Melbourne Water Corporation

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

Environmental Audit

CARMS Reference 41460-4

May 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 (refrred to in this audit report as Area 4B) located at Riverwalk Estate, Princes Freeway, Werribee, Victoria, 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. The former gravel track/road, which extends from Area 4F and crosses Area 4B from north to south along area 4I boundary (see Figure 3) 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.
2. Any fill or soil brought to the site must be chemically tested soil or fill that classifies as "fill material" in accordance with relevant EPA guidelines.
3. The hard rubbish pile located on the western side of the site (see Figure 3) 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:

- Any unsuitable material located on site (i.e. as stated in conditions 1 and 3 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 relevant EPA guidelines.
- A storm water pipe remained in situ at the site as shown on Figure 3.
- The four groundwater monitoring wells (MW-3, MW-9, MW10 and MW-11) as listed in the attached Figure 4) 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 National Uniform Drillers Licensing Committee.
- Asbestos containing materials (ACM) were found on the site, particularly in the vicinity of the former Hangar 5 (refer Figure 3), and have been removed as far as practicable. Small quantities of bonded ACM fragments may remain on or within the soil and may be uncovered during excavation works. These ACM fragments were not anticipated to represent a health risk to occupiers of the completed development as discussed in the audit report. If encountered during future development or use of the site, any fragments should be handled and disposed of in accordance with the relevant regulations.

This Statement forms part of the Environmental Audit report: *"Melbourne Water Corporation, Area 4B of Riverwalk Estate, Princes Highway, Werribee, Victoria, May 2014"* (Ref 31/11575/00/222252 – CARMS Reference 41460-4). Further details regarding the condition of the site may be found in the Environmental Audit Report.

DATED: 15 May 2014

SIGNED: .....

DR FOUAD ABO

ENVIRONMENTAL AUDITOR

(Appointed Pursuant to the Environment Protection Act 1970)

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 N 5 800 580
OF LAND IN PLAN 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

ORIGINAL SHEET SIZE A3

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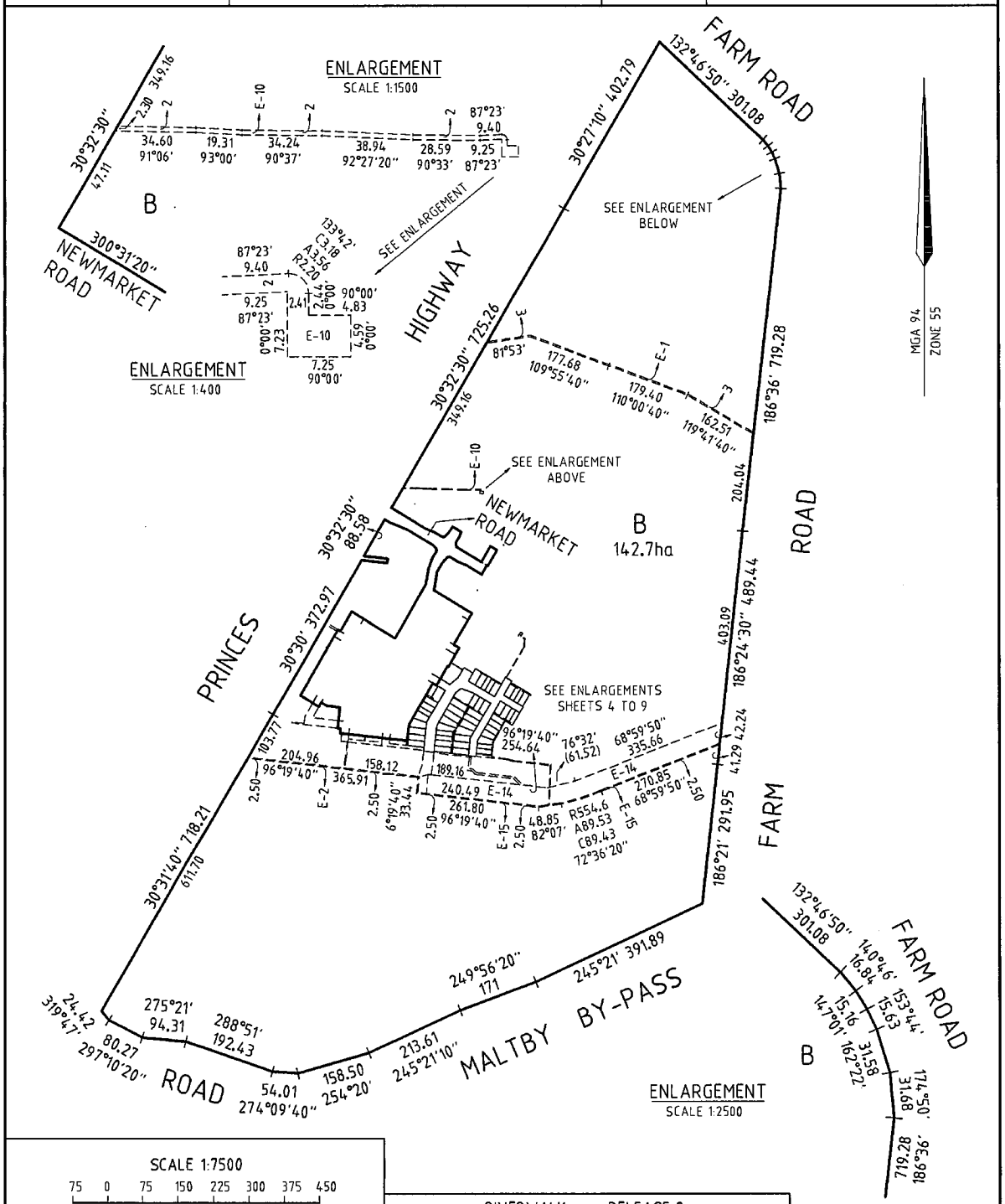
PLAN OF SUBDIVISION

STAGE NO	PLAN NUMBER
—	PS 636839Q



SCALE 1:7500

75 0 75 150 225 300 375 450

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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LICENSED SURVEYOR: P.J.S. TYNKKYNEN

SIGNATURE ..... DATE / /

REF: 3936PS2 VERSION: 23 (4.05.12)

DATE / /

COUNCIL DELEGATE SIGNATURE

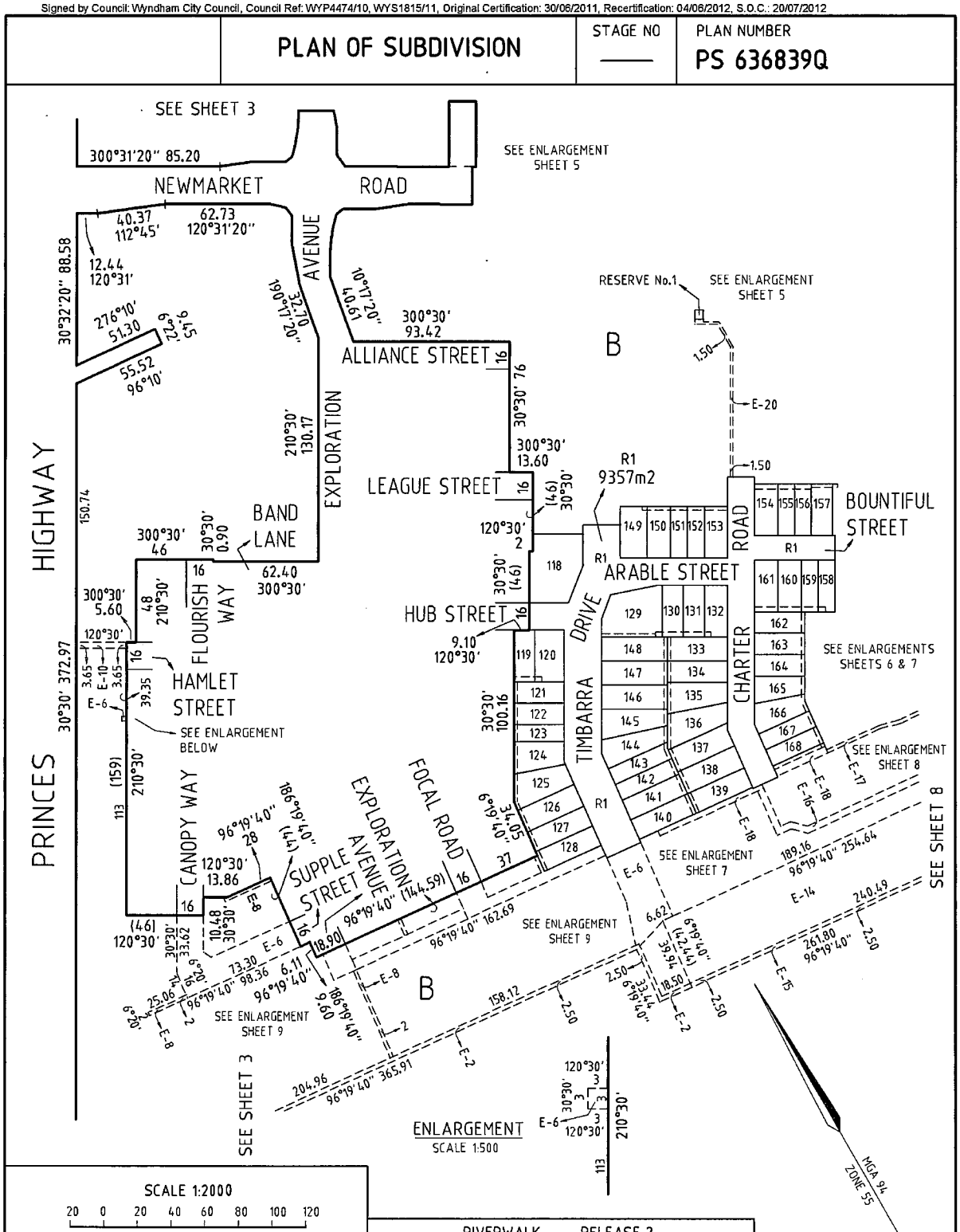
ORIGINAL SHEET SIZE A3

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**



SCALE 1:2000

20 0 20 40 60 80 100 120

LENGTHS ARE IN METRES

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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Mont Albert Vic 3127
Tel: 9890 0933
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LICENSED SURVEYOR: P.J.S. TYNKKYNEN

SIGNATURE ..... DATE / /

REF: 3936PS2 VERSION: 23 (4.05.12)

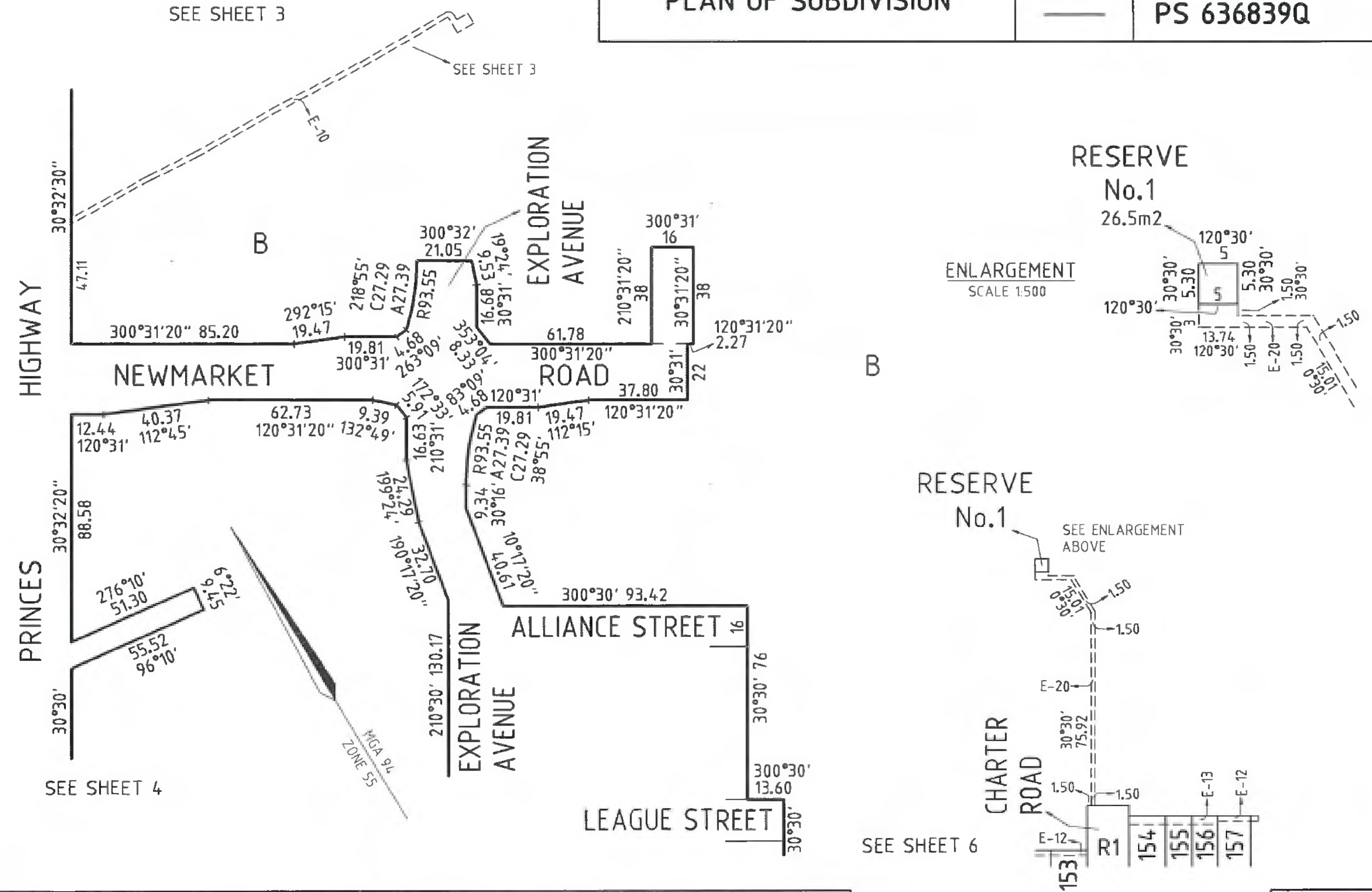
DATE / /

COUNCIL DELEGATE SIGNATURE

ORIGINAL SHEET SIZE A3

Signed by 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**



RIVERWALK RELEASE 2	No of Lots 51 (excluding Lot B) Release 2 Land Area: 3.248ha	SHEET 5

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LAND SURVEYORS
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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)

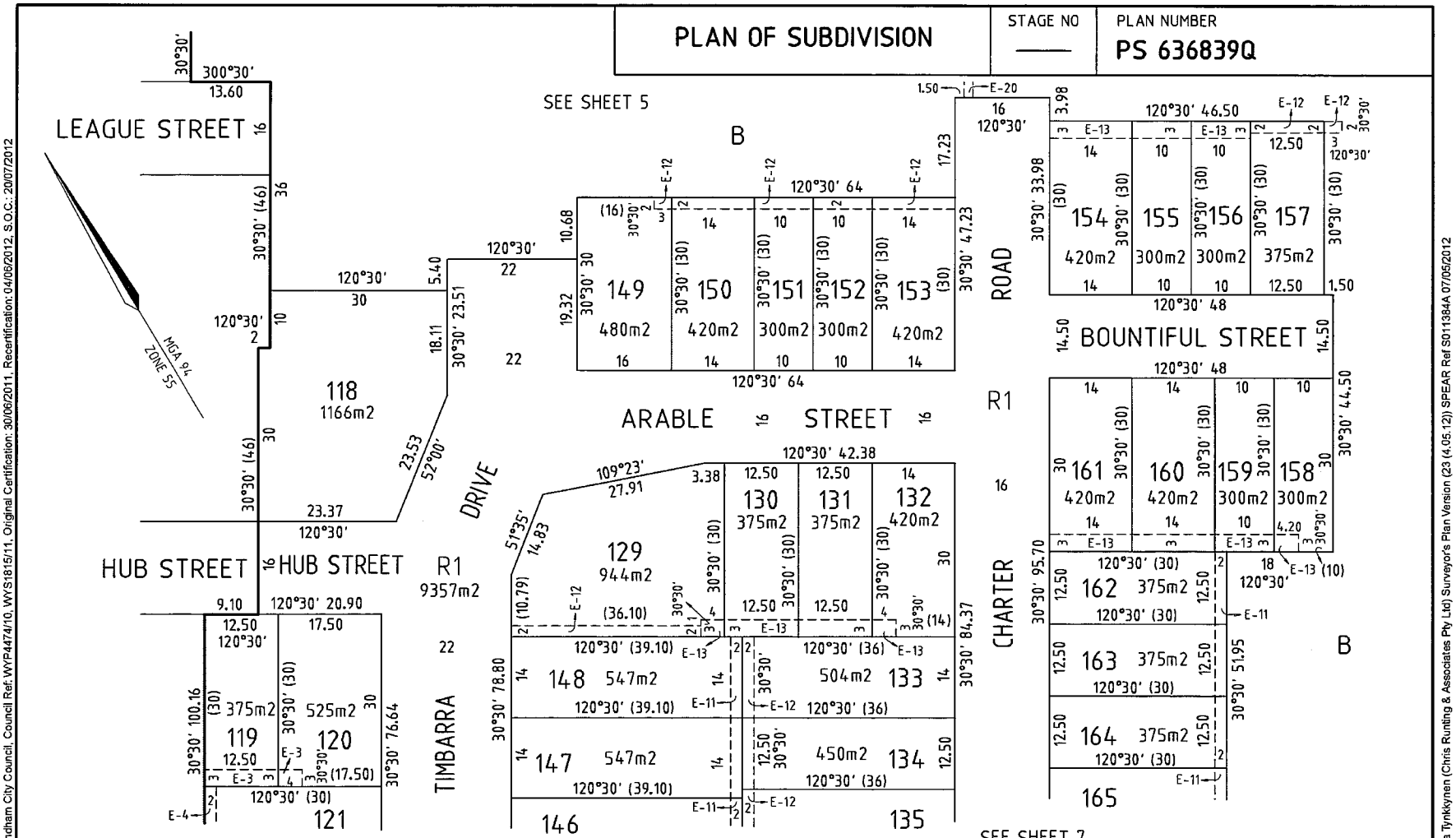
DATE / /
....
COUNCIL DELEGATE SIGNATURE
ORIGINAL SHEET SIZE A3

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 6

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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)

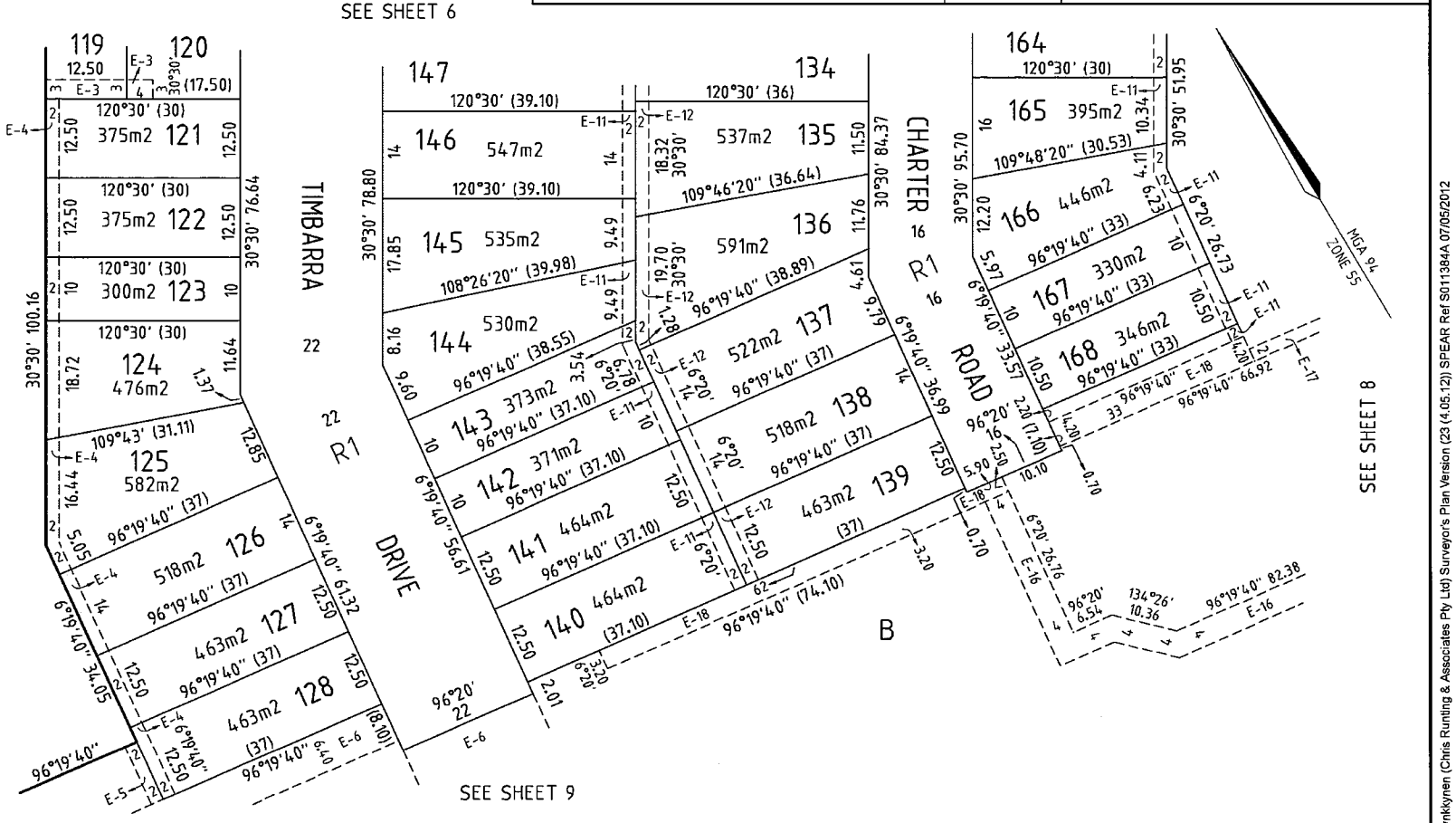
DATE / /

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 7

CHRIS RUNTING & ASSOCIATES PTY LTD
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TOWN PLANNERS
DEVELOPMENT CONSULTANTS
20 Hamilton Street
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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)

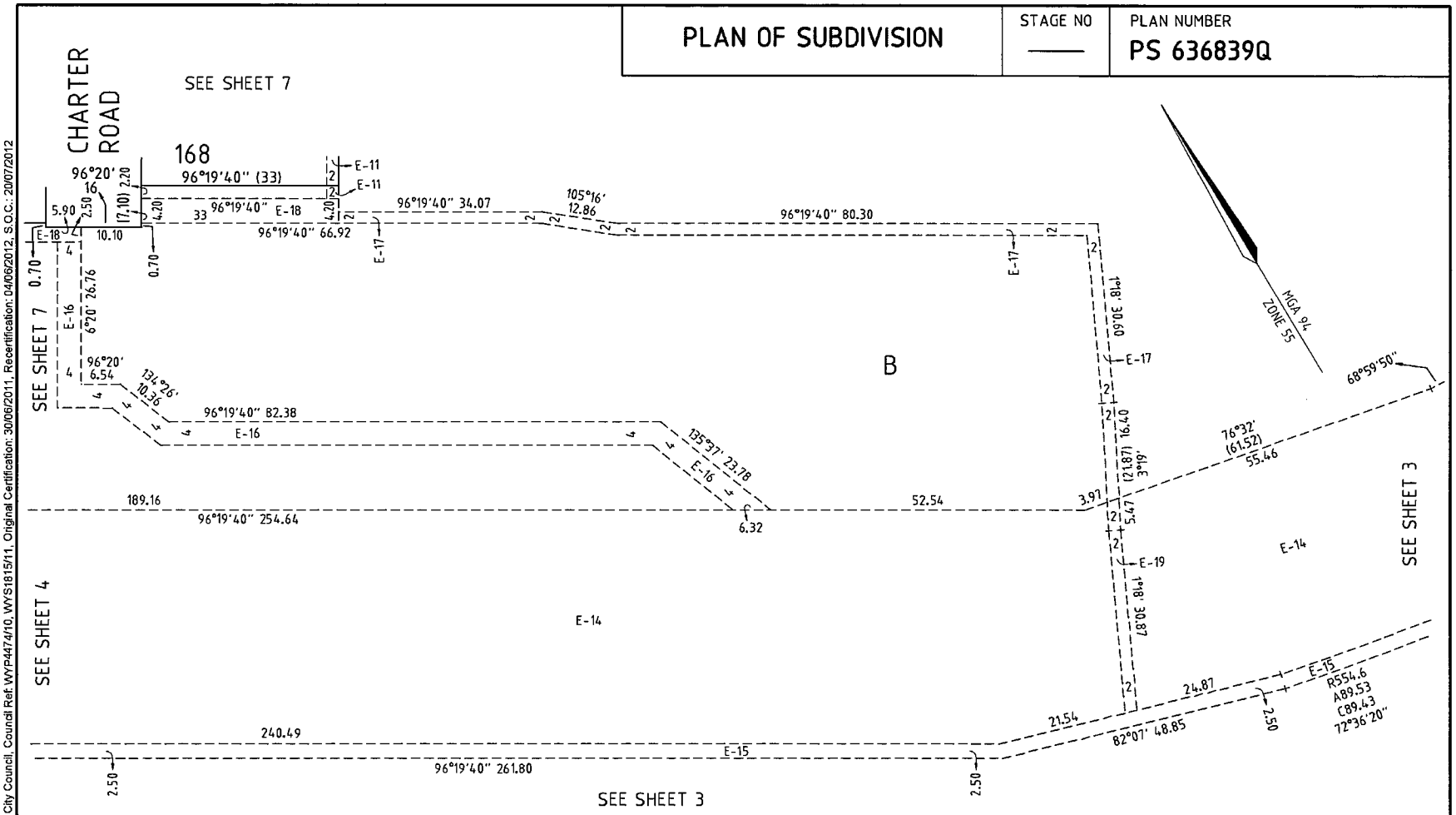
DATE / /

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

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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)

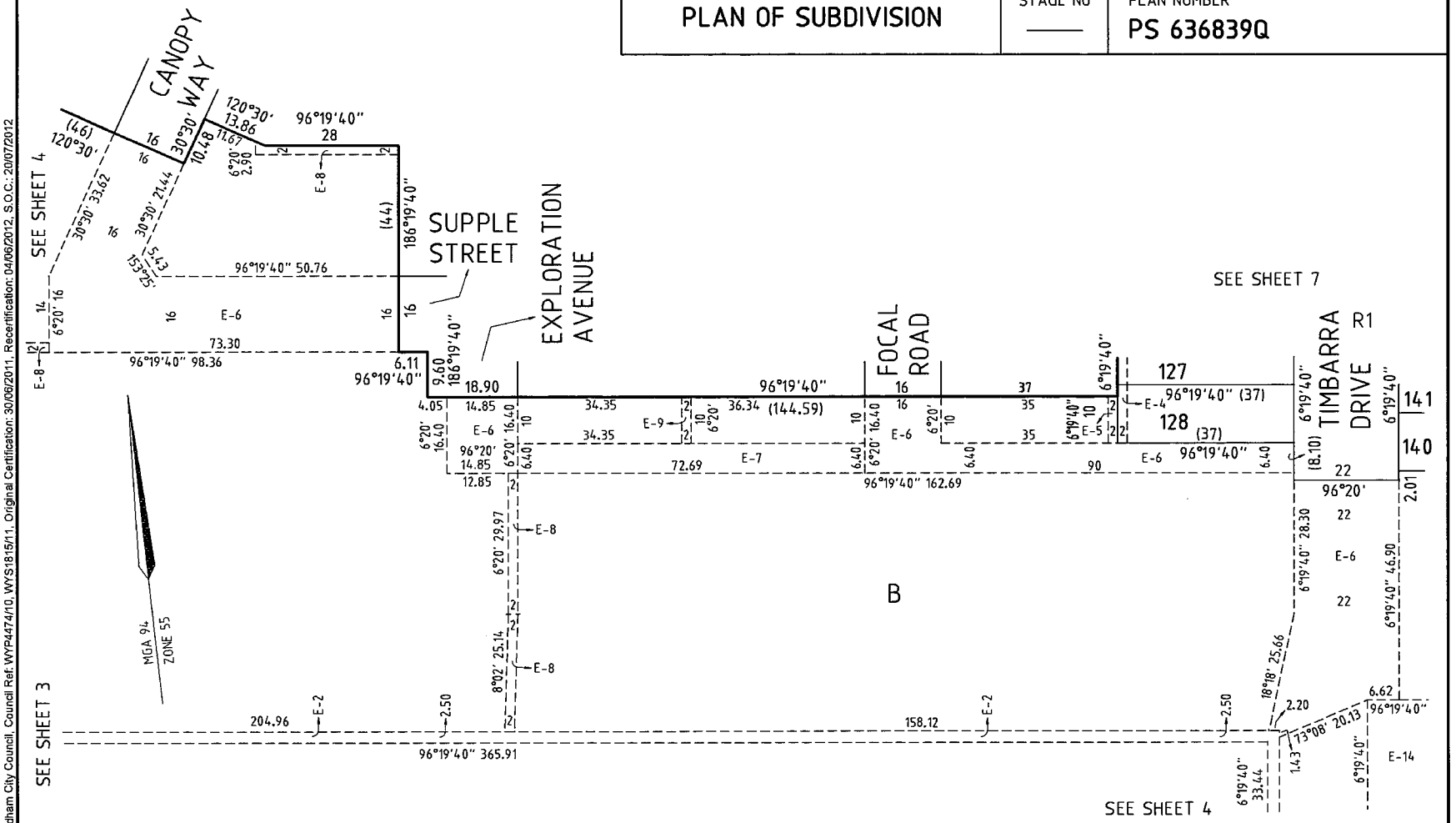
DATE / /

..... 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

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

CHRIS RUNTING & ASSOCIATES PTY LTD
LAND SURVEYORS
TOWN PLANNERS
DEVELOPMENT CONSULTANTS
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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)

SHEET 10

DATE / /

COUNCIL DELEGATE SIGNATURE

ORIGINAL SHEET SIZE A3

	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 B)
Release 2 Land Area: 3.248ha

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LICENSED SURVEYOR: P.J.S. TYNKKYNEN

SIGNATURE ..... DATE / /

REF: 3936PS2 VERSION: 23 (4.05.12)

SHEET 11

DATE / /

..... COUNCIL DELEGATE SIGNATURE

ORIGINAL SHEET SIZE A3

	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

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)

SHEET 12

DATE / /

..... COUNCIL DELEGATE SIGNATURE

ORIGINAL SHEET SIZE A3

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

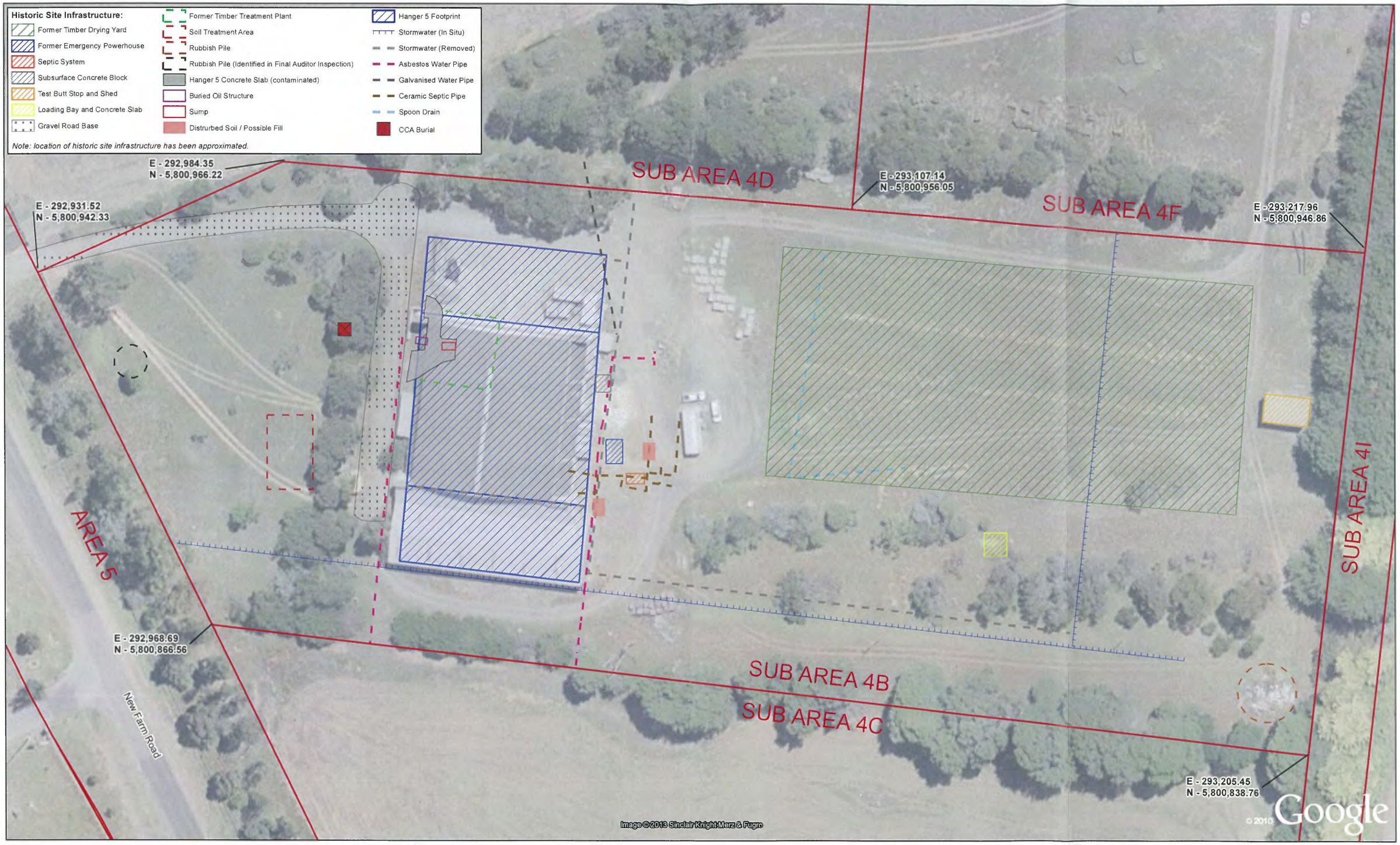
Public Open Space

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



1:750 at A3

0 7.5 15 22.5 30

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

Audit Areas

Note: The data displayed in this figure has been digitised from images extracted from the following reports: OTEK (2012) *Sub-Area 4B Environmental Site Assessment (Draft)*, OTEK (2011) *Remediation Action Plan - Version 3 (Soil Contamination Sub-Area 4B)*, and OTEK (2012) *Remediation and Validation Report (Draft) Sub-Area 4B, Werribee, Victoria*. Therefore GHD cannot guarantee the accuracy of this data.
This figure should only be viewed as a point of reference.

Melbourne Water
Environmental Audit of Area 4B,
Riverwalk Estate Princes Highway Werribee VIC

Defined Audit Boundary and Site Infrastructure / Features

Job Number	31 / 1157500
Revision	2
Date	14 May 2014

Figure 3

G:\31\1157500\Cad\GIS\Maps\Deliverables\Area_4B\311157500_003_Defined_Audit_Boundary_and_Site_Infrastructure_A3L_FINAL.mxd

Data source: Audit Boundaries, OTEK 2012; Site Infrastructure, OTEK 2012; CCA Burial, Enterra 2001; Background Imagery (2006), Google Earth Pro 2013. Created by bcoughlan

180 Lonsdale Street Melbourne VIC 3000 Australia **T** 61 3 8687 8000 **F** 61 3 8687 8111 **E** melmail@ghd.com **W** www.ghd.com

Historic Site Infrastructure:

- Former Timber Drying Yard
- Former Emergency Powerhouse
- Septic System
- Subsurface Concrete Block
- Test Butt Stop and Shed
- Loading Bay and Concrete Slab
- Gravel Road Base
- Former Timber Treatment Plant
- Soil Treatment Area
- Rubbish Pile
- Hanger 5 Concrete Slab (contaminated)
- Buried Oil Structure
- Sump
- Distrurbed Soil / Possible Fill
- Hanger 5 Footprint
- Stormwater (In Situ)
- Stormwater (Removed)
- Asbestos Water Pipe
- Galvanised Water Pipe
- Ceramic Septic Pipe
- Spoon Drain
- CCA Burial

Note: location of historic site infrastructure has been approximated.

SUB AREA 4D
SUB AREA 4F
SUB AREA 4I
SUB AREA 4B
SUB AREA 4C
AREA 5
New Farm Road

Image © 2013 Sinclair Knight Merz & Fugro
© 2010 Google

1:750 at A3
0 7.5 15 22.5 30
Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Audit Areas
- Grid Sample - Exceeded EIL
- Grid Sample - Exceeded HIL
- Target Sample - Exceeded EIL
- Target Sample - Exceeded HIL
- Grid Sample - No Exceedance
- Target Sample - No Exceedance
- Grid Sample - Not Analysed
- Groundwater Monitoring Well

Note: The data displayed in this figure has been digitised from images extracted from the following reports; OTEK (2012) *Sub-Area 4B Environmental Site Assessment (Draft)*, OTEK (2011) *Remediation Action Plan - Version 3 (Soil Contamination Sub-Area 4B)*, and OTEK (2012) *Remediation and Validation Report (Draft) Sub-Area 4B, Werribee, Victoria*. Therefore GHD cannot guarantee the accuracy of this data.
This figure should only be viewed as a point of reference.

Melbourne Water
Environmental Audit of Area 4B,
Riverwalk Estate Princes Highway Werribee VIC

Job Number	31 / 1157500
Revision	3
Date	14 May 2014

Grid, Targeted and Monitoring Well Locations

Figure 4

G:\31\1157500\Cad\GIS\Maps\Deliverables\Area_4B\311157500_004_Grid_Targeted_and_Monitoring _Well_Locations_A3L_FINAL.mxd

Data source: Audit Boundaries, OTEK 2012; Sampling Locations, OTEK 2012; Groundwater Monitoring Wells, OTEK 2011; Site Infrastructure, OTEK 2012; CCA Burial, Enterra 2001; Background imagery (2006), Google Earth Pro 2013. Created by bcoughlan

180 Lonsdale Street Melbourne VIC 3000 Australia **T** 61 3 8687 8000 **F** 61 3 8687 8111 **E** melmail@ghd.com **W** www.ghd.com

Executive summary

Table 1 Summary of audit information

Summary information required	
EPA file reference no.	41460-4
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 4B on 15 March 2000. Due to the development timing requirements, Melbourne Water decided to request a separate audit for this Area (4B). The request for the audit of Area 4B 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 4B specifically on 13 July 2009.
Completion date of the audit	15 May 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
• Street suffix (North, South etc.)	

Summary information required	
• Suburb	Werribee
• Postcode	3030
GIS Coordinate of Site centroid • Longitude / Northing (GDA94) • Latitude / Easting (GDA94)	 Northing - 5800906.16 Easting - 293083.57
Site Area (hectares)	2.721 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 were 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	10 – 13 m
Groundwater segment	Segment C
Groundwater flow direction	Groundwater flow is expected to be the east towards the Werribee River which flows approximately north-south and is located approximately 500 m to the east north east of the Overall Audit Area (at its closest point). Regionally, the flow is expected to be to the south east toward Port Phillip Bay located approximately 7 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 4D and Area 4F. East: Area 4I. South: Area 4C. West: Area 5.
Proposed future use	The site is proposed to be used for mixed use, including retail, commercial, and low density residential use.

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Appendix A - Certificate of Title

Appendix B - Proposed development plans and planning scheme information

Appendix C - Historical reports

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

Appendix E - Area 4B Environmental Site Assessment Report (OTEK, 2012a)

Appendix F - Area 4B Remediation and Validation Report (OTEK, 2012b)

Appendix G - Letter regarding OTEK liquidation

Appendix H - Groundwater database search

Appendix I - Auditor's QA/QC review

Appendix J - Issue register

Appendix K - Extract of Superseded Remediation Action Plan (OTEK, 2009)

Appendix L - Laboratory report for auditor verification sample – former rubbish pile

Appendix M - Laboratory report for Hangar 5 validation samples

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 and environmental audit as a due diligence measure in 2000. The Overall Audit Area is roughly triangular in shape and comprises approximately 200 hectares. The current Melbourne Water Corporation operations office and Discovery Centre will remain onsite and were not subject to an audit. The location 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 a number of these areas were 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 4B only, herein referred to as 'the site'. The total area of the site is 2.721 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 publication 759.2 (2014) 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 Input 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 support team (all GHD staff)

Name	Qualification/Role/Experience Area	Contribution to Audit
Kate Fairway	Project Manager / Auditor's assistant	Assisted in the auditing process, assisted in preparation the draft environmental audit report and inspected the site.
Julie Davies	Auditor's assistant	Assisted in the auditing process and preparation the draft environmental audit report.
Penny Flukes	Auditor's assistant	Assisted in the auditing process and preparation the draft environmental audit report.

