wells in the vicinity and down gradient of potential sources. Furthermore, use of the septic tanks ceased circa 1950s.
- Concentrations of nitrate in soil across Area 4 were typically low (generally less than 20 mg/kg), with the exception of a few isolated higher concentrations in Areas 4C and 4D) and were considered unlikely to migrate to groundwater given the low permeability of soils and depth to groundwater.
- Nitrate is known to be naturally occurring in the Newer Volcanics Aquifer at concentrations up to 60 mg/L (as nitrate, Leonard 1992). Furthermore, the widespread agricultural land use across the Werribee Area may have contributed, to an extent, to the nitrate concentrations (e.g. through fertiliser application and livestock).

Given these lines of evidence the concentrations of the abovementioned inorganics (including nitrate) observed across the Overall Audit Area, including the site, are considered to be regionally occurring and not derived from a site source.

Further discussion regarding specific analyte concentrations is provided in Section 6.4 below.

6.4 Summary of groundwater assessment results

The findings of the groundwater assessment undertaken at the site are summarised in Table 26 below. Tabulated groundwater results for MW4 from 2007 to 2011 are presented in Tables 56 to 59 of OTEK 2013 (attached as Appendix E of this report). Results for the wells across the Overall Audit Area were reported in the Draft Hydrogeological Assessment Report (OTEK 2010). As noted in Section 3.4, although OTEK adopted ANZECC 1992 investigations levels, the following discussion is based on a comparison of groundwater analytical results with more recent guidelines (ANZECC 2000 and NHMRC 2008).

Guidelines for industrial water use have not been included given that the relevant investigation levels would depend upon the broad application of this use. The beneficial use of buildings and structures was not considered to be adversely impacted by the concentrations of inorganics and therefore this beneficial use has not been presented in Table 26.

Table 26 indicated that concentrations of several inorganics were reported above the adopted investigation levels for maintenance of ecosystems and/or primary contact recreation, which is discussed further below. Concentrations of all organic analytes were reported below the laboratory LOR.

6.4.1 Maintenance of ecosystems

Nitrate

Concentrations of nitrate-N were above the investigation level for maintenance of ecosystems in monitoring well MW-4. As discussed in Section 6.3.2 above, the auditor considered the concentrations of nitrate to be representative of background conditions, based on the following lines of evidence:

- Concentrations in the vicinity of the site were consistent with those observed across the Overall Audit Area (refer to Table 25);
- Concentrations were consistent with levels expected in groundwater agricultural areas, and in the New Volcanics Aquifer (Leonard, 1992); and
- Aside from former agricultural use in the region, there was no point source of nitrate impact on groundwater identified on the site apart from a limited potential onsite sources (i.e. the former septic that was ceased as mentioned below circa 1950). It was noted that agricultural activities on the site ceased a few years ago and the use of the septics ceased circa 1950s and, therefore any residual nitrate in soil (i.e. potential secondary source) would have decreased over time, and hence any potential risk would have further diminished.

Copper, Nickel and Zinc

OTEK provided a reasonable discussion regarding the concentrations of inorganics in Section 13.2 of OTEK 2013, concluding that concentrations of copper, nickel, and zinc in groundwater were naturally occurring. The auditor agreed with this conclusion, based on the following lines of evidence:

Concentrations of copper and zinc in soil were low and below their respective EILs, with the exception of a single concentration of copper (109 mg/kg) and zinc (300 mg/kg) detected during

the metal delineation sampling in the northern portion of the site (at locations 4C/T7/S3, depth 0.25 mbgl for copper and 4C/T6/N1, depth 0.5 mbgl for zinc). These soil concentrations were still within the range of concentrations detected across the Overall Audit Area and, therefore were not expected to adversely impact on the groundwater, especially in the context of the nature of the soil and the depth to groundwater as discussed below.

Table 26 Exceedances of adopted investigation levels (mg/L)

Adopted Investigation Level								
Beneficial Use		**Copper**	**Nickel**	**Zinc**	**Manganese**	**Nitrate-N**	**Chloride**	**Sodium**
Maintenance of Ecosystems[1]		*0.0014*	*0.011*	*0.008*	*1.9*	*0.07*[6]		
Primary Contact Recreation[2]		2[4], 1[5]	0.02[4]	3[5]	0.5[4], 0.1[5]	11.3[4,7]	250[5]	180[5]
Stock watering[3]		**0.5**	**0.1**	**5**	**0.02**			
Sample Date	***Monitoring Well***				***Analytical Results***			
Aug 2007	MW-4			*0.02*		*7.19*	1690	788
Nov 2007	MW-4	*0.015*		*0.081*				
Feb 2008	MW-4			*0.066*				
Nov 2009	MW-4		*0.013*	*0.014*	0.861	*3.72*	1700	776
Dec 2011	MW-4			*0.009*		*2.93*	1810	741

NOTES:

Only results exceeding investigation levels (ILs) are presented (if cell blank result was <IL).
Italicised results exceed ecosystem protection criteria.
Underlined results exceed protection of primary contact recreation.
Bold results exceed stock watering guidelines.
1 ANZECC (2000), 95% level of protection (slightly to moderately disturbed ecosystems) for freshwater guidelines.
2 NHMRC (2008), Guidelines for Managing Risks in Recreational Water.
3 ANZECC (2000), water quality trigger values (low risk) for heavy inorganics and metalloids in livestock drinking water.
4 Health Guideline.
5 Aesthetic Guideline.
6 ANZECC issued an erratum in June 2005 stating that for nitrate: *"Delete all trigger values and replace with "Under Review"*. The investigation level has been retained for general guidance only.
7 For consistency of comparison between Tables 25 and 26, NHMRC guideline of 50 mg/L has been converted to Nitrate-N by applying conversion factor of 4.43.

- Nickel concentrations in soil were below the EIL, and results were consistent with concentrations detected across the Overall Audit Area. On this basis and in the absence of a specific site source for nickel, the nickel concentration of 0.013 mg/L detected in Area 4C well was considered to be naturally occurring. In addition, this nickel concentration only marginally exceeded the ANZECC maintenance of ecosystem criterion of 0.011 mg/L, and was the only nickel exceedance detected during the five monitoring events.
- The site history review did not identify any potential point or diffuse sources of these inorganics;
- The nature of natural soils, where the abovementioned inorganics concentrations were detected exceeding EILs was expected to reduce the mobility of most inorganics (e.g. low permeability silty clay which is expected to be of high cation exchange capacity (CEC), generally neutral to alkaline soil pH) and hence minimise migration from shallow soils to groundwater;
- The depth to groundwater and the above mentioned low permeability soils were expected to reduce entrainment of inorganics; and
- Concentrations in groundwater were consistent with those detected across the Overall Audit Area (refer Section 6.3).

6.4.2 Primary contact recreation

Manganese

The concentration of manganese (0.002 mg/L) in groundwater from MW-4 in 2011 was below all investigation levels and several orders of magnitude lower than the 2009 concentration (0.861 mg/L). OTEK was not able to attribute the cause of the elevated concentration of manganese in the 2009 event. It was noted that similarly elevated manganese concentrations were also observed in other wells sampled across the Overall Audit Area during the same event. Therefore, OTEK considered the elevated manganese concentrations during the 2009 round (including in MW-4) to be anomalous, and unlikely to represent site conditions.

The auditor agreed that the 2009 manganese concentration in MW-4 was inconsistent with the findings across the Overall Audit Area for all other monitoring events and agreed that the manganese concentrations reported in the 2009 event were anomalous. It was noted that the rinsate blank samples collected during the 2009 GME reported all concentrations below the LOR (including manganese), indicating that it was unlikely that cross contamination occurred during sampling, particularly given the low concentrations of manganese in soil and other groundwater samples, and also given the absence of a potentially contaminating source.

Irrespective of the source of manganese, when accounting for the limited likely ingestion associated with primary contact recreation, the guidelines suggest the criteria be modified by a factor of 20 (NHMRC 2008). On this basis the concentration of manganese at MW-4 is below the modified investigation level. Additionally, the concentration detected in the subsequent monitoring event was well below all investigation levels and was consistent with concentrations across the Overall Audit Area. It is therefore not discussed as an exceedance henceforth.