Name	Qualification/Role/Experience Area	Contribution to Audit
Elvira Ryan	Auditor's assistant	Assisted in the auditing process and inspected the site.
Venetia Stewart (then GHD)	Auditor's assistant	Assisted in the auditing process and inspected the site.
Eric Friebel	Risk Asssessor	Assisted with assessment of risk associated with hexavalent chromium concentrations at the site.
Geoff Pettifer	Principal Geophysist	Assisted with review and comment on the geophysics survey results when Enterra conducted its geophysics survey and investigation.

1.4 Documents reviewed

The following documents relating to the Overall Audit Area were reviewed as part of the audit process. These documents are attached as 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.

These reports are discussed in more detail in Section 2.8.1 and 2.8.2.

In addition, at times 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 documents prepared by OTEK were more directly related to 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, *Remediation Action Plan – Version 3*,10 March 2011, (OTEK, 2011) (included as Appendix F of OTEK 2012, which is attached as Appendix F of this report)
- OTEK, 26 September 2012, *Sub-Area 4B Environmental Site Assessment (Draft), Riverwalk Area 4, New Farm Road, Werribee, Victoria* (OTEK 2012a) (refer to Appendix E).
- OTEK, 31 October 2012, *Remediation and Validation Report (Draft)*, Sub-Area 4B, Werribee, Victoria (OTEK, 2012b) (refer to Appendix F).

Work plans were reviewed prior to intrusive works for the various phases of investigation undertaken during the audit, and comments provided to OTEK; where relevant these are discussed throughout the report, and referenced in Section 8.

1.5 Audit methodology

Melbourne Water engaged OTEK AUSTRALIA Pty Ltd (OTEK) to undertake the environmental assessment and subsequent infrastructure removal and remediation works in 2000, where the engagement was for the overall audit Site. OTEK conducted all the works mentioned above as the environmental assessor for the purpose of issuing audits for the different areas of the Site until 30 April 2013. During these years a number of assessments were completed and finalised by OTEK and the auditor has issued a number of audits as discussed in Section 1.1 of this report. On 30 April 2013 OTEK went into Administration and is in liquidation.

Prior to going into liquidation, OTEK had completed all the work required and also prepared a draft report for the Site; however, OTEK had not issued a final report. Melbourne Water has advised GHD (letter dated 25 October 2013) that all the intellectual property produced by OTEK in relation to the Site is owned by Melbourne Water and that it has retrieved both hard and electronic data relating to the work conducted by OTEK for the overall Site including this particular site. Melbourne Water (as the client) has given permission to the Auditor and GHD to use all the reports and all the data to enable the completion the continuation and completion of this audit (refer to Melbourne Water letter in Appendix G).

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 that part of the Site was used by the Department of Defence as discussed in this report); a subsurface geophysical survey; and various intrusive sampling and remediation works. The auditor considered that the audit has followed a logical sequence which provided the auditor with confidence that the site issues have been addressed and closed out – the details of which are the subject of later sections of this audit report.

The Auditor has followed up the standard process of reviewing the draft OTEK ESA report (OTEK, 2012a) for the site and was satisfied that any significant issues including ecological and human health risks were resolved by OTEK as per its draft report attached in Appendix E. The draft Remediation and Validation Report (OTEK, 2012b) is attached in Appendix F. Auditor's comments on the report (OTEK, 2012b) were prepared but were not sent to OTEK as it went into liquidation at the time of completion of the comments. In the absence of the consultant and for efficiency, the auditor and his team undertook a review of the comments and reports again and were able to close out most comments, as they were not affecting the outcome of the audit. Consequently the number of comments in the issue register requiring close out was reduced to those attached in Remediation and Validation Issue Register (J2) of Appendix J.) The auditor's comments on the ESA Issue Register (J1) are included in Appendix J.

The auditor has consulted with EPA (13 June 2013) on the fact that OTEK went into administration and consequently the OTEK report was not issued in final but only in draft. Based on discussions between EPA and the auditor, EPA agreed that given the particular circumstances and the work done by OTEK had been substantially progressed to a close to final stage, that it was appropriate for the auditor to issue this audit report based on the attached OTEK draft report. It was also discussed and agreed with EPA that the fact that OTEK went into administration prior to finalising the report, resulted in the auditor having to undertake additional data review, data interpretation, and where applicable auditor verification works to reach conclusions and audit outcomes as stated in this report, it should be noted that this was conducted having regard for EPA Bulletin 759.1[1].

[1] Please note that EPA Bulletin 759.1 was current at the time; however, the auditor has refrred to the latest version (i.e. 759.2, 7 February 2014).

1.6 Site assessment approach

The assessment of the Overall Audit Area involved multiple phases of work. The approach and sequence of investigations undertaken to identify and investigate potential sources of contamination was thorough and in line with industry practice and guidelines. The site assessment approach was summarised as follows.

- A specialised site history review of former site uses during RAAF occupation (predominantly of Area 4) was undertaken in 2000 by Milsearch (Milsearch 2000);
- Based on the findings of the Milesarch review, Enterra was engaged by Melbourne Water in 2001 to undertake a geophysical survey and, where required, physical investigation of sub-surface anomalies identified by Milsearch. The objectives of Enterra's survey and investigations (Enterra 2001) were:
  - *"To locate any underground storage tanks (UST) and burials.*
  - *To quantify the extent of both ferrous and non-ferrous debris.*
  - *To resolve any uncertainty regarding the presence of unexploded ordnance."*

  Following its survey and investigation Enterra (2001) stated that "the investigations found no evidence of unexploded ordnance (UXO) or live ammunition on the site".
- OTEK subsequently undertook a Phase 1 Assessment (OTEK 2002) of the Overall Audit Area (including the site), which comprised:
  - *"Site History Study – conducting a background study of the past and present use, review of previous investigations conducted at the site, a site reconnaissance, and a report of findings for these works; and*
  - *Further physical investigations – to determine present sub-surface conditions at the site".*

The scope included: review of Melbourne Water property files; a review of site ownership and land use history (Sands and McDougall directories; an historical title search dating back to 1880s; completion of a detailed site inspection to assess building layout, potential filled areas, usual activities, stored materials and to determine if any other visual signs of contamination exist; assessment of the nature and location of buildings and other improvements, past and present; co-ordination of archaeological historical and subsurface investigations; and derivation of conclusions concerning the potential for contamination at the property.

- OTEK then used the findings of the above reviews and investigations to develop sampling and analysis plans (SAPs) to investigate areas of potential concern in more detail. Multiple SAPs were prepared, initially for the Overall Audit Area then for individual areas as required (once the overall audit area was subdivided into separate audits as discussed above). The auditor reviewed and provided comment on each SAP prior to works being undertaken.
- Over the course of the site assessments, OTEK prepared various scopes for infrastructure removal, remedial and validation works as required which the auditor reviewed and discussed prior to implementation.

1.7 Disclaimers

This statutory environmental audit report *Area 4B of Riverwalk Estate, Princes Highway, Werribee, Victoria* ("Report") dated 15 May 2014 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 Residential 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[1]	The site is located on part of Lot B on Plan of Subdivision 636839Q, on Certificate of Title Volume 11367, Folio 778. The site boundary is defined by the coordinates below. The defined audit Area and survey coordinates are shown as Figure 3.	
GIS coordinates defining the boundary of the site (MGA Zone 55)[2].	Easting	Northing
	293,217.96	5,800,946.86
	293,107.14	5,800,956.05
	292,984.35	5,800,966.22
	292,931.52	5,800,942.33
	292,968.69	5,800,866.56
	293,205.45	5,800,838.76
Area	2.721 hectares	
Surrounding Land Use	North: Area 4D and 4F. East: Area 4I and Farm Road. South: Area 4C. West: Area 5.	
Topography	The site and surrounding area were flat.	
Site Coverage / Vegetation	The site was dominated by pasture grasses with mature trees lining the boundaries of the site.	
Sampling Locations	The locations of soil and groundwater samples collected by OTEK during the assessment are shown on Figure 4 (grid and target sample locations), Figure 6 (delineation sample locations), Figure 9A and B (validation sample Locations), and Figure 11 (groundwater well locations).	

NOTES:
[1]The auditor notes that the Certificate of Title (CoT) for the property was revised following issuance of OTEK 2012a and 2012b reports. The correct CoT is provided in Appendix A of this report.
[2]There was some inconsistency in the coordinates included on the Figures in OTEK 2012a. Figure 3 of this audit report shows the accurate coordinates which define the Site boundary.

2.2 Geology and hydrogeology

The field logs for the soil assessment works undertaken on site and the groundwater assessments work (undertaken for the Overall Audit Area) were included in Appendix C of OTEK, 2012a. The auditor noted that no field logs were provided for the remediation and validation works undertaken at the site.

2.2.1 Soils

The assessor indicated that the soil profile on site generally comprised:

- Brown silty loam with organic matter. Debris such as road based gravels, river pebbles, wood and minor domestic rubbish were observed across the site. OTEK (2012a) identified road base materials at 12 locations, which corresponded with former farm tracks and driveways located at the site;
- Silty clays or clayey silts of varying colour (greyish orange, yellowish orange, yellowish brown), moderate plasticity to approximately 1.2 metres below ground level (mbgl);
- Clayey silt (dark yellowish orange and brown) and moderate plasticity to approximately 2.0 mbgl (maximum depth of test pits);
- OTEK (2012a) identified two areas of potential *'fill material'* to a maxium depth of 4.2mbgl at 4B/G25 and 4B/T46. These two locations were were later found to be associated with the former septic system, which was removed and successfully validated (refer Section 5.4.7). The auditor considered that the soil identified at 4B/G25 and 4B/T46 would be better described as 'reworked natural';
- Weathered basalt to approximately 15.8 mbgl (maximum depth of the investigation) at MW-3 located towards the eastern boundary of the site; and
- Silt with sand to approximately 14 mbgl (maxium depth of investigation) at MW10 and MW11. A light olive green clay layer was observed between 14 and 21mbg (maximum depth of investigation) at MW9. These wells were clustered near former Hangar 5 on the western side of the site.

Grid-based test pits were typically terminated at a maximum depth of 1.0 mbgl, and targeted test pits generally extended to 2.0 mbgl.

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 Volcanic Formation, which predominantly comprises dark to light grey olivine basalt. The Newer Volcanic is underlain by the Brighton Group Formation and the Newport Formation. Regional data indicate 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 500 m to the east of the site.

Regionally, the groundwater flow is expected to be on a south-eastern direction toward the Port Phillip Bay, which is located about 7 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. Bore 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 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. Bore 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 logs for the site (Appendix M, OTEK 2012b) indicated that wells were installed within the Newer Volcanics aquifer (MW3) and Werribee Delta Aquifer (MW9-MW11).

2.2.4 Groundwater database and groundwater quality

Groundwater database

The auditor conducted a groundwater database search and review. The search identified 21 wells within a 1 km radius of the site, as tabulated and shown on a plan in Appendix H (the well locations are approximate only, and several of the wells are plotted in the same location due to the scale of the plan). 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 were listed as being used for domestic, stock, and groundwater investigation purposes, with the use of several wells listed as not known. No groundwater chemistry data were available. The majority of groundwater wells were located cross or up gradient of the site, or beyond the Werribee River and were considered unlikely to be in the flow path of groundwater from the site.

In addition to the above wells, OTEK installed a further 11 monitoring wells across Area 4 of Overall Audit Area to investigate groundwater quality. Those wells that were relevant to the site are discussed in further detail in Section 6 of this report.

Groundwater quality

Based on groundwater data from the Overall Audit Area (including this site), information from nearby audits and published references, groundwater in the region was found to have elevated concentrations of some inorganics, including nitrate. This was considered to be attributed to naturally occurring concentrations in the Newer Volcanics Aquifer, and also potentially to widespread regional agricultural land use, especially for nitrate. Regional groundwater quality is discussed further in Section 6.3 of this report.

2.3 Surface water

The Werribee River is located approximately approximately 500 m to the east north east of the site (at its closest point) and flows in a southerly direction towards Port Phillip Bay, located about 7 km south east of the site.

No surface water bodies were located on the site.

2.4 Site physical status at audit commencement and completion

Various infrastructure was identified at the site during the site history review and site assessment work by OTEK (2012a). Further infrastructure was uncovered by OTEK (2012b) identified during the infrastructure removal and remediation works.

A summary of the site infrastructure that was known to have been present at the site and their status at audit completion is provided in Table 5. The site features (former and current) are shown on Figure 3. At the time of audit completion, the only infrastructure remaining on the site was the stormwater pipe (shown on Figure 3).

Table 5 On-site infrastructure and status

Infrastructure /features / activity	Status
Former Emergency powerhouse (removed prior to audit commencement).	Removed circa 1950.
Test butt stop and shed including concrete slab base.	Test Butt stop removed in 1951. Test Butt shed and concrete slab removed in June 2009.
Use of former Hangar 5 for TTP.	TTP dismantled in 1988.
Timber drying yard east of Hangar 5 (including spoon drain (decommisioned prior to audit commencement).	TTP dismantled in 1988 Spoon drain removed and validated in August 2009.
Hangar 5 building and shed on southern apron.	Removed in July 2008.
Hangar 5 Concrete slab, includes contaminated section of concrete.	Partially removed in July 2008. Contaminated concrete was removed in June 2009.
Buried oil structure (also referred interchangeably as suspected underground storage tank (UST)).	Removed in June 2009.
Sump within former Hangar 5.	Removed in June 2009.
Concrete footings below Hangar 5	Removed in June 2009.
Septic system and associated ceramic pipework.	Removed in June 2009.
Water bearing asbestos piping (underground).	Removed in July 2009.
Water bearing galvanised piping (underground).	Removed in August 2009.
Loading bay and associated concrete slab.	Removed in July 2009. Refer to Section 5.4.10. However, this is not stated in OTEK 2012a or 2012b reports. The auditor conducted a site inspection on 12 May 2014 and did not see any visible evidence of its presence.
Rubbish pile (dumped domestic rubbish) located near the south eastern boundary of the site.	Not known. Not stated in OTEK 2012a or 2012b reports. The auditor conducted a site inspection on 26 November 2012 in the vicinity of the former rubbish pile. No rubbish, or odours or staining was observed.

Infrastructure /features / activity	Status
CCA Burial	The area was remediated and successfully validated. Refer Section 5.5.5.
Stormwater pipe including concrete block later identified as the stormwater pipe and section of ceramic piping.	A section of the the stormwater pipe and the ceramic piping was removed in August 2009. A section of stormwater pipe remained insitu at the completion of the audit. The location of the remaining stormwater pipe is shown on Figure 8).
Contaminated Gravel Roadbase (west of Hangar 5)	Removed in August 2009

At the time of audit completion, the only infrastructure remaining on the site was the stormwater drain (depicted by a blue line with perpendicular markers) on Figure 3. Further discussion regarding the investigation activities undertaken during the infrastructure removal is provided in Section 5.4 of this report.

2.5 Proposed site development

The Site was part of the Riverwalk Estate which was proposed to be developed for residential development (with lot sizes between 300 m^2 and 400 m^2) and associated uses such as public open space and recreation areas.

As per the development plan and in accordance with 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 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 4B.

The site is not on the EPA Priority Sites register, and is 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. Since the audit commenced an Environmental Audit Overlay (EAO) was placed over the site. It is understood the EAO was placed on the site at the time of re-zoning of the land for residential use.

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 undertaken. 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, hence provided further confidence in our 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) attached as Appendix C of this audit report. The following

historical reports were considered; however, the first two were not relied upon for the purposes of the audit as they were out-dated and were superseded by more recent and relevant detailed assessments conducted by OTEK, 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 sample was collected from the site to the east of Hangar 5 in the timber drying area, and was analysed for inorganics and organochlorine pesticides. Results indicated that copper, chromium, and arsenic concentrations exceeded the adopted investigation levels. Findings from this assessment are not considered to affect the audit outcome as this work was limited and was superseded by much more detailed environmental investigations conducted and discussed in the following sections.

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 Site. 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 did not identify any heritage or cultural issues in Area 4B.

The Biosis report is attached as Appendix C.

Milsearch Pty Ltd (April, 2000)

Milsearch undertook a specialised review of the site history during the World War II era (during this period the Royal Asutralian Air Force (RAAF) occupied Area 4) to determine the potential for the presence of residual munitions and other material burials or contaminants at the site.

The report did not identify any potential munition or contamination resulting from the occupation of the site by the RAAF during 1942 to 1952. However, the investigation did indicate the presence of a concrete structure for the testing of aircraft machine guns called a 'stop test butt'. The structure was designed with concrete wings at either side with an earth filled receptor bund at the front. Anecdotal evidence indicated that the test butt was only used for occasional small arms practice. The test butt stop was removed in 1951. Milsearch reported that a check with metal detectors in the vicinity of the test butt failed to reveal any spent cartridges.

The Milsearch report is attached as Appendix C.

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 any unexploded ordnance (UXO), buried wastes or other underground facilities. The investigation was undertaken using various geophysical techniques including the use of a digital magnetometer and electromagnetic detection equipment.

The report referred to a survey conducted in the vicinity of the test butt during which 11 expended small arms ammunition and only 13 empty fired cartridge cases for small arms ammunition were identified.

The report identified a burial thought to contain drums and other debris. Enterra identified the burial to be located at 292998E and 5800930N (GDA94 MGA Zone 55)[2] (p.g 17 Section 3.17,

[2] The coordinates provided by Enterra (2001) were provided in AGD66. GHD converted the coordinates to GD94 for the purposes of this report.

Enterra (2001)). Enterra estimated the depth of the burial to be 1.6m, but no estimation on size was reported. The auditor plotted the coordinates provided by Enterra (Figure 3), which showed that the burial was located within Area 4B, situated to the west of Hangar 5. The burial was investigated by OTEK (2012a and 2012b) and was interchangeably referred to as the CCA burial / geophysical anomaly in OTEK's reports (2012a and 2012b). It is referred to as the CCA burial within this audit report.

Copper chrome arsenate (CCA) contamination was revealed through a range of investigations (targeted, delineation and validation sampling) in this area which are discussed in Sections 5.1.3, 5.2.1, 5.3, and 5.5.5 of this report.

The survey did not identify any UXO burial sites within the site.

The Enterra report is attached as Appendix C.

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). The site history review undertaken by OTEK (2002) was undertaken for the Overall Audit Area. The following summarises the main findings that were considered relevant to the site (Area 4B).

- From circa 1880 to 1900 the Overall Audit Area and land in the general vicinity was owned by the Melbourne Metropolitan Board of Works (MMBW) and leased for dairy farming, stock grazing, and vegetable growing (Biosis 2000).
- According to Biosis (2000), circa 1900, the MMBW 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 land (off-the Overall Audit Area) 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 Aarea. The Caltex Service Station and the Freeway Access Ramp now occupy this area, which is not part of the Overall Audit Area.
- Melbourne Water Corporation acquired the Audit Site in the 1920s.
- The northern part (Area 4 and a portion of Area 5) of the Overall Audit Area was temporarily occupied by the RAAF from circa 1940 to 1952. Five hangars, numerous small buildings and USTs were understood to have been constructed in Area 4 during this time. Hangar 5, a test butt, an emergency powerhouse, septic system and various pipework was located on Area 4B (refer to Section 2.4 for a list of all infrastructure that was present at the site).
- Post World War II, the former Hangar 5 was used as a carpentry workshop by Melbourne Water until the late 1960s. From the late 1960s to the mid 1980s the former Hangar 5 was used as a timber treatment plant (TTP) where approximately two 44-gallon drums of dried CCA waste were produced each year. The TTP included timber drying racks in the timber drying area situated east of the former Hangar 5 (refer to Appendix C for historical photos of the infrastructure). The TTP was dismantled in 1988. The hangar structure remained (refer to Section 2.4 for a summary of infrastructure and the date of removal).
- Enterra (2001) identified a geophysical anomaly assumed to be a burial which could potentially contained drums and other debris to the west of Hangar 5 (within Area 4B).

Further investigations undertaken by OTEK (2012a and 2012b reports) identified CCA contamination at this location. During a site visit (1 July 2009), the auditor's assistant observed rusted metal, from an excavation at this location, that was thought to be associated with the buried drums (refer to Section 4.4).

2.9 Identified contaminants of potential concern

OTEK provided information relating to contaminants of potential concern (CoPCs) in Section 3.3 of OTEK, 2012a which was based on the site infrastructure, historical site use and surrounding land uses. Based on this information provided by OTEK, and the auditor's understanding of the Overall Audit Area, a summary of the previous site uses and the associated COPCs identified are summarised in Table 6 along with specific comments related to each potential source.

Additional potential sources of contamination were identified during the remediation and validation works (OTEK 2012b), and are discussed in Section 5.4 of this report.

Table 6 Potential sources and associated contaminants of potential concern

Potential Contamination Source or Activity	Contaminants of Potential Concern
Former Emergency Powerhouse	Polychlorinated biphenyls (PCBs), hydrocarbons (TPHs, BTEX, PAHs*) and inorganics.
Test butt stop and shed including concrete slab base	Munitions and inorganics.
Use of former Hangar 5 for TTP	Copper, chromium and arsenic.
Timber drying yard east of Hangar 5 (including spoon drain)	Copper, chromium and arsenic.
Hanger 5 building including shed on southern apron Hangar 5 concrete slab including contaminated section of concrete	Inorganics including copper chromium and arsenic, TPHs, PAHs, phenols, volatile organic hydrocarbons (VOCs) and asbestos.
Buried oil structure (also referred to as suspected underground storage tank (UST))	Hydrocarbons (i.e. TPHs, BTEX, PAHs*).
Sump within former Hangar 5 and Concrete footings below Hangar 5	Inorganics including copper chromium and arsenic, TPHs, PAHs, phenols and VOCs.
Septic system and associated ceramic pipework	Inorganics, pH, ammonia, nitrate, nitrite. Ecoli and faecal coliforms.
Water bearing asbestos piping (underground)	Asbestos
Water bearing galvanised piping (underground)	Inorganics
Concrete slab (associated with the loading bay) in south of site (near sampling location 4B/G28)	Inorganics
Rubbish pile (dumped domestic rubbish) located near the south eastern boundary of the site	Inorganics, pH, organochlorine pesticides (OCPs) / organophosphate pesticides (OPPs) and PAHs.
Geophysical anomaly, suspected to be a shallow burial (as identified by Enterra Pty Ltd, 2001).	Copper, chromium and arsenic.
Concrete stormwater pipe including concrete block later identified as the stormwater pipe	Potential for a broad range of contaminants. The following CoPCs were analysed: inorganics, TPHs, PAHs, E.coli, faecal coliforms, OCPs, VOCs, nitrate, nitrite, ammonia, asbestos, pH, phenols, sulphates and PCBs.
Gravel Roadbase Fill (west of Hangar 5)	Inorganics, PAHs, copper, chromium and arsenic.
Agriculture, farming, grazing and related activities	Inorganics, OCPs/OPPs, herbicides, pH, nitrite, nitrate and ammonia.

Notes: *Total petroleum hydrocarbons (TPHs), benzene, toluene, ethylbenzene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs).

2.10 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 the potentially contaminating activities that may have occurred at the site. The site history assessment indicated that the majority of the site was considered likely to be green field land, with a low potential for contamination. The former RAAF infrastructure and site uses were considered unlikely to have generated significant impacts to soil and groundwater.

The matter of the CCA burial required much consideration. Various OTEK sources conflicted with the historical reports and the auditor's understanding based on his involvement with the site when the geophysical surveys were undertaken. This required detailed investigation including geophysical survey, field test pitting and and trenching as discussed in this report.

The site history assessment provided a comprehensive understanding of potentially contaminating activities that may have occurred at the site. The auditor was satisfied that the site history review of both 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 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 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 7 below.

Table 7 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 was 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 use of land to be protected for the under the sensitive use (other) category were:

- 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. All of the assessment work for the audit was undertaken during 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 (amended 2013) and as such the auditor considered that use of 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 (2000).

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 were no published criteria specific to assessment of aesthetic impact. However, the Land SEPP includes aesthetics as a protected beneficial use of the land and also states, "Contamination must not cause the land to be offensive to the senses of human beings", (Land SEPP, Table 2 pg. 8). 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 (Table 2 pg. 8) required 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, sulfate, 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 fibre

The Land SEPP (Table 2 pg. 8) required 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 Land 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, in relative terms more appropriate for determining 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 8 below.

Table 8 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		✓			
Potable mineral water supply	✓	✓	✓		

Beneficial Uses	Segments (mg/L TDS)				
	A1 (0-500)	A2 (501-1000)	B (1001-3500)	C (3501-13,000)	D (greater than 13,000)
Agriculture, parks & gardens	✓	✓	✓		
Stock watering	✓	✓	✓	✓	
Industrial water use	✓	✓	✓	✓	✓
Primary contact recreation (eg. 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 8 above does not apply to groundwater where:

- there is insufficient 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 groundwaters throughout Victoria."

EPAV (2014) Publication 759.2 *Environmental Auditor (Contaminated Land) Guidelines for Issue of Certificates and Statement of Environmental Audit* provides further explanation:

- Section 9.2 (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 a 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 13.3 states: "Beneficial uses of groundwater may be considered 'relevant' for the purpose of determining whether to issue a Certificate in the following circumstances:
  - 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 under existing or reasonably foreseeable conditions (including altered groundwater flow resulting from groundwater 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:
    (i) use of groundwater in the same hydrogeological setting nearby or elsewhere in Victoria
    (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.

OTEK (2012b) reported the TDS of groundwater ranged from 4520 mg/L to 6680 mg/L. Therefore, under the Groundwater SEPP, groundwater at the site would be classified as Segment C. The relevant beneficial use of land to be protected for the under the sensitive use (other) category 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. In its assessment report (OTEK 2012a), OTEK adopted ANZECC 1992 guidelines for comparison purposes. The auditor considered the most recent guidelines, as summarised in Table 9 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.

These investigation levels are specified in Table 9 below.

Table 9 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 (Chapter 4.2 Water Quality for irrigation and general water use).
Stock Watering	ANZECC (2000) *Australian Water Quality Guidelines for Fresh and Marine Waters*, investigation levels for Primary Industries (Chapter 4.3 Livestock drinking water quality).
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.
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.*

Beneficial Use Category	Water Quality Indicators
Buildings & Structures	Introduced contaminants shall not cause groundwater to be corrosive to structures or building materials (pH, sulphate, redox potential) (Groundwater SEPP). 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) December 2001 (AQM SEPP) states (Clause 9) 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 10 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 10 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	Offensive odours were not reported during assessment works at the site.	No
Visibility	Given the site was covered by vegetation 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 offensive 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 the site activities relevant to the environmental audit

The chronology of site activities and a description of the soil works undertaken relevant to the environmental audit is presented in Table 11. The auditor's opinion of the adequacy of the assessment and a consideration of risks to human health and the environment are discussed in Section 5 (soil) and Section 6 (groundwater).

Table 11 Sequence of site activities

Date of Investigation	Site Activity and Objective	Report Reference
1993 - 2001	Various historical reports were prepared for the Overall Audit Area.	Section 2.8.1
2002 (OTEK, 2002)	OTEK undertook a site history investigation (OTEK, 2002) of the Overall Audit Area to determine if infrastructure and former activities may have resulted in contamination.	Section 2.8.2
May 2006	Based on the abovementioned historical review, OTEK undertook a soil investigation at the site. This included collection of samples via test pit at 34 grid locations from across the site. Samples from two additional grid locations (4B/G15 and 4B/G24) were collected in February 2009 and samples from one additional grid location (4B/G15) were collected in July 2009. Selected soil samples were analysed individually, and/or combined into three-part composites for analysis. In addition, targeted soil samples were collected from the former test butt, former emergency power house, former Hangar 5, former septic system, and the former timber drying area.	Sections 5.1 and 5.2
June 2006	Collection of targeted soil samples from the identified CCA burial to the west of Hangar 5 and collection of further targeted samples from the timber drying area.	Sections 5.1 and 5.2
July 2006	Collection of further targeted samples from the timber drying area. Installation of groundwater well MW3	Sections 5.1 and 5.2 Section 6.1
March 2007	Collection of further targeted samples samples from the identified CCA burial to the west of Hangar 5 (OTEK, 2012a).	Sections 5.1 and 5.2
April 2008	Resampling of grid samples 4B/G4 and 4B/G13. Targeted sampling at 4B/T57 and 4B/T58 in the vicinity of the CCA burial to the west of Hangar 5. Collection of further targeted samples and trenching in the former timber drying area.	Sections 5.1 and 5.2
August 2007	First groundwater monitoring event (i.e. GME 1).	Section 6.1.2
November 2007	Groundwater monitoring event (GME 2).	Section 6.1.2
February 2008	Groundwater monitoring event (GME 3).	Section 6.1.2
July 2008 to April 2009	Demolition and removal of the hangar.	Sections 5.1.3, 5.2, 5.4.2, 5.4.3, 5.5.5
January 2009	Asbestos validation sampling of ground surface surrounding Hangar 5.	Section 5.5.1
February 2009	Sampling of grid locations 4B/G14 and 4B/G24 which were not sampled during the initial grid sampling. Collection of targeted samples from the former Hangar 5 building	Sections 5.1 and 5.2

Date of Investigation	Site Activity and Objective	Report Reference
	footprint. Collection of further targeted samples from the identified CCA burial located west of Hangar 5. Collection of a targeted sample from the buried oil structure. Delineation sampling at former target locations 4B/T57 and 4B/T58 in the vicinity of the CCA burial to the west of Hangar 5. Delineation sampling at former target locations 4B/T48 in the vicinity of the CCA burial to the west of Hangar 5.	Section 5.3
May 2009	Preparation of the Remediation Action Plan (RAP) Version 1.	Section 5.4
June 2009	Removal of the test butt concrete slab and validation of the test butt area.	Section 5.4.1
June 2009	Asbestos removal works and validation at affected locations 4B/G13 and 4B/VS-27/SS-1.	Sections 5.2.4 and 5.5.1
June 2009	Removal of buried oil structure and the remediation and validation of surrounding soil.	Section 5.4.5
June to September 2009	Sampling of 4B/G15 which was unable to be sampled previously. A subsurface concrete block (later found to be the stormwater pipe) was identified at this location. The stormwater pipe was later removed and validated. Subsurface infrastructure removal and validation This includes: • Septic tank and overflow piping; • Asbestos water pipe; • Spoon drain (timber drying yard); • 20 inch diameter stormwater drain; • ceramic and galvanised pipes; and • concrete footing.	Sections 5.4.4, 5.4.6, 5.4.7, 5.4.8, 5.4.9, and 5.4.11
August 2009	Remediation and validation of hypodermic syringe location (4B/G28A).	Section 5.5.4
August to September 2009	Remediation and validation of contaminated road base and road base substrate.	Section 5.5.6
October 2009	Installation of groundwater wells MW-9, MW-10, MW-11.	Section 6.1.1
November 2009	Groundwater monitoring event (GME) 4.	Section 6.1.2
March 2011	Remediation Action Plan (RAP) Version 3.	Section 5.4
December 2011	Groundwater monitoring event (GME 5).	Section 6.1.2
12 May 2014	Auditor's final site inspection	Sections 4.4 and 5.7.4

4.2 Field sampling and laboratory testing program

The field sampling and laboratory testing program was designed by the assessor to assess the presence of contamination in soils at the site. Groundwater from the Overall Audit Area was also tested, and was, in combination with the site specific wells used to assess the groundwater conditions onsite. 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 Environmental (ALS), Labmark Laboratories Pty Ltd (Labmark), and Australian Safer Environment & Technology Pty Ltd (ASET, for asbestos testing); and

- Secondary (split sample) testing: ALS, Labmark, Leeder Consulting (Leeder) 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 quality assurance and quality control

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 reliability of the data presented. This review is provided in Appendix I, and indicated the following:

- Overall the frequency and analytical suite of QC samples, specifically field duplicate and field split samples were generally acceptable (i.e. >1:20 primary sample analysed).
- 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. OTEK noted the elevated RPDs were likely associated with low analyte concentrations (i.e. near the laboratory reporting limits), sample heterogeneity, and/or differences in laboratory methodologies. The auditor concured with this.The RPD exceedances were considered minor in the context of the entire data set.
- Most rinsate and trip blank sample results were below the laboratory detection limit for all analytes tested. Where minor inorganic exceedances were reported, OTEK followed up with the laboratory to investigate whether the laboratory supplied water was contaminated.
- While trip blank samples were not always analysed for volatile contaminants (as is standard practice) this was not considered a significant issue given the absence of volatile contaminants detected in soil and groundwater. Additionally volatiles were not considered COPC, based on historical activities at the site.
- Sample holding times were generally acceptable. Where holding times were 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 organics, which is not in accordance with Australian Standard 4482.1. Given a reasonable number of individual samples were analysed for these parameters across the site (refer Table 13) and results of the composite samples were consistent with data from the Overall Audit Area, this error in methodology was not considered to affect the outcome of the audit.

4.4 Auditor verification activities

The Auditor and/or his representative observed the field investigations across the Overall Audit Area on numerous occasions. Works were frequently undertaken both on the site and other audit areas during the same sampling event. Few of particular relevance to the site were the following inspections:

Date of Inspection	Observations
17 October 2005	Inspected Area 4 The site walkover focused on areas of potential concern including the former timber treatment plant and drying yard, hangers, incinerators, USTs etc.
15 May 2006	Inspected Areas 4B, 4C, and 4D. Area 4B - the auditor and his assistant observed 'green stained soils' at 4B/G13/0.2. The extent of the 'green stained soils' were not known at this time.
17 June 2006	Inspected Area 4. The locations of the proposed groundwater well network were inspected. With respect to Area 4B, one well (MW3) was proposed down gradient of the former timber treatment plant and drying yard. The structural integrity and fate of the remaining hangars were discussed, including Hangar 5 which was located on Area 4B. Historical photographs of the timber treatment plant and drying yard were provided to the audit team (attached as Appendix C). As requested by the auditor, OTEK collected plant samples (Galenia Pubescens, commonly known as 'carpet weed') within the timber drying yard to examine the extent of plant uptake of Cu, Cr, As (i.e. assess the phytoavailability of these inroganics).
10 July 2006	Inspected Area 4. The 'Tree Clearance Areas' outlined by Tree Logic (arboricultural consultants were inspected. Two small areas were observed between Hangars 4 and 5. Surface debris such as asbestos cement sheeting, broken bottles, some pieces of wood and scrape metal was observed in these asreas.
31 January 2008	Project meeting held to discuss project and audit objectives and outcomes. Two draft reports pertaining to stockpiled soils and surface debris across the site were discussed.
8 December 2008	Inspected Area 4 – Project update. Hangar 5 had been removed. The contaminated concrete slab remained insitu at the time of the inspection.
14 January 2009	Inspected Area 4 – Project update. The area surrounding former Hangar 5 footprint was inspected. CCA contamination had been identified at the following locations: • Surface soils west of Hangar 5 (associated with CCA burial); • Hangar 5 concrete slab; • Buried oil structure; and • Sump, spoon drain and concrete footings. The 'deep fill' locations (4B/G25 and 4B/T46) were marked for further investigation, together with the removal of the septic system and associated ceramic pipework. The Auditor requested that the underground stormwater network also required further investigation.
18 May 2009	Site meeting and inspection. The audit team attended a site 'kick off' meeting for the infrastructure removal and remediation works proposed for Area 4B. Regular meetings were held during the removal and remediation works at the site. The auditor's assistant also undertook a general site familiarisation inspection of Area 4 with OTEK.

Date of Inspection	Observations
28 May 2009	Site meeting. A meeting was held to discuss the Remediation Action Plan for Area 4B. A detailed inspection of Area 4B was also undertaken.
3 June 2009	Site meeting and inspection. Further investigation of the area west of Hangar 5 was in progress at the time. Trunks of trees west of Hangar 5 had been removed and chipped into a stockpile near the entrance of the site.
16 June 2009	Site meeting and inspection. Hangar 5 contaminated concrete had been disposed offsite with the exception of some additional concrete discovered under the slab. The auditor discussed that this section of concrete required further testing prior to disposal. The buried oil structure was removed at the time of inspection. The structure was square (dimensions ~2m high x 2.5m wide, 1.5m deep). The tank was in a fairly good condition with the exception of a couple of punctures resulting from the removal works. A hole (of ~3cm diameter) was observed in the base of the structure. Once the structure was dislodged, it was removed and placed on black plastic. Product was leaking from both the top and base of the structure and was black to brown in colour with a strong hydrocarbon (naphthalene/creosote like) odour. Odorous soils were also observed on one side of the structure. The product and soils were removed and placed on black plastic. Black stained soils were observed within the base of the excavation. The excavation was being prepared for validation when the auditor left the site. It was understood that validation samples were collected from the walls and based of the excavation. A sump located directly east of the buried oil structure excavation was identified during these works. The sump was not identified during previous desk top studies of the area. The northern wall of the sump was brick lined; the remaining walls and base were made of concrete. The sump contained damp soils and pebbles which were stained 'green'. (XRF results: As~10,000 mg/kg, Cr ~12-15,000 mg/kg).
1 July 2009	Site meeting and inspection. Zone 3 and 4 remediation areas (as shown on Figure 7) were inspected. Within the area west of Hangar 5, the auditor and his auditor's assistant observed 'green stained' soils at depth. Rusted metal was also observed within the excavation and was thought to be associated with the 'buried drums' identified in the site history review. At the time of inspection OTEK had submitted validation samples within the excavation to the laboratory for analysis. It was decided that the excavation would remain open until these results were evaluated and submitted to the auditor for review. Contaminated soils identified west of Hangar 5 were chemically treated by Enviropacific Services (EPS) at the time of the inspection to stabilise mobile contaminants in accordance with EPAV Classification Approval 2009/014 (Appendix S of OTEK (2010) RAP).
10 July 2009	Site meeting and inspection. The auditor and his assistant inspected the remaining Hangar 5 contaminated concrete. OTEK indicated that this concrete was classified as Category A, B and C Prescibed Industrial Waste in accordance with EPAV Classification Approval 2009/014 (Appendix S of OTEK (2010) RAP). The buried oil structure was being cut into manageable pieces and placed into a skip for disposal at the time of the inspection. Based on the odours from the tank noted during its removal, the audit team advised that further validation sampling for creosote within the resultant pit was required. Samples from the excavation were analysed for TPHs, PAHs, and phenolic compounds as discussed in Section 5.4.5.

Date of Inspection	Observations
	Syringes were identified beneath a concrete slab located south of the timber drying yard (near grid location 4B/G28). At the time of the inspection the area had been fenced off while a safe work method statement was prepared. It was assumed that the syringes were associated with former livestock activities.
12 August 2009	Site meeting and inspection. Chemical treatment of soils west of Hangar 5 had been completed by EPS. A site walkover of the areas affected by Cr VI was conducted (Zone 3 and 4). 'Slight green staining' within scraped shallow soils that had been exposed to air for approximately 2 weeks were observed. The assessor discussed the issue of potential oxidisation occurring in Zone 3 and 4 where site conditions may have allowed soils to convert from Cr III to Cr VI (i.e. soils exposed to air, water, an environment containing Mn oxides & pH 7-8 may have the potential to complete the above process).
19 August 2009	Site meeting and inspection. Hangar 5 contaminated concrete characterisation and removal was still in progress. Category A concrete had been removed in accordance with EPAV Classification Approval 2009/014 (Appendix S of OTEK (2010) RAP). Category B concrete was earmarked for disposal shortly. All trees located adjacent to areas of high contamination in Zone 3 and 4 had been removed. Remediation of the area west of Hangar 5 continued following laboratory results reporting concetrations above site criteria. Contents of buried oil structure was classified as Cateogry A waste and removed from site. Backfilling of excavations across Area 4 was in progress.
2 September 2009	Site meeting and inspection. All Hangar 5 contaminated concrete had been removed from site in accordance with EPAV Classification Approval 2009/014 (Appendix S of OTEK (2010) RAP). The depth of the resultant excavation located west of Hangar 5 was approximately 3-3.5mbgl. Approximately 400m^3 of soil was removed from site. Concentrations of chromium were reported above EIL but below HIL criteria. The audit team, assessor, and the client concluded that it was impractical and not cost effective to continue with the current remediation strategy. As such three groundwater wells were proposed (MW-9, MW-10 and MW-11) to assess whether groundwater was impacted by the CCA contamination from the area west of Hangar 5 or from the buried oil structure.
	Contaminated road base materials adjacent to Hangar 5 had been characterised and removed from site.
17 September 2009	Site meeting and inspection. Excavation west of Hangar 5 had been backfilled. Vehicle tracks across Area 4B had been assessed and successfully validated. No samples reported concentrations above EIL or HIL criteria. OTEK sampled the soil treatment 'hardpan'. No samples reported concentrations above EIL or HIL criteria. 'Deep fill' locations 4B/G25 and 4B/T46 were thought to be associated with the former septic system. No further works in these areas was considered necessary.
20 October 2009	The auditor's assistant inspected site conditions during drilling of MW9 on Area 4B. Groundwater was encountered at approximately 14 mbgl; however, OTEK continued drilling to ascertain the geological profile beyond this point. It was expected that basalt would be encountered; however, river bed gravels and an olivine clay layer were observed. MW9 was backfilled to 15 mbgl and groundwater well installed.
17 December 2009	A meeting was held to discuss management options for asbestos fragments and surface debris identified site wide.