Chloride and Sodium

In addition to the abovementioned inorganics, OTEK noted that concentrations of chloride and sodium were identified above the criteria for recreational use in MW-4. These analytes were not considered CoPC, rather were assessed to provide an indication of groundwater hydrogeochemistry. Additionally, all results were below the modified criteria (i.e. to account for limited ingestion of recreational waters). Accordingly the concentrations observed were not

considered to have exceeded the investigation levels, were not likely to impact on the beneficial uses of groundwater, and have not been discussed henceforth.

6.4.3 Aesthetic impacts

There was no sheen or odour observed in groundwater monitoring well MW-4 or other wells in the Overall Audit Area during any of the monitoring events.

6.4.4 Off-site migration of groundwater contamination

Groundwater was not considered to be polluted and therefore offsite migration of groundwater was not considered an issue of concern.

6.5 Summary of groundwater conditions and impact on beneficial uses

As discussed above, the results of the groundwater assessment program indicated groundwater at the site was not polluted. Elevated concentrations of copper, nickel and zinc were naturally occurring and therefore potential or existing beneficial uses were not adversely impacted by a site source. Concentrations of nitrate were considered to be representative of regional conditions (likely occurring from widespread anthropogenic sources such as agricultural use). Concentrations of sodium, magnesium and chloride were below criteria for primary contact recreation when accounting for the modified ingestion criteria as discussed in Section 6.4.2. The relevance of protected beneficial uses at the site and the potential for an adverse impact on the groundwater conditions on the relevant beneficial uses is summarised in Table 27.

Table 27 Likelihood of beneficial uses being realised

Protected Segment C Beneficial Uses	Existing Use?	Likelihood / Relevance of Beneficial Use	Analytes	Comments
Maintenance of ecosystems	Yes	The groundwater is likely to discharge to the Werribee River and/or Port Phillip Bay, located approximately 800 m to the east and 7 km to the south east of the site.	Copper, nickel, zinc, and nitrate	Maintenance of ecosystem was not precluded, given that concentrations of copper, nickel, zinc, and nitrate were considered either regional or naturally occurring in the region as discussed in this report.
Stock watering	Unlikely	It is possible, given the current rural setting that stock watering may be realised on neighbouring properties in the future. However, the proposed urban development, lot size and access to a reticulated water system make this unlikely.	None	Beneficial use not precluded
Primary contact recreation	Unlikely	Not relevant on site, however, groundwater wells may be used to fill or top up swimming pools in the vicinity of the site. However, this was considered unlikely given access to a reticulated water system is available.	Manganese, sodium, and chloride	Beneficial use was not precluded, given that the concentrations of manganese, sodium and chloride were below the modified criteria, and the manganese exceedance was considered anomalous as discussed in this report.

Protected Segment C Beneficial Uses	Existing Use?	Likelihood / Relevance of Beneficial Use	Analytes	Comments
Industrial use	No	Criteria are usually industry specific, however, given neutral pH and low TDS groundwater could support a number of industries.	NA	Use of groundwater for this beneficial use was considered unlikely given proposed development.
Buildings and structures	No	When assessing the groundwater with respect to this beneficial use the groundwater results were compared with the requirements set in Australian Standard AS2159:1995 (Piling – Design and Installation). The pH results indicated that the groundwater was not aggressive. It was considered that buildings and structures would not come into contact with the groundwater.	NA	Beneficial use not precluded given that pH conditions do not indicate potentially corrosive conditions to buildings and structures. It was also not considered that such beneficial use was likely as the depth of any foundation is unlikely to come into contact with groundwater.

6.5.1 Conclusion on groundwater quality, existing and likely future uses

The relevant beneficial uses of maintenance of ecosystems, stock watering, industrial water use, primary contact recreation (e.g. bathing, swimming), and buildings and structures were not precluded by the concentrations of any contaminant tested that were attributed to the site (i.e. not naturally occurring). Therefore, groundwater at the site was not considered to have adversely impacted on-site or off-site current or future uses.

6.5.2 Auditors opinion on the groundwater conditions and impact to beneficial uses

Based on all the information available and the multiple lines of evidence provided above, the auditor was of the opinion that current and historical uses of the site have not impacted any beneficial uses of groundwater to any extent of concern. This was further supported by the absence of elevated concentrations in soil of contaminants associated with former site uses and activities, and observations made during field works (e.g. no visible staining or odours).

Concentrations of copper, nickel, zinc and nitrate were reported above the adopted investigation levels for maintenance of ecosystems. However, the concentrations of these inorganics were considered naturally occurring (refer to discussions through Section 6.4 above).

7. Audit conclusions

Following completion of this environmental audit for Area 4C of Riverwalk Estate, Princes Highway, Werribee, Victoria and based on all the data available to the auditor at the time of the completion of the ESA and other remediation and validation works, as detailed and discussed in this report, the following conclusions are provided:

- The overall QA/QC activities undertaken by the assessor indicated that the analytical results of the soils and groundwater were representative of site conditions and could be relied on to reach the opinions stated in this audit report at the time of assessments (please refer to Section 4 for details). It was noted the auditor has to provide comments to OTEK in order to obtain a report of suitable quality, and that OTEK made a few errors during the assessment works. These were discussed throughout this audit report, and consequently were not considered to impact the overall conclusions.
- The density and distribution of sampling exceeded and were in general accordance with AS 4482.1 requirements and identified former potential sources and activities, which were appropriately targeted. The sampling program was considered acceptable (please refer to Section 5.1 for details).
- Several concentrations of barium, copper, manganese, vanadium and zinc were observed in soils across the site. These concentrations were considered to be naturally occurring, and were not considered to impact the future use of the site (refer to Sections 5.2 and 5.6 for details.
- A single concentration of benzo(a)pyrene marginally above the HIL A remained on site on an area of surface soil in the northern portion of the site. This minor concentration of benzo(a)pyrene was considered to be isolated in extent and unlikely to pose a risk to human health (refer to Section 5.6.2 for details).
- Groundwater was not considered polluted at the site. The elevated concentrations of copper, nickel, zinc, and nitrate detected were considered to be naturally occurring and, hence the auditor was of the opinion that current and historical uses of the site have not impacted any beneficial uses of groundwater to any extent of concern (please refer to Section 6.5 for details).
- At the time of completion of this audit, the site surface was covered with grass. The auditor confirmed the site appearance during his final site inspection on 4 February 2014, and concluded there were no issues precluding the aesthetics beneficial use.
- The conditions of soil and groundwater were not considered to adversely impact off-site uses.

The auditor is therefore of the opinion that the site is suitable for Parks and Reserves; Agricultural; Sensitive use (high density, medium density and single dwelling/low density residential use, child care centre, pre-school or primary school); Recreation/Open space; Commercial; and Industrial. In accordance with the Environment Protection Act 1970 and the appropriate policies and guidelines issued by the EPA, a Statement of Environmental Audit has been issued as part of this report.

These conclusions must be read in conjunction with the full audit report, *"Melbourne Water, Audit Report for Area 4C of Riverwalk Estate, Princes Highway, Werribee, February 2014"*

DATED: 21 February 2014

SIGNED:

Dr FOUAD ABO
ENVIRONMENTAL AUDITOR
(Appointed pursuant to the Environment Protection Act 1970)

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Figures

REGIONAL MAP
NOT TO SCALE

LOCALITY MAP
METRES
0 150 200 300 400 500 1000
APPROXIMATE SCALE ONLY

VICINITY MAP
METRES
0 50 100 150 300m
APPROXIMATE SCALE ONLY

This figure was originally prepared by OTEK for "Environmental Site Assessment, Riverwalk Sub-Area 4C, New Farm Road, Werribee, Victoria" (4C ESA Report). The image represented here is an extract from the 4C ESA Report and therefore the accuracy of the data displayed cannot be guaranteed by GHD.
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Note: Image was extracted from OTEK ESA Report (above) and is not represented to scale.

Client: Melbourne Water
Project: Environmental Audit of Area 4C, Riverwalk Estate, Princes Highway, Werribee
Source: Environmental Site Assessment, Riverwalk Sub-Area 4C, New Farm Road, Werribee, Victoria (OTEK, 2013)
scale: Not to Scale | date: 2 September 2013

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Report No. 215722
Rev No. B

Figure 1
Regional & Vicinity Maps

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Figure 2
Riverwalk Estate - Overall Audit Area

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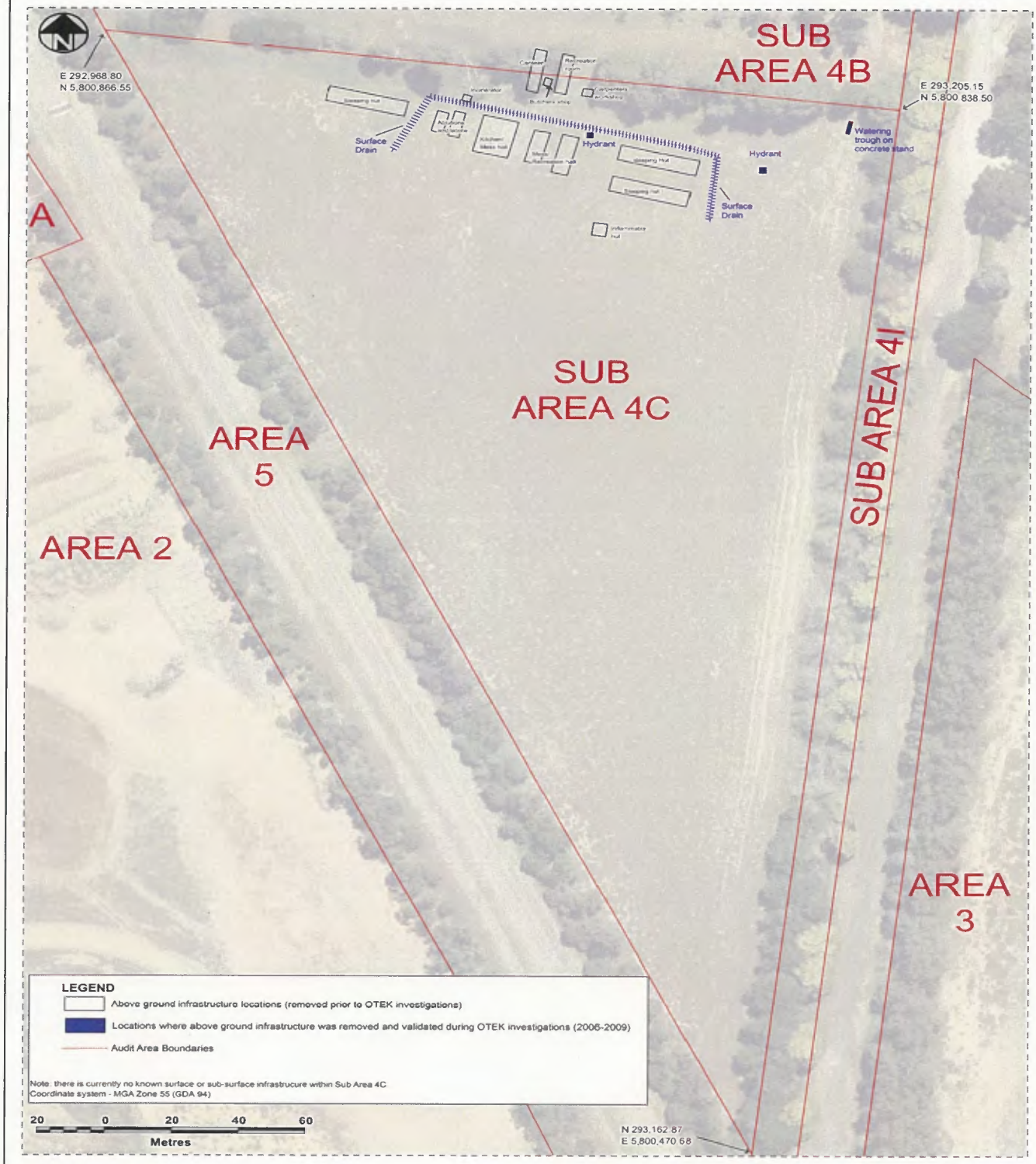

This figure was originally prepared by OTEK for "Environmental Site Assessment, Riverwalk Sub-Area 4C, New Farm Road, Werribee, Victoria" (4C ESA Report). The image represented above is an extract from the 4C ESA Report and therefore the accuracy of the data displayed cannot be guaranteed by GHD.
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Note: Image was extracted from OTEK ESA Report (above) and is not represented to scale.

Client: Melbourne Water
Project: Environmental Audit of Area 4C, Riverwalk Estate, Princes Highway, Werribee
Source: Environmental Site Assessment, Riverwalk Sub-Area 4C, New Farm Road, Werribee, Victoria (OTEK, 2013)

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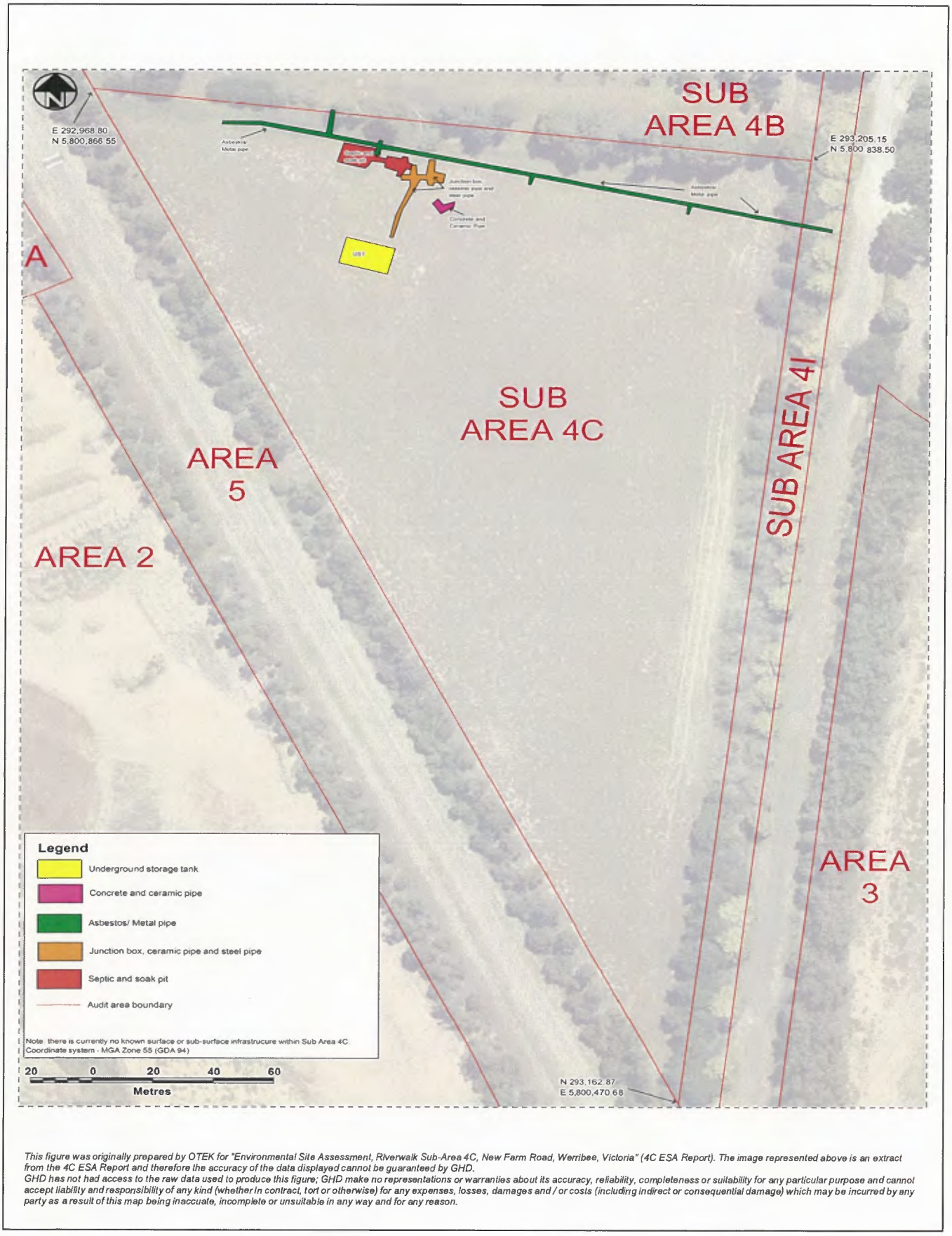
Report No. 215722
Rev No. B

Figure 3
Defined Audit Boundary and Historical Aboveground Infrastructure

scale: Not to Scale | date: 2 September 2013

Level 8, 180 Lonsdale Street, Melbourne VIC 3000 T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com.au



This figure was originally prepared by OTEK for "Environmental Site Assessment, Riverwalk Sub-Area 4C, New Farm Road, Werribee, Victoria" (4C ESA Report). The image represented above is an extract from the 4C ESA Report and therefore the accuracy of the data displayed cannot be guaranteed by GHD.
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Note: Image was extracted from OTEK ESA Report (above) and is not represented to scale.