Date of Inspection	Observations
12 May 2014	The auditor conducted his final site inspection to assess any visible changes to the final status of the site. The inspection confirmed the site status was not changed and that the site was mostly covered with dense weed especially carpet weed and grass. The auditor also noted that a manhole was visible (barricaded with metallic sticks and orange plastic mesh) which was located on the south eastern side of the site closer to the southern boundary. The manhole was open (no lead) and the auditor was able to see the stormwater pipe, which has a small volume of water flowing. The water didn't appear to have any sheen. There were also few dead trees and some dead tree branches on the ground in a couple of locations at the site.

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 the site. 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.

5. Assessment of soil quality

A summary of the location of key information within in OTEK's reports (OTEK, 2012a and OTEK, 2012b) is provided in Table 12 below.

Table 12 Assessor's site assessment information – soil

Assessment Details	Section in Assessor's ESA Report (OTEK 2012a, attached as Appendix E of this report)	Section in Assessor's Remediation and Validation Report (OTEK 2012b, attached as Appendix F of this report)
Historical Information	Section 3	Section 2.4
Details of soil sampling and laboratory analysis	Section 4	Section 3 and 4
Discussion of results	Section 8	Section 6
Borelogs	Appendix C	-
Site Plans	Figures 1 to 3	Figures 1-6
Analytical Results (Summary Tables)	Tables 1 to 48	Tables 1-42

5.1 Soil sampling and analytical program

To assess soil quality at the site, OTEK developed a Scope of Works – Target and Grid Sampling Analysis Plan (SAP) in 2005 (OTEK 2005, attached as Appendix E of OTEK 2012a) which was based on previous investigations Milsearch 2000, Enterra 2001 and OTEK's Phase I assessment (OTEK, 2002). The Scope of Works was finalised after the auditor's review, and implemented accordingly. OTEK collected soil samples from grid based and targeted locations and undertook a trenching exercise in the former timber drying area (referred to as the north/south/east/west trench) to assist with characterising the former timber drying area and assess the potential for buried materials.

A SAP for the metals delineation was prepared in 2008 (attached as Appendix F of OTEK, 2012a) to delineate the extent of inorganics identified in the grid and targeted sampling. Although not proposed in SAP, the delineation works were undertaken in two phases. The first phase of delineation works was undertaken in April 2008 and reported in OTEK (2012a), and the second phase of delineation works was undertaken in February 2009 and reported in OTEK (2012b).

A SAP for the validation of the stormwater pipelines identified at the site was prepared in 2009 (attached as Appendix K of OTEK 2012b). The SAP reported that one sample was collected every 100 m along the alignment of the stormwater pipe that remained in-situ. The stormwater pipe that remained in situ at audit completion is discussed in Section 5.1.3 and the section of pipe that was removed and successfully validated was discussed in Section 5.4.11 of this report.

Following excavation of the former infrastructure and excavation of hotspots, validation samples were collected. OTEK summarised the soil investigation activities in Table E of OTEK (2012b) and discussed in Section 5.4 of this report.

5.1.1 Grid-based samples

A total of 41 grid-based soil sampling test pit locations were advanced at the site between 2006 and 2009, however, samples from only 37 locations were submitted for analysis (some of these were submitted as composites only). The Australian Standard (AS 4482.1) indicated that to detect hot spots of contamination of 32.4 m (refer Table E1 of the AS 4482.1) diameter with a confidence of 95%, 40 sampling points are required for a site area of 2.721 ha. The total number of grid locations from which samples were analysed was marginally less than the density specified in Australian Standard (AS4482.1). Grid soil sampling locations are shown on Figure 4. A total of 87 individual grid samples were selected for laboratory analysis. The auditor did not consider that the sampling density marginally less than Australian Standard (AS4482.1) affected the outcome of the audit based on:

- the detailed site history undertaken including the Milsearch (2000) specialised site history;
- the number of composite samples collected and analysed in addition to the individual samples (refer to Section 5.1.2); and
- the number of samples collected during the targeted (refer to Section 5.1.3) especially in the area of the four locations where samples were not analysed, delineation (refer to Section 5.3), and validation sampling (refer to Sections 5.4 and 5.5), which provided sufficient information on the site conditions.

Section 4.1.2 of OTEK (2012a) reported that the four locations (4B/G6 to 4B/G9) were excavated (i.e test Pits), and soil samples were collected and logged in the field, however, the soil samples were not submitted to the laboratory for analysis due to an oversight by OTEK. Locations 4B/G6 to 4B/G9 were situated along the northern boundary of the timber drying area. OTEK's field observations and PID screening did not indicate any obvious signs of contamination at these locations. Subsequent targeted sampling (refer to Section 5.1.3 of this report) was undertaken in the vicinity of 4B/G6 to 4B/G9 and was considered to be adequate to characterise these locations.

In addition soil location 4B/G15 was unable to be completed due to a mechanical issue with the excavator and a concrete block was identified at this location. Section 4.1.3.1 of OTEK (2012b) indicated that this location was re-investigated on 22 July 2009 and the concrete block, initially reported was found to be a concrete stormwater pipe, which was later removed (refer to Section 5.4.11 of this report).

In July and August 2009 additional depth samples 4B/G13/1.8 and 4B/G13/2.2 were collected and analysed for hexavalent chromium as part of the remediation and validation works undertaken west of Hangar 5 (refer Soil Analytical Summary Table 16, OTEK 2012b).

All grid locations are shown Figure 4. The soil laboratory analytical schedule is summarised in Table 13 below (derived from Tables 1 to 22 in OTEK 2012a and Table 16 in OTEK 2013b reports).

5.1.2 Composite samples

A total of 22 three-part composites formed from 27 test pit locations were analysed. Table 13 below provides a summary of the grid and composite analytical schedule (derived from Tables 1 through 26 in OTEK 2013a).

Not all individual samples from composites containing inorganic concentrations above the modified investigation levels were subsequently analysed, due to an oversight by OTEK. Given the number of individual samples analysed across the site and that the exceedances reported were consistent with the findings of the individual samples, the auditor does not consider this oversight to affect the outcome of the audit.

Four composite samples (4B/C4, 4B/C6, 4B/C10 4B/C23) were selected for leachability testing (refer Summary Analytical Tables 9-12 OTEK 2012a report), which is not in accordance with Australian Standard 4482.1, and is not standard industry practice. The auditor raised this issue with OTEK (refer item 40 in the ESA Issue Register (J1) in Appendix J). The auditor considered the composite results still provided relevant information regarding the leachability of inorganics at the site, given a reasonable number of individual samples were collected, and they were generally consistent with the results of individual samples collected. This error in methodology was not considered to affect the outcome of the audit.

Composite samples were analysed for pH, volatile and semi-volatile analytes (PAHs, OCPs/OPPs, and phenols), which is not in accordance with Australian Standard 4482.1, and is not standard industry practice. OTEK acknowledged that this practice was not appropriate, but it considered that composite results still provided information regarding the condition of soils at the site (OTEK 2012a). The auditor considered the composite results in his assessment of the site condition, and 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, OCPs/OPPs and phenols across the site (refer Tables 16 to 19 and 21 of OTEK 2012a) and results were consistent with data from the Overall Audit Area, this error in methodology was not considered to affect the outcome of the audit.

Table 13 Grid-based analytical schedule

Analytes	Total No. of Individual Samples Analysed	No. of Composite Samples Analysed
Antimony	22	22
Arsenic	58	22
Barium	37	22
Beryllium	23	22
Boron	21	22
Cadmium	23	22
Total Chromium	41	22
Hexavalent Chromium	1	-
Cobalt	23	22
Copper	41	22
Lead	24	22
Manganese	45	22
Molybdenum	22	22
Nickel	40	22
Selenium	22	22
Tin	22	22
Vanadium	42	22
Zinc	48	22
Mercury	27	22
Total petroleum hydrocarbons (TPHs)	29	-
Polycyclic aromatic hydrocarbons (PAHs)	3	22
Phenols	2	22
Polychlorinated biphenyls (PCBs)	2	9
Organochlorine pesticides (OCPs)	3	13
Organophosphate pesticides (OPPs)	1	9
Volatile organic compounds (VOCs)	2	-
Total cyanide (CN), fluoride (F)	-	10
Asbestos	27	-
pH	33	-

- No sample analysed

It was considered that based on the site history sufficient samples were analysed for the COPC.

It was noted that the 2005 and 2008 sampling and analysis plans (OTEK 2005 and OTEK 2008a) were developed prior to the 2009 Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in WA (DOH, 2009) asbestos guidelines. Approximately 30% of all grid samples across the site were analysed for asbestos. Based on the site history review, field observations, and the targeted asbestos sampling undertaken in the vicinity of the former hangar and asbestos pipework, it is considered there is minimal risk associated with asbestos across the site (refer Section 5.2.4 of this report). The specific sources of asbestos identified (i.e. Hangar 5 and the underground water bearing pipework) were appropriately removed and validated (refer Section 5.5.1 of this report).

5.1.3 Targeted samples

A total of 101 targeted locations were sampled and 356 samples were collected and analysed during the field investigation works (OTEK, 2012a and 2012b reports) to assess potential contamination sources. OTEK based the targeted sampling program on an understanding of available site history documentation (discussed in Section 2.8 of this report) and results of the grid sampling (refer to Section 5.1.1 of this report). Table E (in Section 4.1.5 of OTEK, 2012a) indicated the areas targeted and their corresponding targeted sample identification. Some additional targeted sampling was reported in OTEK (2012b) report. In some cases, grid samples discussed in Section 5.1.1 provided information to assess specific sources of contamination. Where this has occurred, the relevant grid samples are discussed in Table 14 (but have not been included in the sample counts noted above).

Multiple phases of targeted sampling and delineation sampling were undertaken in the area to the west of Hangar 5 and within the timber drying yard. OTEK refered to the sampling event conducted on 14-24 April 2008 in the timber drying area as delineation samples; however, these locations (i.e. 4B/T59 to 4B/T92) were considered targeted sampling locations in this report as they were individual sampling locations and were not part of the delineation step out works discussed in Section 5.3.

The program targeted site infrastructure primarily associated with former RAAF activities and use of the site as a timber treatment plant and a drying area.

Targeted sampling works (and relevant grid samples) undertaken are summarised in Table 14.

Table 14 Potential contamination sources and associated target sampling locations

Potential Contamination Source	Sampling Location(s)	Samples Analysed	Date/s	Analytes
Former emergency powerhouse	4B/T24	4B/T24/0.25, B/T24/1.0, 4B/T24/3.0	15 May 2006	Inorganics (18 suite)* in all three samples. TPHs, BTEX, PCBs and pH (in 0.25 m and 1.0 m sample only).
Test butt stop and shed including concrete slab base	4B/T1, 4B/T2, 4B/T3, 4B/T4 located in front of the test butt stop.	4B/T1/0.25, 4B/T1/0.5, 4B/T2/0.25, 4B/T2/0.5, 4B/T3/0.25, 4B/T3/0.5, 4B/T4/0.25, 4B/T4/0.5	15 May 2006	Inorganics (18 suite)*, explosives, pH
Hangar 5 and shed on southern apron.	Northern Apron: 4B/T32, 4B/T33, 4B/T42 Southern Apron: 4B/T28, 4B/T37, 4B/T38 Hangar 5 concrete slab: 4B/T29, 4B/T30, 4B/T31, 4B/T34, 4B/T35, 4B/T36, 4B/T39, 4B/T40, 4B/T41 East of Hangar 5: 4B/T25, 4B/T26, 4B/T27 West of Hangar 5: 4B/T43, 4B/T44, 4B/T45	4B/T25/0.25, 4B/T25/0.5, 4B/T26/0.25, 4B/T26/0.5, 4B/T26/1.0, 4B/T27/0.25, 4B/T27/0.5, 4B/T28/0.25, 4B/T28/0.5, 4B/T28/1.0, 4B/T29/0.25, 4B/T29/0.5, 4B/T29/1.0, 4B/T29/2.0, 4B/T30/0.1, 4B/T30/0.25, 4B/T30/0.5, 4B/T30/1.0, 4B/T31/0.25, 4B/T31/0.5, 4B/T32/0.25, 4B/T32/0.5, 4B/T33/0.25, 4B/T33/0.5, 4B/T34/0.25, 4B/T34/0.5, 4B/T34/1.0, 4B/T34/2.0, 4B/T35/0.25, 4B/T35/0.5, 4B/T36/0.25, 4B/T36/0.5, 4B/T36/1.0, 4B/T36/2.0, 4B/T37/0.25, 4B/T37/0.5, 4B/T37/1.0, 4B/T38/0.25, 4B/T38/0.5, 4B/T39/0.25, 4B/T39/0.5, 4B/T39/1.0, 4B/T39/2.0, 4B/T40/0.25, 4B/T40/0.5, 4B/T40/1.0, 4B/T40/2.0, 4B/T41/0.25, 4B/T41/0.5, 4B/T41/1.0, 4B/T41/2.0, 4B/T42/0.25, 4B/T42/0.5, 4B/T43/0.1, 4B/T43/0.25, 4B/T43/0.5, 4B/T44/0.1, 4B/T44/0.25, 4B/T44/0.5, 4B/T45/0.1, 4B/T45/0.25, 4B/T45/0.5	15 May 2006 6 to 11 February 2009	Inorganics (18 suite)* or As, total Cr and Cu, TPHs, PAHs, phenols, OCPs, pH 20 samples analysed for asbestos (all except 4B/T27). All at 0.25 m.
Former timber drying yard east of Hangar 5 (including spoon drain).	4B/T5, 4B/T6, 4B/T7, 4B/T8, 4B/T9, 4B/T10, 4B/T11, 4B/T12, 4B/T13, 4B/T14, 4B/T15, 4B/T16, 4B/T17, 4B/T18, 4B/T19, 4B/T20, 4B/T21, 4B/T22, 4B/T47, 4B/T49, 4B/T50, 4B/T51, 4B/T52, 4B/T53, 4B/T54, 4B/T55, 4B/T56, 4B/T59, 4B/T60, 4B/T61 4B/T62, 4B/T63, 4B/T64, 4B/T66, 4B/T68, 4B/T73, 4B/T74, 4B/T75, 4B/T76, 4B/T77, 4B/T78, 4B/T79, 4B/T80,	4B/T5/0.25, 4B/T5/0.5, 4B/T6/0.25, 4B/T6/0.5, 4B/T6/1.0, 4B/T7/0.25, 4B/T7/0.5, 4B/T8/0.25, 4B/T8/0.5, 4B/T8/1.0, 4B/T8/2.0, 4B/T9/0.25, 4B/T9/0.5, 4B/T10/0.25, 4B/T10/0.5, 4B/T10/1.0, 4B/T11/0.25, 4B/T11/0.5, 4B/T12/0.25, 4B/T12/0.5, 4B/T12/1.0, 4B/T12/2.0, 4B/T13/0.25, 4B/T13/0.5, 4B/T14/0.25, 4B/T14/0.5, 4B/T14/1.0, 4B/T15/0.25, 4B/T15/0.5, 4B/T16/0.25, 4B/T16/0.5, 4B/T16/1.0, 4B/T16/2.0, 4B/T17/0.25, 4B/T17/0.5, 4B/T18/0.25, 4B/T18/0.5, 4B/T18/1.0, 4B/T19/0.25, 4B/T19/0.5, 4B/T20/0.25, 4B/T20/0.5, 4B/T20/1.0, 4B/T20/2.0, 4B/T21/0.25, 4B/T21/0.5, 4B/T22/0.25, 4B/T22/0.5, 4B/T22/1.0	16 and 17 May 2006	Inorganics (18 suite)*, TPHs, PAHs, phenols, OCPs, VOCs, pH 13 samples analysed for asbestos
		4B/T47/0.25, 4B/T47/0.5, 4B/T49/0.05, 4B/T49/0.10, 4B/T49/0.20,4B/T49/0.25, 4B/T49/0.30, 4B/T49/0.40,	27-29 June 2006	As, Cr, Cu, Cr6+

Potential Contamination Source	Sampling Location(s)	Samples Analysed	Date/s	Analytes
	4B/T81, 4B/T82, 4B/T83, 4B/T84, 4B/T85, 4B/T86, 4B/T87, 4B/T88, 4B/T89[3] 4B/T90, 4B/T91, 4B/T92 Trenching: 4B/T65, 4B/T67, 4B/T69, 4B/T70, 4B/T71 and 4B/T72	4B/T49/0.50, 4B/T49/0.70, 4B/T49/0.90, 4B/T49/1.0, 4B/T49/1.25, 4B/T49/1.5, 4B/T49/2.0, 4B/T50/0.05, 4B/T50/0.1, 4B/T50/0.2, 4B/T50/0.3, 4B/T50/0.4, 4B/T50/0.5, 4B/T50/0.7, 4B/T50/0.9, 4B/T50/1.0, 4B/T50/1.25, 4B/T50/1.5, 4B/T50/2.0,4B/T51/0.05, 4B/T51/0.1, 4B/T51/0.2, 4B/T51/0.3, 4B/T51/0.4, 4B/T51/0.5, 4B/T51/0.7, 4B/T51/0.9, 4B/T51/1.0, 4B/T51/1.25, 4B/T51/1.5, 4B/T51/2.0, 4B/T52/0.05, 4B/T52/0.1, 4B/T52/0.2, 4B/T52/0.3, 4B/T52/0.4, 4B/T52/0.5, 4B/T52/0.7, 4B/T52/0.9, 4B/T52/1.0, 4B/T52/1.25, 4B/T52/1.5, 4B/T52/2.0		
		4B/T53/0.05, 4B/T53/0.1, 4B/T53/0.15, 4B/T53/0.2, 4B/T53/0.3, 4B/T53/0.4, 4B/T53/0.5, 4B/T53/0.7, 4B/T53/0.9, 4B/T53/1.0, 4B/T53/1.25, 4B/T53/1.5, 4B/T53/2.0, 4B/T54/0.05, 4B/T54/0.1, 4B/T54/0.2, 4B/T54/0.3, 4B/T54/0.4, 4B/T54/0.5, 4B/T54/0.7, 4B/T54/0.9, 4B/T54/1.0, 4B/T54/1.25, 4B/T54/1.5, 4B/T54/2.0, 4B/T55/0.05, 4B/T55/0.1, 4B/T55/0.2, 4B/T55/0.3, 4B/T55/0.4, 4B/T55/0.5, B/T55/0.7, 4B/T55/0.9, 4B/T55/1.0, 4B/T55/1.25, 4B/T55/1.5, 4B/T55/2.0, 4B/T56/0.05, 4B/T56/0.1, 4B/T56/0.2, 4B/T56/0.3, 4B/T56/0.4, 4B/T56/0.5, 4B/T56/0.7, 4B/T56/0.9, 4B/T56/1.0, 4B/T56/1.25, 4B/T56/1.5, 4B/T56/2.0	3 and 27 July 2006	4B/T47: Inorganics (18 suite)*, TPHs, PAHs, phenols, OCPs, VOCs, pH 4B/T54, to 4B/T56: As, total Cr, Cu, Cr6+ Vegetation sampling: shoots and roots of carpet weed (Galenia Pubescens) from 4B/T49 to 4B/T56 were analysed for As, total Cr and Cu.

Potential Contamination Source	Sampling Location(s)	Samples Analysed	Date/s	Analytes
		4B/T59/0.25, 4B/T59/0.5, 4B/T59/1.0, 4B/T60/0.25, 4B/T60/0.5, 4B/T60/1.0, 4B/T61/0.25, 4B/T61/0.5, 4B/T61/1.0, 4B/T62/0.1, 4B/T62/0.25, 4B/T62/0.5, 4B/T62/1.0, 4B/T63/0.25, 4B/T63/0.5, 4B/T63/1.0, 4B/T64/0.25, 4B/T64/0.5, 4B/T64/1.0, 4B/T65/0.25, 4B/T65/0.5, 4B/T65/1.0, 4B/T66/0.25, 4B/T66/0.5, 4B/T66/1.0, 4B/T67/0.05, 4B/T67/0.25, 4B/T67/0.5, 4B/T67/1.0, 4B/T68/0.25, 4B/T68/0.5, 4B/T68/1.0, 4B/T69/0.25, 4B/T69/0.5, 4B/T69/1.0, 4B/T70/0.25, 4B/T70/0.5, 4B/T70/1.0, 4B/T71/0.1, 4B/T71/0.25, 4B/T71/0.5, 4B/T71/1.0, 4B/T72/0.25, 4B/T72/0.5, 4B/T72/1.0, 4B/T73/0.25, 4B/T73/0.5, 4B/T73/1.0, 4B/T74/0.25, 4B/T74/0.5, 4B/T74/1.0, 4B/T75/0.20, 4B/T75/0.5, 4B/T75/1.0, 4B/T76/0.25, 4B/T76/0.5, 4B/T76/1.0, 4B/T77/0.25, 4B/T77/0.5, 4B/T77/1.0, 4B/T78/0.20, 4B/T78/0.5, 4B/T78/1.0, 4B/T79/0.20, 4B/T79/0.5, 4B/T79/1.0, 4B/T80/0.25, 4B/T80/0.5, 4B/T80/1.0, 4B/T81/0.15, 4B/T81/0.25, 4B/T81/0.5, 4B/T81/1.0, 4B/T82/0.25, 4B/T82/0.5, 4B/T82/1.0, 4B/T83/0.25, 4B/T83/0.5, 4B/T83/1.0, 4B/T84/0.20, 4B/T84/0.5, 4B/T84/1.0, 4B/T85/0.25, 4B/T85/0.5, 4B/T85/1.0, 4B/T86/0.25, 4B/T86/0.5, 4B/T86/1.0, 4B/T87/0.25, 4B/T87/0.5, 4B/T87/1.0, 4B/T88/0.25, 4B/T88/0.5, 4B/T88/0.8, 4B/T88/1.0, 4B/T90/0.25, 4B/T90/0.5, 4B/T90/1.0, 4B/T91/0.5, 4B/T91/1.0, 4B/T92/0.25, 4B/T92/0.5, 4B/T92/1.0	14-24 April 2008	As, total Cr and Cu. Chromium speciation (3 occasions)
Buried oil structure	4B/T93	4B/T93/0.5	17 February 2009	**12 metals suite, hexavalent chromium (Cr 6+), sulphate (SO_4), sulphide (total) (SO_{2-}), cyanide (CN), fluoride (F), BTEX, TPHs, VOCs, PAHs, phenols, OCPs, PCBs
Septic system (and associated ceramic pipework).	Septic System 4B/T23 Disturbed soil/possible fill 4B/T46, 4B/G25/FL/VS 4B/G25[4]	Septic System 4B/T23/0.5, 4B/T23/2.0 Disturbed soil/possible fill 4B/T46/2.0, 4B/T46/4.0, 4B/G25/2.0, 4B/G25/4.0, 4B/G25/FL/VS-1, 4B/G25/FL/VS-2	16 and 17 May 2006 and 11 August 2008	4B/T23: Inorganics (18 suite)*, TPHs, PAHs, OCPs, organophosphate pesticides (OPPs), ammonia, nitrate/nitrite, ecoli, pH. 4B/G25: Inorganics (18 suite)*, PAHs. 4B/T46: Inorganics (18 suite)*, PAHs, phenols, pH. 4B/G25/FL/VS-1, 4B/G25/FL/VS-2: Inorganics (18 suite)*, cyanide and fluoride, TPHs, PAHs, phenols, OCPs, OPPs.

Potential Contamination Source	Sampling Location(s)	Samples Analysed	Date/s	Analytes
Loading Bay	4B/G28A	4B/G28/0.25[4], 4B/G28/0.5[4] 4B/G28/1.0[4], 4B/G28A/0.25 4B/G28A/0.5, 4B/G28A/1.0	11 May 2006	4B/G28/0.25: As, Mn, V, Zn. 4B/G28/0.5, 4B/G28/1.0, 4B/G28A/0.5, 4B/G28A/1.0: As, Zn. 4B/G28A/0.25: Inorganics (18 suite)*, OCPs and OPPs.
Rubbish pile	4B/G40 and 4B/G41[4]	4B/G40/0.25, 4B/G40/0.5 4B/G41/0.25 (as part of composite)	11 May 2006	4B/G40: TPHs, pH. 4B/G41/0.25: Inorganics (18 suite)*, PAHs, phenols, OCPs, OPPs, PCBs, fluoride, cyanide (as part of composite).
CCA burial	4B/T48, 4B/T48A, 4B/T57 and 4B/T58	4B/T48/0.1, 4B/T48/0.25, 4B/T48/0.5, 4B/T48/1.0, 4B/T48/2.0, 4B/T48/3.0, 4B/T57/ 0.25, 4B/T57/0.5, 4B/T57/1.0, 4B/T57/1.4, 4B/T58/ 0.25, 4B/T58/0.5, 4B/T58/1.0	28 June 2006 and 8 March 2007 18 May 2009 9 July 2009	4B/T48: Inorganics (18 suite).* 4B/T48A: As, Cr, Cu, phenols, VOCs. 4B/T57 and 4B/T58: As, Cr, Cu. 4B/T57/1.4: As, Cr, Cr VI, Cu.
Concrete stormwater pipe (remaining in-situ)	4B/VS-56 to 4B/VS-61	4B/VS-56, 4B/VS-57, 4B/VS-58, 4B/VS-59, 4B/VS-60, 4B/VS-61	11 September 2009	Inorganics, OCPs, TPHs, Ecoli, Faecal Coliforms
Totals	**101**	**356**		

Notes

[1] Inorganics (18 suite) – antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, tin, vanadium, zinc and mercury.

[2] Inorganics (12 suite) – arsenic, cadmium, chromium, copper, lead, molybdenum, nickel, selenium, silver, tin, zinc, and mercury.

[3] Samples were collected from 4B/T89 but were not analysed. This location has not been included in the sample counts.

[4] This location was counted as a grid sample and discussed in Section 5.1.1, but may provide further information on this particular potential source area given its proximity. This location has not been included in the sample counts for targeted samples.

Targeted sampling

The targeted sampling did not assess all potential source areas identified. Areas not assessed included the underground asbestos and galvanised piping as well as road base materials located west of Hangar 5. However, these features were assessed during the removal and validation works (refer Section 5.4).

Former emergency powerhouse

According to Table E and Figure 3 of OTEK (2012a) soil location 4B/T24 targeted the former emergency powerhouse. Soils were collected to a maximum depth of 4mbgl. Three samples were analysed for PCBs, TPHs, and inorganics (refer Table 14). The analytical program was considered to be adequate to assess the former emergency powerhouse.

Test butt stop and shed including concrete slab base

According to Table E and Figure 3 of OTEK (2012a) eight samples were collected from four soil test pit locations north of the former test butt stop. This area was considered to be the most likely area for potential contamination from the use of the test butt. Samples were collected to a maximum depth of 0.5mbgl and analysed for inorganics (including lead), pH and explosives (refer Table 14). Following removal of the test butt shed and concrete slab in 2009, OTEK undertook validation sampling below the concrete slab which is discussed in Section 5.4.1 of this report.

Hangar 5 building footprint

According to Table C of OTEK (2012b) the demolition and removal of Hangar 5 was conducted between 17 July 2008 and 14 April 2009. As discussed in Section 5.4.3 of this report, a section of contaminated concrete was observed, this remained insitu at the time of this targeted sampling. This section of contaminated concrete was believed to be associated with the former TTP operations in this area of the hangar. The contaminated section of concrete was later removed and successfully validated (refer Section 5.4.3).

A total of 21 test pit locations were advanced across the building footprint. The majority of the test pits were advanced in February 2009, following removal of Hangar 5 (building structure and the non-contaminated section of the concrete slab, refer to Section 5.4.2 and 5.4.3). Nine test pit locations targeted the former concrete slab, including the former TTP area within the hangar. Six test pit locations targeted the northern and southern aprons of former Hangar 5. In addition, three test pits were advanced to the east and west of the building footprint area respectively.

The area of contaminated concrete was not assessed at this time. OTEK (2012a) considered these samples to be part of the targeted sampling program, however, the auditor considered that these samples provide additional information on the validation of the former Hangar 5 building footprint as later discussed in Section 5.4.3. Validation of the area for asbestos from the asbestos cladding is discussed in Section 5.4.2.

A total of sixty two soil samples were collected to a maximum depth of 2mbgl and analysed for a combination of inorganics, TPHs, PAHs, phenols, OCPs, pH, and asbestos (refer Table 14). Grid sampling locations 4B/G14 and 4B/G24 located within Hangar 5 building footprint were also advanced during this sampling event. Five soil samples were collected to a maximum depth of 1mbgl and analysed for arsenic, chromium, and copper.

The distribution of the test pits and analytical program were considered adequate to assess the former building footprint area.

Former timber drying yard east of Hangar 5 (including spoon drain)

According to the site history review (refer Section 2.8), the north eastern portion of the site was historically used for drying and storing treated timber. A total of 60 test pit targeted locations were advanced across the timber drying yard to assess any associated impacts from timber drying and storage activities. A total of 252 soil samples were collected to a maximum depth of 2mbgl and analysed for a combination of inorganics (including arsenic, chromium and copper), TPHs, PAHs, phenols, OCPs, VOCs, pH and asbestos (refer Table 14).

The distribution of the test pits and analytical program was considered adequate to assess the timber drying yard. Remediation of hotspots found was required. Details on the remediation and successful validation of the hotspots in this area are discussed in Section 5.5.2).

In addition to targeted test pit locations, trenching was undertaken in April 2008 in the former timber drying yard to assist with characterising this area. Trenching was undertaken in a north to south, and east to west direction and the trenches were excavated to a maximum depth of 1.0mbgl, and encapsulated samples collected from target locations 4B/T65, 4B/T67, 4B/T69, 4B/T70, 4B/T71 and 4B/T72.

Buried oil structure

A suspected UST was identified in February 2009 during the demolition of Hangar 5, when the weight of equipment being used in the demolition of Hangar 5 caused a release to discharge at the surface. The information was documented in the superseded RAP (OTEK, 2009) of which a relevant extract is attached Appendix K. It was not documented in the most recent RAP (OTEK, 2011) which was appended to OTEK, (2012b). The structure was initially suspected to be a UST and was interchangeably referred to as a suspected UST and buried oil structure throughout OTEK's (2012a and 2012b) reports. The auditor would describe the tank as a UST for waste oil however, for consistency; this potential source is referred to as the buried oil structure throughout this audit report.

One test pit location (4B/T93) targeted the buried oil structure located north west of former Hangar 5. In February 2009 soil sample 4B/T93/0.5 was analysed for inorganics, sulphate, total sulphide, cyanide, fluoride, BTEX, TPHs, VOCs, PAHs, phenols, OCPs and PCBs. The analytical program was considered adequate to assess the buried oil structure. The buried oil structure was removed and successfully validated during the infrastructure removal and validation works as discussed in Section 5.4.5 of this report.

Septic system

According to Table E of OTEK (2012a) and Figure 3, test pit location 4B/T23 targeted the septic system and network of ceramic pipes identified east of Hangar 5 in May 2006. The test pit was advanced to a maximum depth of 2m, and two soil samples were collected and analysed for inorganics, TPHs, PAHs, OCPs, OPPs, ammonia, nitrate/nitrite, ecoli and pH. The analytical program was considered adequate to assess the septic system.

Two areas (4B/G25 and 4B/T46) of 'disturbed fill material' were identified to the east of Hangar 5 during the grid and target sampling works in May 2006. Both locations were advanced to a maximum depth of 4.2m. Four samples were analysed for a combination of inorganics, PAHs, phenols, and pH. During the removal of septic system, OTEK (2012b) later concluded that these two locations (advanced originally as grid samples) were associated with the installation of the septic system. The auditor considered that soil at 4B/G25 and 4B/T46 would be better described as 'reworked natural'. This was based on the field observations and the proximity to the septic system. The septic system was removed and validated during the infrastructure removal and validation works as discussed in Section 5.4.7 of this report.

Loading bay

The *Riverwalk Area 4 Scope of Works for the Removal and Validation of Site Infrastructure and Buried Debris, Werribee, Victoria* (OTEK, 2009a) identified a loading bay in the south of the site. A concrete slab was also depicted on Figure 10 of the RAP (OTEK, 2011). OTEK (2012a and 2012b) did not provide any information on the assessment, removal or validation of the concrete slab / loading bay.

The auditor noted that the loading bay appeared to be in close proximity to 4B/G28 and 4B/G28A (refer to Figure 4). 4B/G28 was a grid location as discussed in Section 5.1.1 and 4B/G28A was collected due to the observation of a degraded plastic container during grid sampling works.

Further investigation in this area (due to elevated zinc concentrations discussed in Section 5.2.1) resulted in the discovery of hypodermic syringes. The auditor's assistant visited the site on 10 July 2009 and noted that syringes were found beneath a concrete slab (refer to Section 4.4 for the site notes). In their report, OTEK (2012b) referred to grid location 4B/G28 as the '*hypodermic syringe location'* based on syringes having been encountered here. Removal of the syringes and validation of the underlying soil was undertaken and is discussed in Section 5.5.4. Final validation samples reported concentrations below the EILs and HILs A.

The auditor considered that grid location 4B/G28 and targeted location 4B/G28A were adequate to characterise the former loading bay. 4B/G28 and 4B/G28A were advanced to a maximum depth of 1mbgl and analysed for inorganics 18 (OCPs and OPPs were also analysed at 4B/G28A). All results were below HILs A and EILs.

Based on the absence of contamination in the samples analysed, the absence of any observed staining or odours during the auditor and/or the auditor's assistant's site visits and the low potential for contamination at this location, the auditor considered this location was adequately assessed.

The auditor didn't see any visible trace of the loading bay in his final site inspection undertaken on 12 May 2014.

Rubbish pile

OTEK (2012a) stated that grid locations 4B/G40 and 4B/G41 were relevant to the rubbish pile located in the south eastern corner of the site. Both locations were advanced to maximum depth of 0.5mbgl. The auditor noted that these locations were in the vicinity of the rubbish pile but were located approximately 5 to 10m away. The analytical program was considered to be limited to assess the potential contaminants associated with the rubbish pile given that 4B/G40 was only analysed for TPHs and pH and 4B/G41 was analysed as part of composite sample 4B/C25.

The auditor conducted a site inspection on 26 November 2012 in the vicinity of the former rubbish pile. No obvious odours or staining was observed. A verification sample (G4 (R)) was collected and analysed for pH, inorganics, OCPs, OPPs, and PAHs. The results confirmed the the absence of contamination in this area (refer to Appendix L of this report for the laboratory report for the verification sample).

CCA burial

The potential issue of a copper chrome arsenate (CCA) burial to the west of Hangar 5 began with the identification of a geophysical anomaly by Enterra (refer to Section 2.8). Enterra (2001) inferred that the burial may be drums and suggested that further investigation of the area be undertaken by OTEK.

In June 2006 OTEK (2012a) investigated this location through test pitting at targeted location 4B/T48. Target location 4B/T48 was advanced to a maximum depth of 3m and analysed for inorganics. In March 2007 OTEK undertook further works to investigate the extent of contamination to the east of 4B/T48. The works included additional targeted locations 4B/T57 and 4B/T58. Both target locations were advanced to a maximum depth of 1mbgl and analysed for arsenic, chromium and copper. OTEK (2012b) stated that 4B/T48 was re-sampled in May 2009; 4B/T48A was collected and analysed arsenic, chromium, copper, phenols and VOCs. The rationale for the extended suite of analysis is not known but does not materially affect the outcome of this audit. It is also noted that grid location 4B/G13 was located within the CCA burial area and assists with the soil characterisation of this area.

The analytical program for 4B/G13, 4B/T48, 4B/T57 and 4B/T58 was considered adequate to assess the CCA burial located west of Hangar 5.

To characterise the extent of the contamination identified within the CCA burial, delineation sampling was undertaken at locations 4B/G13, 4B/T48, 4B/T57 and 4B/T58 (refer Section 5.3 of this report). This approach was unable to fully characterise the CCA contamination in the area west of the hangar, therefore remediation and validation works were required, which was conducted as discussed in Section 5.5.5 of this report.

Concrete stormwater pipe (in-situ)

During the infrastructure removal and validation works a concrete stormwater pipeline was identified at the site. The stormwater pipeline ran from the western boundary to the east (in the southern part of the site), with a 'T' section running north to the boundary (refer Figure 3). The stormwater pipe was in use at the time of the remediation works, and therefore it remained in-situ at audit completion. OTEK (2012b) reported that the samples collected along the alignment of the stormwater pipe were validation samples, however, given the pipe was not removed, these samples were considered part of the targeted sampling program.

One sample was collected every 100 m along the alignment of the stormwater pipe that remained in-situ in accordance with the SAP (Appendix K OTEK 2012b). Six soil samples were collected and analysed for inorganics, OCPs, TPHs, ecoli, and faecal coliforms. The analytical program was considered adequate to assess any impact arising from the use of the stormwater pipeline. The section of the pipe removed during the infrastructure removal and validation works is discussed in Section 5.4.11 of this report.

5.1.4 Auditor's opinion on adequacy of soil assessment program

The auditor and his support team have assessed the information available. Consequently, it was considered that overall the grid-based and targeted sampling locations and analytical program provided a good and an adequate coverage to allow determination of the potential risk from the potentially contaminating sources at the site. This was based on the following lines of evidence.

- The auditor, based on the site history information and his and his assistants multiple field visits, 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;
- With the exception of the former rubbish pile located in the south eastern corner of the site; the analytical program sufficiently addressed all identified COPC. The auditor conducted a site inspection on 26 November 2012 in the vicinity of the former rubbish pile. No obvious odours or staining was observed. A verification sample was collected and confirmed the absence of gross contamination in this area (refer Section 5.1.3 of this report);

- Despite OTEK not having undertaken targeted sampling of the asbestos and galvanised piping, all infrastructure was subsequently removed and underlying soils validated;
- 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.

It was noted the auditor had to provide numerous comments regarding OTEK's draft ESA reports, however, sufficient information was provided to be able to draw conclusions on the audit outcomes. The issues raised and responses from OTEK (where available) are provided in Appendix J of this report.

5.2 Summary of soil assessment results

The results of the grid and target sampling programs are summarised in Table 15. The table shows only individual samples containing contaminants at concentrations exceeding the adopted investigation levels, and does not include composite samples, which are discussed further below.

A full summary of soil analytical results is presented in Tables 1 to 56 of OTEK (2012a) and Table 16 of OTEK (2012b) reports.