Client: Melbourne Water
Project: Environmental Audit of Area 4C, Riverwalk Estate, Princes Highway, Werribee
Source: Environmental Site Assessment, Riverwalk Sub-Area 4C, New Farm Road, Werribee, Victoria (OTEK, 2013)

Job No. 31 / 1157500
Report No. 215722
Rev No. B

Figure 4
Historical Belowground Infrastructure

scale: Not to Scale | date: 2 September 2013

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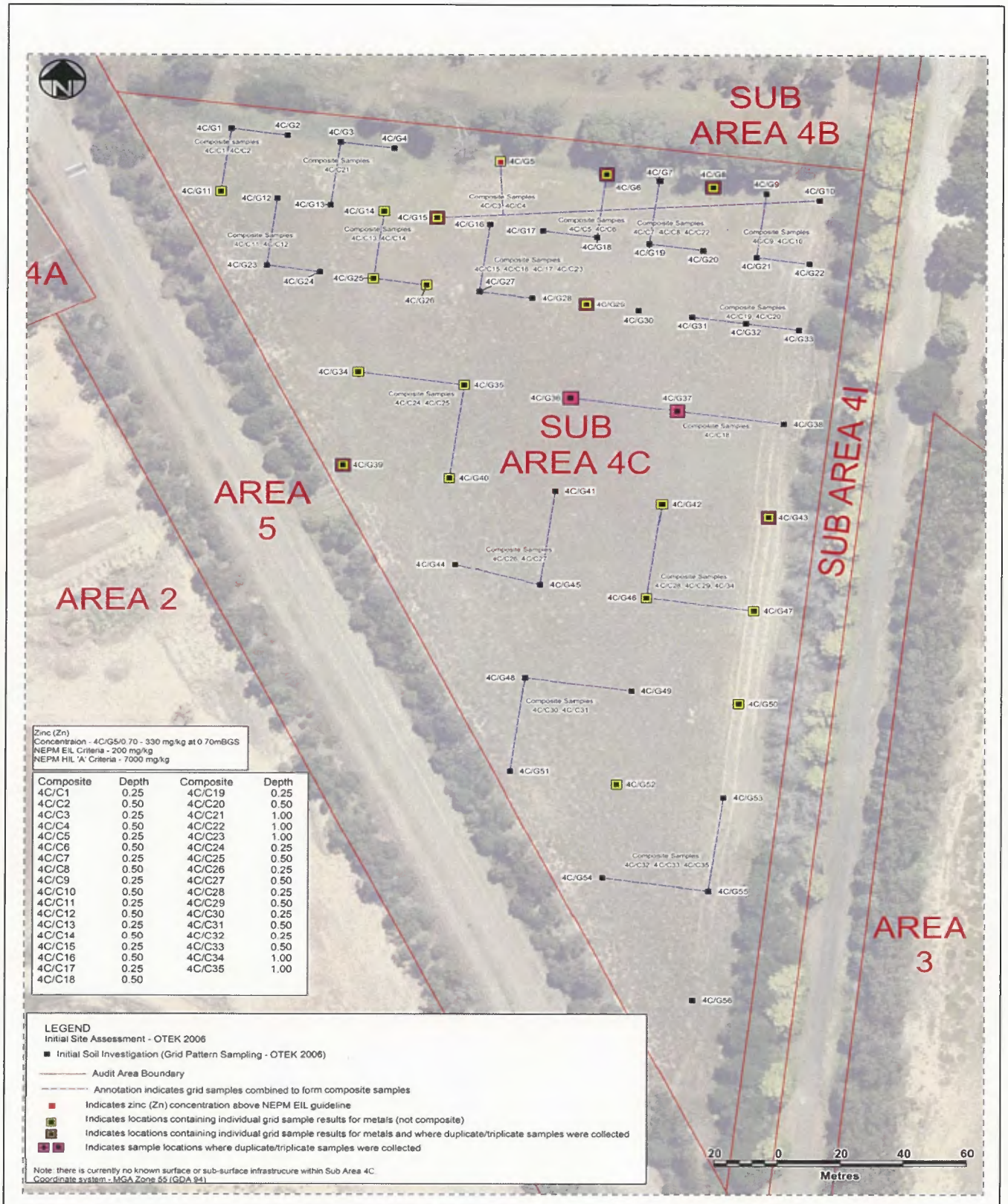

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4C/C2	0.50	4C/C20	0.50
4C/C3	0.25	4C/C21	1.00
4C/C4	0.50	4C/C22	1.00
4C/C5	0.25	4C/C23	1.00
4C/C6	0.50	4C/C24	0.25
4C/C7	0.25	4C/C25	0.50
4C/C8	0.50	4C/C26	0.25
4C/C9	0.25	4C/C27	0.50
4C/C10	0.50	4C/C28	0.25
4C/C11	0.25	4C/C29	0.50
4C/C12	0.50	4C/C30	0.25
4C/C13	0.25	4C/C31	0.50
4C/C14	0.50	4C/C32	0.25
4C/C15	0.25	4C/C33	0.50
4C/C16	0.50	4C/C34	1.00
4C/C17	0.25	4C/C35	1.00
4C/C18	0.50		

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Job No. 31 / 1157500
Report No. 215722
Rev No. B

Figure 5
Area 4C Grid Soil Sampling Sampling Locations

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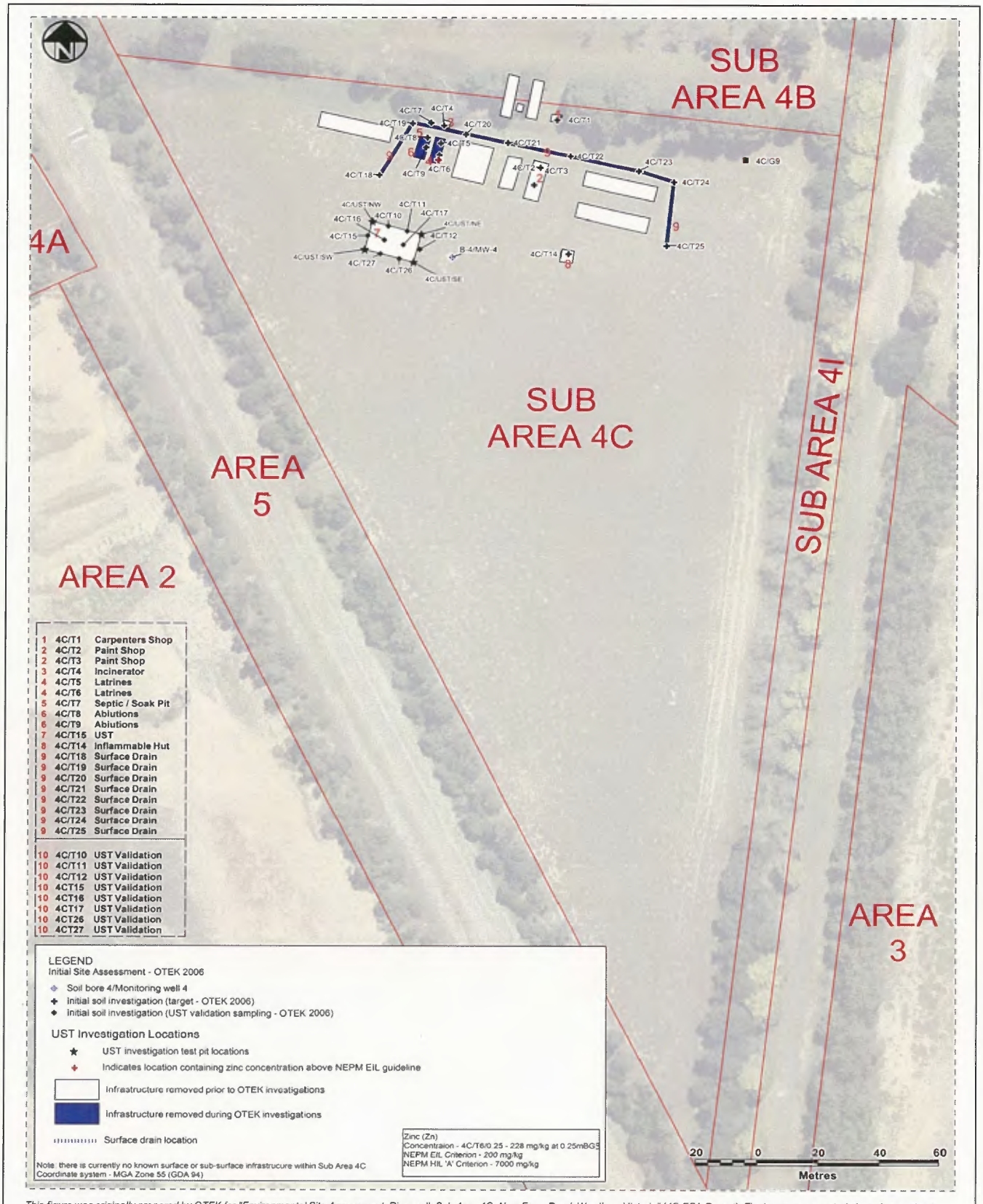

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Report No. 215722
Rev No. B

Figure 6
Area 4C Target and UST Soil Sampling Locations

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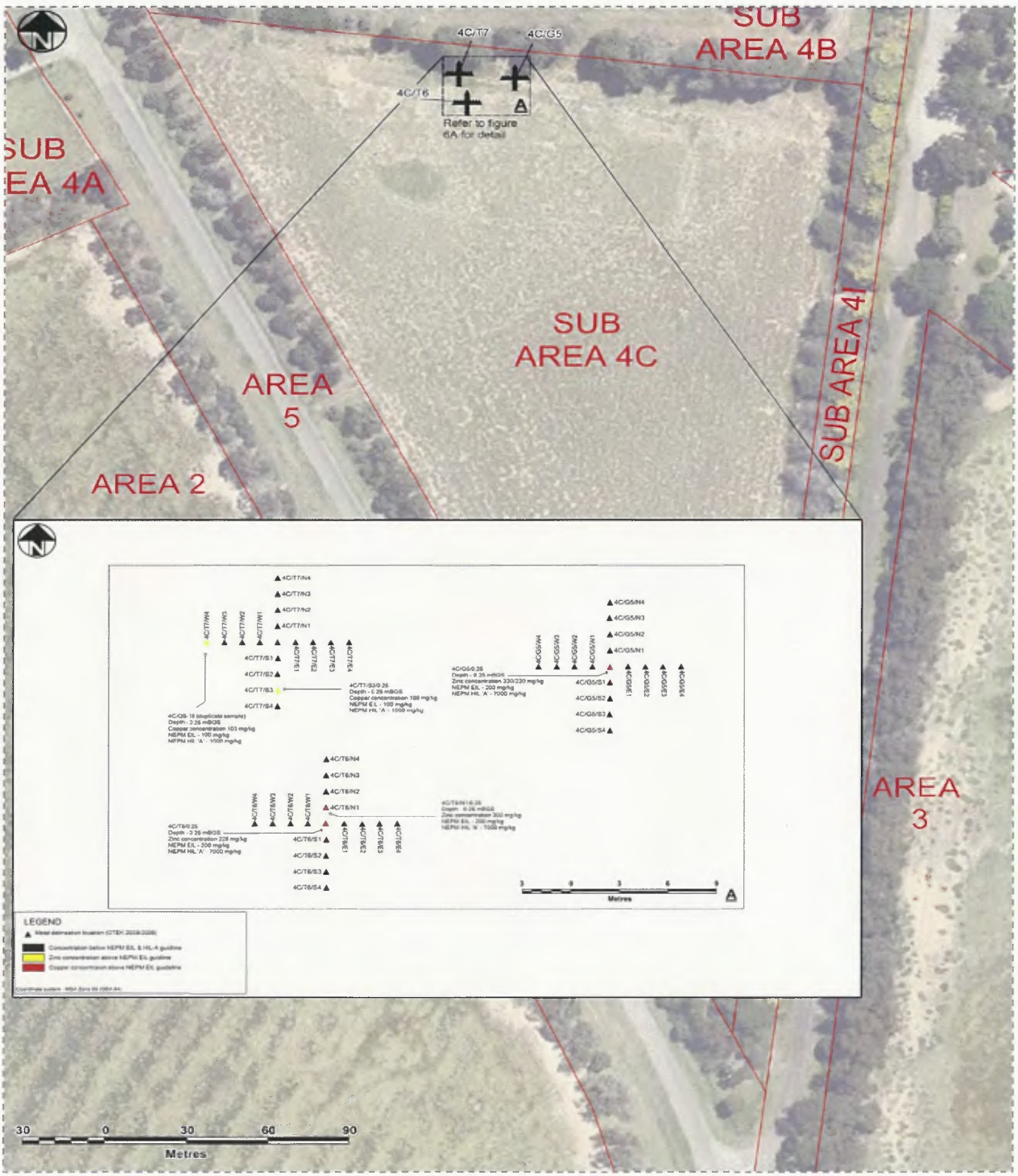

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Report No. 215722
Rev No. B

Figure 7
Delineation Soil Sampling Locations

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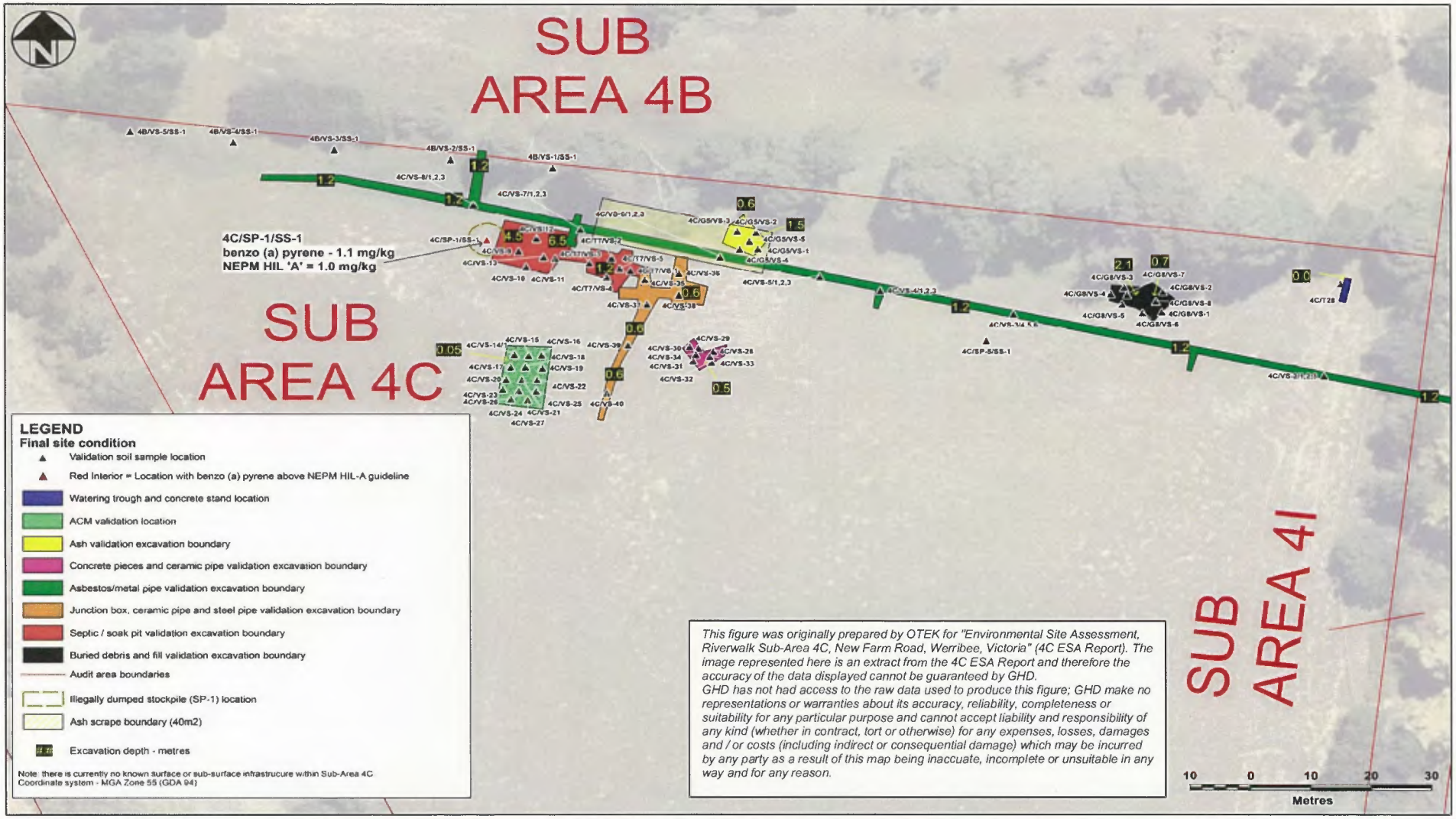