Table 15 Summary of grid and target sampling results

Analyte	NEPM or Adopted IL (mg/kg)		Concentration Range (mg/kg)	Samples exceeding adopted investigation level
	EIL	HIL		
Antimony	Not specified	Not specified	Grid: <1 - 3 Target: <5 – 342	None
Arsenic	20	100	Grid: 1 – 3120 Target: <5 – 76,000 Maximum concentration reported at 4B/T48/A of 76,000 mg/kg	8 grid samples exceeding EIL: 4B/G2/0.25, 4B/G3/0.25, 4B/G4/0.1, 4B/G13/0.25, 4B/G13/0.5, 4B/G13/1.0, 4B/G17/0.25, 4B/G18/0.25. 2 grid samples exceeding HIL: 4B/G2/0.25, 4B/G13/1.0 60 targeted exceeded NEPM EIL 25 targeted exceeded NEPM HIL
Barium	300	Not specified	Grid: 19 - 290 Target: 30 - 450	1 target sample exceeded EIL 4B/T12/0.25
Chromium	1 (CrVI) 400 (CrIII)	100 (CrVI) 12% (CrIII)	Grid: 17 – 4690, CrVI: 2 Target: 16 – 21,200 CrIII 37 -2140, CrVI <1-1.8	2 grid sample exceeded EIL 4B/G13/1.0, 4B/G13/1.8 5 target samples exceeded EIL 4B/T48/0.1, 4B/T50/0.05, 4B/T58/ 0.25, 4B/T68/0.25, 4B/T93/0.5
Copper	100	1000	Grid: 8 - 1900 Target: 9 - 6890	1 grid sample exceeded EIL & HIL: 4B/G13/1.0 13 targeted samples exceeding EIL: 4B/T18/0.25, 4B/T21/0.25, 4B/T48/0.1, 4B/T50/0.05 4B/T50/0.1, 4B/T50/0.4, 4B/T55/0.05, 4B/T55/0.1, 4B/T57/0.25, 4B/T58/0.25, 4B/T59/0.25, 4B/T68/0.25, 4B/T93/0.5 3 targeted samples exceeding HIL: 4B/T93/0.5, 4B/T48/0.1, 4B/T48/A

Analyte	NEPM or Adopted IL (mg/kg)		Concentration Range (mg/kg)	Samples exceeding adopted investigation level
	EIL	HIL		
Manganese	500	1500	Grid: 120 - 780 Target: 118 - 622	8 grid samples exceeded EILs 4B/G2/0.1, 4B/G3/0.1, 4B/G4/0.1, 4B/G15/1.0, 4B/G17/0.25, 4B/G18/0.25, 4B/G19/0.1, 4B/G34/0.1 8 target samples exceeded EIL 4B/T6/1.0, 4B/T9/0.5, 4B/T16/1.0, 4B/T22/0.25, 4B/T43/0.1, 4B/T43/0.25, 4B/T44/0.1, 4B/T45/0.1
Nickel	60	600	Grid: 13 - 120 Target: 15 - 106	5 grid samples exceeding EIL: 4B/G2/0.1, 4B/G3/0.1, 4B/G4/0.1, 4B/G19/0.1, 4B/G34/0.1 3 target samples exceeded EIL: 4B/T43/0.1, 4B/T44/0.1, 4B/T45/0.1
Vanadium	50	Not specified	Grid: 15 - 62 Target: 12 – 125	7 grid samples exceeded EIL 4B/G3/0.5, 4B/G10/0.5, 4B/G12/0.5, 4B/G13/0.5, 4B/G23/0.5, 4B/G34/0.5, 4B/G37/0.5 13 target samples exceeded EIL 4B/T1/0.5, 4B/T2/0.5, 4B/T3/0.5, 4B/T4/0.5, 4B/T6/0.25, 4B/T14/0.25, 4B/T15/0.25, 4B/T18/0.25, 4B/T21/0.5, 4B/T22/0.5, 4B/T45/0.5, 4B/T48/0.1, 4B/T48/0.5.
Zinc	200	7000	Grid: 25 - 770 Target: 26 – 960	1 grid samples exceeded EIL: 4B/G29/0.5 3 target sample exceeded EIL: 4B/G28A/0.25, 4B/G28A/1.0, 4B/T93/0.5
PAHs	Not specified	20	Grid: <0.5 Target: <0.5 – 2500	1 target sample exceeded HIL 4B/T93/0.5
TPH C10-C36	1000 (NSW EPA criteria		<LOR - 89,600	All <LOR except one target sample 4B/T93/0.5

5.2.1 Inorganics

Multiple composite samples contained concentrations of arsenic, barium, chromium, copper, manganese, nickel, vanadium, zinc and mercury above the modified EIL (investigation levels divided by number of samples in composite), as outlined in Section 6 of OTEK (2012a) report. Concentrations of arsenic and copper exceeded the modified HIL (investigation levels divided by number of samples in composite). The samples which exceeded the modified HIL were located west of Hangar 5 and were attributed to grid sample 4B/G13.

Not all individual samples from composites containing inorganic concentrations above the modified investigation levels were subsequently analysed, due to an oversight by OTEK (refer Section 5.1.2). As such the auditor has relied on the results of the individual samples in the following discussion.

A total of 55 grid samples and 102 targeted samples from across the site were analysed for inorganics (18 inorganics suite, refer Table 14). Additionally, a total of 240 targeted samples were analysed for arsenic, chromium and copper to investigate the former timber treatment activities at the site. A summary of the results is provided below.

- Concentrations of arsenic (outside the area west of Hangar 5 and the former timber drying yard), barium, manganese, nickel and vanadium reported grid and target samples above the EIL but were within background ranges across the Overall Audit Site.
- Concentrations of arsenic (in the area west of Hangar 5 and the former timber drying yard), chromium and copper were above the EIL and some instances the HIL. The source and extent of these inorganics is discussed in the following section.
- Four samples reported zinc concentrations above EIL. The distribution of zinc was not considered to be widespread across the site. The highest concentration reported was 960 mg/kg in target sample 4B/T93/0.5 located in the vicinity of the buried oil structure located to the west of Hangar 5. Soil samples 4B/G28A/0.25, 4B/G28A/1.0 (located near the loading bay) and 4B/G29/0.5 also reported zinc concentrations above the EIL. The source of the elevated zinc at these locations was unknown; however, it is likely to be due to a nural background variation. The concentrations were below HIL A. Remediation and validation sampling near surface (refer to Section 5.5.4) indicated that zinc concentrations (collected at 0.25 m) were below the EIL and HIL A. It is possible that isolated elevated zinc concentrations may exist in this area (beyond 0.25 m), however, based on the results of the validation sampling, the extent is limited and the auditor considered the zinc concentrations unlikely to pose an unacceptable risk.
- The results from the leachability tests generally returned low leachability, they also indicated that when the extract solution was of a low pH (i.e. for the TCLP test) there was some low leaching of zinc in the soil (i.e. 31.4%, 4B/G28A/1.0, Table 24 and 55.32%, 4B/T4/0.5, Table 44 of OTEK 2012a report), and the remainder of the inorganics analysed reported much lower leaching concentrations. For the ASLP tests, where the extract solution was relatively neutral; as expected the leaching concentrations for all of the inorganics tested were much lower. It is considered that the ASLP results are most likely to be more representative of "real life "conditions" (e.g. the natural rainwater infiltration conditions and the soil pH at Area 4B).
- No individual samples exceeded investigation levels for mercury.

Further discussion of the naturally occurring inorganics and the exceedances in the area west of Hangar 5 and the former timber drying yard are discussed in the following sections.

Naturally occurring inorganics

The concentrations of arsenic (outside the area west of Hangar 5 and the former timber drying yard), barium, manganese, nickel and vanadium were considered to be naturally occurring, based on the following lines of evidence. These inorganics have not been discussed as exceedances throughout the remainder of this report.

- Samples were collected from natural soils;
- Results were consistent with concentrations detected across the Overall Audit Area (as detailed in Section 6.1.2, Table K of OTEK (2012a) report);
- There were no identified potential sources of these inorganics;
- Concentrations were within NEPM background ranges; and
- Leachability testing returned low leachability results for these inorganics.

Arsenic, chromium and copper

The concentrations of arsenic), chromium and copper, in the area west of Hangar 5 and the former timber drying yard that were detected above the EIL and the HIL (in some instances) were considered to be due to the former timber treatment plant activities, specifically the use of copper chrome arsenate (CCA) to treat timber.

As presented in Table 15, elevated concentrations of arsenic, chromium and / or copper were reported at 4B/T48, 4B/G2, 4B/G13, 4B/T57 and 4B/58 which were located in the area west of Hangar 5. The maximum concentrations of arsenic (29,900mg/kg), chromium (21,200mg/kg) and copper (6890mg/kg) were reported in surface sample 4B/T48 (OTEK, 2012a, Table 25). This was consistent with the field observations reported by OTEK (2012a), that '*a shallow green lens of soil'* was observed at this location. Deeper contamination was identified during the remediation works (refer to Section 5.5.5) and was believed to be associated with the the CCA burial (identified as the geophysical anomaly by Enterra (2001)). The elevated concentrations identified at 4B/G2, 4B/G13, 4B/T57 and 4B/58 were within the top metre of soil.

A total of 22 test pit locations (i.e. 4B/G17, 4B/G18, 4B/T7, 4B/T8, 4B//T9, 4B/T12, 4B/T14, 4B/T15, 4B/T18, 4B/T20, 4B/T21, 4B/T49, 4B/T50, 4B/T51, 4B/T52, 4B/T54, 4B/T55, 4B/T56, 4B/T59, 4B/T61, 4B/T68, 4B/T88) within the former timber drying yard reported concentrations of arsenic, chromium and / or copper above the EIL and HIL A (in some instances). The maximum concentration of arsenic (412 mg/kg), chromium (513 mg/kg) and copper (322 mg/kg) was reported at surface sample 4B/T50/0.05. Remediation and successful validation was undertaken at these 22 CCA hotspots. A 23rd location (4B/T5) was also excavated and validated; however, concentrations at this location were below the EIL and HIL A. The remediation and validation works are discussed in Section 5.5.2. The exceedances are shown on Figure 5.

The distribution of these analytes was presented in Figure 6 of OTEK (2012a) and the distribution clearly correlated with former timber treatment plant activities identified in the site history review (refer Section 2.8.1). The concentrations observed in the area west of Hangar 5 and former timber drying yard were not reported elsewhere on the Overall Audit Site.

Four test pits (4B/G2, 4B/G4, 4B/G28A, 4B/T81) reported concentrations of arsenic, chromium and copper above the EIL and HIL A (in some instances) across the general site area. OTEK (2012b) reported that '*hotspots outside of the timber drying yard are thought to have originated from general site usage associated with CCA treatment chemicals'. Further delineation sampling was undertaken at* 4B/G4 (refer to Section 5.3). Remediation works undertaken to the west of Hangar 5 incorporated the CCA impacts identified at 4B/G2 (refer to Section 5.5.5). Remediation and successful validation of CCA impacts identified at 4B/G3, 4B/G4, 4B/G28A,

4B/G29 (where an exceedance of zinc had been reported) and 4B/T81 was undertaken and is discussed in Section 5.5.3.

OTEK undertook delineation sampling in an attempt to determine the extent of CCA contamination identified in the area west of Hangar 5 as well as some of the locations on the general site area. The results of the delineation sampling are discussed Section 5.3. The remediation and successful validation in the area west of Hangar 5, timber drying yard, and general site area is discussed in Sections 5.5.2, 5.5.3 and 5.5.5 respectively. The delineation sampling exceedances are displayed in Figure 7.

5.2.2 Vegetation sampling

OTEK (2012a) reported 18 primary samples of plant matter from the plant Galenia Pubescens were submitted to a laboratory for arsenic, chromium and copper testing. The plant matter comprised of either shoots or roots, did not include any soil, and was sourced from targeted locations 4B/T49 to 4B/T56. The auditor requested the sampling and analysis of plants as an important test to assess the "real life" phytoavailability of CCA contaminants in treated timber drying area containing especially high levels of arsenic. The results were provided in Analytical Table 46 of OTEK (2012a). The plant samples were collected form a number of locations across the timber drying area.

The results obtained for both shoots and roots demonstrated a low level of plant uptake (e.g. the coefficient of uptake for As was < 1%) and, hence added another line of evidence regarding the insignificance of any potential phytoxicity impact of CCA levels remaining on site. This is also consistent with the soil ASLP results, soil pH and nature of soil.

5.2.3 Organics

Concentrations of PAHs and TPHs C_{10} – C_{36} were above the adopted investigation level at location 4B/T93/0.5, which targeted the buried oil structure. The buried oil structure was later removed and the excavation successfully validated and is discussed in Section 5.4.5.

Remaining samples reported concentrations of organic analytes tested below the investigation levels, and predominantly below the laboratory limits of reporting.

5.2.4 Asbestos

A total of 60 (27 grid and 33 targeted) soil samples were collected and analysed for asbestos. Asbestos fragments were noted in test pit logs for 4B/G13 and 4B/G25.

OTEK indicated that asbestos fibres were reported at 4B/G13 (OTEK 2012b), however, the borelog for 4B/G13 (included in Appendix C of OTEK 2012a) reported that broken asbestos was observed at 0.1 m. It is assumed that the observations recorded in the borelog refer to asbestos fragments as they were visible to the naked eye. Consequently OTEK collected a sample from this location and submitted it for laboratory testing. The laboratory report (E026597, ASET8632/ 11755 / 1 – 31) stated that this sample consisted of a 'mixture of soil, stones, plant matter, fragments of plaster, cement, fibre cement and brick' and confirmed that the fibre cement was 'chrysotile and amosite asbestos'. The laboratory report did not indicate that any free asbestos fibres were present in the sample and as such the auditor considered that the reference to asbestos fibres by OTEK (2012b) was incorrect.

Location G13 was located adjacent to Hangar 5, close to the northwest corner of the former building; and the asbestos fragment observed was most likely associated with the asbestos cement sheeting of Hangar 5.

Asbestos remediation (refer to Section 5.5.1) was later undertaken at 4B/G13, and 4B/VS-27/SS-1, where another positive positive detection of asbestos was reported during validation sampling (refer to Section 5.4.2).

No sample was analysed for asbestos from 4B/G25 where a fragment had been observed during the grid sampling, and it was unknown as to whether the fragment was removed. However, 4B/G25 was later found to be associated with the septic system (refer to Section 5.4.7) which was removed and successfully validated. Four samples from the septic excavation were sampled for asbestos and no asbestos was detected. Furthermore the auditor revisited 4B/G25 during his final site inspection and did not observe any asbestos fragments.

5.2.5 Auditor's conclusion on soil assessment results

The results of the grid and targeted sampling indicated that the emergency powerhouse, insitu stormwater pipe and former rubbish pile (south eastern corner of site) had not been a source of contamination.

The following infrastructure and areas of concern identified during the assessment field works required further investigation, removal or remediation and validation as discussed in this report.

- CCA burial located west of Hangar 5;
- The contaminated section of concrete associated with Hangar 5;
- Former timber drying yard east of Hangar 5 (including spoon drain);
- Asbestos fragments from former Hangar 5 building footprint;
- Buried oil structure;
- Septic system and associated ceramic pipework;
- Stop test butt shed (including associated concrete slab);
- The loading bay;
- Underground asbestos piping; and
- Underground galvanised piping.

5.3 Delineation sampling

Results of grid and targeted sampling (refer to Section 5.2.1), and site observations indicated the presence of CCA contamination to the area west of Hangar 5 and in the former timber drying yard (refer to Figure 6).

As a result a total of 282 delineation samples were collected from 75 locations in the area west of Hangar 5. The samples were analysed for one or more of copper, chromium and arsenic. The sampling was undertaken over a period of approximately one year. In April 2008, delineation sampling was undertaken in the area west of Hangar 5. Mature gum trees in the vicinity of target location 4B/T48 prevented completion of the delineation sampling in this area until February 2009 when the trees were removed. Due to delineation results, further delineation sampling was undertaken from June to August 2009. The delineation sampling locations were shown on Figure 3 of OTEK 2012a and Figure 6 of OTEK 2012b. For completeness, Figure 6 of this report combines the outputs of these two figures and shows all delineation sampling locations.

Delineation sampling was also undertaken at grid location 4B/G4 (located north east of former Hangar 5) in April 2008. The sampling locations are shown on Figure 3 of OTEK, (2012a) report. The rationale and objective for this sampling was not explained by OTEK (2012a), however, based on a review of the field logs it appears that road base materials were identified at this location and hence the delineation sampling.

During the delineation sampling, OTEK (2012b) identified road base materials that were contaminated with CCA. The contaminated road base was later removed and validated (refer Section 5.5.6 of this report).

A summary of the delineation sampling is presented in Table 16. This summary was compiled using Summary Analytical Table 48 from OTEK, 2012a and Table 16 from OTEK, 2012b reports.

Table 16 Delineation sampling based analytical schedule

Grid / Target Location being delineated	Date/s	Sample Locations	Samples Analysed	Analytes	Concentration Range (mg/kg)	Results exceeding adopted investigation level
4B/G13	18 and 21 April 2008	4B/G13/E1, 4B/G13/E2, 4B/G13/E3, 4B/G13/E4, 4B/G13/E5, 4B/G13/E6, 4B/G13/W1, 4B/G13/W2, 4B/G13/W3, 4B/G13/W4, 4B/G13/W5, 4B/G13/W6	4B/G13/E1/0.25, 4B/G13/E1/0.5, 4B/G13/E1/1.0, 4B/G13/E1/1.5 4B/G13/E1/2.0, 4B/G13/E2/0.25, 4B/G13/E2/0.5, 4B/G13/E2/1.0, 4B/G13/E2/1.5, 4B/G13/E2/2.0, 4B/G13/E3/0.25, 4B/G13/E3/0.5, 4B/G13/E3/1.0, 4B/G13/E3/1.5, 4B/G13/E3/2.0, 4B/G13/E4/0.25, 4B/G13/E4/0.5, 4B/G13/E4/1.0, 4B/G13/E4/1.5, 4B/G13/E4/ 2.0, 4B/G13/E5/0.25, 4B/G13/E5/0.5, 4B/G13/E5/1.0, 4B/G13/E5/1.5, 4B/G13/E5/2.0, 4B/G13/E6/0.2, 4B/G13/E6/0.25, 4B/G13/E6/0.5, 4B/G13/E6/1.0, 4B/G13/E6/1.5, 4B/G13/E6/2.0, 4B/G13/W1/0.25, 4B/G13/W1/0.5, 4B/G13/W1/1.0, 4B/G13/W1/1.5, 4B/G13/W1/2.0, 4B/G13/W2/0.25, 4B/G13/W2/0.5, 4B/G13/W2/1.0, 4B/G13/W2/1.5, 4B/G13/W2/2.0, 4B/G13/W3/0.25, 4B/G13/W3/0.5, 4B/G13/W3/1.0, 4B/G13/W3/1.5, 4B/G13/W3/2.0, 4B/G13/W4/0.25, 4B/G13/W4/0.5, 4B/G13/W4/1.0, 4B/G13/W4/1.5, 4B/G13/W4/2.0, 4B/G13/W5/0.25, 4B/G13/W5/0.5, 4B/G13/W5/1.0, 4B/G13/W5/1.5, 4B/G13/W5/2.0, 4B/G13/W6/0.25, 4B/G13/W6/0.5, 4B/G13/W6/1.0, 4B/G13/W6/1.5, 4B/G13/W6/2.0	Arsenic, total chromium and copper. Chromium speciation (15 occasions)	Arsenic: 6–20200 Chromium: 32-13300 Chromium III: 37-2140 Chromium VI: <1 Copper: 19-4070 Maximum reported at 4B/G13/E6/0.2 Concentrations decrease with depth.	Arsenic: 24 samples above EIL 13 samples above HIL Chromium: 7 samples above EIL Copper: 10 samples above EIL 1 sample above HIL

Grid / Target Location being delineated	Date/s	Sample Locations	Samples Analysed	Analytes	Concentration Range (mg/kg)	Results exceeding adopted investigation level
	13 February 2009	4B/G13/W7, 4B/G13/W8, 4B/G13/W9, 4B/G13/W10, 4B/G13/W11	4B/G13/W7/0.25, 4B/G13/W7/0.5 4B/G13/W8/0.25, 4B/G13/W8/0.5 4B/G13/W9/0.25, 4B/G13/W9/0.5 4B/G13/W10/0.25, 4B/G13/W10/0.5 4B/G13/W11/0.25, 4B/G13/W11/0.5	Arsenic, cadmium, total chromium, copper , lead, nickel, zinc	Arsenic: 3.8-9.8 Chromium: 27-52 Copper: 8.8-21	None
	16 February 2009 9 July 2009 12 August 2009	4B/T48/E2, 4B/T48/E4, 4B/T48/N2, 4B/T48/N4, 4B/T48/N6, 4B/T48/W2, 4B/T48/W4, 4B/T48/W6, 4B/T48/W8,	4B/T48/E2/0.5, 4B/T48/E2/1.0 4B/T48/E2/1.6,4B/T48/E2/2.0 4B/T48/E4/0.25, 4B/T48/E4/0.5 4B/T48/E4/1.4, 4B/T48/N2/0.25 4B/T48/N2/0.5, 4B/T48/N4/0.25 4B/T48/N4/0.5, 4B/T48/N6/0.25 4B/T48/N6/0.5, 4B/T48/W2/0.25 4B/T48/W2/0.5, 4B/T48/W2/1.0 4B/T48/W2/1.3, 4B/T48/W4/0.25 4B/T48/W4/0.5, 4B/T48/W4/1.3 4B/T48/W6/0.25, 4B/T48/W6/0.5 4B/T48/W8/0.25, 4B/T48/W8/0.5	Arsenic, cadmium, total chromium, copper , lead, nickel, zinc Chromium speciation (4 occasions)	Arsenic: 3.1-990 Chromium: 40-1360 Chromium VI: <0.5-2.2 Copper: 7.3-200 Maximum reported at 4B/T48/W2/0.25 Concentrations decrease with depth.	Arsenic: 9 samples above EIL 3 samples above HIL Chromium: 1 sample above EIL Chromium VI: 1 sample above EIL Copper: 1 sample above EIL
	8 July 2009	4B/T48/W4/N11	4B/T48/W4/N11/0.25, 4B/T48/W4/N11/0.5, 4B/T48/W4/N11/1.0, 4B/T48/W4/N11/1.5	Chromium speciation	Chromium VI: <0.5	None
	18 April 2008	4B/T57/N1, 4B/T57/N2, 4B/T57/N3, 4B/T57/N4	4B/T57/N1/0.25, 4B/T57/N1/0.5 4B/T57/N1/1.0, 4B/T57/N1/1.5 4B/T57/N1/2.0, 4B/T57/N2/0.25 4B/T57/N2/0.5, 4B/T57/N2/1.0 4B/T57/N2/1.5, 4B/T57/N2/2.0 4B/T57/N3/0.25, 4B/T57/N3/0.5 4B/T57/N3/1.0, 4B/T57/N3/1.5 4B/T57/N3/2.0, 4B/T57/N4/0.25 4B/T57/N4/0.5, 4B/T57/N4/1.0 4B/T57/N4/1.5, 4B/T57/N4/2.0	Arsenic, total chromium and copper Chromium speciation (4 occasions)	Arsenic: 6-602 Chromium: 29-508 Chromium III: 102-480 Chromium VI: <1.0 Copper: 19-174 Maximum reported at 4B/T57/N2/0.25 Concentrations decrease with depth.	Arsenic: 8 samples above EIL 4 samples above HIL Chromium: 2 samples above EIL Chromium III: 1 sample above EIL Chromium VI: None Copper: 4 samples above EIL

Grid / Target Location being delineated	Date/s	Sample Locations	Samples Analysed	Analytes	Concentration Range (mg/kg)	Results exceeding adopted investigation level
	13 February 2009 9 July 2009	4B/T57/N5, 4B/T57/N6, 4B/T57/N7, 4B/T57/N8, 4B/T57/N9, 4B/T57/S2, 4B/T57/S4, 4B/T57/S6,	4B/T57/N5/0.25, 4B/T57/N5/0.5 4B/T57/N5/1.0,4B/T57/N6/0.25 4B/T57/N6/0.5, 4B/T57/N6/1.0 4B/T57/N7/0.25, 4B/T57/N7/0.5 4B/T57/N7/1.0, 4B/T57/N8/0.25 4B/T57/N8/0.5, 4B/T57/N9/0.25 4B/T57/N9/0.5, 4B/T57/S2/0.25 4B/T57/S2/0.5, 4B/T57/S2/1.0 4B/T57/S4/0.25, 4B/T57/S4/0.5 4B/T57/S4/1.0, 4B/T57/S6/0.25 4B/T57/S6/0.5, 4B/T57/S6/1.0 4B/T57/S6/1.8	Arsenic, cadmium, total chromium, copper , lead, nickel, zinc Chromium speciation (1 occasion)	Arsenic: 5.9-760 Chromium: 31-820 Chromium: VI <0.5 Copper: 9.8-280 Maximum reported at 4B/T57/S2/0.25 & 4B/T57/S6/0.25 Concentrations decrease with depth.	Arsenic: 10 samples above EIL 4 samples above HIL. Chromium: 2 samples above EIL Copper: 2 samples above EIL
	3-4 June 2009	4B/T57/W4/N11, 4B/T57/N4/E6, 4B/T57/N15, 4B/T57/N15/E6, 4B/T57/N21, 4B/T57/N21/E8, 4B/T57/N27	4B/T57/W4/N11/0.25, 4B/T57/W4/N11/0.5, 4B/T57/W4/N11/1.0, 4B/T57/W4/N11/1.5, 4B/T57/W4/N11/2.0, 4B/T57/N4/E6/0.25, 4B/T57/N4/E6/0.5, 4B/T57/N4/E6/1.0, 4B/T57/N4/E6/1.5, 4B/T57/N4/E6/2.0, 4B/T57/N15/0.25, 4B/T57/N15/0.5, 4B/T57/N15/1.0, 4B/T57/N15/1.5 4B/T57/N15/2.0, 4B/T57/N15/E6/0.25 4B/T57/N15/E6/0.5, 4B/T57/N15/E6/1.0 4B/T57/N15/E6/1.5, 4B/T57/N15/E6/2.0 4B/T57/N21/0.25, 4B/T57/N21/0.5 4B/T57/N21/1.0, 4B/T57/N21/1.5 4B/T57/N21/2.0, 4B/T57/N21/E8/0.25 4B/T57/N21/E8/0.5, 4B/T57/N21/E8/1.0 4B/T57/N21/E8/1.5, 4B/T57/N21/E8/2.0 4B/T57/N27/0.25, 4B/T57/N27/0.5 4B/T57/N27/1.0, 4B/T57/N27/1.5 4B/T57/N27/2.0	Arsenic, total chromium, copper, zinc	Arsenic: 4.6-4900 Chromium: 39-2700 Copper: 13-740 Maximum reported at 4B/T57/N21/0.25 Concentrations decrease with depth.	Arsenic: 8 samples above EIL 3 samples above HIL Chromium: 2 samples above EIL Copper: 2 samples above EIL

Grid / Target Location being delineated	Date/s	Sample Locations	Samples Analysed	Analytes	Concentration Range (mg/kg)	Results exceeding adopted investigation level
	21 April 2008	4B/T58/S1, 4B/T58/S2, 4B/T58/S3, 4B/T58/S4	4B/T58/S1/0.25, 4B/T58/S1/0.5 4B/T58/S1/1.0, 4B/T58/S2/0.25 4B/T58/S2/0.50, 4B/T58/S2/1.0 4B/T58/S3/0.25, 4B/T58/S3/0.5 4B/T58/S3/1.0, 4B/T58/S4/0.25 4B/T58/S4/0.5, 4B/T58/S4/1.0	Arsenic, total chromium and copper Chromium speciation (4 occasions)	Arsenic: 7-506 Chromium: 38-694 Chromium: III 88-578 Chromium: VI <1 Copper: 20-202 Maximum reported at 4B/T58/S1/0.25 Concentrations decrease with depth	Arsenic: 6 samples above EIL 4 samples above HIL Chromium: 1 sample above EIL Chromium III: 1 sample above EIL Chromium VI: None Copper: 4 samples above EIL
	13 February 2009 9 July 2009	4B/T58/N2, 4B/T58/N6, 4B/T58/S5, 4B/T58/S6, 4B/T58/S7, 4B/T58/S8, 4B/T58/S9,	4B/T58/N2/0.25, 4B/T58/N2/0.5 4B/T58/N2/1.0, 4B/T58/N6/0.25 4B/T58/N6/0.5, 4B/T58/N6/1.0 4B/T58/S5/0.25, 4B/T58/S5/0.5 4B/T58/S5/1.0, 4B/T58/S5/1.4 4B/T58/S6/0.25, 4B/T58/S6/0.5 4B/T58/S6/1.0, 4B/T58/S7/0.25 4B/T58/S7/0.5, 4B/T58/S7/1.0 4B/T58/S8/0.25, 4B/T58/S8/0.5 4B/T58/S8/1.0, 4B/T58/S9/0.25 4B/T58/S9/0.5, 4B/T58/S9/1.0	Arsenic, cadmium, total chromium, copper , lead, nickel, zinc Chromium speciation (1 occasion) 4B/T58/S5/1.4	Arsenic: 3.9-150 Chromium: 16-260 Copper: 12-160 Maximum reported at 4B/T58/S6/1.0 4B/T58/S9/0.25	Arsenic: 10 samples above EIL 4 samples above HIL Chromium: None Chromium VI: <5 Copper: 3 samples above EIL Nickel: 1 sample above EIL
	3 June 2009	4B/T58/E6, 4B/T58/S15	4B/T58/E6/0.25, 4B/T58/E6/0.5 4B/T58/E6/1.0, 4B/T58/S15/0.25 4B/T58/S15/0.5, 4B/T58/S15/1.0 4B/T58/S15/1.5, 4B/T58/S15/2.0	Arsenic, cadmium, total chromium, copper, zinc Chromium speciation (all)	Arsenic: 4.1-8.4 Chromium: 35-65 Chromium VI: <0.5 Copper: 11-29	None
	16-17 April 2008	4B/G4/E1, 4B/G4/E2, 4B/G4/E3, 4B/G4/E4, 4B/G4/N1, 4B/G4/N2, 4B/G4/N3, 4B/G4/N4,	4B/G4/E1/0.1, 4B/G4/E1/0.25 4B/G4/E1/0.5, 4B/G4/E1/1.0 4B/G4/E2/0.1, 4B/G4/E2/0.25 4B/G4/E2/0.5, 4B/G4/E2/1.0 4B/G4/E3/0.1, 4B/G4/E3/0.25 4B/G4/E3/0.5, 4B/G4/E3/1.0	Arsenic, total chromium and copper Chromium speciation (1 occasion)	Arsenic: <5-61 Chromium: 18-70 Copper: 12-36 Maximum reported at 4B/G4/W2/0.1 Concentrations decrease	Arsenic: 6 samples above EIL Chromium :None Copper: None

Grid / Target Location being delineated	Date/s	Sample Locations	Samples Analysed	Analytes	Concentration Range (mg/kg)	Results exceeding adopted investigation level
		4B/G4/S1, 4B/G4/S2, 4B/G4/S3, 4B/G4/S4, 4B/G4/W1, 4B/G4/W2, 4B/G4/W3, 4B/G4/W4	4B/G4/E4/0.1, 4B/G4/E4/0.25 4B/G4/E4/0.5, 4B/G4/E4/1.0 4B/G4/N1/0.1, 4B/G4/N1/0.25 4B/G4/N1/0.5, 4B/G4/N1/1.0 4B/G4/N2/0.1, 4B/G4/N2/0.25 4B/G4/N2/0.5, 4B/G4/N2/1.0 4B/G4/N3/0.1, 4B/G4/N3/0.25 4B/G4/N3/0.5, 4B/G4/N3/1.0 4B/G4/N4/0.1, 4B/G4/N4/0.25 4B/G4/N4/0.5, 4B/G4/N4/1.0 4B/G4/S1/0.25, 4B/G4/S1/0.5 4B/G4/S1/1.0, 4B/G4/S2/0.1 4B/G4/S2/0.25, 4B/G4/S2/0.5 4B/G4/S2/1.0, 4B/G4/S3/0.1 4B/G4/S3/0.25, 4B/G4/S3/0.5 4B/G4/S3/1.0, 4B/G4/S4/0.1 4B/G4/S4/0.25, 4B/G4/S4/0.5 4B/G4/S4/1.0, 4B/G4/W1/0.1 4B/G4/W1/0.25, 4B/G4/W1/0.5 4B/G4/W1/1.0, 4B/G4/W2/0.1 4B/G4/W2/0.25, 4B/G4/W2/0.5 4B/G4/W2/1.0, 4B/G4/W3/0.1 4B/G4/W3/0.25, 4B/G4/W3/0.5 4B/G4/W3/1.0, 4B/G4/W4/0.1 4B/G4/W4/0.25, 4B/G4/W4/0.5 4B/G4/W4/1.0		with depth.	
Totals		**75**	**282**			

5.3.1 Auditor's conclusion on delination sampling

The assessment and delineation sampling undertaken provided a good understanding of the extent of the CCA contamination in the area west of Hangar 5. Aside from the impact (2.2 mg/kg) at depth (1.6 mbgl) identified at targeted location 4B/T48/E2/1.6 in the vicinity of the CCA burial, the majority of CCA contamination was near surface (within the top 0.5 – 1 m).

The results of the delineation sampling indicated that the CCA impacts in the area west of the hangar were significant and extended well beyond the extent of the initial grid and targeted locations. The delineation sampling results reported elevated concentrations above the EIL and HIL A., However, in the majority of the instances, the concentration of CCA impact decreased with depth, (refer to Figure 6). While the delineation sampling helped to characterise the problem, it did not fully delineate the extent of the CCA impacts and continual delineation during the remediation was deemed necessary to confirm that unacceptable contamination was successfully removed and validated. The remediation and validation works are discussed in Section 5.5.5.

5.4 Infrastructure removal and validation sampling

OTEK (2009) developed a *'Scope of Works for the Removal and Validation of Site Infrastructure and Buried Debris, Werribee, Victoria'* (dated 15 April 2009) for Area 4. This document was included as Appendix Q of the RAP (Version 3) which is included as Appendix F of the Remediation and Validation Report (OTEK, 2012b).

The scope of works (OTEK, 2009) only identified a septic tank system (at 4B/T23) and a loading bay (at 4B/G28A) to be removed from Area 4B.

Further to the scope of works (OTEK, 2009) and after the delineation works, OTEK developed a *'Remediation Action Plan – Version 3'* (dated 10 March 2011), (OTEK, 2011) included as Appendix F of OTEK (2012b). The Remediation Action Plan (RAP) specifically addressed the infrastructure removal and areas of concern (requiring remediation) identified in Area 4B during the assessment works (discussed in Section 5 of this report).

The ESA report (OTEK, 2012a) and the RAP-V3 (OTEK, 2011) identified additional infrastructure to be removed, including:

- concrete slab of Hangar 5 and the associated contaminated concrete;
- buried oil tank / suspected UST;
- underground asbestos;
- test butt shed and concrete slab; and
- a shallow concrete slab (later identified to be part of the stormwater pipework).

The RAP also identified areas of concern which required remediation. These are discussed in Section 5.5 of this report.

The RAP identified six zones requiring either infrastructure removal or remediation based on their understanding of the site following the assessment and delineation works (refer to Section 5). The proposed remediation zones are shown on Figure 7 of this report and were discussed in Section 4.1.1 of OTEK (2012b). The zones relating to infrastructure removal were Zone 1, 5, and 6. Zone 2 related to surface asbestos contamination, and Zones 3 and 4 related to inorganics hotspots which are discussed in Section 5.5 of this report.

Additional infrastructure was identified during the infrastructure removal works. This included:

- underground galvanised piping;
- sump, footings and spoon drain beneath contaminated concrete; and
- spoon drain in the timber drying area.

Based on the review of various historical reports and OTEK's (2012a and 2012b) reports, the auditor prepared a complete list (in Section 2.4) of site infrastructure that was present or had previously existed at the site and its status.

The emergency powerhouse, the test butt stop, and the timber drying racks were removed prior to commencement of the audit. The assessment of these features was discussed in Section 5.1.3 of this report and further investigation was not considered necessary.

Removal of sub-surface infrastructure was undertaken in conjunction with remediation and validation works. The remediation and validation works are discussed in Section 5.5 of this report.

During the course of the audit remaining site infrastructure was removed, with the exception of a section of stormwater pipe which remained insitu (discussed in Section 5.1.3).

Following removal of the infrastructure the underlying soils were validated. Table 17 provides a summary of the site infrastructure removal and the validation sampling. The analytical suites and results of contaminants tested were included in Tables 1 - 55 (OTEK, 2012b) and laboratory analytical reports were included in Appendix R (OTEK, 2012b). The location of former site infrastructure (including the approximate location of structures removed prior to the commencement of the audit), and the section of stormwater pipe which remained insitu are shown in Figure 3. The excavation extents and the validation sampling locations are shown in Figure 8, Figure 9A and Figure 9B.

Table 17 Removal of Infrastructure and Validation Sampling

Infrastructure / features / activity	Infrastructure Removal Works Undertaken	Date of Works	Validation Samples Collected	Analysis [1]	Sample(s) exceeding adopted investigation level	Fate of Excavated Material and Backfill/Site reinstatement
Test butt shed including concrete slab base	Removal of test butt shed and concrete slab. Collection of samples to validate soil below concrete slab.	Removal works 8 June 2009 Validation sampling 10 June 2009	4B/VS-8 to 18	All Samples analysed for Arsenic, Cr, Cr6+, Copper 4B/VS-13 was analysed for lead, mercury, silver, explosives	Explosives below LOR. All other concentrations were below the EIL and HIL A for the analytes tested.	Approximately 15m^3 of concrete was disposed offsite.
Hangar 5 building (and shed on southern apron)	Removal of asbestos cladding and frame from Hangar 5.	Commenced on 17 July 2008. Asbestos validation sampling undertaken on 14 January 2009 (lab received samples on 21 January 2009)	A total of 50 samples (4B/VS-1/ SS–1 to 4B/VS-49/SS–1) Two samples were labelled as 4B/VS-49/SS–1. The laboratory provided different laboratory IDs for the two samples (refer to Appendix M)	Asbestos	One location (4B/VS-27SS-1) reported asbestos (refer to Figure 9A). The description of the sample in the laboratory report stated that 'fibres' were present and that these fibres were asbestos. The description provided indicates that the fibres were visible to the naked eye. Remediation of this area was required. The remediation works undertaken are discussed in Section 5.5.1.	Approximately 25.4 tonnes of ACM was removed from Hanger 5 and disposed of at an accredited disposal facility.
Hangar 5 Concrete slab (includes contaminated section of concrete)	Removal of the concrete slab. In-situ categorisation of a section of contaminated concrete prior to removal. Collection of samples to validate soil below contaminated concrete following removal of infrastructure beneath the contaminated concrete (including spoon drain, sump, concrete footings and the buried oil structure).	Removal works 12 and 16 June 2009 Validation sampling 15 June to 9 July 2009	A total of 34 samples collected from beneath the buried oil structure, spoon drain and concrete footings. The specific samples are listed against each piece of infrastructure below.	All 34 final validation samples were analysed for arsenic and chromium. Samples from below the sump and the buried oil structure, and samples 4B/H5/FT2/VS-1, 4B/H5/FT2/VS-2, 4B/H5/FT2/VS-3 were also analysed for cadmium, copper, lead, nickel, and zinc.	All final validation samples were below the adopted investigation levels for the analytes tested.	Approximately 322m^3 of non-contaminated concrete disposed to the Alex Fraser concrete recycling facility in Laverton for crushing and re-use. Approximately 3.4m^3 of Category A was disposed to Veolia Brooklyn; 1.2m^3 of Category B was disposed of to SITA Lyndhurst; and 13.5m^3 of Category C concrete was disposed to High Quality Sales.

Infrastructure / features / activity	Infrastructure Removal Works Undertaken	Date of Works	Validation Samples Collected	Analysis [1]	Sample(s) exceeding adopted investigation level	Fate of Excavated Material and Backfill/Site reinstatement
Timber drying yard east of Hangar 5 – spoon drain.	Excavation and removal of 90 linear metres of concrete spoon drain. Collection of samples to validate surrounding soil.	Removal works 3 August 2009. Validation sampling 4 and 12 August 2009	4B/Z3/SD/VS-1, 4B/Z3/SD/VS-2, 4B/Z3/SD/VS-3, 4B/Z3/SD/VS-4, 4B/Z3/SD/VS-5, 4B/Z3/SD/VS-6A, 4B/Z3/SD/VS-7, 4B/Z3/SD/VS-8, 4B/Z3/SD/VS-9	Eight of the final validation samples were analysed for E. coli, Faecal Coliforms, inorganics[1], TPHs, OCPs. Sample 4B/Z3/SD/VS-6A was only analysed for arsenic.	Concentrations of arsenic exceeded the EIL in sample 4B/Z3/SD/VS-8. Concentrations of barium possibly still remaining above the EIL in one sample. Considered naturally occurring.	Soil excavated from above the trench was stockpiled and later used for backfilling. The broken pipe was stockpiled for disposal offsite.
Buried oil structure	Removal of a crude rectangular shaped tank fabricated from steel sheeting. Collection of samples to validate soil below the buried oil structure.	Removal works 16 June 2009 Validation sampling 17 June to 17 July 2009	4B/H5/UST/1, 4B/H5/UST/2, 4B/H5/UST/3, 4B/H5/UST/4, 4B/H5/UST/5, 4B/H5/UST/6, 4B/H5/UST/7, 4B/H5/UST/8, 4B/H5/UST/9, 4B/H5/UST/10, 4B/H5/UST/11, 4B/H5/UST/12, 4B/H5/UST/13, 4B/H5/UST/14B	Majority of all samples for arsenic, cadmium, chromium, copper and zinc, BTEX, TPHs, PAHs, phenols, VOCs. Sample 4B/H5/UST/14B for arsenic and chromium.	All final validation samples were below the adopted investigation levels for the analytes tested. Concentrations of TPH C_{10} - C_{36} were reported above the LOR, but were below the Threshold concentrations for sensitive land use (NSW EPA (1994).	A total volume of 16m^3 was removed from within the buried oil structure and disposed offsite. A total of 3 m^3 of debris was removed from within the sump and disposed offsite. A total of 7 m^3 of concrete associated with the spoon drain and sump was removed and disposed offsite. A total volume of 25m^3 of soil from the excavation associated with the buried oil structure, sump, spoon drain and concrete footings and was disposed offsite. As reported in OTEK (2012b), this material ranged from category A to fill material and was sent to various disposal facilities based upon the waste category.
Sump within former Hangar 5	Removal of concrete spoon drain leading to a concrete sump, debris with the sump, and three concrete footings. Collection of samples to validate soil below the spoon drain, concrete sump, and three concrete footings.	Removal works 31 August 2009 Validation sampling 1 September 2009.	4B/H5/SUMP/VS-1, 4B/H5/SUMP/VS-2, 4B/H5/SUMP/VS-3, 4B/H5/SUMP/VS-4, 4B/H5/SUMP/VS-5, 4B/H5/SUMP/VS-6A	Majority of samples for arsenic, cadmium, chromium, copper and zinc. Sample 4B/H5/SUMP/VS-5 and 4B/H5/SUMP/VS-6 (removed) for one or more of TPH, PAH, phenols.	All final validation samples were below the adopted investigation levels for the analytes tested.	
Concrete footings below Hangar 5			4B/H5/FT1/VS-1, 4B/H5/FT1/VS-2, 4B/H5/FT1/VS-3A, 4B/H5/FT1/VS-4, 4B/H5/FT1/VS-5, 4B/H5/FT2/VS-1,	Majority of samples for arsenic, cadmium, chromium copper and zinc.	All final validation samples were below the adopted investigation levels for the analytes tested.	