Note: Image was extracted from OTEK ESA Report (above) and is not represented to scale.

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Figure 8
Infrastructure Removal Activities and Validation Sampling Locations

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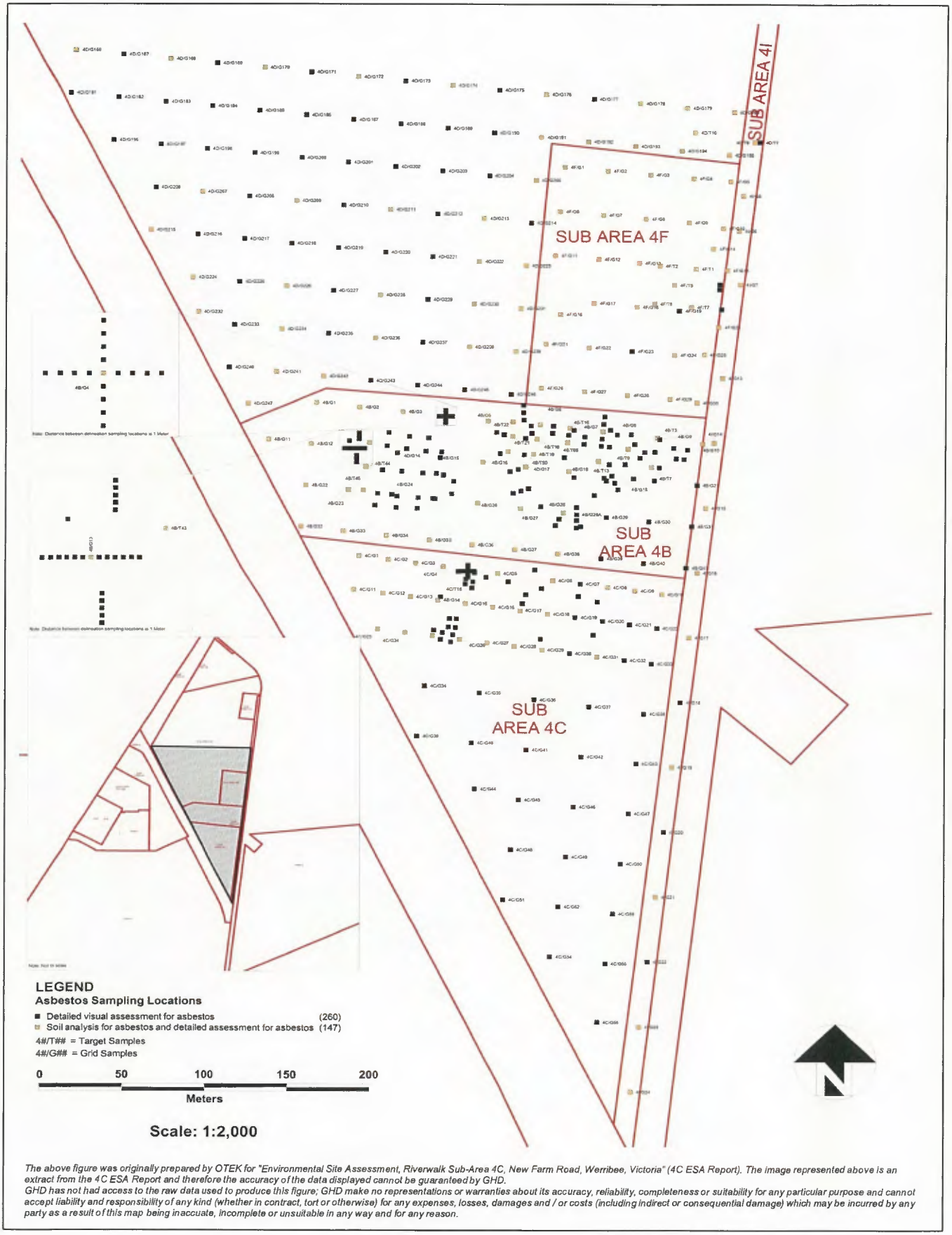

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Figure 9
Asbestos Investigations Locations

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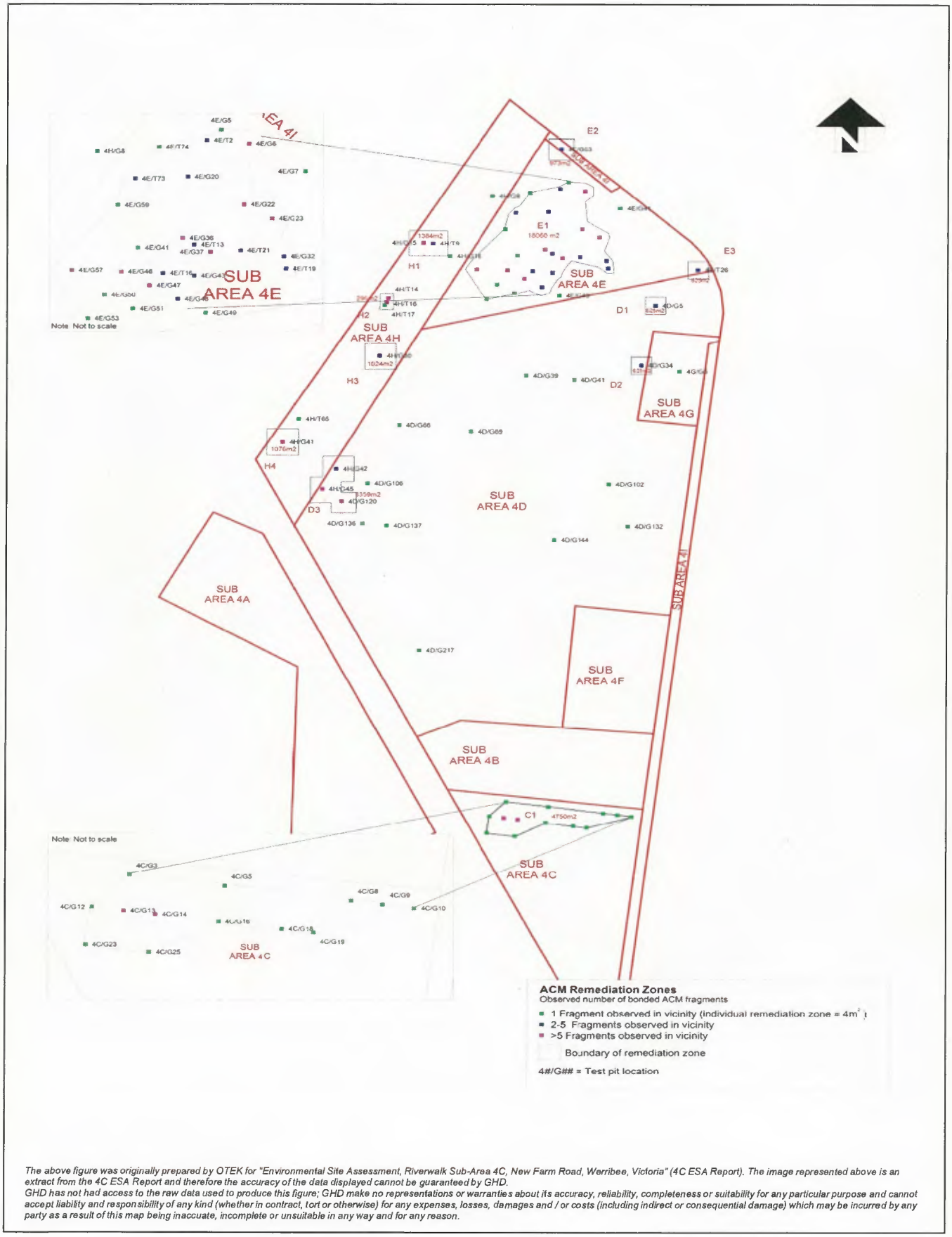