Infrastructure / features / activity	Infrastructure Removal Works Undertaken	Date of Works	Validation Samples Collected	Analysis [1]	Sample(s) exceeding adopted investigation level	Fate of Excavated Material and Backfill/Site reinstatement
			4B/H5/FT2/VS-2, 4B/H5/FT2/VS-3, 4B/H5/FT2/VS-4A, 4B/H5/FT2/VS-5A, 4B/H5/FT3/VS-1, 4B/H5/FT3/VS-2, 4B/H5/FT3/VS-3, 4B/H5/FT3/VS-4			
Removal of septic system (and associated ceramic pipework)	Exavation of a concrete septic tank and ceramic overflow piping. Collection of samples to validate surrounding soil.	Removal works and validation sampling 9 and 10 June 2009	Septic Tank 4B/T23/VS-1, 4B/T23/VS-2A, 4B/T23/VS-3A, 4B/T23/VS-4, 4B/T23/VS-5 Ceramic Piping 4B/VS-1, 4B/VS-2, 4B/VS-3, 4B/VS-4, 4B/VS-5A, 4B/VS-6, 4B/VS-7 (0.3), 4B/VS-7 (0.5) and 4B/VS-24	Majority of samples for inorganics 13*, TPHs. Selected samples for e.coli, faecal coliforms, pH, ammonia, nitrate, nitrite, sulphate, asbestos, OCPs, PAHs.	Concentrations of vanadium exceeded the EIL in some samples. Considered naturally occurring.	
Removal of water bearing asbestos piping (underground)	Removal of 167 m of asbestos piping. Collection of samples to validate surrounding soil.	Removal works and validation sampling 14 July 2009 and 24 July 2009	4B/VS-19, 4B/VS-20, 4B/VS-21, 4B/VS-22/A, 4B/VS-23/A, 4B/VS-25, 4B/VS-26, 4B/VS-27/A, 4B/VS-28, 4B/VS-29, 4B/VS-30, 4B/VS-44, 4B/VS-45[4]	Asbestos	No asbestos detected in final validation samples.	A total of 12 m^3 (4B/IR/SP-2) was disposed as fill material containing <1% asbestos to Maddingly Brown Coal.
Removal of water bearing galvanised piping (underground)	Removal of 65m of galvanised piping. Collection of samples to validate surrounding soil.	Removed works 19 August 2009 Validation sampling on 20 and 21 August 2009	4B/VS-32/1 to 3, 4B/VS-33/1 to 3, 4B/VS-34/1 to 3, 4B/VS-35/1 to 3, 4B/VS-36/1 to 3, 4B/VS-37/1 to 3	All samples for inorganics 18*. Sample 4B/VS-37/3 for e.coli and faecal coliforms.	Concentrations of barium and vanadium exceeded the EIL in some samples. Considered naturally occurring.	
Loading Bay	Auditor's assistant's notes from 10 July 2009 indicated that syringes were found beneath a	10 July 2009	Samples 4B/Z3/T81/VS-1 to 4B/Z3/T81/VS-5 and 4B/G28 and 4B/G28A	Refer to Sections 5.1.3	None	

Infrastructure / features / activity	Infrastructure Removal Works Undertaken	Date of Works	Validation Samples Collected	Analysis [1]	Sample(s) exceeding adopted investigation level	Fate of Excavated Material and Backfill/Site reinstatement
	concrete slab suggesting that the slab was removed. OTEK (2012a and 2012b) did not discuss the assessment or removal of the loading bay (refer to Section 5.4.10), however the auditor confirmed that it had been removed in the final site inspection.		also characterise the area. Refer to Section 5.1.3.		Refer to Section 5.2.1	
Concrete stormwater pipe	Removal of 202 m of concrete stormwater piping and 20 m of ceramic piping. Collection of samples to validate surrounding soil.	Removed on 7 August 2009 Validation sampling on 10 and 25 August 2009	Concrete stormwater piping 4B/IR/VS-1, 4B/IR/VS-2, 4B/VS-40, 4B/VS-41, 4B/VS-42, 4B/VS-43 Ceramic stormwater piping 4B/VS-38 and VS-39	All samples for inorganics[2] Samples 4B/VS-40 – 4B/VS-43 for OCP, TPHs, Ecoli, Faecal Coliforms	Concentration of barium in 4B/V3-39 exceeded the EIL. Considered naturally occurring.	

NOTES

1) Inorganics suite for the spoon drain (arsenic, barium, beryllium, cadmium, chromium (hexavalent),chromium (III+VI), cobalt,copper, lead, manganese, mercury, nickel vanadium and zinc).
2) Inorganics suite for the stormwater piping (arsenic, barium, beryllium, cadmium, chromium (hexavalent),chromium (III+VI), cobalt, copper, lead, manganese, mercury, nickel,vanadium and zinc (two samples were also analysed for molybdenum).
3) Copper results for for a number of validation samples were not reported on Table 6 (OTEK, 2012a) due to a transcription error. As such the auditor referred to the laboratory analytical reports (EM0907237, EM0907950)(refer to Item 71 of the Remediation and Validation Report Issue Register (J2) of Appendix J).
4) The precise location of this sample (4B/VS-45) was unknown. This sample location was not shown on the Figures.

5.4.1 Test butt shed and concrete slab

The test butt shed and concrete slab was removed by Alex Fraser Pty Ltd on 8 June 2009. The size of the concrete slab was approximately 8 m x 12 m. The excavation was rectangular in shape.

OTEK (2012b) stated that the *'Validation sampling of the removed test butt area was performed to ensure residual explosive compounds did not exist at the test butt location as a legacy of former use'*. This statement was unwarranted as it was:

- Inconsistent with information provided Milsearch (2000) which indicated that the test butt was only used for occasional small arms practice (refer to Section 2.8.1) and also with other sections of OTEK's report (2012b).
- Inconsistent with the location, visual appearance and set up of test butt.
- Inconsistent with the following OTEK own statement: "Anecdotal evidence and field investigations suggest that the test butt was never used for its purpose, due mainly to the positioning of the test butt in relation to site accommodation and administration buildings", (OTEK 2012a, Section 3.1.1, P 7).

Based on the above lines of evidence, its limited historical use, and its purpose for occasional small arms practice; the auditor considered it was unlikely that explosives would be a COPC at the test butt.

Eleven validation samples (4B/VS-8 - 4B/VS-18) were collected in a grid pattern from beneath the concrete slab. Ten of the samples were analysed for arsenic, chromium and copper. As these analytes were not considered to be COPC, it is considered that OTEK most likely analysed them for these contaminants in error due to the close proximity to the timber drying area. One sample (4B/VS-13) was analysed for lead, mercury, silver and explosives. Concentrations of metals were either below the LOR or below the EILs and HILs. Concentrations of explosives were below the LOR.

The analytical suite described above resulted in only one sample from below the test butt concrete slab, having been analysed for relevant COPCs. However, as discussed in Section 5.1.3, four targeted samples (4B/T1 – 4B/T4) were collected from the area in front of the test butt and analysed for inorganics (including lead), pH, and explosives. The area in front of the test butt is considered to be the most likely area for potential contamination from the use of the test butt. Results of the sampling were below the EILs and HILs A for all inorganics except vanadium (above EIL, but considered naturally occurring) and pH. Explosives were below the LOR.

While the auditor noted some deficiencies in the validation sampling program, he considered that the test butt had been appropriately assessed and validated. In drawing this conclusion he had regard for, in addition to the above the following.

- The size of the test butt;
- The limited historical use of the test butt; and
- That the four samples collected from in front of the test butt (the most likely area for potential contamination) and the one validation sample collected beneath the concrete slab reported concentrations of COPCs below the LOR, EILs or HILs.

5.4.2 Hangar 5 building (and shed on southern apron)

A brief methodology for the demolition of Hangar 5 was outlined in Riverwalk Area 4 Scope of Works for demolition and validation of Hangars 3, 4 & 5 (OTEK, 2008b).

OTEK (2012b) reported that the demolition and removal of Hangar 5 commenced with the removal of asbestos cladding from the roof and walls by qualified asbestos personnel. The qualified asbestos personnel were not named by OTEK (2012b) and asbestos clearance certificates were not provided. The auditor sought further clarification from Melbourne Water Corporation (MWC) who confirmed via email (dated 26 July 2013) that in May 2008, MWC awarded the contract for the demolition of hangars 4, 5 and the base of hangar 3, together with the removal of the ring water main and the in situ hangar assets to Transfield Services Pty Ltd. They in turn sub-contracted the asbestos works to Alex Fraser Demolitions Pty Ltd, an accredited asbestos removal contractor, who employed several asbestos hygienists. Following removal of the asbestos, Alex Fraser Pty Ltd was engaged to remove the remainder of the structure. Photographs of the demolition works were provided in Appendix E (OTEK, 2012b). The Auditor attended a meeting with Alex Fraser, Transfield and Melbourne Water to discuss the scope of work prior to implementation.

The Scope of Works (OTEK, 2008b) proposed that 50 validation samples were to be taken and analysed for asbestos following demolition of the Hangar. OTEK (2012b) reported in Section 3.1.1.1 that 50 validation samples were collected; however, discussion of the sampling methodology undertaken was not reported in OTEK (2012a) or OTEK (2012b). The tabulated results were presented on Table 61 and Figure 8 of the RAP (OTEK, 2011). The auditor requested the laboratory analytical report directly from OTEK. A laboratory report (ASET17389/20569/1-50) dated 26 January 2009, was provided and is included in Appendix M. The laboratory report described sample 4B/VS-27/SS-1 as containing 'fibres', the fibres were confirmed to be asbestos. The detection of asbestos at 4B/VS-27/SS-1 was mentioned in the RAP (2011) and in OTEK (2012b) in the context of identifying 4B/VS-27/SS-1 for remediation (refer to Section 5.5.1 for discussion of the remediation works undertaken).

As discussed in Section 5.2.4, prior to removal of Hangar 5, broken asbestos was also identified at the surface near 4B/G13 (as per the borelog included in Appendix C (OTEK, 2012a) and confirmed as asbestos in laboratory testing for sample 4B/G13/0.1. Both locations (4B/G13 and 4B/VS-27/SS-1) were noted on Figure 10 of the RAP (OTEK 2011) as requiring asbestos remediation. This is further discussed in Section 5.5.1.

In addition to the 50 samples collected and analysed for asbestos, Section 5.1.3 discussed targeted sampling undertaken in the former Hangar 5 footprint. Aside from the contaminated section of concrete (discussed further in Section 5.4.3) results did not indicate contamination below the majority of the concrete slab.

5.4.3 Hangar 5 concrete slab (includes contaminated section of concrete)

Following removal of the Hangar 5 structure and asbestos cladding, the concrete slab of the hangar, measuring approximately 46m x 37m (1702m^2 in area), was removed. OTEK (2012b) reported that the hangar demolition works were undertaken between 17 July 2008 and 14 April 2009. During the removal of the concrete slab, a CCA contaminated section of concrete was observed. As such the concrete slab was removed in two parts; the non-contaminated section was removed first, followed later by the CCA contaminated section.

OTEK (2012b) reported that the non-contaminated concrete slab was broken into manageable fragments that were stockpiled for later disposal (refer to Table 17 for a summary of the fate of the concrete). Waste transport certificates were not provided. Photographs of the stockpiled concrete were provided in Appendix E (OTEK, 2012b).

A total of 21 targeted samples were collected from beneath or associated with the non-contaminated concrete slab of the Hangar 5 footprint as discussed in Section 5.1.3 and 5.2. Results indicated that concentrations were below the EILs and HILs A. These samples also serve as validation samples for the removal of the non-contaminated concrete slab.

During the works it was noted that a section of the slab measuring approximately 75m^2, in the north-west corner of the hangar was contaminated. This was evident by green staining, assumed to be associated with the former TTP operations in the hangar. The section of contaminated concrete remained until it was tested in-situ and categorised for off-site disposal. OTEK (2012b) reported that the pre-categorised and marked sections of the contaminated concrete slab were loaded directed onto trucks and removed during 12 June 2009 to 16 June 2009 (refer to Table 17 for a summary of the fate of the concrete). Waste transport certificates were requested but were not provided. However, OTEK (2012b) provided a summary of the destination of the waste in their report.

During the removal of the contaminated concrete, a sub-surface spoon drain leading to a sump and three concrete footings were encountered. The spoon drain, sump and three concrete footings were encountered and removed. The excavation of the spoon drain, sump and footings was adjacent to the buried oil structure. The total excavation area made up the bulk of the area beneath the contaminated concrete. As such validation samples from the spoon drain, sump and footings and the buried oil structure excavations also validated the contaminated concrete.

OTEK (2012b) stated that validation samples were collected on 15 and 16 of June 2009 at a density of one sample per 3 m^2 from a total excavation area of approximately 90 m^2. The estimated area of the contaminated concrete differed from estimated area of the excavation below the concrete. The reason for this is unknown but is not considered to impact the outcome of the audit. Based on the auditor's review of the analytical tables, a total of 34 validation samples (refer to Item 5 of Remediation and Validation Issue Register (J2) in Appendix J for discrepancies in the number of samples) were collected from the excavation associated with the contaminated concrete, spoon drain, sump footings and the buried oil structure. Results of the validation sampling indicated that all final validation samples were below the adopted investigation levels for the analytes tested and the excavation was considered to have been successfully validated.

Discussion on the removal of the sump, spoon drain and concrete footings and the buried oil structure is provided in Section 5.4.6.

5.4.4 Timber drying yard east of Hangar 5 – spoon drain

During remediation of exceedances of CCA in the former timber drying yard (discussed further in Section 5.5.2), a concrete spoon drain was identified in the proximity of 4B/T20, 4B/T21, 4B/T22, 4B/T49, 4B/T85, 4B/T86 and 4B/T88 (refer to Figure 4). The spoon drain was found to be an 'L' shaped structure on the western side of the former timber drying yard (refer to Figure 3). OTEK (2012b) reported that the spoon drain was associated with the former TTP operations. Photographs of the spoon drain were included in Appendix E (OTEK, 2012b).

OTEK (2012b) removed the 90 m concrete spoon drain on 3 August 2009. A total of nine final validation samples were collected at three locations along the former spoon drain alignment. OTEK (2012b) reported that three samples (two from the walls and one from the base) were collected at each location. Samples were collected at a depth of 0.3 m, with the exception of sample 4B/Z3/SD/VS-6A which superseded sample 4B/Z3/SD/VS-6 and was collected at 0.6m.

The reason for further excavation and sampling at this location was due to an exceedance of arsenic above the EIL. Sample 4B/Z3/SD/VS-6 reported concentrations of arsenic and barium above the EIL, sample 4B/Z3/SD/VS-6A was only analysed for arsenic (and reported concentrations below the EIL). Barium was not analysed in the final validation sample. As discussed in Section 5.2.1, arsenic (at these concentrations) and barium were considered to be naturally occurring and are not considered to pose a risk.

Monitoring well MW-3 was installed to assess potential CCA impacts. The results of groundwater sampling are discussed in Section 6.4.

5.4.5 Buried oil structure

The buried oil structure was identified in February 2009 during the demolition of Hangar 5. Hangar 5 caused a release to discharge at the surface. Results of targeted sampling indicated that contamination was present at this location (refer to Section 5.1.3 and Section 5.2.2).

The buried oil structure was removed on 16 June 2009 in the presence of the auditor. The auditor's observations were discussed in Section 4.4. On excavation the structure was found to be a crude rectangular shaped tank (with dimensions of approximately 2.4 m x 1.7 m x 2 m) fabricated from steel sheeting. A strong, aged, and heavy hydrocarbon (oil) odour was noted. Photographs of the buried oil structure were provided in Appendix E of OTEK, 2012b. OTEK (2012b) assumed that the purpose of the buried oil structure was as a former waste oil storage tank installed as part of the TTP.

Prior to removal of the buried oil structure, the contents of the tank were emptied. OTEK (2012b) described the tank contents as *'a mixture of oily sludge, heavily impacted soil and assorted debris and rubble'*. It is understood the buried oil structure was tracked approximately 20 m north and placed on black plastic sheeting. The contents were also stockpiled (4B/H5/SP-10) on plastic sheeting. A validation sample (4B/H5/USTD/VS-1) was collected from the ground surface where the buried oil structure was dismantled post removal. Results were below the EIL and HIL A.

A sample (4B/H5/UST/C1) was collected from an area of visibly contaminated soils (this was not identified on any figure provided by OTEK) at a depth of 1.1 mbgl. It was understood that this sample was used to characterise the impacted soils. Results indicated concentrations of PAHs above HIL A and arsenic above the EIL. Visually impacted soil was removed and was later validated by subsequent validation samples (as detailed in Table 17). OTEK (2012b) reported slight odours during removal of the buried oil structure. During his site visit at the time of the excavation works, the auditor considered the odour to be strong.

Prior to validation sampling, the walls and base of the excavation were screened using a portable XRF. It was understood that based on generic statements (OTEK, 2012b) and photographs (OTEK, 2012b, Appendix E), a PID was also used to screen the excavation for volatiles. However, PID readings were not reported. OTEK (2012b) indicated that the final excavation was approximately 58 m^2 in area and 2.4 m in depth.

Validation sampling was undertaken on 17th June 2009. A total of 14 final validation samples were collected and analysed for a range of contaminants as detailed in Table 17 above. OTEK (2012b) reported that two validation samples were collected from each wall of the excavation, and two samples were taken from the base of the excavation. An additional four samples were taken from the benching undertaken on the southern edge of the excavation.

Based on a phone conversation with OTEK (27/11/2012), sections of text in OTEK (2012b), and photgraphs included in Appendix E of (OTEK, 2012b)); the auditor understood that the excavation created from the removal of the spoon drain, sump and footings was adjacent to the buried oil structure (refer to Figure 3). The total excavation area made up the bulk of the area beneath the contaminated concrete. As such validation samples from the the spoon drain, sump and footings and the buried oil structure excavations also validated the contaminated concrete based on the auditor's observations during the site inspection.

Although the results of the validation sampling indicated that the excavation was successfully validated, a monitoring well (MW-9) was installed down gradient of the former buried oil structure to investigate the potential for impacts to groundwater. Discussion of the well construction is provided in Section 6.1.1. Results of groundwater did not indicate that the buried oil structure had resulted in impacts to groundwater. Further discussion is provided in Section 6.4.

5.4.6 Sump, spoon drain and three concrete footings

A sub-surface spoon drain leading to a sump and three concrete footings were encountered during removal of the contaminated concrete in the Hangar 5 as discussed in Section 5.4.3. This infrastructure was located in close proximity to the buried oil structure (refer to 5.4.5). The RAP (OTEK, 2011) identified the possibility that former TTP infrastructure may have been present in this area.

OTEK (2012b) described the sump as highly contaminated and full of building debris and an opaque aqueous solution. Elevated PID readings were not detected. OTEK (2012b) reported to have removed the debris from the sump, stockpiling it on black plastic (4B/H5/SP-3). Samples from the stockpile reported elevated concentrations of copper, chromium, arsenic and TPHs, confirming OTEK's observations. This material was disposed offsite.

Although not stated by OTEK, it was understood through Table F and photographs in Appendix E (OTEK, 2012b) that the concrete sump was removed and disposed offsite. The spoon drain structure and concrete footings were then excavated and disposed offsite. As mentioned above, the sump and concrete footings were within the vicinity of the buried oil structure and the removal of the infrastructure was considered to have formed one final excavation (refer to Figure 3). Photographs (OTEK, 2012b, Appendix E) show the debris (bricks and building rubble) from the sump, and the sump being removed which support this assumption. The date of these works was not included in the report but is assumed that they were undertaken during the removal of the contaminated concrete and the buried oil structure which was undertaken on 12 and 16 June 2009. The auditor attended the site on 17 June 2009 to observe that this work was completed; the auditor noted that this work was completed adequately.

OTEK (2012b) stated that remaining soil was remediated based on visual observations and by use of an XRF as a field screening device. The auditor observed OTEK using the XRF for remediation purposes. The results of XRF screening were not presented in the report. OTEK (2012b) did not discuss validation samples relating to the excavation of the spoon drain, sump and concrete footings in the text of the report, but did mention in Section 4.1.3.3 that validation samples from this excavation and the buried oil structure had been used to validate the contaminated concrete. The auditor concluded that a total of 20 final validation samples were collected from the former excavation (as detailed in Table 17).

Results of the validation sampling indicated that all final validation samples were below the adopted investigation levels for the analytes tested and the excavation was considered to have been successfully validated. As discussed above, validation samples from this excavation were also considered to have validated the section of contaminated concrete.

5.4.7 Septic system (and associated ceramic pipework)

A septic system including a network of ceramic piping (referred to as septic tank overflow piping) was removed on 9 and 10 June 2009. In Section 4.1.1.6 of their report, OTEK (2012b) stated that a total of 72 m^3 of concrete from the septic tank was removed. Section 4.2.3.6 of their report (OTEK, 2012b) indicated that there was an open excavation of 72 m^3 from the septic tank removal. The auditor considered that 72 m^3 was a very large volume of concrete for a septic tank and was most likely the volume of the excavation rather than the volume of concrete removed. OTEK (2012b) stated that a total of 93 linear metres of ceramic overflow pipes were removed. OTEK (2012b) did not provide information on the volume of concrete or ceramic pipe removed from the septic system excavation or its disposal.

During the removal of septic system, OTEK (2012b) concluded that two locations 4B/G25 and 4B/T46 (which had previously been identified as possible fill marterial as discussed in Section 5.1.3) were associated with the installation of the septic system. This was based on the field observations and the proximity to the septic system. Results of the grid and targeted

investigation (discussed in Section 5.2) did not indicate contamination. The auditor considered that soil at 4B/G25 and 4B/T46 previously described as fill would be better described as 'reworked natural'.

A total of 14 final validation samples were collected from the septic tank and ceramic pipe excavation. Samples were collected from the walls and base of the septic system excavation, wall samples were collected at a depth of 1.4 mbgl with one base sample being collected at 2.0 mbgl. Samples were collected from depths ranging between 0.3 and 0.5 mbgl to validate the ceramic piping. One sample (4B/VS-24) was collected at a depth of 1.2 mbgl (refer to item 31 on Remediation and Validation Issue Register (J2) in Appendix J regarding this sample).

Results were below the adopted investigation levels for all anlaytes tested with the exception of 4B/VS-3 and 4B/VS-4 for vanadium which was considered naturally occurring. Asbestos was not detected in the samples analysed. There are no available investigation levels for nitrate in soil, the auditor reviewed the results for nitrate and compared them to the regional concentrations for the Overall Audit Area. The concentrations of nitrate were considered to be within regional concentrations and most unlikely to be an issue of significance.

Two locations (4B/VS-1 and 4B/VS-2) were apparently sampled twice at the same depth on different dates (this is further discussed in item 73 of the Remediation and Validation Issue Register (J2) in Appendix J). This was not considered to affect the outcome of the audit, given that final validation samples reported concentrations below the adopted investigation levels (with the exception of vanadium which was considered naturally occurring) for the analytes tested and the excavation had been successfully validated.

5.4.8 Water bearing asbestos piping (underground)

OTEK (2012b) reported that 167 m of underground asbestos piping associated with the former fire system at the site was removed on 14 July 2009. OTEK stated that the methodology for removal included excavation of soil to within approximately 20 mm above the asbestos pipe, taking care not to make contact with the pipe. A ripper was then used to free soil from each side of the pipe, and suitably qualified asbestos contractors removed the pipe from the trench in sections, wrapping each section in PVC piping for disposal. Soil described as fill material containing asbestos was disposed offsite. Waste transport certificates were requested but were not available.

A total of 13 final validation samples were collected to validate the asbestos piping. The samples were collected on 14 July 2009, 24 July 2009, and 3 and 4 September 2009. All samples were analysed for asbestos, selected samples were also analysed for inorganics. Asbestos was intially detected in three validation samples (4B/VS-22, 4B/VS-23 and 4B/VS-27). Further excavation was undertaken at these locations and samples 4B/VS-22A, 4B/VS-23A and 4B/VS-27A successfully validated the trench. Asbestos was not detected in any of the final validation samples tested, concentrations of inorganics were below the adopted investigation levels in the samples tested and the excavation was considered to have been successfully validated.

5.4.9 Water bearing galvanised piping (underground)

OTEK (2012b) reported that 65 m of underground galvanised piping was removed on 19 August 2009. OTEK (2012b) did not provide discussion of the methodology for removing the galvanised piping. Given that the auditor expected the water pipe carried potable water and there was limited potential for contamination from the pipe itself, the auditor did not consider this uncertainty to have affected the audit outcome.

Furthermore, a total of 18 validation samples were collected from the excavations associated with the removal of the galvanised pipe. Three samples were collected from six locations along

the pipeline alignment. Two samples were collected from the walls and one from the base at each location. Sample depths ranged from 0.2 to 0.4mbgl. All samples were analysed for inorganics, concentrations of inorganics were below the adopted investigation levels in the samples tested, with the exception of concentrations of vanadium and barium above the EIL in six samples, however, these were considered to be within the natural background variation. Base on the resultst the excavation was considered to have been successfully validated.

5.4.10 Loading bay

As discussed in Section 5.1.3, the former loading bay was not discussed by OTEK (2012a) or OTEK (2012b). However, based on the auditor's assistant's site inspection notes (dated 10 July 2009) which indicated syringes were identified below a concrete slab (refer to Section 4.4) and photographs, it can be confirmed that the former loading bay was removed.

Removal of the syringes and validation of the underlying soil was undertaken as discussed in Section 5.5.4. No visual staining or odours were observed and three final validation samples collected beneath the concrete slab (to validate the area below the syringes) were below the EIL and HIL A. Furthermore, as discussed in Section 5.1.3, the auditor considered that the results from locations 4B/G28 and 4B/G28A were representative of soil conditions in the area.

Additionally, samples 4B/Z3/T81/VS-1 to 4B/Z3/T81/VS-5 (analysed for arsenic and chromium only) and 4B/G28 and 4B/G28A were collected from the area of the former loading bay and help to characterise the conditions in the area (refer to Sections 5.1.3 and 5.2 (for samples 4B/G28 and 4B/G28A) and Section 5.5.3 (for samples 4B/Z3/T81/VS-1 to 4B/Z3/T81/VS-5). Analytical results from these samples were all below the criteria, with the exception of a concentration of zinc above the EIL at 4B/G28A (discussed in Section 5.7.1).

The auditor considered that the three validation samples collected to validate the syringes also validated the former loading bay.

5.4.11 Stormwater pipe

OTEK (2012b) reported that 202 m of concrete stormwater piping (with a diameter of 20 inches) was removed on 7 August 2009. Approximately 20 m of ceramic piping was also encountered and removed on 21 August 2009. OTEK (2012b) did not clearly explain the discovery of the 20 m section of ceramic piping. However, it was assumed that the ceramic piping was associated with the stormwater system based on:

- A review of figures showing the proximity to the stormwater pipe;
- The distance from the septic system (where other ceramic pipe had been identified);
- Photographs (refer to Appendix E of OTEK, 2012b) of samples identified as stormwater validation samples were shown to have been collected from the ceramic pipe trench; and
- Previous knowledge that ceramic piping was associated with the stormwater network in other areas of the Overall Audit Area (as described in OTEK, 2009 (SAP for stormwater validation).

During the removal of the concrete stormwater pipe, it was found that the concrete block identified at 4B/G15 (as discussed in 5.1.1) was associated with the stormwater network.

A total of six validation samples were collected to validate the section of concrete stormwater pipe that was removed. Sample depths ranged from 0.7 to 1.2 mbgl. All samples were analysed for inorganics, selected samples were also analysed for e.coli, faecal coliforms, OCPs and TPH. Concentrations of analytes tested were below the adopted investigation levels in the samples tested with the exception of barium which was considered naturally occurring. OTEK (2012b) did not provide discussion of the methodology for removing the concrete stormwater pipe.

However, based on the review of the photographs pertaining to the stormwater pipe excavation and the absence of elevated concentrations in the validation samples collected, the auditor considered that the stormwater pipe was adequately validated.

It is understood that two samples (4B/VS-38 and 4B/VS-39) were collected to validate the 20 m length of ceramic piping. Although the ceramic piping was removed on 19 August 2009, the validation sampling was undertaken on 21 August 2009 and the photgraphs were dated 24 August 2009. The reason for the discrepancy between the dates is unknown, but it is expected that the photographs were taken following the validation sampling and is not expected to affect the outcome. Samples were collected at a depth of 0.4 mbgl. OTEK provided an additional hand-drawn figure subsequent to their Remediation and Validation Report (OTEK, 2012b) which indicated that the piping near samples 4B/VS-38 and 4B/VS-39 was part of the concrete stormwater system, however, the auditor assumed this to be incorrect. The auditor considered that the pipe material, whether concrete or ceramic, was unlilkely to affect the outcome of the audit as the pipework was successfully removed and validated.

A section of stormwater piping formed part of the operational Area 4 stormwater network and was left in-situ. Targeted sampling was undertaken on the section of stormwater piping remaining in-situ. Refer to Section 5.1.3.

5.4.12 Auditor's conclusions on infrastructure removal and validation

The auditor considered that the reporting of the infrastructure removal and remediation works (refer to 5.5) were poorly reported by by OTEK (2012b) and in most cases the auditor had to draw together the sequence and occurrence of works at the site. It was also difficult to determine whether the additional infrastructure / areas of concern identified during the instrustructure removal and remediation works were assigned to zones. However, the auditor considered that given the zones were an arbitrary tool to aid the undertaking of the remediation works, the auditor did not consider this to materially affect the outcome. Furthermore the auditor's involvement from the commencement of the project (refer Section 1.6), the numerous site visits, and regular site meetings during the remediation (refer Section 4.4) allowed the auditor to use the raw data available (analytical results and photographs) to outline the works in this report.

The auditor considered that the infrastructure identified during the various phases of work had been appropriately removed and validated as discussed in Section 5.4. The only exception was the former loading bay; however, as discussed above, the auditor did not consider this to be a potential issue affecting the outcome of the audit as it was confirmed to have been removed, and the potential for contamination associated with this location was considered low.

5.5 Remediation and validation sampling

The following areas required remediation based on the findings of the site assessment works and / or infrastructure removal works. The auditor was satisfied that all infrastructure had been identified, removed and successfully validated (refer to Section 5.4).

- Surface asbestos at 4B/G13 and 4B/VS-27/SS-1;
- CCA hotspots in the timber drying yard;
- Syringes below the former loading bay;
- Area west of Hangar 5;
- Contaminated Roadbase; and
- The soil treatment area (used for fixation of CCA impacted soils).

As discussed in Section 5.4 of this report, a RAP (OTEK, 2011) was developed which specifically addressed the infrastructure removal and areas of concern (requiring remediation) identified in Area 4B during the assessment works. The RAP identified arbitrary zones to assist with the works. Zone 2 related to surface asbestos contamination, and Zones 3 and 4 related to inorganic hotspots (which included the area west of Hangar 5 and the timber drying yard). The syringes beneath the loading bay were identified during the infrastructure removal works (refer to Section 5.4.10). The contaminated roadbase was identified during the remediation of the area west of Hangar 5 which is discussed in Section 5.5.5 below.

OTEK (2011) reviewed potential remediation options with consideration of logistical, temporal and financial contraints. The RAP (2011) outlined that excavation and disposal was the preferred option for the remediation of the hotspots of CCA contamination in the area west of the hangar and in the timber drying yard (discussed in Section 5.5.2). Heavily impacted CCA contamination (located in the area west of Hangar 5 (refer to Section 5.5.5) was treated using chemical fixation. The RAP (OTEK, 2011) outlined the remediation options analysis and the details of the chemical fixation technology proposed. The chemical fixation works were undertaken in a designated soil treatment area. This area required validation on completion of the remediation works and is discussed in Section 5.5.7, and displayed in Figure 9B.

The remediation works undertaken at each area is discussed in the relevant sections below (Sections 5.5.1 to 5.5.7). Following remediation, underlying soils were validated. Table 18 provides a summary of the remediation areas and validation sampling. The analytical suites and results of contaminants tested were included on Tables 1 - 55 and laboroatory analytical reports were included in Appendix R (OTEK, 2012b). The excavation extent and the location of validation samples are displayed in Figure 8, Figure 9A, Figure 9B, Figure 10A, Figure 10B and Figure 10C of this report.

Table 18 Remediation and validation based sampling analytical schedule

Remediation Area	Remediation Works Undertaken	Date of Works	Validation Samples Collected	Analysis [1]	Sample(s) exceeding adopted investigation level	Fate of Excavated Material and Backfill/Site reinstatement
Surface asbestos	Excavation of a 5 m x 5 m grid of soil at 4B/G13 and 4B/VS-27/SS-1. Collection of samples to validate the excavation.	15 and 16 June 2009	4B/VS-27/SS-2, 4B/VS-27/SS-3, 4B/VS-27/SS-4, 4B/VS-27/SS-5, 4B/VS-27/SS-6, 4B/G13/SS-1, 4B/G13/SS-2, 4B/G13/SS-3, 4B/G13/SS-4, 4B/G13/SS-5[3]	Asbestos	Asbestos not detected.	Approximately10 m^3 of soil was stockpiled (4B/SP1), and disposed offsite as Category C contaminated soil.
CCA impacted hotspots in the timber drying yard	Excavation of a 4 m x 4 m pit at 23 hotspots identified in the timber drying yard. Collection of samples to validate the excavations.	Remediation works 18 June 2009 to 13 August 2009 Validation works 25 June to 2 September 2009	A total of 115 final validation samples. 4B/Z3/G17/VS-1- 5, 4B/Z3/G18/VS-1- 5, 4B/Z3/T5/VS-1- 5, 4B/Z3/T7/VS-1- 5, 4B/Z3/T8/VS-1- 5, 4B/Z3/T9/VS-1- 5, 4B/Z3/T12/VS-1-5, 4B/Z3/T14/VS-1 to 3, 4A, 5, 4B/Z3/T15/VS-1- 5, 4B/Z3/T18/VS-1- 5, 4B/Z3/T20/VS-1, 2, 3A, 4A, 5, 4B/Z3/T21/VS-1- 5, 4B/Z3/T49/VS-1- 5, 4B/Z3/T50/VS-1- 5, 4B/Z3/T51/VS-1- 5, 4B/Z3/T52/VS-1- 5, 4B/Z3/T54/VS-1- 5, 4B/Z3/T55/VS-1- 5, 4B/Z3/T56/VS-1 to 3, 4A, 5, 4B/Z3/T59/VS-1, 2, 3A, 4, 5A, 4B/Z3/T61/VS-1- 5, 4B/Z3/T68/VS-1- 5, 4B/Z3/T88/VS-1, 2, 3B, 4B, 5	All final validation samples for one or more of arsenic, chromium and / or copper.	All final validation samples were below the adopted investigation levels for the analytes tested.	OTEK (2012b) discussed the remediation of hotspots in the timber drying yard and the general site collectively. Approximately 115m^3 of soil was stockpiled (4B/Z3/SP2 and 4B/Z3-4/SP2) and disposed as fill material after characterisation. Approximately 140m^3 of soil was stockpiled (4B/Z3/SP1 and 4B/Z3-4/SP1Y) and disposed offsite as Category C contaminated soil. Approximately 22m^3 of soil was stockpiled (4B/Z3-4/SP12Y) and disposed offsite as Category B contaminated soil.
CCA impacted hotspots in general site area	Excavation of a 4 m x 4 m at five hotspots identified at 4B/G3, 4B/G4, 4B/G28A, 4B/G29 and 4B/T81 on the general site area. Collection of samples to validate the excavations.	Remediation works 18 June 2009 to 13 August 2009 Validation works	4B/Z3/G3/VS-1A, 2A, 3A, 4A, 5A, 4B/Z3/G4/VS-1- 5 4B/Z3/G28A/VS-1- 5, 4B/Z3/G29/VS-1-5, 4B/Z3/T81/VS-1- 5	Majority of final validation samples for arsenic and chromium. Selected samples for zinc.	All final validation samples were below the adopted investigation levels for the analytes tested.	

Remediation Area	Remediation Works Undertaken	Date of Works	Validation Samples Collected	Analysis [1]	Sample(s) exceeding adopted investigation level	Fate of Excavated Material and Backfill/Site reinstatement
		29 June				
Syringes beneath loading bay concrete slab	Hand picking of visual syringes from the surface. Scraping of an approximately 3m × 3m excavation and hand removal of any further syringes uncovered. Collection of samples to validate the excavation.	Excavation works 10 July 2009[1] Validation works 21 August 2009	4B/VS/NEEDLE/1A to 3A	Inorganics 13**	All final validation samples were below the adopted investigation levels for the analytes tested.	Approximately 10m^3 of silty clay /topsoil that was stockpiled (4B/SP/NEEDLE) and later disposed offsite as fill material.
Area West of Hangar 5	Excavation of impacted soil identified at the CCA burial identified at target location 4B/T48, the removal of green stained soils and the removal of heavy metal hotspots resulting in one large exacavation. Collection of samples to validate the final excavation.	Validation works 25 June to 7 September 2009	A total of 104 final validation samples 4B/Z3-4/T1/VS-1 to 14, 15A, 16A, 17, 18 4B/Z3-4/T2/VS-1 to 4, 5A, 7 to 14, 15A, 16, 17. Location of 4B/Z3-4/T2/VS-9 unknown. 4B/Z3-4/T3/VS-1B, 2C, 5B, 6B 6D, 7D, 8C, 9D, 10B, 14A[2], 14D, 16 to 21, 22A, 23, 26A, 27A TO 36, 37A, 38B, 39 to 42, 43A, 46 to 49. 4B/Z3-4/T4/VS-2A, 3, 8, 9A, 10 to 17, 18A, 19A, 20 to 24, 27, 28A, 29A, 30A, 31A, 32, 33A, 34. 4B/VS-53, 54, 55	All final validation samples for one or more of arsenic, chromium and / or copper. Leachability testing of hexavalent chromium was also undertaken on selected samples.	Ten final validation samples exceeded the EIL for hexavalent chromium. All other final validation samples were below the adopted investigation levels for the analytes tested.	Approximately 500 m^3 of soil (not requiring treatment) was stockpiled (4B/Z3-4/SP10) and disposed offsite as Category C. Approximately 30 m^3 of treated soil including the top 100 mm of the clay pan from the treatment area (4B/Z3-4/SP4B) was disposed offsite as Category C.
Contaminated Roadbase	Excavation of contaminated roadbase material and soil beneath the roadbase. Collection of samples to validate the final excavation. Collection of additional samples from seven test pits to delineate and confirm validation of the contaminated material.	Validation sampling of excavated road base removed on 28 August, 1 and 3 September 2009. Validation sampling of remaining road base material on 7 September	A total of 34 final validation samples. 4B/ROADBASE/VS-1A, 2 to 4, 5A, 6 to 9, 10A, 11 to 20 4B/VS-46/1, 2, 4B/VS-47/1, 2, 4B/VS-48/1, 2, 4B/VS-49/1, 2, 4B/VS-50/1, 2, 4B/VS-51/1, 2, 4B/VS-52/1, 2	Arsenic, chromium, copper	All final validation samples were below the adopted investigation levels for the analytes tested.	Approximately 120m^3 of road base material and100m^3 of road base substrate was stockpiled (4B/RB/SP1 and 4B/ROADBASE/SP1) and disposed offsite as Category C.

Remediation Area	Remediation Works Undertaken	Date of Works	Validation Samples Collected	Analysis [1]	Sample(s) exceeding adopted investigation level	Fate of Excavated Material and Backfill/Site reinstatement
		2009				
Soil Treatment Area	Collection of samples to validate clay pan where chemical fixation works were undertaken.	2 September 2009	4B/VS-45/1, 4B/VS-45/2, 4B/VS-45/3, 4B/VS-45/4, 4B/VS-45/5	Arsenic, chromium, copper	All validation samples were below the adopted investigation levels for the analytes tested.	The top 100mm of clay from the clay pan was disposed off site with the treated soil (refer to soil disposed from area west of Hangar 5).
Total			296			

1 The date of excavation was not provided by OTEK, 2012b. The date of the auditor's site inspection when the syringes were identified and excavated was noted.

2 It was unclear whether sample 4B/Z3-4/T3/VS-14A was removed. The summary tables and figures (OTEK, 2012b) indicated that it remained onsite, however, there were samples labelled with postfixes B, C, and D. Samples labelled postfix B and C were indicated as having been superseded. Given there was an exceedance of hexavalent chromium at this location, the auditor has assumed that it still remains onsite.

3 The precise location of these samples was unknown. These sample locations were not shown on the Figures.

5.5.1 Surface asbestos

Asbestos was positively identified in laboratory analysis of only two samples, which were collected from two locations. 4B/G13/0.1 was collected during the grid sampling and 4B/VS-27/SS-1 was collected during the validation sampling following the removal of Hangar 5 (refer to Sections 5.2.4 and 5.4.2 for discussion of the asbestos results).

Asbestos sheeting was noted in the borelog for 4B/G25. Samples from this location were not analysed for asbestos and it was unknown as to whether the fragment was removed. Also, the auditor revisited this location during the final site inspection (12 May 2014) and did not observe any visible asbestos fragments at the soil surface.

The locations where asbestos was detected were in close proximity to the hangar (refer to Figure 3). OTEK (2012a) suggested that the asbestos fragments identified were likely due to the deterioration of the asbestos cladding of Hangar 5. Remediation was undertaken in these two locations (i.e. 4B/G13/0.1 and 4B/VS-27/SS-1).

Asbestos remediation included excavation of a 5 m x 5 m grid of soil to a depth of 0.2 m. The location where the asbestos was detected was used as the centre point for the excavation. Soil from the excavations was loaded directly into a plastic lined bin referred to as 4B/SP-1. Asbestos was not detected in samples collected analysed from 4B/SP-1. Photographs of the remediation works were included in Appendix E of OTEK 2012b.

A total of ten validation samples were collected from the base of the excavation (there was some discrepancy regarding the depth at which the samples were collected on the 15 and 16 June 2009, discussed in item 22 of Remediation and Validation Issue Register (J2) in Appendix J). This was not considered to affect the outcome of the audit as asbestos was not detected in the samples analysed from either excavation.

The asbestos at locations 4B/G13/0.1 and 4B/VS-27/SS-1 was considered to have been appropriately remediated and validated. The auditor considered that there may be the possibility for fragments of asbestos to remain at the site.

Asbestos was also reported in samples collected at three locations (4B/VS-22, 4B/VS-23 and 4B/VS-27) during the removal of the water bearing asbestos piping. However, this has been further remediated and validated successfully. The works conducted and results were discussed in Section 5.4.8 above. The trenches were further excavated and asbestos was not detected in the final validation samples collected from the trenches. No further remediation was required.

5.5.2 Hotspots in the timber drying yard

The RAP (2011) outlined that excavation and disposal was the preferred option for the remediation of the hotspots of CCA contamination in the timber drying yard.

Based on the results of grid, targeted and delineation sampling (refer to Sections 5.2 and 5.3), remediation of 22 CCA contamination hotspots in the former timber drying yard was required (refer to item 17 of Remediation and Validation Issue Register (J2) in Appendix J) regarding the number of hotspots). Remediation at a 23rd location (4B/T5) was also undertaken, although results were below the EIL and HIL A and the reason for excavation and validation works at this location was not made clear in OTEK report. This was not considered to impact the outcome of the audit, rather it provided further data to characterise the timber drying yard. The 23 locations proposed to be remediated in the timber drying yard are shown on Figure 7. The extent of the excavations, with exceeded grid and target samples are shown on Figure 8.

OTEK (2012b) discussed the remediation and validation of the CCA contamination in the timber drying yard and the area west of Hangar 5 collectively given the use of similar remediation method in both areas. The auditor found that combining the discussion on two separate source

areas (based on a remediation method) was confusing. As a consequence and in order to make it easier for the reader, the auditor has reviewed the raw data and has discussed the hotspots in the timber drying yard (and general site area), and the area west of Hangar 5 separately. Refer to Section 5.5.5 for discussion of the remediation and validation of the area west of Hangar 5.

The remediation of the CCA hotspots included excavation of an approximate 4 m x 4 m grid of soil at each location to depths varying from approximately 0.25 to 1.25 mbgl, the depth was guided by the extent of contamination. The size of the excavations varied based on the results of initial validatation samples. The surface area of the excavations ranged from 12 to 24 m^2. Samples were collected from the walls and base of each excavation to validate the surrounding soil. An XRF was used to screen the remaining soil surface to confirm that concentrations were below the adopted investigation levels before final validation sampling was conducted. Soil was removed until the XRF showed all readings were below the adopted investigation levels. The majority of locations were validated after initial validation sampling. However, further excavation and re-validation was required at 4B/Z3/T14, 4B/Z3/T20, 4B/Z3/T56, 4B/Z3/T59 and 4B/Z3/T88 due to detecting elevated concentrations of arsenic above the EIL and HIL A (at 4B/Z3/T14 and 4B/Z3/T88 only for the HIL A). As per Table 18, all final samples were below the adopted investigation levels for arsenic, chromium, and copper.

A monitoring well (MW-3) was installed down gradient of the TTP operations and timber drying yard to investigate the potential for impacts to groundwater. Discussion of the well construction is provided in Section 6.1.1. A single concentration of hexavalent chromium above the investigation level for maintenance of ecosystems was detected in MW-3 during GME3 (February 2008), this is discussed further in Section 6.4.1. The auditor considered the former timber treatment activities were potentially a former source, hence the investigation of the potential impact on soil and/or groundwater as discussed in this report. The results of such investigation have indicated that this was not considered an issue of significance (refer to Section 6.4).

5.5.3 Hotspots in the general site area

Based on the results of grid, targeted and delineation sampling (refer to Sections 5.2 and 5.3), four test pits (4B/G2, 4B/G4, 4B/G28A, 4B/T81) reported concentrations of arsenic, chromium and copper above the EILs and HILs A (in some instances) across the general site area. Remediation was undertaken at 4B/G3, 4B/G4, 4B/G28A, 4B/G29 (where an exceedance of zinc had been reported) and 4B/T81. These five remediated locations in the general site area were shown on Figure 7.

The method of remediation used at these hotspots was the same as that used in the timber drying yard (refer to Section 5.5.2). The majority of locations were successfully validated after the first round of clean up excavation. However, further excavation and re-validation was required at 4B/Z3/G3 due to concentrations of arsenic detected above the EIL. As per Table 18, all final samples were below the adopted investigation levels for arsenic, chromium, and copper.

5.5.4 Syringes near 4B/G28

Syringes, thought to have been from former use of the site for animal grazing activities, were identified below the former loading bay near 4B/G28. OTEK (2012b) appropriately removed syringes that were visible on the surface initially manually, then an area of approximately 2 m x 2 m was raked using the teeth of the excavator to uncover any syringes at the near surface (approx 0.005 m – 0.01 m BGL). OTEK (2012b) indicated that all syringes had been removed.

Initially three validation samples reported concentrations of arsenic, copper, manganese and mercury above the EIL in one or more samples. Further excavation was undertaken and the concentrations in the three final validation samples were below the EILs and HILs A.

The auditor considered that the three validation samples collected to validate the syringes also validated the former loading bay (refer to Section 5.4.10).

5.5.5 Area west of Hangar 5

Based on the results of grid, targeted and delineation sampling (refer to Sections 5.2 and 5.3), and field observations in the area to the west of Hangar 5, remediation of CCA contamination was required.

Furthermore, during the remediation works (as discussed in this section) the CCA contamination to the west of Hangar 5 was found to be more widespread than previously understood through the assessment works (refer to Section 5). Additional areas of concern (as discussed in Section 4.1.2 of OTEK, 2012b) were identified. OTEK (2012b) referred to these areas as the *'contaminated ground surface Horizon North of 4B/T48'* and *'Hexavalent chromium affected area'*. Further discussion on the nature of the contamination is discussed in this section.

Although not clearly presented in OTEK (2012b), it was understood based on field observation, photos, auditor's and/or auditor's assistant site inspections during the remediation work, site meetings during the clean up stage, and discussion with OTEK that the remediation of the different contaminated areas (i.e. CCA burial, the hotspots, the contaminated ground surface, and hexavalent chromium affected area, which wasidentified during the remediation works) commenced individually but ended in one large final excavation. This has happened due to progressive clean up and progressive validation that revealed the need for further clean up, as a consequence the clean up ended up to be one large excavation covering all of these areas and more and was only finished when validation indicated the clean up was successful. This is further discussed below.

The remediation in the area west of Hangar 5 began with excavation of the contamination which was previously identified during assessment works (discussed in Sections 5.2 and 5.3). This included the CCA burial (at location 4B/T48). During excavation of the CCA burial, the *'contaminated ground surface Horizon North of 4B/T48'* was identified. Shallow CCA stained soil was observed at a depth of approximately 0.10 to 0.15 m BGL and was considered to be a legacy of TTP operations (OTEK, 2012b). The area of the observed surface contamination was approximately 16 m x 6 m. OTEK removed approximately 20 m^3 of soil using an excavator. The soil was stockpiled (4B/Z3-4/SP-10, refer Figure 9B). The surface of the excavation was initially screened in the field using an XRF. Thereafter, a total of ten validation samples were collected and laboratory analysed for arsenic, chromium, and copper. Results were below the adopted investigation levels for all samples analysed indiacting the clean up was successful.

During the remediation of the CCA burial and hotspots in the area west of Hangar 5, concentrations of hexavalent chromium were reported well above (approximately 50 times) the investigation levels. The elevated results were reported below and adjacent to the CCA burial and were believed to have been associated with the CCA burial. OTEK (2012b) referred to this investigation as the *'hexavalent chromium affected area';* this was due to the specific nature of contamination identified in this area and for practicability reason as well. However, it should be noted that it was identified as part of the ongoing remediation and chasing of contamination from the CCA burial. Given the nature of the remediation and excavation works, some of the areas of concern that were validated were subsequently removed during the ongoing remediation works. Multiple rounds of remediation and validation sampling were undertaken and the final excavation engulfed the earlier remediation and validation of the *'contaminated ground surface Horizon North of 4B/T48'* and hotspots 4B/G13, 4B/T48, 4B/T57 and 4B/T58. The extent

of the final excavation and the final validation sampling locations is shown on Figure 10A, Figure 10B and Figure 10C. The surface of the excavation was screened using an XRF as an efficient field test to guide the clean up in the fieled. Results of the XRF analysis prior to the validation sampling were not provided, this was not considered an issue of significance as the XRF screening was on going to broadly guide the remediation and validation samples were collceted and analysed.

Based on the RAP (OTEK, 2011), and concentrations reported during the assessment and delineation works, soils excavated from the area west of Hangar 5 at locations 4B/G13, 4B/G13/E2 to 4B/G13/E6, 4B/T48 and 4B/T48/W2, and 4B/T58 were identified as requiring chemical treatment prior to disposal to landfill. OTEK (2012b) referred to this work as Zone 4 remediation. As soil was excavated, it was assessed visually and screened using an XRF and allocated to various stockpiles based on the expected degree of contamination. The results of the XRF analysis were presented in Section 4.1.1.4, Table D of OTEK (2012b). Soils requiring chemical fixation were transferred to the soil treatment area (refer to Figure 3). The chemical fixation works are discussed in Section 5.5.7. Although not clearly explained in OTEK (2012b), it is understood that stockpiles that did not require fixation were validated and disposed offsite accordingly. It was understood that a total of 500 m^3 of impacted soil was removed during the remediation of this area in total.

The auditor reviewed the validation results of the final excavation in order to assess the final contamination condition of the site. The results of the delineation sampling discussed in Section 5.3 were also considered in delineating the final excavation; the samples considered were shown on Figure 10A, Figure 10B and Figure 10C. A total of 104 final validation samples were collected from the final excavation of the CCA impacted area west of Hangar 5. The majority of samples were analysed for arsenic, chromium and copper, with selected samples were also analysed for pH and zinc.

Samples were collected at various depths from the walls and base of the excavation. Contamination in this area varied in depth from the near surface to a depth of 4.2 mbgl in the vicinity of the buried drums. On completion of the remediation works, concentrations of hexavalent chromium remained above the EIL in 11 final validation samples in the resulting excavation for the area west of Hangar. It was decided that further excavation of soil was not practical. The area was deemed to have been remediated to the extent practicable. Table 19 provides a summary of residual exceedances at the site. The remainder of results were below the adopted investigation levels for analytes tested.

Table 19 Summary of residual exceedances in area west of hangar

Sample	Depth (mbgl)	Hexavalent Chromium (mg/kg)
EIL		**1**
HIL A		**100**
4B/Z3-4/T3/VS-6B	3.6	41.3
4B/Z3-4/T3/VS-6D	4.2	49.1
4B/Z3-4/T3/VS-7D	4.2	40.7
4B/Z3-4/T3/VS-9D	4.2	61.4
4B/Z3-4/T3/VS-14A	2.4	1.4
4B/Z3-4/T3/VS-14D	4.2	61.6
4B/Z3-4/T3/VS-38B	2.0	6.3
4B/Z3-4/T3/VS-43A	2.4	10.5
4B/Z3-4/T3/VS-46	1.8	2.7
4B/Z3-4/T3/VS-47	1.8	8.1
4B/Z3-4/T3/VS-49	2.5	6

Given the nature of the contamination and the residual impacts, two monitoring wells (MW-10 and MW-11) were installed down gradient and up gradient of the CCA burial (and residual impacts in soil) to investigate the potential for impacts to groundwater. Discussion of the well construction is provided in Section 6.1.1. Results of groundwater monitoring indicated that total chromium concentrations were below the investigation level for total chromium and hexavalent chromium, and as such the impacts at the source was not a source of groundwater impact (refer to Section 6.4). The fact that the majority of the contamination as well as any primary sources were removed was also considered on assessing that the potential for remaining risk was unlikely to be of significance.

5.5.6 Contaminated roadbase

During the excavation and remediation of the area west of Hangar 5 (as discussed in Section 5.5.1 above), visual CCA contamination was observed in roadbase material associated with the roadway west of Hangar 5. Furthermore, samples (4B/T57/N21/E8 and 4B/T57/N15/E6) collected in the vicinity of the roadway during the delineation sampling, as discussed in Section 5.3, reported concentrations of arsenic above the EIL.

OTEK (2012b) described the contamination as a thin horizon of green CCA compound at the road base / substrate interface. OTEK (2012b) reported that the interface was at a depth of approximately 0.25 mbgs. Based on photographs included in Appendix E (OTEK, 2012b), it was assumed that the 'substrate' referred to by OTEK (2012b) was actually 'natural' soil.

The contaminated roadbase material (approximately 120 m^3) was removed and stockpiled in the north east corner of the site (depicted by the 4B/RB/SP-1/SS samples shown in Figure 9A). OTEK (2012b) reported that an XRF was used to screen the substrate / natural soil. The XRF indicated elevated arsenic concentrations on the ground surface. Further excavation was undertaken and the excavated soil (approximately 100 m^3) was also stockpiled in the north east corner of the site (depicted by the 4B/ROADBASE/SP-1/SS samples shown in Figure 9A). Results of the XRF were not provided in OTEK (2012b). The final excavation area was reported to be rectangular in shape and approximately 82 m long and 5 m wide.

Validation sampling was undertaken on 28 August, 1 and 3 September 2009. This included collection of 20 final validation samples from the excavation and analysis for arsenic, chromium and copper. The majority of samples were collected at depths of 0.25 m to 0.45 m. As discussed in Section 4.4, during a site visit on 2 September 2009, the auditor observed that contaminated road base materials adjacent to Hangar 5 had been characterised and removed from site.

OTEK (2012b) reported that additional test pitting was undertaken to investigate remaining road base and road base substrate to the west of the hangar. These works helped to laterally delineate the impacted roadbase material. The sampling was undertaken on 7 of September 2009. A total of 14 samples were collected from seven locations (two from each location) and analysed for arsenic, chromium and copper to validate the surface of the excavation. Samples were collected from depths of 0.01 m and 0.15 m at each location. The 0.15 m sample was generally consistent with the depth of substrate reported in the remediation area.

Results of the 34 final validation samples (20 from the excavation and 14 from the testpitting) were below the adopted EIL and HIL A for the analytes tested.

5.5.7 Chemical Fixation and the soil treatment area

As discussed in Section 5.5.5, soil from the area west of Hangar 5 had been identified as requiring chemical fixation prior to disposal offsite as the concentrations (prior to fixation) exceeded the allowable concentrations for disposal (as per EPA Bulletin 448.3 (2007) which was current at the time of works). Following excavation of the area west of Hangar 5, it was

found that a volume of approximately 30 m^3 required treatment (i.e. chemical fixation) and was transferred to a designated soil treatment area.

The soil treatment area had been prepared with a non-permeable clay pan mixing area. The chemical fixation works were undertaken by EnviroPacific Services (EPS) on 14 August 2009. OTEK (2012b) reported that the fixation works were carried out according to the relevant EPA Approvals and Immobilisation Targets as outlined in Section 9.3.1 of the RAP (OTEK, 2011). EPA approval documentation for the on-site fixation treatment is provided in Appendix I (OTEK 2012b).

Following completion of the the soil treatment works, the top 100 mm of the clay mixing area was removed and disposed of offsite with the treated material to ensure no residual contamination. Five validation samples (4B/VS-45/1, 4B/VS-45/2, 4B/VS-45/3, 4B/VS-45/4 and 4B/VS-45/5) were collected beneath the soil treatment area. Samples were analysed for arsenic, chromium and copper. Results were below the adopted investigation levels for the samples analysed.

Based on the methodology used (use then removal of the non-permeable clay layer) and the results of the sampling undertaken, it was considered unlikely that the soil treatment activities had led to contamination of the soil treatment area.

5.6 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 (2012b) referenced the appropriate waste guidelines for the duration of the works, and stated that works were undertaken in accordance with these guidelines.

OTEK, (2012b) also reported that the chemical fixation works were carried out according to the relevant EPA Approvals and Immobilisation Targets as outlined in Section 9.3.1 of the RAP (OTEK, 2011). EPA approval documentation for the on-site fixation treatment was provided in Appendix I (OTEK 2012b).

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

Copper chrome arsenate (CCA) was reported in soils in the area west of Hangar 5, the former timber drying yard and minor areas of the general site. Concentrations of arsenic (in the area west of Hangar 5, the former timber drying yard and minor areas of the general site), chromium and copper above the EILs and the HIL A (in limited instances) were considered to be due to the former timber treatment plant activities, specifically the use of CCA. As discussed above, remediation of soil was required in the area west of Hangar 5, the former timber drying yard and minor areas of the general site.

The potential for CCA contamination of soils was also noted beneath the contaminated section of concrete within Hangar 5 as detailed above. However, upon removal and validation of the concrete and infrastructure beneath further remediation was not required.

The detected concentrations of arsenic (outside the area west of Hangar 5 and the former timber drying yard), barium, manganese, nickel, and vanadium were considered to be naturally occurring. Concentrations of nitrate were considered to be within background ranges and not likely to pose a risk to ecological or human health (as discussed in Section 5.2.1).

In addition to CCA contamination identified at the site:

- Elevated concentrations of PAHs, TPH and zinc were reported during targeted sampling near the buried oil structure. However, upon removal and successful validation of this infrastructure, these elevated concentrations were removed, and further remediation was not required.
- Elevated concentrations of zinc above the EILs were reported during targeted sampling at 4B/G28A (located near the loading bay) and 4B/G29 to depths of 1 m. Remediation and validation sampling to 0.25 m was undertaken and results were below the EIL.
- Asbestos fibres were confirmed by laboratory analysis to be present at two locations; both areas were remediated and successfully validated.
- Syringes found beneath the former loading bay were remediated by removing all syringes observed. The area was validated visually and also through collection of validation samples.

Following removal and validation of the remainder of potentially contaminating infrastructure, further remediation was not required as contamination of concern was not detected in the validation analytical results.

Following completion of the assessment, infrastructure removal, remediation and validation works, concentration of hexavalent chromium remained at concentrations above the EIL at 11 locations in the area west of Hangar 5 (as discussed in Section 5.5.5 above).

Additionally, several slightly elevated concentrations of arsenic (outside the area west of Hangar 5 and the former timber drying yard), barium, manganese, nickel and vanadium 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 Section 5.2.1).

5.7.1 Maintenance of ecosystems

Concentration of hexavalent chromium remained at concentrations above the EIL at ten locations in the area west of Hangar 5 (as discussed in Section 5.5.5 above). The residual impact remained at depths of 1.8 m to 4.2 m below ground surface. OTEK (2012b) reported that concentrations appeared to be increasing with depth. OTEK, 2012b considered that the area had been clean up to the extent practicable. The risk to future users of the site was considered limited given the depth, lateral extent and concentrations of the residual impact. As discussed in Section 5.5.5, the residual concentrations ranged from 1.4 mg/kg to 61.6 mg/kg (which was above the EIL but below the HIL A).

A site meeting including the auditor, assessor and client was held on 2 September 2009 (refer to Section 4.4 and Appendix W of OTEK 2012b for meeting minutes) at the time of the remediation works. The auditor concurred with OTEK that there was a limited risk to future users of the site and that further excavation may not be the most appropriate, sustainable and economically sound option, particularly given that a volume of approximately 500 m^3 of soil had been excavated and already disposed to landfill. However, he concluded that the concentrations of hexavalent chromium above the EIL could not be overlooked and requested that groundwater monitoring was conducted as well as an evaluation of the impacts of the residual contamination on ecological receptors was required. OTEK (2012b) reported that the pathways from the contamination to the surface or near surface ecological receptors were prevented by the following factors.

- Depth to the contamination (a minimum of 1.8 mbgl);
- Capping of the residual impacts with fill material and compaction to 95% dry density;

- Unlikely that tree or plant roots would reach the depths required to reach the contamination;
- Highly unlikely that animals would burrow deep enough to reach the contamination; and
- The contamination is localised (confined to sub-surface area of approximately 4m x 5m) and is not widespread.

The auditor further considered the likelihood that tree or plant roots could reach the residual contamination present at the site at a minimum depth of 1.8 mbgl. According to O'Perry (1982), large woody tree roots grow horizontally in the soil. They are predominantly located in the top 0.3 m of soil and do not normally extend to depths greater than 1 to 2 m. The depths of the roots for smaller trees and plants would be even less.

Furthermore, the auditor requested that the potential for impact to groundwater was of concern and that a groundwater investigation in the area was required. The results of the groundwater assessment indicated that total chromium concentrations were below the investigation level for total chromium and hexavalent chromium, and as such the impacts at the residual secondary source were unlikely to be a source of groundwater impact (refer to Section 6.4). It is also widely known that chromium in soils strongly attaches to soil particles and as a result it will not move towards groundwater. In water chromium will be adsorb on sediment and become immobile. Only a small part of the chromium that ends up in water will eventually dissolve. Evidence also suggested hexavalent chromium does not cause cancer when ingested, most likely because it is rapidly converted to the trivalent form after entering the stomach[3]

Studies on environmental impact from CCA treatment carried out in the US (Solo-Gabriele et al, 2004) indicated that with high concentrations of arsenic, copper and chromium, subsurface horizons showed their potential to retain more metals than surface horizons. The slow release of trace metals on desorption with KCl showed that these horizons have high arsenic, chromium and copper retention potential. The same study indicated that correlation analyses using sorption and desorption curves for copper and chromium showed that CEC, texture, and OC, played a significant role in sorption and retention. The effects of texture and organic carbon on arsenic retention have been well documented (Chen et al., 1999; Jacobs et al., 1970). However, CEC also displayed a major role in arsenic retention; the increase in CEC may have been due to an increase in clay content and OC both of which lead to increased arsenic retention (Chen et al., 2002).

Concentrations of arsenic (outside the area west of Hangar 5 and the former timber drying yard), barium, manganese, nickel and vanadium above the EILs remained on the site. As discussed in Section 5.2.1, these concentrations were detected in natural soils and are considered representative of background conditions.

Concentrations of zinc above the EIL at two isolated locations, 4B/G28A (located near the loading bay) and 4B/G29 (located south of the timber drying yard), may remain onsite. The zinc concentrations were reported in samples collected at 0.25 m, 0.5 m and 1 m. Remediation and validation sampling near surface (refer to Section 5.5.4) indicated that zinc concentrations (collected at 0.25 m) were below the EIL and HIL A. It is possible that isolated elevated zinc concentrations may exist in this area (beyond 0.25 m); however, based on the results of the validation sampling, the extent of zinc above the EIL is limited and the auditor considered the zinc concentrations (at 4B/G28A and 4B/G29) were unlikely to pose an unacceptable risk to the maintenance of ecosystems..

[3] US EPA, Technology Innovation and Field Services Division, Contaminated Sites, clean up information, Chromium IV overview, 2014: http://www.clu-in.org/contaminantfocus/default.focus/sec/chromium_vi/cat/overview Last updated on Friday, April 4, 2014.

Additionally, the range of pH (7.5 to 9.3) encountered at the site was most unlikely to adversely impact the beneficial use maintenance of ecosystems, as it was naturally occurring and there were no visual adverse effect on site vegetation.

5.7.2 Human health

All concentrations of all analytes tested in samples which indicate the final site condition were below the investigation levels for protection of human health (HIL A).

5.7.3 Building and structures

The pH in soils across all assessment and validation samples was ranging from neutral to alkaline (7.5 to 9.3).

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 Newer Volcanic parent materials described in this report (refer to 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 was considered naturally occurring and not associated with any 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 (from one sample 4B/T93/0.5) 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.

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

5.7.4 Aesthetics

OTEK (2012b) reported that slight odours were observed during the removal of the buried oil structure. The buried oil structure was appropriately validated following removal (refer to Section 5.4.5) and there was no odour noted after the remediation.

Syringes were encountered below the former loading bay. However, the syringes were consequently removed and visually validated.

Visual CCA staining was identified at isolated areas across the site as discussed above. These areas were remediated and validated and were not considered to pose an aesthic limitation at the completion of the audit.

The auditor, during his final site inspection on 12 May 2014, observed the site surface was predominantly covered with grass. The auditor confirmed there was no visual evidence of contamination.

5.7.5 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 considered the EILs should also be taken into account. Accordingly, the concentrations of arsenic, barium, manganese, nickel, vanadium, and zinc in a limited number of samples exceeded the EILs. As discussed previously (Section 5.2.1) arsenic, barium, manganese, nickel and vanadium were considered to be naturally occurring and within the natural background range. The concentration of zinc was encountered in natural soil with no

evidence linking it to a source and was limited to only two locations across the site. These results were considered unlikely to pose an adverse impact to ecological receptors and hence nor to the beneficial use production of food, flora or fibre.

The elevated concentrations of hexavalent chromium remained at depths of 1.8 m to 4.2 m and was also considered unlikely to adversely impact this beneficial use (refer to Section 5.7.1).

5.8 Off-site contamination

Based on the available information through the collation of data 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.

5.9 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) between June 2006 and December 2011. Four of the monitoring wells (i.e. MW-3, MW-9, MW-10, and MW-11) were installed within the site.

The findings of the overall groundwater assessment were reported under separate cover as a draft document (OTEK, 2010a). The auditor referred to OTEK (2010a) for background information where necessary. The OTEK findings of the groundwater investigation relevant to Area 4B were reported in OTEK (2012a) (MW-3) and OTEK (2012b) (MW-3 and MW-9 to MW-11). The auditor referred primarily to OTEK 2012b as it contained information from all monitoring wells at the site. A summary of the location of key information is presented in Table 20 below.

Table 20 Assessor's site assessment information – groundwater

Assessment Details	Section in OTEK 2012a (refer to Appendix E)	Section in OTEK 2012b (refer to Appendix F)
Details of groundwater field sampling and assessment	Section 4.2	Section 4.3
Groundwater analytical results	Section 6.2	Section 6.2
Field observations	Sections 4.2.2 to 4.2.5	Sections 4.3.2 to 4.3.5
Monitoring well logs	Appendix G	Appendix M
Field measurements (groundwater)	Appendix H	Appendix N and P
Site plans	Figure 5	Figures 7 to 9
Analytical results (summary tables)	Tables 65 to 73	Tables 43 to 55

6.1 Adequacy of the groundwater assessment program

6.1.1 Monitoring well installation and sampling

A summary of monitoring wells installed at the site is presented in Table 21. The locations of monitoring wells at the site and across the Overall Audit Area are presented inFigure 11.

Table 21 Monitoring well details

Monitoring Well ID	Installation date	Potential source targeted	Well depth (m)	Aquifer[1]	SWL (mTOC)[1]	Top of screen (mbgl)
MW-3	18 July 2006	Timber drying area and TTP area.	15.8	NVA	13	10.8
MW-9	19-20 Oct 2009	Removed buried oil structure.	15	Werribee Delta	11	10
MW-10	22 Oct 2009	Down gradient of hexavalent chromium impacted area.	14	Werribee Delta	10	10
MW-11	20-21 Oct 2009	Up gradient of hexavalent chromium impacted area.	14	Werribee Delta	11.25	10

NOTES:
mTOC – metres below top of casing
mbgl – metres below ground level
SWL – standing water level
NVA – Newer Volcanics Aquifer
[1] Stabilised SWL measured date of installation therefore not directly comparable as wells installed on different days, and also SWLs likely to require a longer period to stabilise.

Groundwater flow direction

Groundwater across the Overall Audit Area was inferred to flow towards the east and south east (refer to Figure 12A and Figure 12B) which was consistent with the expected flow direction towards the Werribee River located approximately 500 m to the east north east of the Overall Audit Area, and Port Phillip Bay located approximately 7 km to the south east of the site. On this basis monitoring wells MW-3, MW-9 and MW-10 were appropriately installed in the immediate vicinity, or down gradient of potential sources. Monitoring well MW-11 was positioned upgradient of the potential source, however, it covers other areas such as the timber drying area adequately.

Soil profile

A similar soil profile comprising clay and silt was identified in all wells until approximately 12 mbgl. At 12 mbgl weathered basalt was encountered in MW-3, whereas MW-9 to MW-11 encountered silt with sand. Gravels and cobbles were encountered in MW-9 underlying the clay / silt at approximately 21 mbgl, where drilling ceased (i.e. based on the log for MW-9, drilling did not penetrate more than approximately 0.1 m into the gravels). OTEK inferred MW-9 to MW-11 were installed in the Werribee Delta aquifer, whereas MW-3 was installed within the Newer Voolcanics Aquifer (NVA). From the consistencies in hydraulic conductivity (see below regarding slug tests), TDS concentrations and standing water levels, the auditor considered it likely the Werribee Delta and NVA aquifers were interconnected.

Drilling and installation methodologies

Section 4.2.3 of OTEK (2012a) stated that MW-3 was drilled using hollow stem augers then hammer drilling. However, the borelog for MW-3 indicated it was drilled using solid flight augers to 10.0 mbgl, then hammer drill. Therefore, the diameter of the well annulus could not be determined. As samples were collected using low flow methodology as opposed to being reliant on well volume estimates (for which the well annulus diameter is required) the lack of this information was not considered an issue. The drilling methods adopted were considered appropriate.

Monitoring wells MW-10 and MW-11 were drilled using hollow stem augers (basalt was not encountered). Well MW-9 was drilled using diamond core drilling to approximately 20 mbgl to gain an understanding of soil profile. The auditor noted that OTEK did not specify what was used to backfill the borehole from 20 mbgl to 15 mbgl (depth of well). The auditor therefore considered several likely scenarios:

- The bore was backfilled with cuttings: this would be unlikely to impact the quality of groundwater to any great extent given all soil results from MW-9 were below the investigation levels;
- The bore was backfilled with a grout / cement mixture, as per standard industry practice: this would effectively create a seal, and would be the preferred option;
- The bore was left open between 15-21 mbgl, or backfilled with sand: this would potentially provide a preferential pathway for vertical groundwater migration, resulting either in dilution of groundwater (if upwards hydraulic gradient) or migration of shallow groundwater to greater depths (assuming downward hydraulic gradient). Given the absence of contamination detected in soils or groundwater at this location, the implications of either occurring were not significant.

Overall the omission of backfill information was not considered to impact the outcome of the audit.

Monitoring well development

Monitoring well MW-3 was developed using compressed air. Development records were not provided, and it was not stated how much water was removed. Monitoring wells MW-9 to MW-11 were developed using a surge block then pumped with a submersible electric pump to remove fines. OTEK indicated that approximately 10 well volumes were removed from MW-9 to MW-11, with water remaining turbid throughout. Well records were provided for MW-9 to MW-11, which indicated reasonably stable groundwater parameters. Overall, given the number of sampling events undertaken, and reasonably consistent analytical results (refer Section 6.4), the well development was considered adequate.

Slug tests

Slug tests were conducted in January 2010 on all four monitoring wells to assess the hydraulic conductivity of the aquifer. OTEK provided details in Section 4.3.4 of OTEK (2012b). Hydraulic conductivity was found to range from 0.942 m/day to 1.352m/day in the upper Werribee Delta aquifer, providing a groundwater velocity from 3.89 to 8.77 m/year. Hydraulic conductivity in the Newer Volcanic Aquifer (NVA) (MW-3) was estimated as 0.442 m/day to 2.8 m/day, providing a groundwater velocity of 4 to 27 m/year.

6.1.2 Groundwater monitoring events

Five groundwater monitoring events (GMEs) were undertaken, as summarised in Table 22.

Table 22 Summary of groundwater sampling events and analysis

Monitoring Event	Date[1]	Wells Sampled	Analysis
GME1	23 August 2007	MW-3	Inorganics[2], BTEX, TPHs, PAHs, cations/anions[3], TDS, pH
GME 2	15 November 2007	MW-3	Inorganics[2], BTEX, TPHs, PAHs, cations/anions[3], TDS, pH
GME 3	4-5 February 2008[1]	MW-3	Inorganics[2], BTEX, TPHs, PAHs[4], cations/anions[3], TDS, pH
GME 4	25 November 2009	MW-3, MW-9, MW-10, MW-11	Inorganics[2], BTEX, TPHs, PAHs, phenols (MW-9, MW-11), VOCs (MW-9, MW-11) OCPs/OPP (MW6 only), cations/anions[3], TDS, pH
GME 5	8 December 2011	MW-3, MW-9, MW-10, MW-11	Inorganics[2], BTEX/TPHs (MW-9 only), PAHs (MW-11 only), cations/anions[3], TDS, pH

NOTES:

[1] Laboratory reports indicate sampling was undertaken on 4 February 2008, report states 5 February 2008, and the sampling record states "2/05/2008" which was inferred to be in the format "m/dd/yyyy" (i.e. 5 February 2008).

[2] Antimony (GME 4 and 5 only), arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, ferrous iron (GME 2 only) manganese, mercury, molybdenum, nickel, selenium, tin, vanadium, zinc.

[3] Alkalinity, bicarbonate, calcium, carbonate, chloride, electrical conductivity, magnesium, nitrate, nitrite, potassium, sodium, sulphate.

[4] Table 45 of OTEK 2012b shows a sample for MW-3 from 5 August 2007 as being analysed for PAHs. Based on the laboratory analytical reports this was considered a typographical error, with the correct date being 4 February 2008 (i.e. GME3).

Groundwater samples were collected using low flow micro-purge to reduce the potential loss of volatiles. Purging continued until stabilisation of physical and chemical parameters had occurred. Groundwater sampling records (provided in Appendix P of OTEK 2012b) showed acceptable stabilisation of parameters and standing water levels (i.e. minimal drawdown of water level) during all sampling events. The auditor noted that it was possible that insufficient volumes of water were purged from all wells during GME3 (ranging from 1.5 L to 2.0 L). Given so little water was removed, it was considered likely the collected samples contained at least

some water from the stagnant water column. However, given results were generally consistent with other sampling events, parameters were stable, and the standing water levels stabilised it was not considered to have significantly impacted on the analytical results.

OTEK reported that samples were collected in laboratory provided bottles, placed on ice and transported to the NATA certified laboratory, under COC protocol. While some deficiencies in the QA/QC protocols were observed (refer to Section 4.3 and Appendix I), the sampling methodologies employed were considered generally appropriate

Samples were submitted to Labmark Pty Ltd (Labmark) as the primary laboratory and ALS Pty Ltd (ALS) as the secondary laboratory for GMEs 1 to 3. For GME4, ALS was the primary laboratory and Labmark was the secondary laboratory. For GME5, ALS was the primary laboratory and Groundswell Laboratories Pty Ltd (Groundswell) was the secondary laboratory. Laboratory reports 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 an indication of groundwater quality beneath the site;
- The monitoring wells were placed appropriately to assess groundwater quality from potential onsite sources;
- Appropriate construction methods were generally adopted for the monitoring wells. While OTEK did not specify what was used to backfill MW-9 between 15mbgl (base of the well) and 21 mbgl (depth of the borehole), this was considered unlikely to have impacted results;
- The analytical schedule and field measurements generally were adequate; and
- The low flow sampling methodology adopted was considered appropriate.

6.2 Beneficial uses of groundwater to be protected

OTEK reported the TDS of groundwater ranged from 4520 mg/L to 6680 mg/L (OTEK, 2012b). On this basis and in accordance with the Groundwtaer SEPP, groundwater at the site was classified as Segment C of the groundwater environment. The Groundwater SEPP specifies the following beneficial uses to be protected under Segment C:

- 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 20, and discussed further below. It was noted that much of these 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 23 Regional groundwater quality

Analyte	Investigation Level Maintenance of Ecosystems	Audit Area and Sample Dates			
		Area 1 March 2003	Area 2 October 2003	Area 3 May to Sept 2005 (three monitoring events)	Area 4 August 2007 – Dec 2011 (six monitoring events)
		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[a]
Manganese	1.9	0.017-0.068	0.018-0.13	0.15-2.3	<0.001-0.861[c]
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[b]
Nitrate-N	0.16	12.4[d]	5.3-6.7	2.3-9.8	1.25-5.82

NOTES:

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

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

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

[(d)] converted from nitrate-NO_3^- (55 mgL).

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

[(f)] ANZECC issued an errata 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.

Sources:

GHD 2004, GHD 2008, GHD 2011 (refer References in Section 8), OTEK 2010, OTEK, 31 October 2012b, *Remediation and Validation Report (Draft), Sub-Area 4B, Werribee, Victoria.*

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 NVA.

Nitrate

Similarly, groundwater in the vicinity of the Overall Audit Area was 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". The investigation level was therefore 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, 4E4F/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 such potential point sources (i.e. no elevated concentrations of nitrate were detected close to potential sources). The concentrations of nitrate observed in groundwater across the Overall Audit Area were reasonably consistent (refer Table 20 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 20mg/kg, with the exception of a few isolated higher concentrations in Area 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 NVA at concentrations up to 60mg/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 fertilizer 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, were considered to be regionally occurring.

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 24 and discussed below. Tabulated groundwater results from 2007 to 2011 were presented in Tables 43 to 47 (OTEK, 2012b). As noted in Section 3.4, although OTEK (2012b) adopted ANZECC 1992 investigation 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 were not included, given that the relevant investigation levels would depend upon the broad potential application of this use. The beneficial use of buildings and structures was not considered to be adversely impacted by the elevated concentrations of inorganics, and therefore this beneficial use has not been presented in Table 24.

Table 24 Exceedances of adopted investigation levels (mg/L)

Beneficial Use Requiring Protection		Analyte / Adopted Investigation Level							
		Hexavalent Chromium	Copper	Manganese	Nickel	Zinc	Sodium	Sulphate	Nitrate-N
Maintenance of Ecosystems [1]		*0.001*	*0.0014*	*1.9*	*0.011*	*0.008*			*0.16* [7]
Stock watering [2]			0.4 [4]		1	20			90 [8]
Primary Contact Recreation [3]			**1** [6]	**0.1** [6]	**0.02** [5]	**3** [6]	**180** [6]	**250** [6]	
GME / Date	Monitoring Well	Analytical Result							
GME1 (Aug 07)	MW-3	NA	*<0.01**		*0.014*	*0.012*	**792**	**291**	*4.07*
GME2 (Nov 07)	MW-3	*<0.005**	*<0.01**			*0.063*	NA		NA
GME3 (Feb 08)	MW-3	*0.005*	*<0.01**			*0.025*	NA		NA
GME4 (Nov 09)	MW-3	*<0.01**	*0.005*			*0.014*	**841**	**323**	*4.01*
	MW-9	*<0.01**	*0.010*	**0.135**	***0.047***	*0.018*	**1130**	**316**	*1.25*
	MW-10	*<0.01**	*0.008*	**0.137**	***0.034***	*0.022*	**1080**	**296**	*1.48*
	MW-11	*<0.01**	*0.008*		***0.022***	*0.016*	**1060**	**296**	*1.43*
GME5 (Dec 11)	MW-3	*<0.01**	*0.003*			*0.020*	**1100**	**281**	*3.91*
	MW-9	*<0.01**	*0.006*		***0.100***	*0.100*	**1350**	**274**	*1.27*
	MW-10	*<0.01**	*0.003*			*0.022*	**1250**	**273**	*1.45*
	MW-11	*<0.01**	*0.003*			*0.023*	**1200**	**280**	*1.44*

NOTES:
Italicised results exceed ecosystem protection criteria.
Underlined results exceed stock watering guidelines.
Bold results exceed protection of primary contact recreation.
NA - Not analysed
1. ANZECC (2000), 95% level of protection (slightly to moderately disturbed ecosystems) for freshwater guidelines.
2. ANZECC (2000); Australian Water Quality Guidelines for Fresh and Marine Waters, investigation levels for Primary Industries
3. NHMRC (2008); Guidelines for Managing Risks in Recreational Water.
4. Values range for various animals. Most conservative value for sheep selected.
5. Health Guideline.
6. Aesthetic Guideline.
7. 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.
8. ANZECC 2000 (Volume 3, 9.3.4.3): *"400 mg/L nitrate and 30 mg/L nitrite are recommended for livestock drinking water. Depending on the nitrate content of feed, the type of livestock and other factors such as animal age and condition, concentrations up to 1500 mg/L nitrate may tolerated, at least for short-term exposure*".
* LOR > investigation level.
NA – Not analysed.