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Job No. 31 / 1157500
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Rev No. B

Figure 10
Asbestos Surface Locations and Remediation Zones

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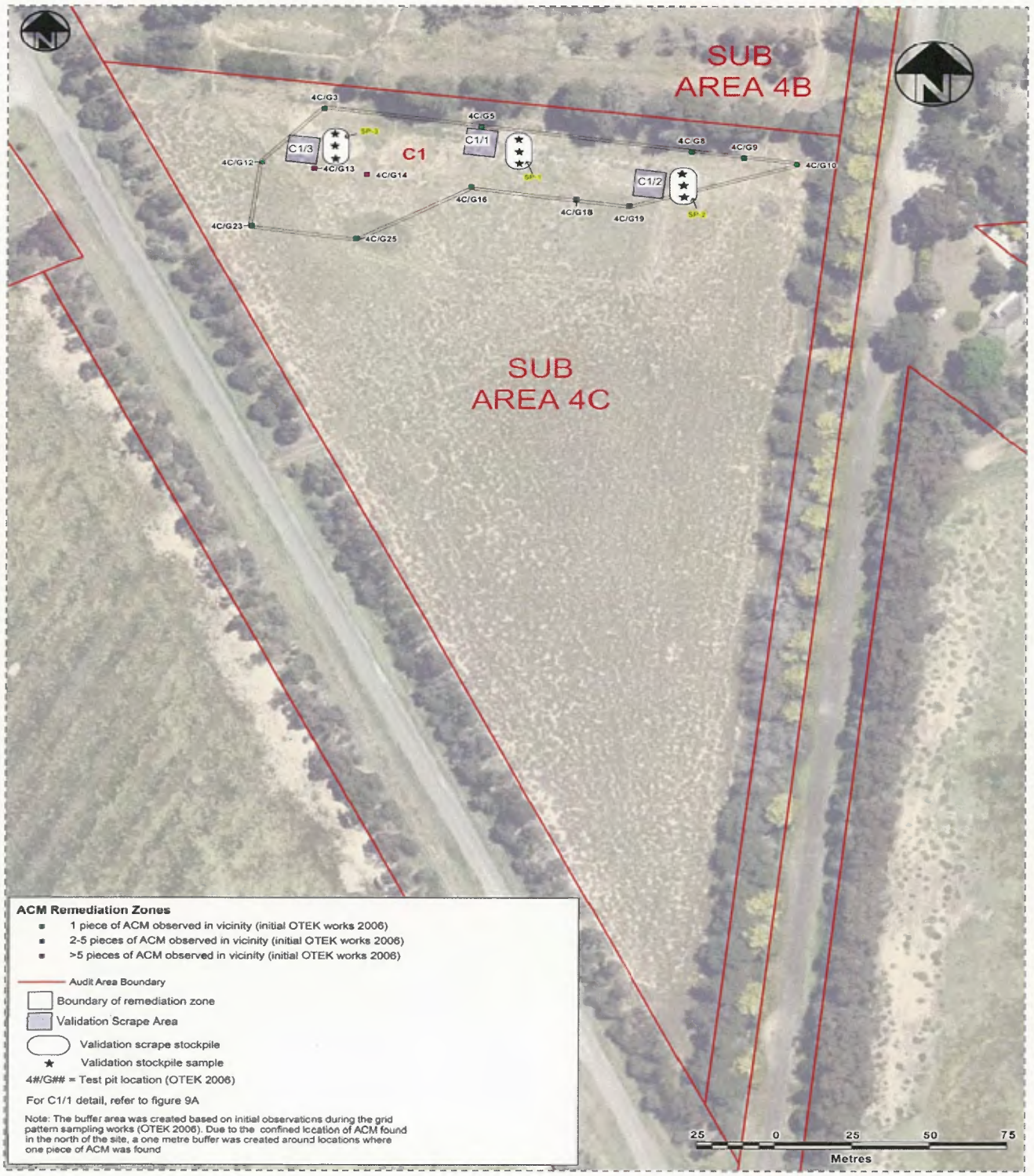

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Report No. 215722
Rev No. B

Figure 11
Asbestos Removal: Hand Pick and Validation Sample Locations

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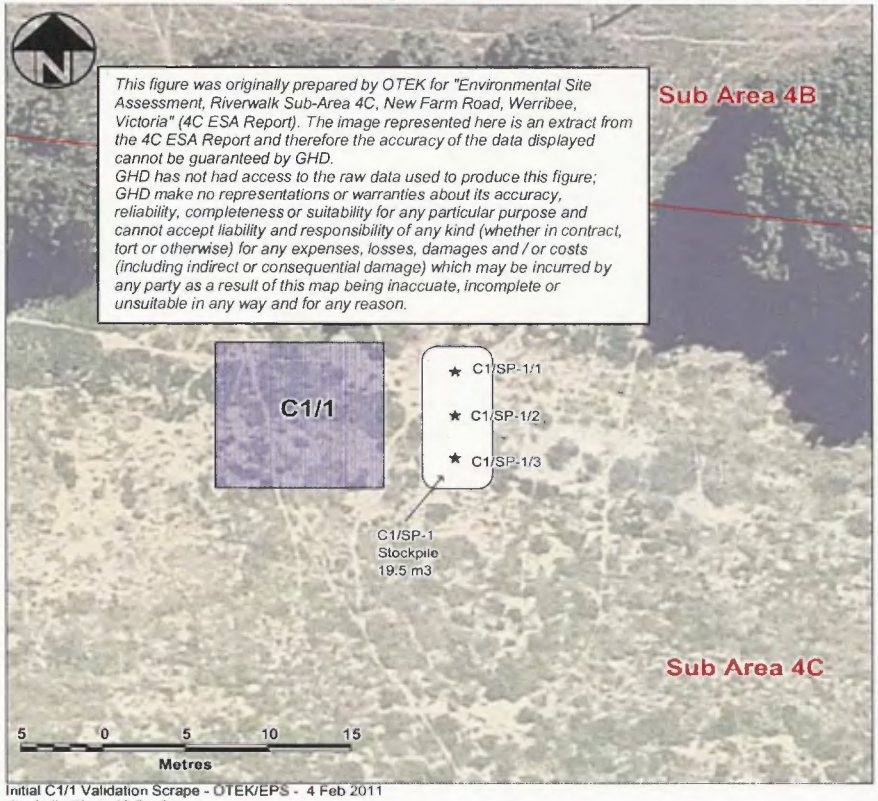
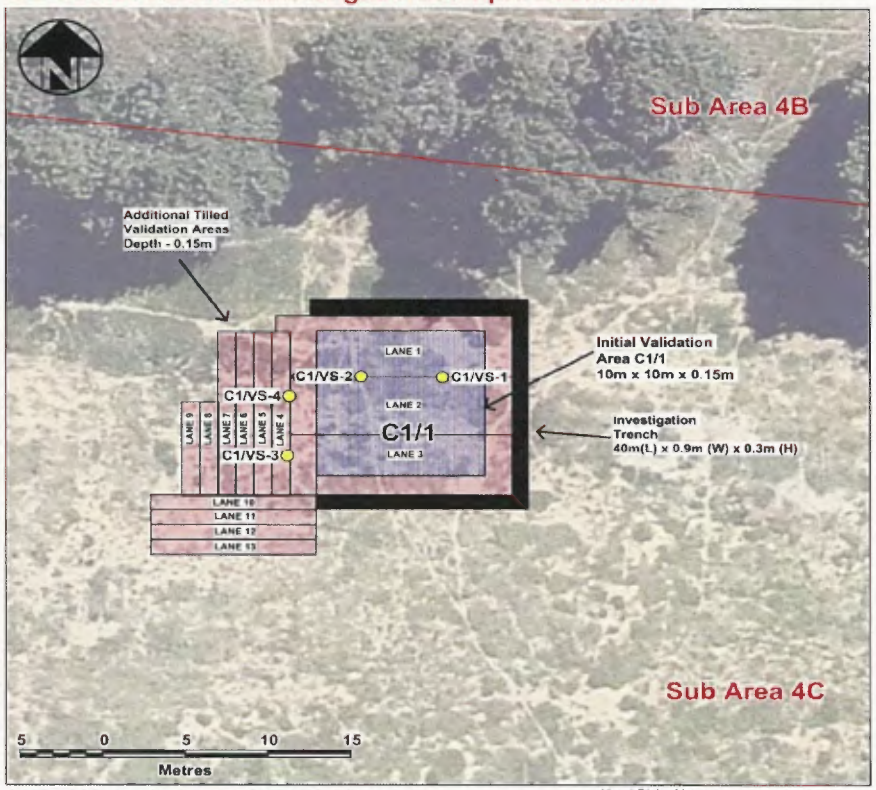
A - Initial ACM Validation Scrape Location