As shown in Table 24, concentrations of several inorganics were reported above the adopted investigation levels for maintenance of ecosystems, and / or primary contact recreation, discussed further below. Concentrations of all organic analytes were reported below the laboratory LOR.

6.4.1 Hexavalent chromium

A single concentration of hexavalent chromium above the investigation level for maintenance of ecosystems was detected in MW-3 during GME3 (February 2008). OTEK did not comment on the likely source of the hexavalent chromium concentration in MW-3 in OTEK (2012a) or OTEK (2012b). The auditor considered the former timber treatment activities would come to mind as possibly a former source. However, a review of the soil analytical results from samples collected upgradient and down gradient of the well, indicated that there were no hexavalent chromium or total chromium concentrations that exceeded the investigation level in the samples tested.

The results for hexavalent chromium from all monitoring wells (including MW-3) in GME4 and GME5 were below the laboratory LOR, however, the LOR was above the investigation level and therefore it was not possible to make a meaningful comparison with the investigation level. The auditor therefore compared the results for total chromium with the investigation levels for hexavalent chromium, on the basis that hexavalent chromium concentrations would be less than the results for total chromium. The auditor did not consider the marginally elevated concentrations of hexavalent chromium observed in MW-3 in 2008 were indicative of a significant issue, based on the following lines of evidence.

- All total chromium results were below the investigation level for hexavalent chromium in all wells in GME4 and GME5, which indicated concentrations of hexavalent chromium were below the investigation level (as total chromium would always be greater than or equal to hexavalent chromium);
- As mentioned above, the soil analytical results from samples collected upgradient and down gradient from MW3, indicated that there were no hexavalent chromium or total chromium concentrations that excedded the investigation level in the samples analysed;
- Although MW-3 contained a concentration of 0.006mg/L total chromium in GME2, which indicated hexavalent chromium could potentially have exceeded the investigation level for Hexavalent chromium, all subsequent GMEs indicated total chromium concentrations below the investigation level for Hexavalent chromium, hence hexavalent chromium was also below the investigation level;
- All primary sources of chromium had been removed from the site and activities had ceased (i.e. former timber treatment processes, etc.), and the vast majority of secondary sources (i.e. chromium impacted soil) were removed during the remediation works (refer Sections 5.4 and 5.5);
- Residual hexavalent chromium impact was reported in ten samples collected in the area west of Hangar 5. As discussed in Section 5.5.5, the area was considered to have been cleaned up to the extent practicable. The remainder of hexavalent chromium impacted soil was removed and successfully validated. Two monitoring wells (MW-10 and MW-11) installed in the vincinity of the residual hexavalent chromium impacted soils in the area west of Hangar 5 reported total chromium concentrations were below the investigation level for total chromium and hexavalent chromium. If the residual concentrations in soil were the source of groundwater impact in MW-3, it would have been expected to have been detected in the wells closest to the source also; and
- Natural attenuation of hexavalent chromium (if any) in groundwater can occur through reduction of organic matter, hydrogen sulphide, sulphur, iron sulphide, ammonium and

nitrate[4]. Given the low total chromium results for the two most recent GMEs (GME4 and GME5), and presence of nitrate in groundwater, it was considered possible that natural attenuation had occurred.

Given the concentrations of total chromium (and hence hexavalent chromium) were below the investigation levels for the two most recent GMEs (i.e. GME4 and GME5), groundwater was not considered to be impacted by hexavalent chromium.

6.4.2 Nitrate

Concentrations of nitrate-N were above the investigation level for maintenance of ecosystems in all monitoring wells. As discussed in Section 6.3, the auditor was of the opinion 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 (data are provided in Table DD of OTEK 2012b);
- Concentrations were consistent with levels expected in groundwater agricultural areas, and in the NVA (Leonard, 1992); and
- Aside from former agricultural use in the region, there was only one potential point source of nitrate (i.e. a septic). It was noted that agriculture activities on the site ceased a number of years ago and, hence were not considered an ongoing potential primary source of nitrate. The use of the septic was ceased in the 1980s and it was later removed and successfully validated. Additionally, considering the nature of nitrate, any residual nitrate in soil (i.e. potential secondary source) from previous activities would have decreased over time, and hence any potential for a risk would have further diminished.

6.4.3 Copper, nickel, and zinc

OTEK provided a reasonable discussion regarding the concentrations of inorganics in Section 11.2.1 (OTEK, 2012b), 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 were generally below the adopted investigation levels, with the exception of 13 locations which copper concentrations exceeded the EILs and three locations where zinc concentrations exceeded theEILs (refer to Section 5.2.1). Hence, such concentrations 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.
- The site history review did not identify any potential point or diffuse source of nickel or zinc;
- The primary source of copper (i.e. former timber treatment activities) was removed, and contaminated soils remediated;
- The nature of natural soils where the abovementioned inorganics concentrations were observed 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 pH within the road base and the soil) and hence minimise migration from shallow soils to groundwater;

[4] Agency for Toxic Substances & Disease Registry (ATSDR), *Toxicological Profile for Chromium,* 6. Potential for Human Exposure (http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=62&tid=17)

- The depth to the groundwater and 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).

6.4.4 Sodium and sulphate

Concentrations of sodium and sulphate were reported in all wells exceeding the primary contact recreation criteria. However, OTEK noted that when allowing for minimal ingestion of recreational water the criteria can be modified by a factor of 20[5]. All concentrations were below the modified criteria. The auditor agreed with this approach, and additionally noted the following:

- These analytes were not considered COPC, rather were assessed as part of characterising the groundwater chemistry; and
- The concentrations of sodium and sulphate observed were considered representative of the NVA and were consistent with those across the Overall Audit Area.

6.4.5 Manganese

OTEK did not comment on the possible source of the manganese concentrations in groundwater from MW-9 and MW-10 in GME4 (November 2009), which were above the investigation levels for primary contact recreation. The auditor reviewed the soil analytical data collected during the installation of MW-9 and MW-10, which were generally consistent with concentrations across the remainder of the site and Overall Audit Area.

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 concentrations of manganese at MW-9 and MW-10 were below the modified investigation level. Additionally, the concentrations detected in the subsequent monitoring event (GME5) were well below all investigation levels, and were consistent with concentrations across the Overall Audit Area. The concentrations of manganese were therefore considered naturally occurring.

Based on the discussion above and in accordance with the Groundwater SEPP (part IV, 10, 2(c)), where the background level of a groundwater quality indicator is greater than the objective, the background level becomes the objective, Therefore, concentrations of copper, manganese, nickel, zinc and nitrate-N were not considered to exceed the environmental objectives and are not discussed as exceedances within the remainder of this report.

6.4.6 Aesthetic impacts

There was no sheen or odour observed in groundwater from any of the wells.

6.4.7 Off-site migration of groundwater contamination

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

6.5 Summary of groundwater conditions and impact on beneficial uses

Results of the groundwater assessment program for wells located on the site indicated groundwater was not polluted. Elevated concentrations of copper, manganese, nickel, zinc and

[5] OTEK referenced ANZECC 1992 Raw Waters for Drinking Water. The auditor referred to the more recent guidelines NHMRC 2008, which also allows for modification of criteria by a factor of 20.

nitrate were naturally occurring and, therefore potential or existing beneficial uses were not impacted. The isolated concentration of hexavalent chromium in a single monitoring well in one round of monitoring only was not considered an issue of significance as discussed in details above (see section 6.4.1). Also, two subsequent rounds of groundwater sampling found all concentrations of total chromium (and hence hexavalent chromium) below the investigation levels. Groundwater was therefore not considered to be impacted with hexavalent chromium.

The relevance of protected beneficial uses at the site and the potential impact of the groundwater conditions on the relevant beneficial uses is summarised in Table 25.

Table 25 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 was considered likely to discharge to the Werribee River and / or Port Phillip Bay, located approximately 500 m to the east north east of the Overall Audit Area (at its closest point) and 7 km to the south east of the site respectively.	Copper, nickel, magnesium, zinc and nitrate-N.	Maintenance of ecosystem not precluded, given that concentrations of copper, nickel, magnesium, zinc and nitrate-N considered naturally occurring in the region.
Stock watering	Unlikely	It is possible given the current rural setting that stockwatering may be realised on neighbouring properties in the future. However, the proposed urban development and access to a reticulated water system makes this unlikely.	None	Beneficial use not precluded. Concentrations below the adopted investigation levels.
Primary contact recreation	Unlikely	Not relevant on site. Groundwater wells may be used to fill or top up swimming pools in the vicinity of the site. However, this is considered unlikely given access to a reticulated water system.	None	Beneficial use not precluded. Concentrations below the adopted investigation levels.
Industrial use	No	Criteria are usually industry specific, however, given neutral pH and low TDS groundwater could support a number of industries.	N/A	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 in to contact with the groundwater.	N/A	Beneficial use not precluded given that concentrations did 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 was unlikely to come into contact with groundwater.

6.6 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 was 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.

7. Audit conclusions

Following completion of this environmental audit for Area 4B of Riverwalk Estate, Princes Highway, Werribee, Victoria and based on the data available to the auditor at the time of the completion of the assessment, infrastructure and 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 (refer to Section 4 for details). It was noted the auditor had to provide numerous comments to OTEK during the assessment and remediation in order to obtain an ESA of suitable quality, and that OTEK made few errors during the assessment works, however, these were not considered to impact on the overall conclusions.
- The density of sampling was marginally less than the density specified in Australian Standard (AS4482.1), however, the distribution was appropriate, works were undertaken in general accordance with AS 4482.1 requirements and the identified former potential sources and activities, which were appropriately targeted for removal and validation sampling. The sampling program was considered acceptable (refer to 5.1 for details).
- Concentrations of arsenic (outside the area west of Hangar 5 and the former timber drying yard), barium, manganese, nickel, and vanadium exceeding the EILs were observed in soil at 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 5.2.1 and 5.7).
- Concentrations of zinc above the EIL remained (at a depth greater than 0.25 m) at two locations south of the former timber drying yard. The minor concentrations of zinc at the site were considered to be isolated in extent and unlikely to pose a risk to human or ecological receptors (refer to Section 5.7).
- Hexavalent chromium remained at concentrations above the EIL at 11 locations in the area west of Hangar 5. The residual impact remained at depths of 1.8 m to 4.2 m below ground surface and was believed to be associated with the former CCA burial. The area was considered to have been cleaned up to the extent practicable. However, residual concentrations ranging from 1.4 mg/kg to 61.6 mg/kg (which was above the EIL but below the HIL A) remained at the site. The risk to future users of the site was considered limited given the depth, lateral extent and concentrations of the residual impact. Ecological impacts were considered and the pathways from the contamination to the ecological receptors were considered unlikely to be realised (refer to Section 5.7 for details). A groundwater investigation was undertaken and impacts to groundwater from the residual hexavalent chromium were not observed (refer to Section 6.4).
- Groundwater was not considered polluted at the site. The elevated concentrations of boron, copper, manganese, nickel, selenium, zinc, nitrate, sodium, and sulphate 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 (refer to Sections 6.3 and 6.4 for details).
- A single concentration of hexavalent chromium above the investigation level for maintenance of ecosystems was detected in MW-3 during GME3 (February 2008). However, this was not considered to be a significant issue (refer to Section 6.4).

- At the time of completion of this audit, the site surface had areas covered with grass and trees. A concrete stormwater pipe also remained at the site as described in this report and shown on Figure 3. The auditor confirmed the site appearance during his final site inspection on 12 May 2014.
- 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 Corporation, Area 4B of Riverwalk Estate, Princes Highway, Werribee, Victoria, May 2014*" (Ref: 31/11575/00/222252 – CARMS Reference 41460-4).

DATED: 15 May 2014

SIGNED:

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

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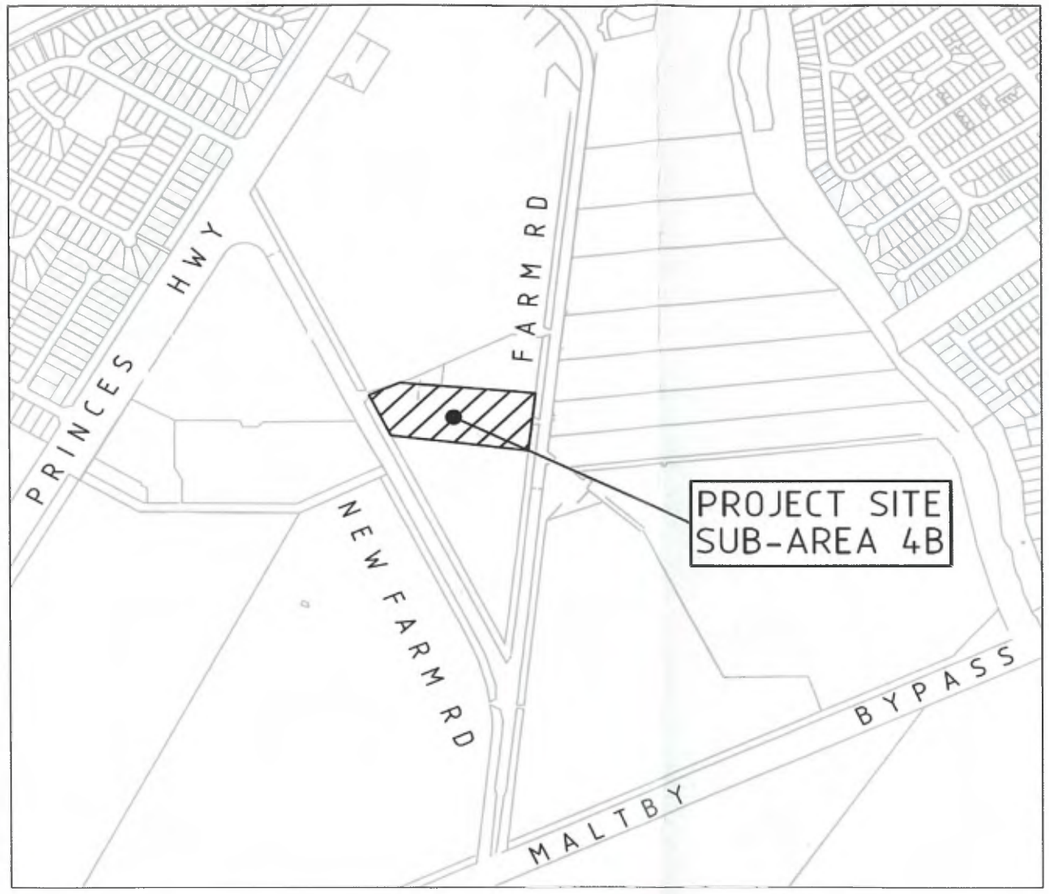
REGIONAL MAP

LOCALITY MAP



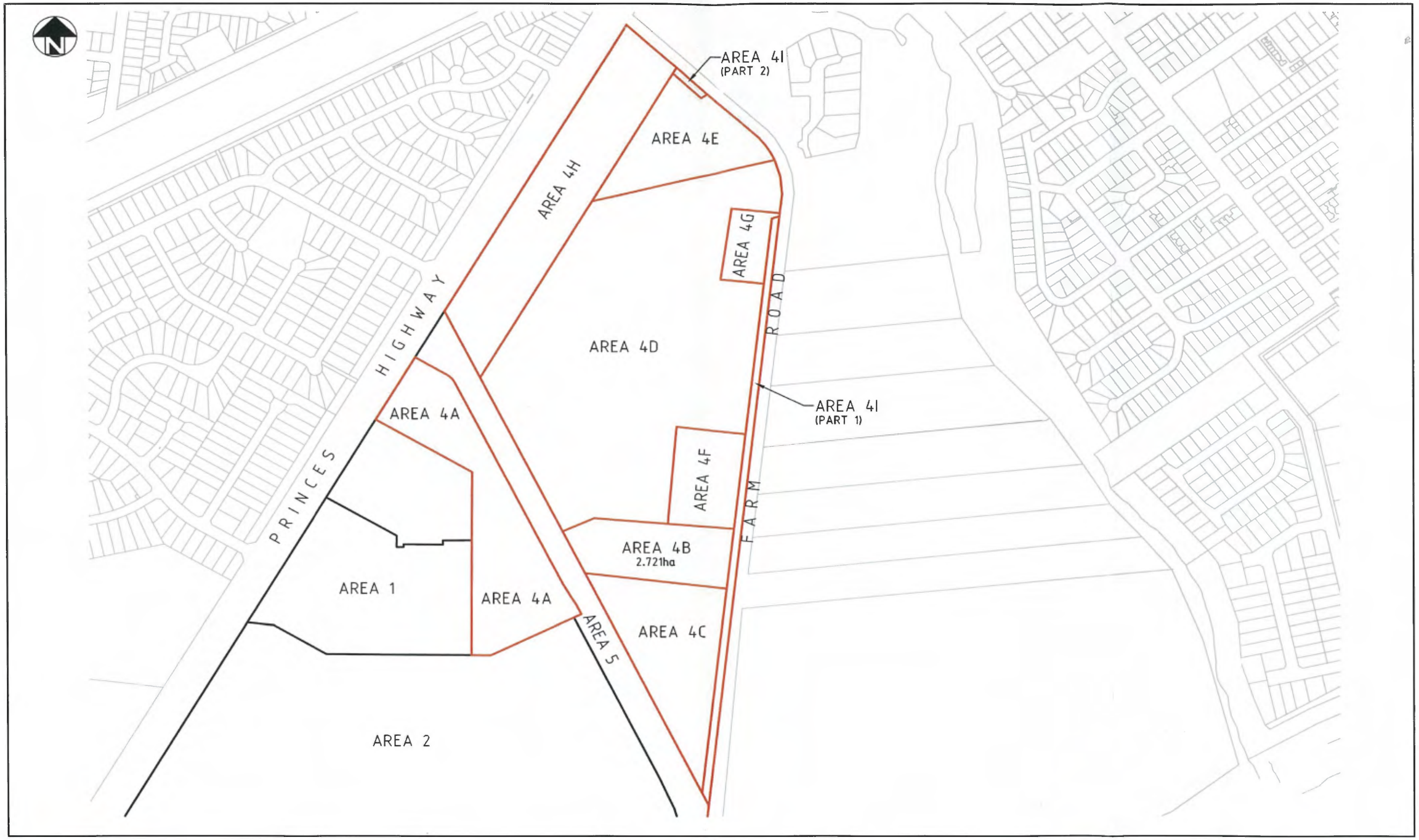
VICINITY MAP

Client: Melbourne Water
Project: Environmental Audit of Area 4B, Riverwalk Estate, Princes Highway, Werribee
Source: Remediation Action Plan - Version 3 (Soil Contamination Sub-Area 4B) Area 4 Riverwalk, Werribee, Victoria (OTEK, 2011)
scale: Not to Scale | date: 6 May 2014

Job No. 31 / 1157500
Report No. 222252
Rev No. 1

Figure 1
Regional, Locality & Vicinity Map

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



Client: Melbourne Water

Project: Environmental Audit of Area 4B, Riverwalk Estate, Princes Highway, Werribee

Source: Remediation Action Plan - Version 3 (Soil Contamination Sub-Area 4B) Area 4 Riverwalk, Werribee, Victoria (OTEK, 2011)

scale: Not to Scale | date: 21 February 2014

Job No. 31 / 1157500
Report No. 222252 ©
Rev No. 0

Figure 2
Riverwalk Estate - Overall Audit Area

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

Historic Site Infrastructure:

- Former Timber Drying Yard
- Former Emergency Powerhouse
- Septic System
- Subsurface Concrete Block
- Test Butt Stop and Shed
- Loading Bay and Concrete Slab
- Gravel Road Base
- Former Timber Treatment Plant
- Soil Treatment Area
- Rubbish Pile
- Rubbish Pile (Identified in Final Auditor Inspection)
- Hanger 5 Concrete Slab (contaminated)
- Buried Oil Structure
- Sump
- Distrurbed Soil / Possible Fill
- Hanger 5 Footprint
- Stormwater (In Situ)
- Stormwater (Removed)
- Asbestos Water Pipe
- Galvanised Water Pipe
- Ceramic Septic Pipe
- Spoon Drain
- CCA Burial

Note: location of historic site infrastructure has been approximated.

1:750 at A3

0 7.5 15 22.5 30

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

Audit Areas

Note: The data displayed in this figure has been digitised from images extracted from the following reports; OTEK (2012) *Sub-Area 4B Environmental Site Assessment (Draft)*, OTEK (2011) *Remediation Action Plan - Version 3 (Soil Contamination Sub-Area 4B)*, and OTEK (2012) *Remediation and Validation Report (Draft) Sub-Area 4B, Werribee, Victoria*. Therefore GHD cannot guarantee the accuracy of this data.
This figure should only be viewed as a point of reference.

Melbourne Water
Environmental Audit of Area 4B,
Riverwalk Estate Princes Highway Werribee VIC

Defined Audit Boundary and Site Infrastructure / Features

Job Number	31 / 1157500
Revision	2
Date	14 May 2014

Figure 3

G:\31\1157500\Cad\GIS\Maps\Deliverables\Area_4B\311157500_003_Defined_Audit_Boundary_and_Site_Infrastructure_A3L_FINAL.mxd

Data source: Audit Boundaries, OTEK 2012; Site Infrastructure, OTEK 2012; CCA Burial, Enterra 2001; Background Imagery (2006), Google Earth Pro 2013. Created by:bcoughlan

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

Historic Site Infrastructure:

- Former Timber Drying Yard
- Former Emergency Powerhouse
- Septic System
- Subsurface Concrete Block
- Test Butt Stop and Shed
- Loading Bay and Concrete Slab
- Gravel Road Base
- Former Timber Treatment Plant
- Soil Treatment Area
- Rubbish Pile
- Hanger 5 Concrete Slab (contaminated)
- Buried Oil Structure
- Sump
- Distrurbed Soil / Possible Fill
- Hanger 5 Footprint
- Stormwater (In Situ)
- Stormwater (Removed)
- Asbestos Water Pipe
- Galvanised Water Pipe
- Ceramic Septic Pipe
- Spoon Drain
- CCA Burial

Note: location of historic site infrastructure has been approximated.

SUB AREA 4D
SUB AREA 4F
SUB AREA 4I
SUB AREA 4B
SUB AREA 4C
AREA 5
New Farm Road

Image © 2013 Sinclair Knight Merz & Fugro
© 2010 Google

1:750 at A3
0 7.5 15 22.5 30
Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Audit Areas
- Grid Sample - Exceeded EIL
- Grid Sample - Exceeded HIL
- Target Sample - Exceeded EIL
- Target Sample - Exceeded HIL
- Grid Sample - No Exceedance
- Target Sample - No Exceedance
- Grid Sample - Not Analysed
- Groundwater Monitoring Well

Note: The data displayed in this figure has been digitised from images extracted from the following reports; OTEK (2012) *Sub-Area 4B Environmental Site Assessment (Draft)*, OTEK (2011) *Remediation Action Plan - Version 3 (Soil Contamination Sub-Area 4B)*, and OTEK (2012) *Remediation and Validation Report (Draft) Sub-Area 4B, Werribee, Victoria*. Therefore GHD cannot guarantee the accuracy of this data.
This figure should only be viewed as a point of reference.

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Melbourne Water
Environmental Audit of Area 4B,
Riverwalk Estate Princes Highway Werribee VIC

Job Number	31 / 1157500
Revision	3
Date	14 May 2014

Grid, Targeted and Monitoring Well Locations

Figure 4

G:\31\1157500\Cad\GIS\Maps\Deliverables\Area_4B\311157500_004_Grid_Targeted_and_Monitoring _Well_Locations_A3L_FINAL.mxd

Data source: Audit Boundaries, OTEK 2012; Sampling Locations, OTEK 2012; Groundwater Monitoring Wells, OTEK 2011; Site Infrastructure, OTEK 2012; CCA Burial, Enterra 2001; Background Imagery (2006), Google Earth Pro 2013. Created by:bcoughlan

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Historic Site Infrastructure:

- Former Timber Drying Yard
- Former Emergency Powerhouse
- Septic System
- Subsurface Concrete Block
- Test Butt Stop and Shed
- Loading Bay and Concrete Slab
- Gravel Road Base
- Former Timber Treatment Plant
- Soil Treatment Area
- Rubbish Pile
- Hanger 5 Concrete Slab (contaminated)
- Buried Oil Structure
- Sump
- Distrurbed Soil / Possible Fill
- Hanger 5 Footprint
- Stormwater (In Situ)
- Stormwater (Removed)
- Asbestos Water Pipe
- Galvanised Water Pipe
- Ceramic Septic Pipe
- Spoon Drain
- CCA Burial

Note: location of historic site infrastructure has been approximated.

SUB AREA 4D

SUB AREA 4F

SUB AREA 5

SUB AREA 4I

SUB AREA 4B

SUB AREA 4C

New Farm Road

As	0.05m	76000mg/kg
As	0.10m	29900mg/kg
As	0.25m	43mg/kg
As	0.50m	122mg/kg
Cr	0.10m	21200mg/kg
Cu	0.05m	4600mg/kg
Cu	0.10m	6890mg/kg
V	0.10m	125mg/kg
V	0.50m	62mg/kg

As	0.25m	530mg/kg
Mn	0.10m	700mg/kg
Ni	0.10m	120mg/kg

As	0.25m	62mg/kg
Mn	0.10m	700mg/kg
Ni	0.10m	110mg/kg
V	0.50m	53mg/kg

As	0.10m	28mg/kg
Mn	0.10m	550mg/kg
Ni	0.10m	74mg/kg

As	0.25m	210mg/kg
As	0.50m	24mg/kg
As	1.00m	29mg/kg
Cu	0.25m	140mg/kg

Mn	0.10m	585mg/kg
Mn	0.25m	509mg/kg
Ni	0.10m	105mg/kg

V	0.50m	53mg/kg

As	0.25m	32mg/kg
As	0.50m	84mg/kg
As	1.00m	3120mg/kg
Cr	1.00m	4690mg/kg
Cr6	1.80m	1.9mg/kg
Cu	1.00m	1900mg/kg
V	0.50m	52mg/kg

As	0.25m	1310mg/kg
Cr	0.25m	1060mg/kg
Cu	0.25m	480mg/kg

As	0.50m	7000mg/kg	PAH	0.50m	2500mg/kg
Cr	0.50m	8300mg/kg	TPH C10-C14	0.50m	4600mg/kg
Cu	0.50m	4900mg/kg	TPH C15-C28	0.50m	71000mg/kg
Zn	0.50m	960mg/kg	TPH C29-C36	0.50m	14000mg/kg
BaP	0.50m	120mg/kg			

Mn	0.10m	604mg/kg
Ni	0.10m	106mg/kg

V	0.50m	62mg/kg
V	0.50m	57mg/kg

Mn	0.10m	583mg/kg
Ni	0.10m	95mg/kg
V	0.50m	54mg/kg

Mn	0.10m	680mg/kg
Ni	0.10m	110mg/kg
V	0.50m	51mg/kg

V	0.50m	59mg/kg

As	0.05m	32mg/kg
As	0.10m	45mg/kg
As	0.20m	29mg/kg
As	0.30m	47mg/kg

As	0.05m	105mg/kg
As	0.10m	140mg/kg
As	0.20m	83mg/kg
As	0.30m	126mg/kg
As	0.40m	29mg/kg

Mn	0.25m	591mg/kg
V	0.50m	56mg/kg

As	0.25m	38mg/kg

As	0.25m	126mg/kg
As	0.50m	45mg/kg
Cu	0.25m	104mg/kg
V	0.50m	53mg/kg

As	0.25m	79mg/kg

Mn	1.00m	598mg/kg

As	0.25m	190mg/kg
As	0.50m	21mg/kg
Cu	0.25m	162mg/kg

As	0.05m	412mg/kg
As	0.10m	148mg/kg
As	0.20m	132mg/kg
As	0.30m	57mg/kg
As	0.40m	300mg/kg
As	0.50m	46mg/kg
As	1.00m	26mg/kg
Cr	0.05m	513mg/kg
Cu	0.05m	322mg/kg
Cu	0.10m	114mg/kg
Cu	0.40m	279mg/kg

As	0.25m	144mg/kg
Cu	0.25m	107mg/kg
V	0.25m	61mg/kg

Mn	1.00m	622mg/kg

As	0.25m	24mg/kg
V	0.25m	63mg/kg

As	0.50m	105mg/kg

As	0.25m	61mg/kg
Mn	0.25m	780mg/kg

As	0.05m	56mg/kg
As	0.10m	71mg/kg
As	0.20m	77mg/kg
As	0.25m	84mg/kg
As	0.30m	122mg/kg
As	0.40m	127mg/kg
As	0.50m	79mg/kg

As	0.25m	261mg/kg
Cr	0.25m	431mg/kg
Cu	0.25m	230mg/kg

As	0.25m	31mg/kg
Ba	0.25m	450mg/kg

As	0.25m	45mg/kg
V	0.25m	52mg/kg

As	0.25m	25mg/kg
Mn	0.25m	590mg/kg

As	0.05m	125mg/kg
As	0.10m	78mg/kg
As	0.20m	32mg/kg
As	0.30m	21mg/kg
As	0.40m	29mg/kg

As	0.50m	25mg/kg

As	0.25m	140mg/kg
Zn	0.25m	730mg/kg
Zn	1.00m	770mg/kg

As	0.05m	59mg/kg
As	0.10m	82mg/kg
As	0.20m	47mg/kg

As	0.05m	254mg/kg
As	0.10m	164mg/kg
As	0.20m	35mg/kg
Cu	0.05m	152mg/kg
Cu	0.10m	111mg/kg

As	0.25m	99mg/kg
Mn	0.50m	561mg/kg

As	0.25m	119mg/kg

Mn	0.10m	760mg/kg
Ni	0.10m	120mg/kg

As	0.50m	22mg/kg

V	0.50m	65mg/kg

V	0.50m	51mg/kg

V	0.50m	56mg/kg

V	0.50m	60mg/kg

V	0.50m	57mg/kg

V	0.25m	56mg/kg
Mn	1.00m	538mg/kg

4B/G2, 4B/G3, 4B/G4, 4B/G10, 4B/G12, 4B/G13, 4B/G15, 4B/G17, 4B/G19, 4B/G23, 4B/G28A, 4B/G29, 4B/G34, 4B/G37

4B/T1, 4B/T2, 4B/T3, 4B/T4, 4B/T6, 4B/T7, 4B/T8, 4B/T9, 4B/T12, 4B/T14, 4B/T15, 4B/T16, 4B/T18, 4B/T20, 4B/T21, 4B/T22, 4B/T43, 4B/T44, 4B/T45, 4B/T48(A), 4B/T49, 4B/T50, 4B/T51, 4B/T52, 4B/T54, 4B/T55, 4B/T56, 4B/T57, 4B/T58, 4B/T59, 4B/T61, 4B/T68, 4B/T81, 4B/T88, 4B/T93

1:750 at A3

0 7.5 15 22.5 30

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Audit Areas
- Grid Sample - Exceeded EIL
- Grid Sample - Exceeded HIL
- Targeted Sample - Exceeded EIL
- Targeted Sample - Exceeded HIL
- Exceeded EIL (Grid, Target, Delineation)
- Exceeded HIL (Grid, Target, Delineation)
- Exceeded NSW EPA Criteria (Target)

Note: The data displayed in this figure has been digitised from images and analytical tables extracted from the following reports; OTEK (2012) *Sub-Area 4B Environmental Site Assessment (Draft)*, OTEK (2011) *Remediation Action Plan - Version 3 (Soil Contamination Sub-Area 4B)*, and OTEK (2012) *Remediation and Validation Report (Draft) Sub-Area 4B, Werribee, Victoria*. Therefore GHD cannot guarantee the accuracy of this data.
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Melbourne Water
Environmental Audit of Area 4B,
Riverwalk Estate Princes Highway Werribee VIC

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Grid and Targeted Sample Exceedances

Figure 5

G:\31\1157500\Cad\GIS\Maps\Deliverables\Area_4B\311157500_005_Grid_and_Targeted_Sample_Exceedances_A3L_FINAL.mxd

Data source: Audit Boundaries, OTEK 2012; Sampling Locations, OTEK 2012; Site Infrastructure, OTEK 2012; CCA Burial, Enterra 2001; Analytical Results, OTEK 2012; Background Imagery (2006), Google Earth Pro 2013. Created by:bcoughlan

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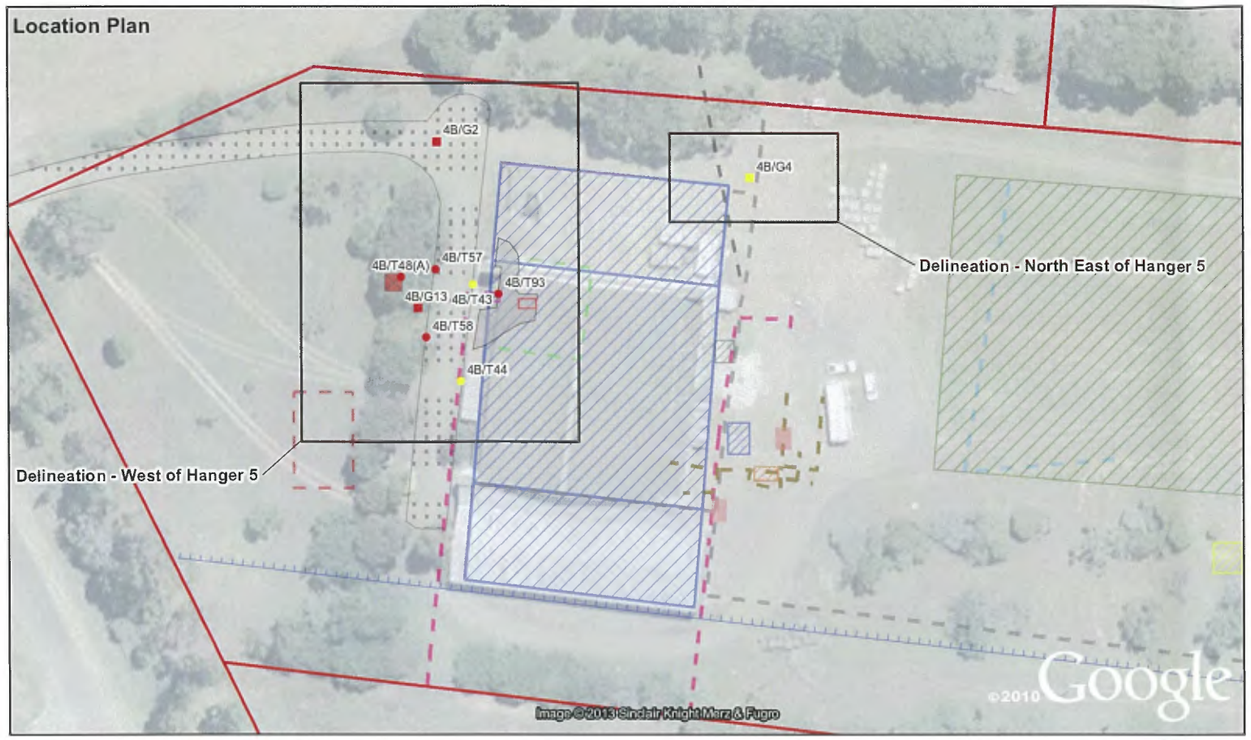
Location Plan



Location Plan Inset
1:1000 at A3

0 10 20 30 40
Metres

Delineation West of Hanger 5
1:250 at A3

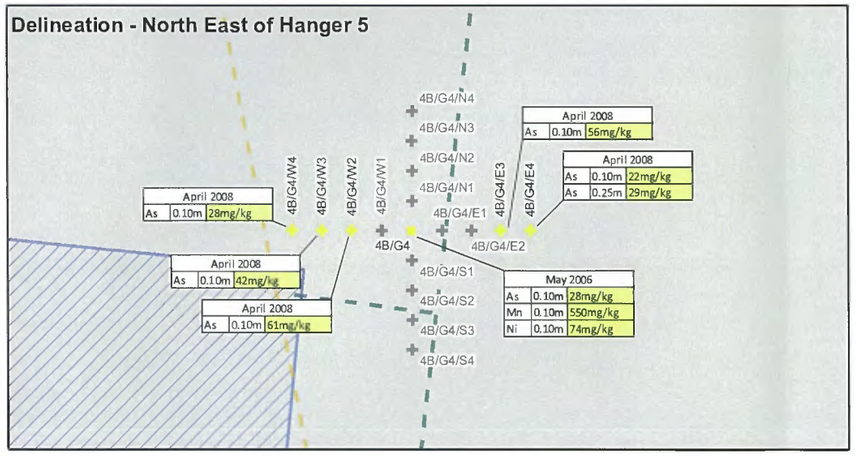
0 2.5 5 7.5 10
Meters

Delineation North East of Hanger 5
1:200 at A3

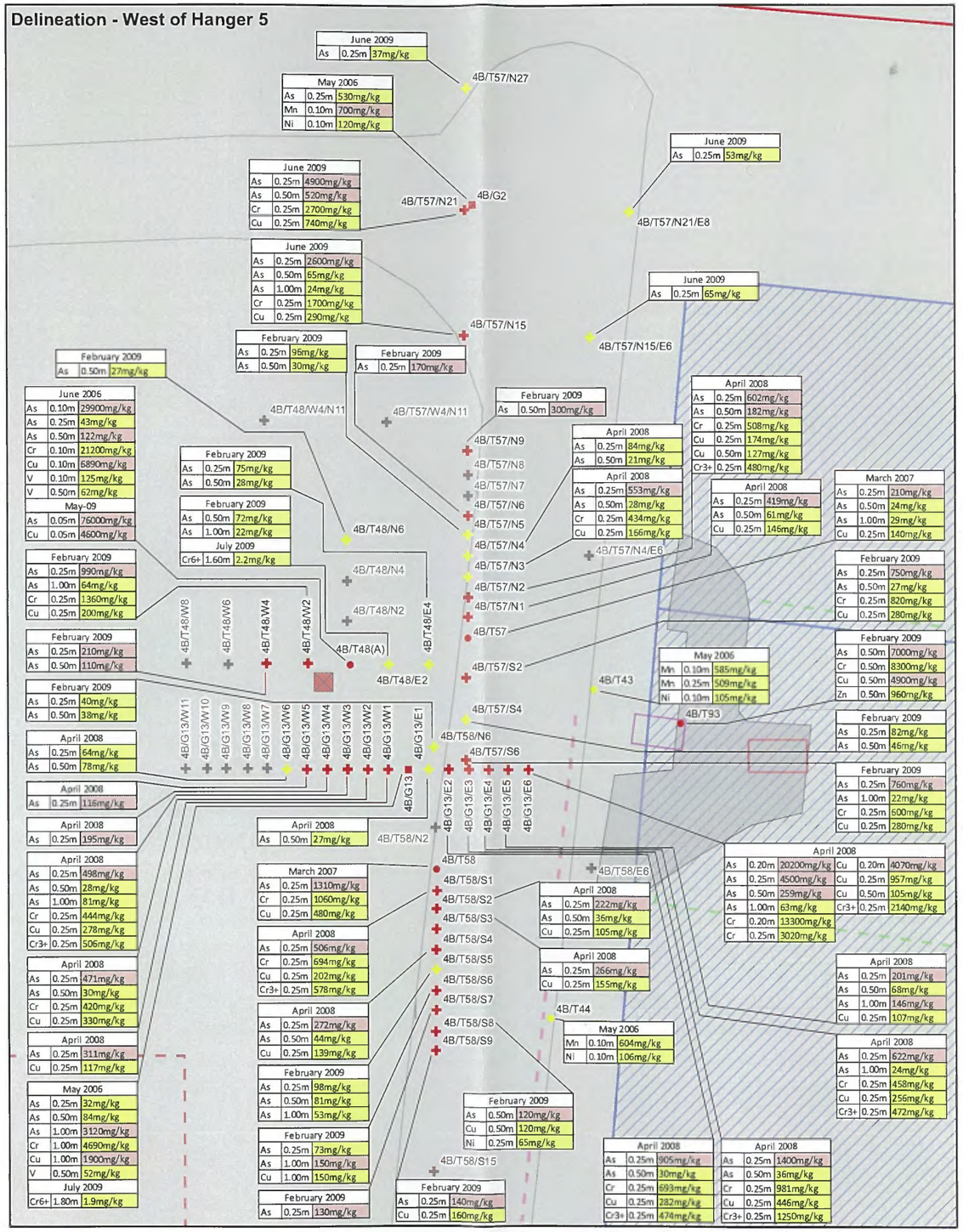
0 2 4 6 8
Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

Delineation - North East of Hanger 5



Delineation - West of Hanger 5



Historic Site Infrastructure:

- Former Timber Drying Yard
- Former Emergency Powerhouse
- Septic System
- Subsurface Concrete Block
- Loading Bay and Concrete Slab
- Gravel Road Base
- Former Timber Treatment Plant
- Soil Treatment Area
- Hanger 5 Concrete Slab (contaminated)
- Buried Oil Structure
- Sump
- Distrurbed Soil / Possible Fill
- Hanger Footprint
- Stormwater (In Situ)
- Stormwater (Removed)
- Asbestos Water Pipe
- Galvanised Water Pipe
- Ceramic Septic Pipe
- Spoon Drain
- CCA Burial

Note: location of historic site infrastructure has been approximated.