Initial C1/1 Validation Scrape - OTEK/EPS - 4 Feb 2011
Stockpile Size - 19.5 m3
ACM hand picked from stockpile - 1.2kg
ACM detected in stockpile sample C1/SP-1/3 - (small fibre bundle)

LEGEND
- Initial Validation Area (OTEK/EPS FEB 2011)
- Sub Area Audit Boundary
- Stockpile Location
- ★ Stockpile Sample

B - Additional ACM Investigation/Sample Locations



Additional ACM investigation areas OTEK/EPS - 8/9 Feb 2011
Additional ACM hand picked - 0.717 kg
No ACM detected in validation samples C1/VS1 - 4
Each lane - 3 passes. No fragments observed on final pass

LEGEND
- Validation Sample Locations (OTEK FEB 2011)
- Initial Validation Area (OTEK/EPS FEB 2011)
- Investigation Trench (OTEK/EPS FEB 2011)
- Additional Investigation Area (120m2 x 0.15m)
- Sub Area Audit Boundary

Hand Picked Lanes

Lane 1 - 90g ACM hand picked
Lane 2 - 170g hand picked
Lane 3 - 73g hand picked
Lane 4 - (southern portion) 100g hand picked
Lane 5 - (southern portion) 123g hand picked
Lane 6 - (southern portion 111g hand picked
Lane 7 - No ACM found
Lane 8 - No ACM found
Lane 9 - No ACM found
Lane 10 - (east portion) - 50g hand picked
Lane 11 - No ACM found
Lane 12 - No ACM found
Lane 13 - No ACM found

Note: Image was extracted from OTEK ESA Raport (above) and is not represented to scale.

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Figure 12
Asbestos Removal: Additional Handpick and Validation Sample

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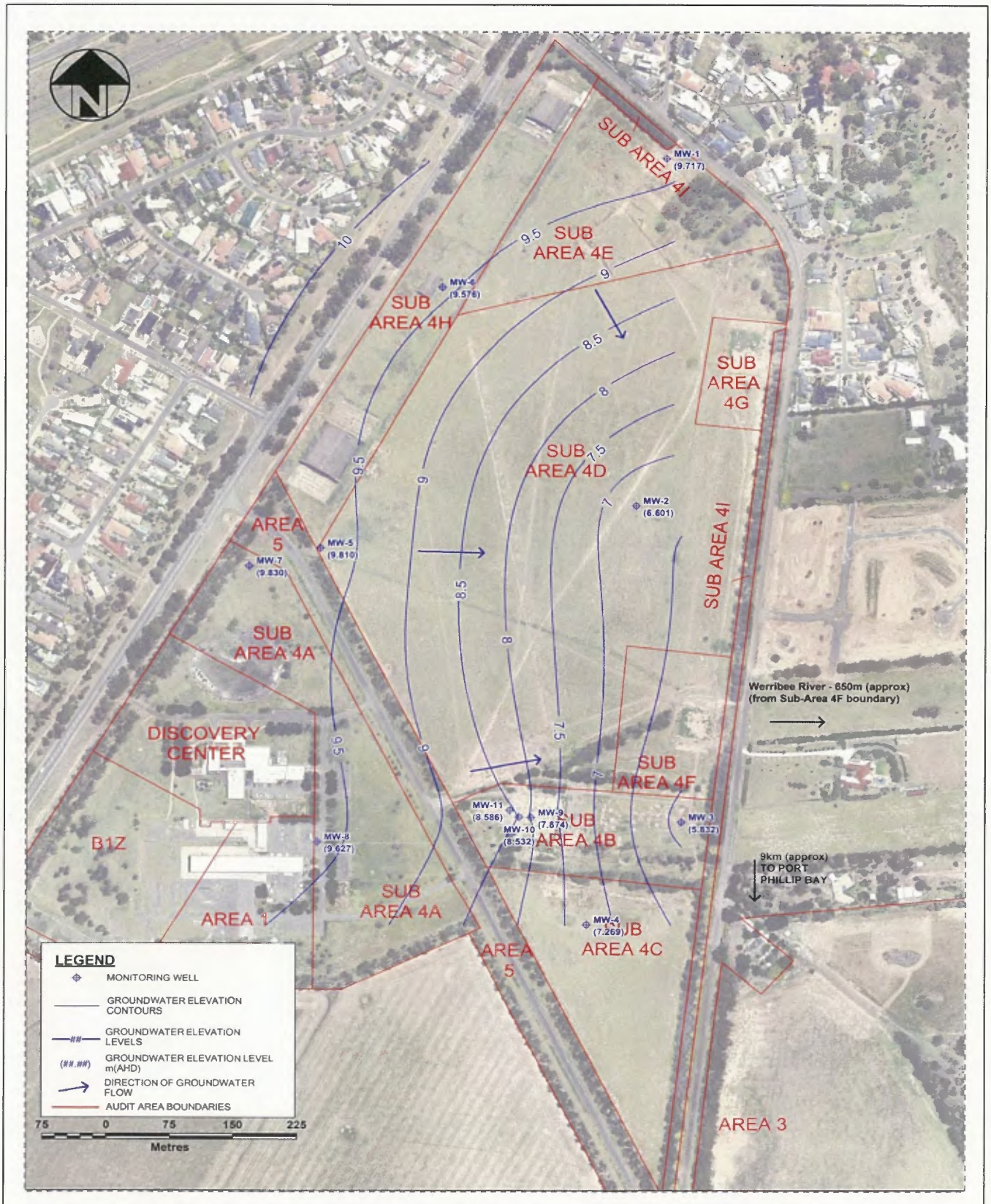

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Figure 13
Area 4 Groundwater Contour Map

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Appendices

Appendix A – Certificate of Title

Appendix B – Development Plans and Planning Scheme

Appendix C - Historical Reports

Appendix D – Phase One Report, Werribee Fields, Werribee, Victoria (OTEK, 2002)

Appendix E - Environmental Site Assessment, Riverwalk Sub-Area 4C, New Farm Road, Werribee, Victoria (OTEK, 2013)

Appendix F - Groundwater Database Search

Appendix G – Auditor's QA/QC Review

Appendix H – - Imported Fill Reports

GHD

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Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	F Abo / K Fairway	F Abo		F Abo		21/02/14