N

LEGEND

- Audit Areas
- Grid Sample - Exceeded EIL
- Grid Sample - Exceeded HIL
- Targeted Sample - Exceeded EIL
- Targeted Sample - Exceeded HIL
- Delineation - Exceeded EIL
- Delineation - Exceeded HIL
- Delineation Sample - No Exceedance

Exceeded EIL (Grid, Target, Delineation)
Exceeded HIL (Grid, Target, Delineation)

Note: The data displayed in this figure has been digitised from images and analytical tables extracted from the following reports; OTEK (2012) *Sub-Area 4B Environmental Site Assessment (Draft)*, OTEK (2011) *Remediation Action Plan - Version 3 (Soil Contamination Sub-Area 4B)*, and OTEK (2012) *Remediation and Validation Report (Draft) Sub-Area 4B, Werribee, Victoria*. Therefore GHD cannot guarantee the accuracy of this data.
This figure should only be viewed as a point of reference.

Melbourne Water
Environmental Audit of Area 4B,
Riverwalk Estate Princes Highway Werribee VIC

Job Number 31 / 1157500
Revision 2
Date 14 May 2014

Delineation Sample Locations

Figure 6

G:\31\1157500\Cad\GIS\Maps\Deliverables\Area_4B\311157500_006_Delineation_Sample_Locations_A3L_FINAL.mxd

Data source: Audit Boundaries, OTEK 2012; Sampling Locations, OTEK 2012; Site infrastructure, OTEK 2012; CCA Burial, Enterra 2001; Analytical Results, OTEK 2012; Background Imagery (2006), Google Earth Pro 2013. Created by:bcoughlan

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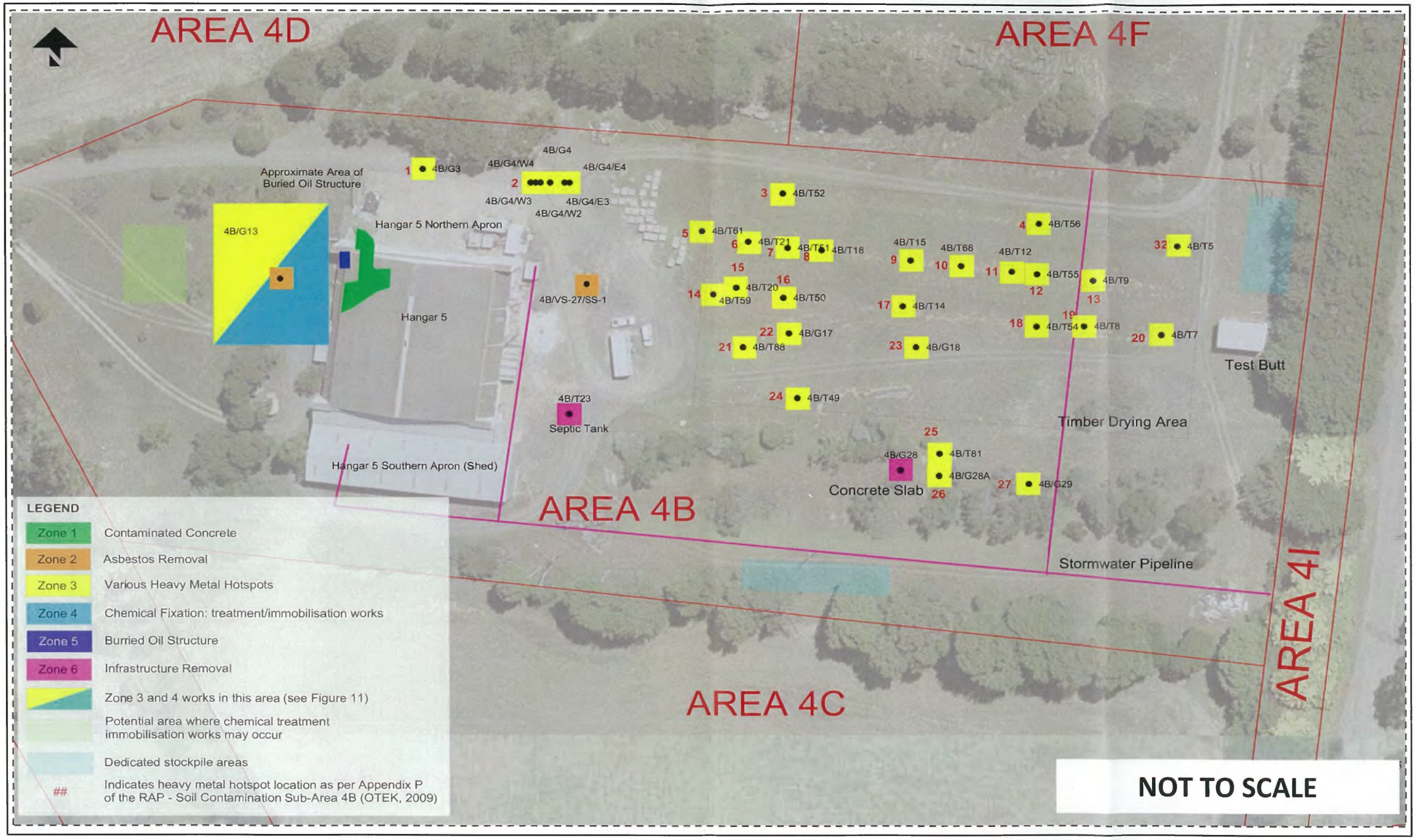

Client: Melbourne Water

Project: Environmental Audit of Area 4B, Riverwalk Estate, Princes Highway, Werribee

Source: Remediation Action Plan - Version 3 (Soil Contamination Sub-Area 4B) Area 4 Riverwalk, Werribee, Victoria (OTEK, 2011)

scale: Not to Scale | date: 6 May 2014

Job No. 31 / 1157500
Report No. 222252
Rev No. 1

Figure 7
OTEK Proposed Remediation Zones

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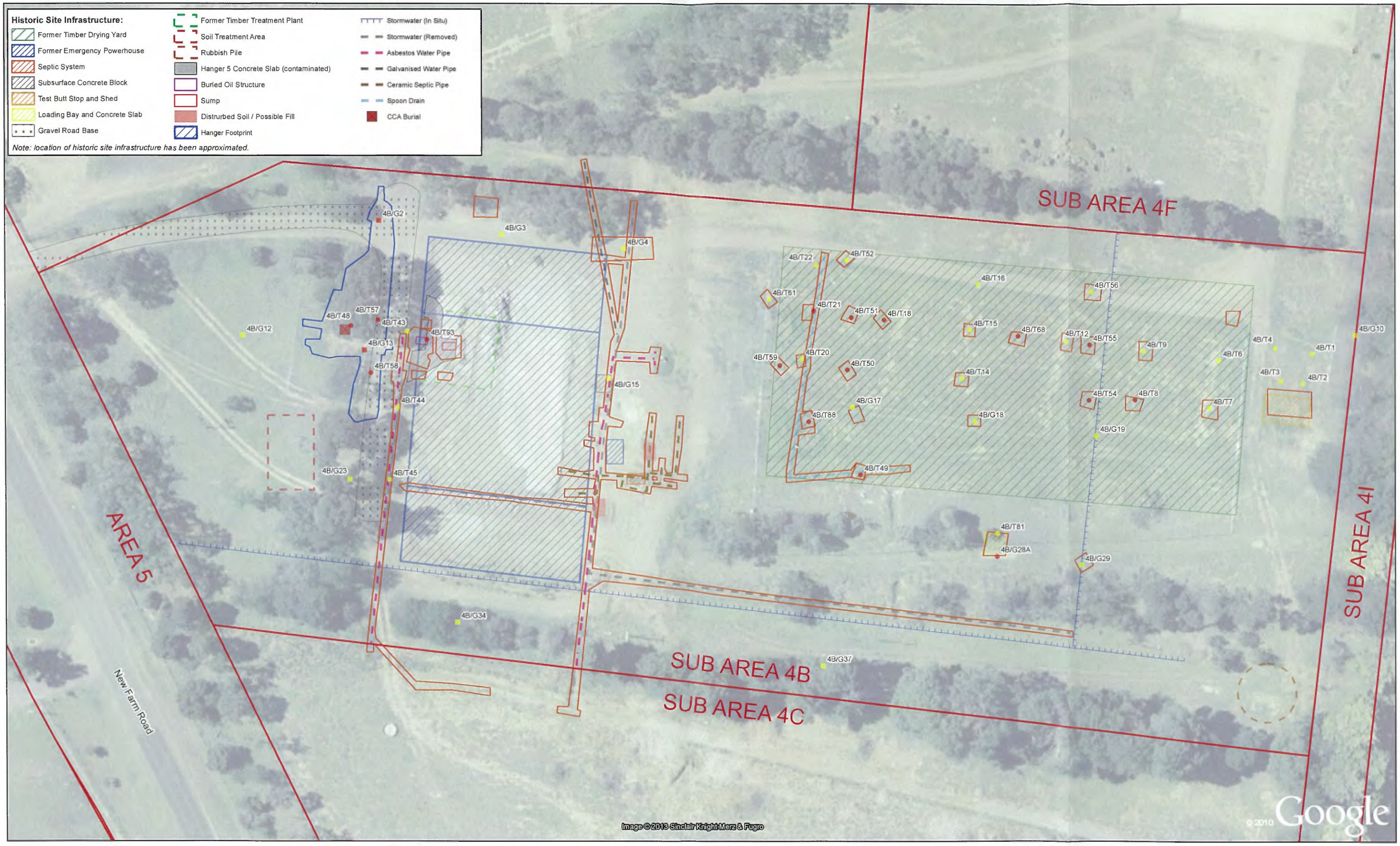

1:750 at A3

0 7.5 15 22.5 30

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Audit Areas
- Excavation Extents
- CCA Excavation Extent
- Grid Sample - Exceeded EIL
- Grid Sample - Exceeded HIL
- Targeted Sample - Exceeded EIL
- Targeted Sample - Exceeded HIL

Note: The data displayed in this figure has been digitised from images extracted from the following reports; OTEK (2012) *Sub-Area 4B Environmental Site Assessment (Draft)*, OTEK (2011) *Remediation Action Plan - Version 3 (Soil Contamination Sub-Area 4B)*, and OTEK (2012) *Remediation and Validation Report (Draft) Sub-Area 4B, Werribee, Victoria*. Therefore GHD cannot guarantee the accuracy of this data.
This figure should only be viewed as a point of reference.

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Melbourne Water
Environmental Audit of Area 4B,
Riverwalk Estate Princes Highway Werribee VIC

Job Number	31 / 1157500
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Infrastructure Removal and Remediation

Figure 8

G:\31\1157500\Cad\GIS\Maps\Deliverables\Area_4B\311157500_008_Infrastructure_Removal_and_Remediation_A3L_FINAL.mxd

Data source: Audit Boundaries, OTEK 2012; Excavation Extents, OTEK 2012; Sampling Locations, OTEK 2012; Site Infrastructure, OTEK 2012; CCA Burial, Enterra 2001; Background Imagery (2009), Google Earth Pro 2013. Created by:bcoughlan

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1:500 at A3

0 5 10 15 20

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

Audit Areas
Excavation Extents
Hanger 5 Footprint
Ceramic Stormwater (In Situ)

Validation Samples:

Validation Sample - Exceeded EIL
Exceeded EIL (Validation)
Validation Sample - No Exceedance
Surface Validation Sample - No Exceedance

Note: The data displayed in this figure has been digitised from images and analytical tables extracted from the following reports: OTEK (2012) *Sub-Area 4B Environmental Site Assessment (Draft)*, OTEK (2011) *Remediation Action Plan - Version 3 (Soil Contamination Sub-Area 4B)*, and OTEK (2012) *Remediation and Validation Report (Draft) Sub-Area 4B, Werribee, Victoria*. Therefore GHD cannot guarantee the accuracy of this data.
This figure should only be viewed as a point of reference.

G:\31\1157500\Cad\GIS\Maps\Deliverables\Area_4B\311157500_009a_Remediation_and_Validation_Samples_East_A3L_FINAL.mxd

Data source: Audit Boundaries, OTEK 2012; Excavation Extents, OTEK 2012; Sampling Locations, OTEK 2012; Site infrastructure, OTEK 2012; Analytical Results, OTEK 2012; Background Imagery (2009), Google Earth Pro 2013. Created by:bcoughlan

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Melbourne Water
Environmental Audit of Area 4B,
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Job Number	31 / 1157500
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Date	14 May 2014

Remediation and Validation Samples (East)

Figure 9A

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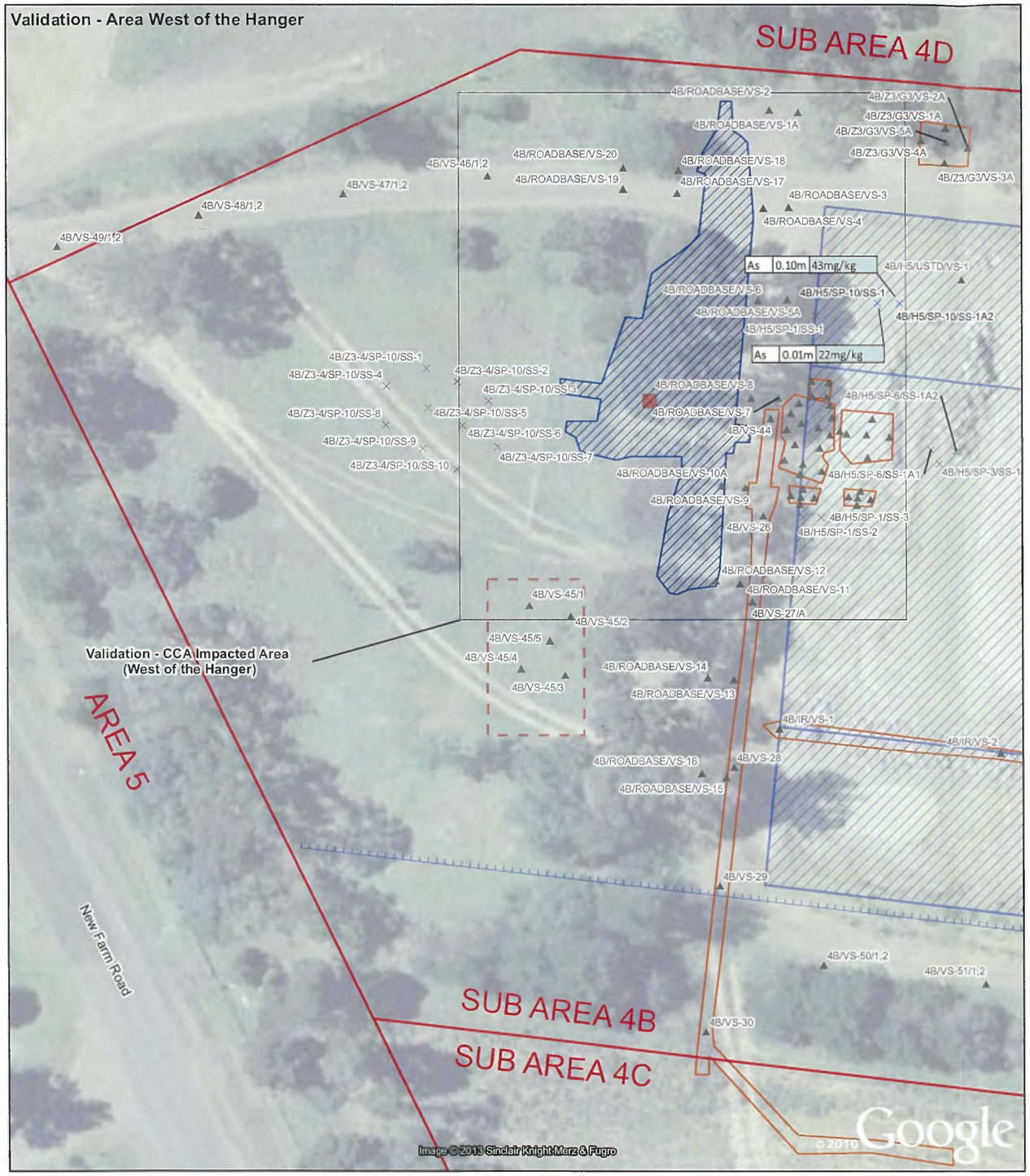
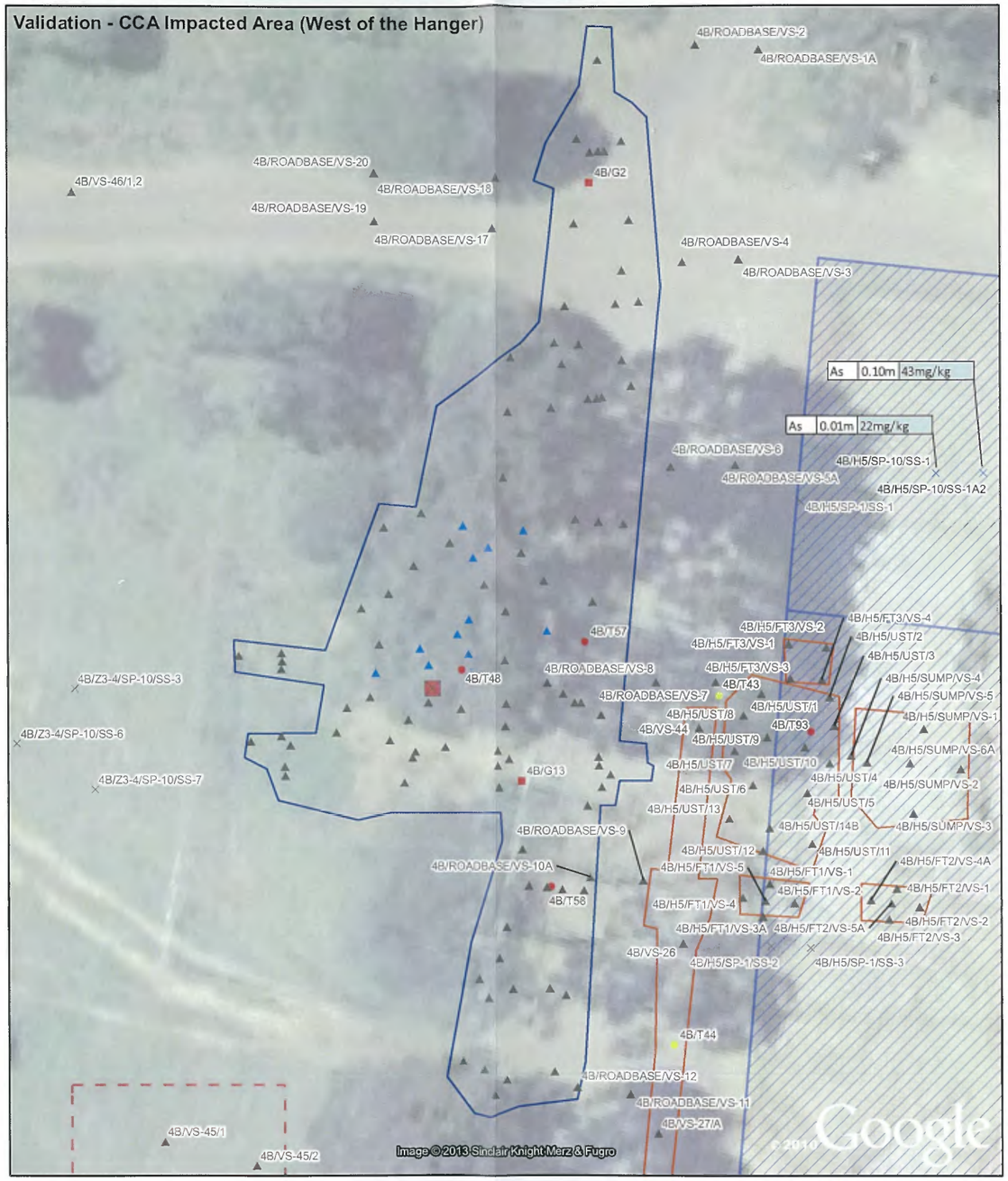
Validation - Area West of the Hanger



Validation - CCA Impacted Area (West of the Hanger)



Validation - Area West of the Hanger
1:500 at A3

0 5 10 15 20
Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

Validation - CCA Impacted Area (West of the Hanger)
1:250 at A3

0 2.5 5 7.5 10
Metres

N

LEGEND
- Audit Areas
- Excavation Extents
- CCA Excavation Extent
- Soil Treatment Area (approximate location)
- Hanger 5 Footprint
- Ceramic Stormwater (In Situ)
- CCA Burial

Validation Samples:
- Validation Sample - Exceeded EIL
- Surface Validation Sample - Exceeded EIL
- Validation Sample - No Exceedance
- Surface Validation Samples - No Exceedance

ESA Samples:
- Grid Sample - Exceeded HIL
- Targeted Sample - Exceeded EIL
- Targeted Sample - Exceeded HIL

Exceeded EIL (Validation)

Note: The data displayed in this figure has been digitised from images and analytical tables extracted from the following reports; OTEK (2012) *Sub-Area 4B Environmental Site Assessment (Draft)*, OTEK (2011) *Remediation Action Plan - Version 3 (Soil Contamination Sub-Area 4B)*, and OTEK (2012) *Remediation and Validation Report (Draft) Sub-Area 4B, Werribee, Victoria*. Therefore GHD cannot guarantee the accuracy of this data. **This figure should only be viewed as a point of reference.**

G:\31\1157500\Cad\GIS\Maps\Deliverables\Area_4B\311157500_009b_Remediation_and_Validation_Samples_West_A3L_FINAL.mxd

Data source: Audit Boundaries, DTEK 2012; Excavation Extents, OTEK 2012; Sampling Locations, DTEK 2012; Site Infrastructure, OTEK 2012; CCA Burial, Enterra 2001; Analytical Results, OTEK 2012; Background Imagery (2009), Google Earth Pro 2013. Created by:bcoughlan

Melbourne Water
Environmental Audit of Area 4B,
Riverwalk Estate Princes Highway Werribee VIC

Job Number	31 / 1157500
Revision	2
Date	14 May 2014

Remediation and Validation Samples (West) Figure 9B

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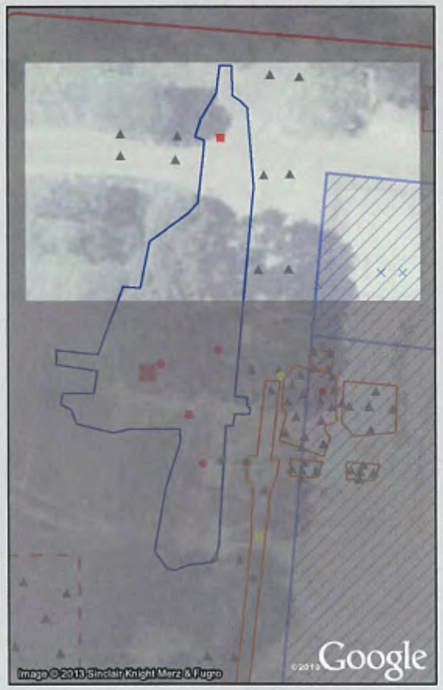

Grid and Target Samples:
- Grid Sample - Exceeded HIL

Delineation Samples:
- Delineation - Exceeded EIL
- Delineation - Exceeded HIL
- Delineation Sample - No Exceedance

Validation Samples:
- Validation Sample - Exceeded EIL
- Surface Validation Sample - Exceeded EIL
- Validation Sample - No Exceedance
- Surface Validation Sample - No Exceedance

4B/ROADBASE/VS-2
4B/ROADBASE/VS-1A
4B/T57/N27
T4/VS-17
T4/VS-29A
T4/VS-30A
T4/VS-15
T4/VS-16
T4/VS-14
4B/ROADBASE/VS-20
4B/ROADBASE/VS-18
4B/T57/N21
4B/G2
4B/T57/N21/E8
4B/ROADBASE/VS-19
4B/ROADBASE/VS-17
T4/VS-28A
T4/VS-31A
4B/ROADBASE/VS-4
4B/ROADBASE/VS-3
T4/VS-22
T4/VS-18A
T4/VS-21
T4/VS-23
4B/T57/N15
4B/T57/N15/E6
T4/VS-19A
T4/VS-13
VS-55
T4/VS-20
T4/VS-24
T4/VS-32
T4/VS-10
T4/VS-12
T4/VS-27
T4/VS-11
4B/T48/W4/N11
4B/T57/W4/N11
VS-54
Cr6+ 1.8m 8.1mg/kg
Cr6+ 1.8m 2.7mg/kg
4B/T57/N9
4B/T57/N8
VS/53
4B/T57/N7
4B/T57/N6
T3/VS-48
T3/VS-37A
T3/VS-46
T3/VS-47
T4/VS-8
T4/VS-9A
4B/T57/N5
T4/VS-33A
4B/ROADBASE/VS-6
4B/ROADBASE/VS-5A
As 0.10m 43mg/kg
4B/H5/SP-10/SS-1
4B/H5/SP-10/SS-1A2
As 0.01m 22mg/kg
4B/H5/SP-1/SS-1

1:100 at A3

0 1 2 3 4

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND
- Audit Areas
- CCA Excavation Extent
- Hanger 5 Footprint
- Exceeded EIL (Validation)

Note: The data displayed in this figure has been digitised from images and analytical tables extracted from the following reports; OTEK (2012) *Sub-Area 4B Environmental Site Assessment (Draft)*, OTEK (2011) *Remediation Action Plan - Version 3 (Soil Contamination Sub-Area 4B)*, and OTEK (2012) *Remediation and Validation Report (Draft) Sub-Area 4B, Werribee, Victoria*. Therefore GHD cannot guarantee the accuracy of this data.
This figure should only be viewed as a point of reference.

Melbourne Water
Environmental Audit of Area 4B,
Riverwalk Estate Princes Highway Werribee VIC

Job Number	31 / 1157500
Revision	2
Date	14 May 2014

CCA Impact in Area West of Hanger

Figure 10A

G:\31\1157500\Cad\GIS\Maps\Deliverables\Area_4B\311157500_010a_CAA_Impact_in_Area_West_of_Hanger_A3L_FINAL.mxd

Data source: Audit Boundaries, OTEK 2012; Excavation Extents, OTEK 2012; Sampling Locations, OTEK 2012; Site Infrastructure, OTEK 2012; CCA Burial, Enterra 2001; Analytical Results, DTEK 2012; Background Imagery (2009), Google Earth Pro 2013. Created by:bcoughlan

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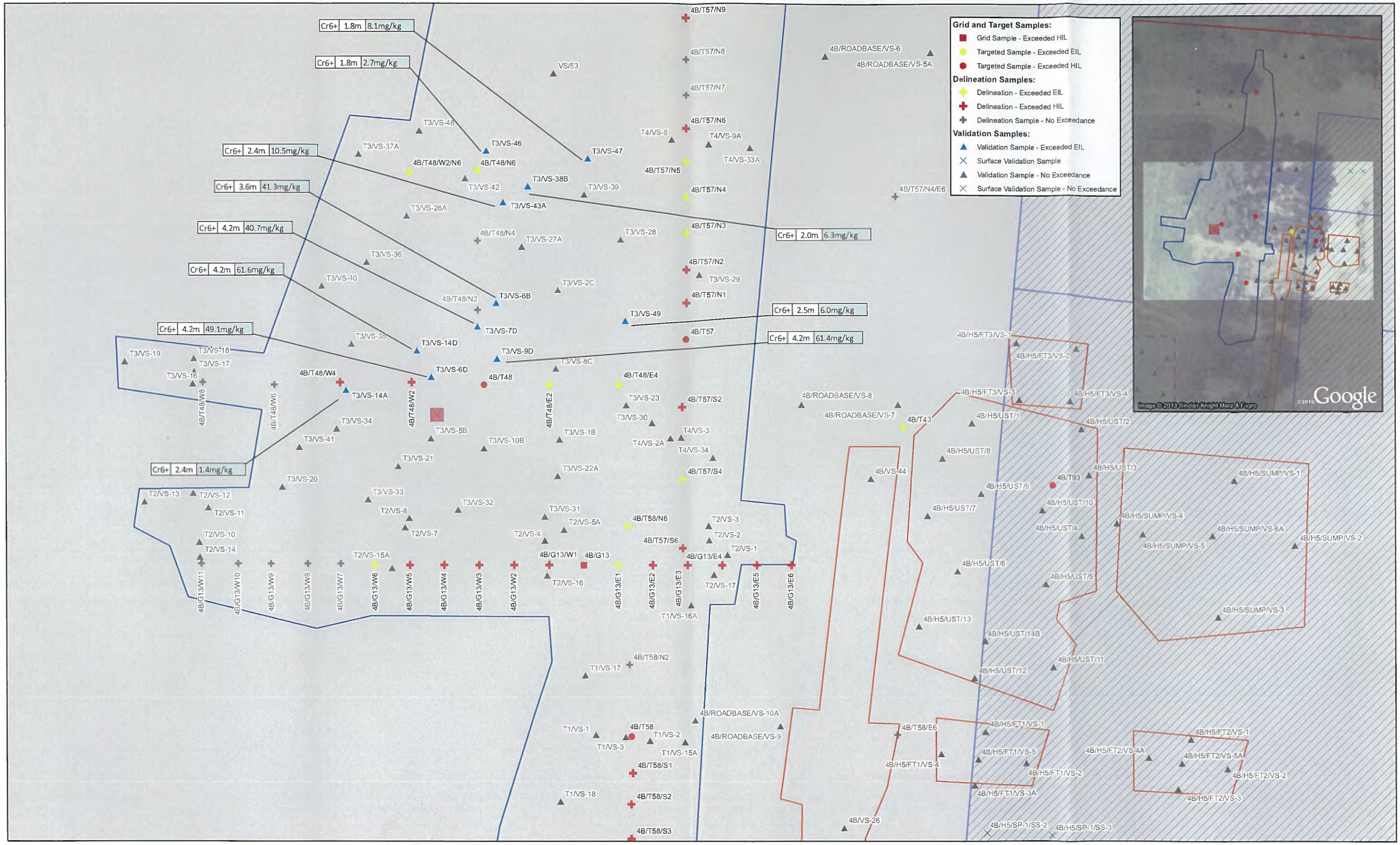

1:100 at A3

0 1 2 3 4

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

Audit Areas
Excavation Extents
CCA Excavation Extent
Hanger 5 Footprint
CCA Burial
Exceeded EIL (Validation)

Note: The data displayed in this figure has been digitised from images and analytical tables extracted from the following reports; OTEK (2012) *Sub-Area 4B Environmental Site Assessment (Draft)*, OTEK (2011) *Remediation Action Plan - Version 3 (Soil Contamination Sub-Area 4B)*, and OTEK (2012) *Remediation and Validation Report (Draft) Sub-Area 4B, Werribee, Victoria*. Therefore GHD cannot guarantee the accuracy of this data.
This figure should only be viewed as a point of reference.

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Melbourne Water
Environmental Audit of Area 4B,
Riverwalk Estate Princes Highway Werribee VIC

Job Number	31 / 1157500
Revision	2
Date	14 May 2014

CCA Impact in Area West of Hanger

Figure 10B

G:\31\1157500\Cad\GIS\Maps\Deliverables\Area_4B\311157500_010b_CAA_Impact_in_Area_West_of_Hanger_A3L_FINAL.mxd

Data source: Audit Boundaries, DTEK 2012; Excavation Extents, OTEK 2012; Sampling Locations, DTEK 2012; Site Infrastructure, OTEK 2012; CCA Burial, Enterra 2001; Analytical Results, OTEK 2012; Background Imagery (2009), Google Earth Pro 2013. Created by:bcoughlan

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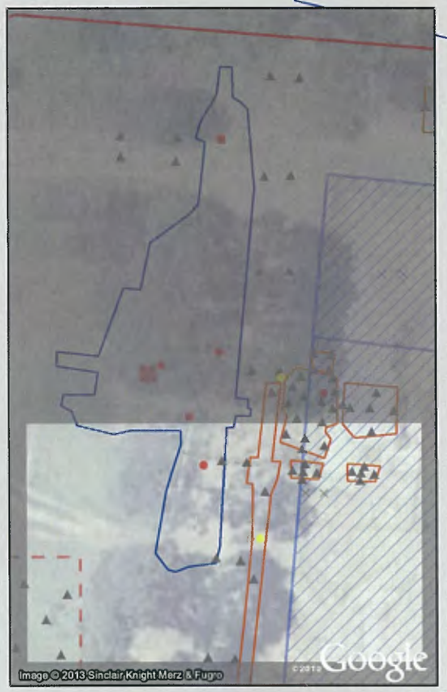

Grid and Target Samples:
- Targeted Sample - Exceeded EIL
- Targeted Sample - Exceeded HIL

Delineation Samples:
- Delineation - Exceeded EIL
- Delineation - Exceeded HIL
- Delineation Sample - No Exceedance

Validation Samples:
- Validation Sample - No Exceedance
- Surface Validation Sample - No Exceedance

T1/VS-16A
4B/T58/N2
T1/VS-17
4B/ROADBASE/VS-10A
4B/ROADBASE/VS-9
T1/VS-1
4B/T58
T1/VS-2
T1/VS-3
T1/VS-15A
4B/T58/S1
T1/VS-18
4B/T58/S2
4B/T58/S3
T1/VS-10
4B/T58/S4
T1/VS-4
T1/VS-5
T1/VS-6
T1/VS-11
T1/VS-14
4B/T58/S5
4B/T58/S6
4B/T58/S7
T1/VS-12
4B/T58/S8
T1/VS-7
T1/VS-13
T1/VS-9
4B/T58/S9
4B/ROADBASE/VS-12
T1/VS-8
4B/ROADBASE/VS-11
4B/H5/UST/13
4B/H5/UST/14B
4B/H5/SUMP/VS-3
4B/H5/UST/11
4B/H5/UST/12
4B/H5/FT1/VS-1
4B/T58/E6
4B/H5/FT2/VS-1
4B/H5/FT1/VS-5
4B/H5/FT2/VS-4A
4B/H5/FT2/VS-5A
4B/H5/FT1/VS-4
4B/H5/FT1/VS-2
4B/H5/FT2/VS-2
4B/H5/FT1/VS-3A
4B/H5/FT2/VS-3
4B/VS-26
4B/H5/SP-1/SS-2
4B/H5/SP-1/SS-3
4B/T44
4B/VS-27/A
4B/VS-45/2
4B/T58/S15
4B/VS-45/5
4B/VS-45/3
4B/ROADBASE/VS-14
4B/ROADBASE/VS-13

1:100 at A3

0 1 2 3 4

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

Audit Areas
Excavation Extents
CCA Excavation Extent
Hanger 5 Footprint
Soil Treatment Area (Approximate)
Exceeded EIL (Validation)

Note: The data displayed in this figure has been digitised from images and analytical tables extracted from the following reports; OTEK (2012) *Sub-Area 4B Environmental Site Assessment (Draft)*, OTEK (2011) *Remediation Action Plan - Version 3 (Soil Contamination Sub-Area 4B)*, and OTEK (2012) *Remediation and Validation Report (Draft) Sub-Area 4B, Werribee, Victoria*. Therefore GHD cannot guarantee the accuracy of this data.
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Melbourne Water
Enironmental Audit of Area 4B,
Riverwalk Estate Princes Highway Werribee VIC

Job Number 31 / 1157500
Revision 2
Date 14 May 2014

CCA Impact in Area West of Hanger

Figure 10C

G:\31\1157500\Cad\GIS\Maps\Deliverables\Area_4B\311157500_010c_CAA_Impact_in_Area_West_of_Hanger_A3L_FINAL.mxd

Data source: Audit Boundaries, OTEK 2012; Excavation Extents, OTEK 2012; Sampling Locations, OTEK 2012; Site Infrastructure, DTEK 2012; CCA Burial, Enterra 2001; Background Imagery (2009), Google Earth Pro 2013. Created by:bcoughlan

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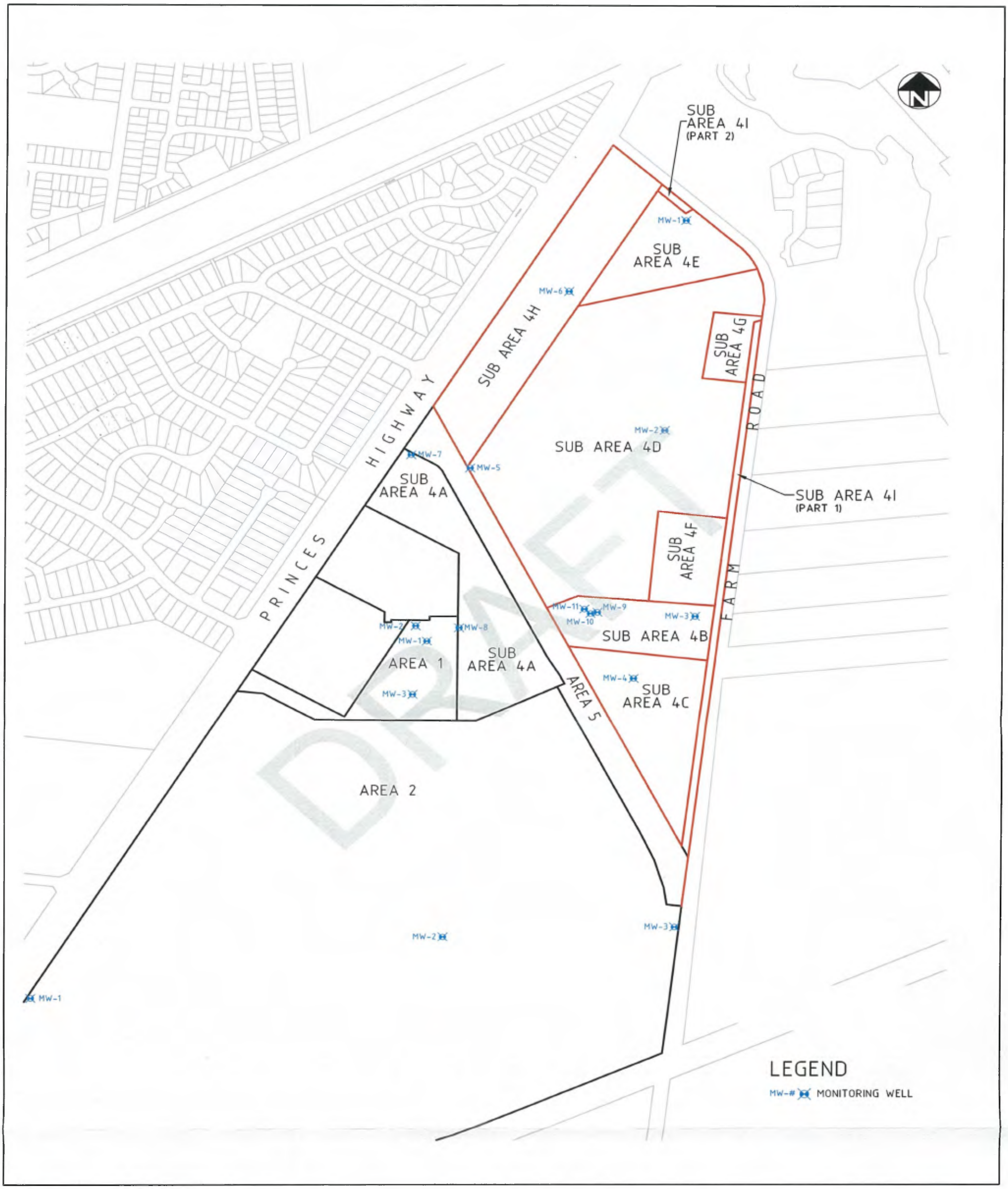

Client: Melbourne Water
Project: Environmental Audit of Area 4B, Riverwalk Estate, Princes Highway, Werribee
Source: Remediation and Validation Report (Draft), Sub Area 4B, Werribee, Victoria (OTEK, 2012)

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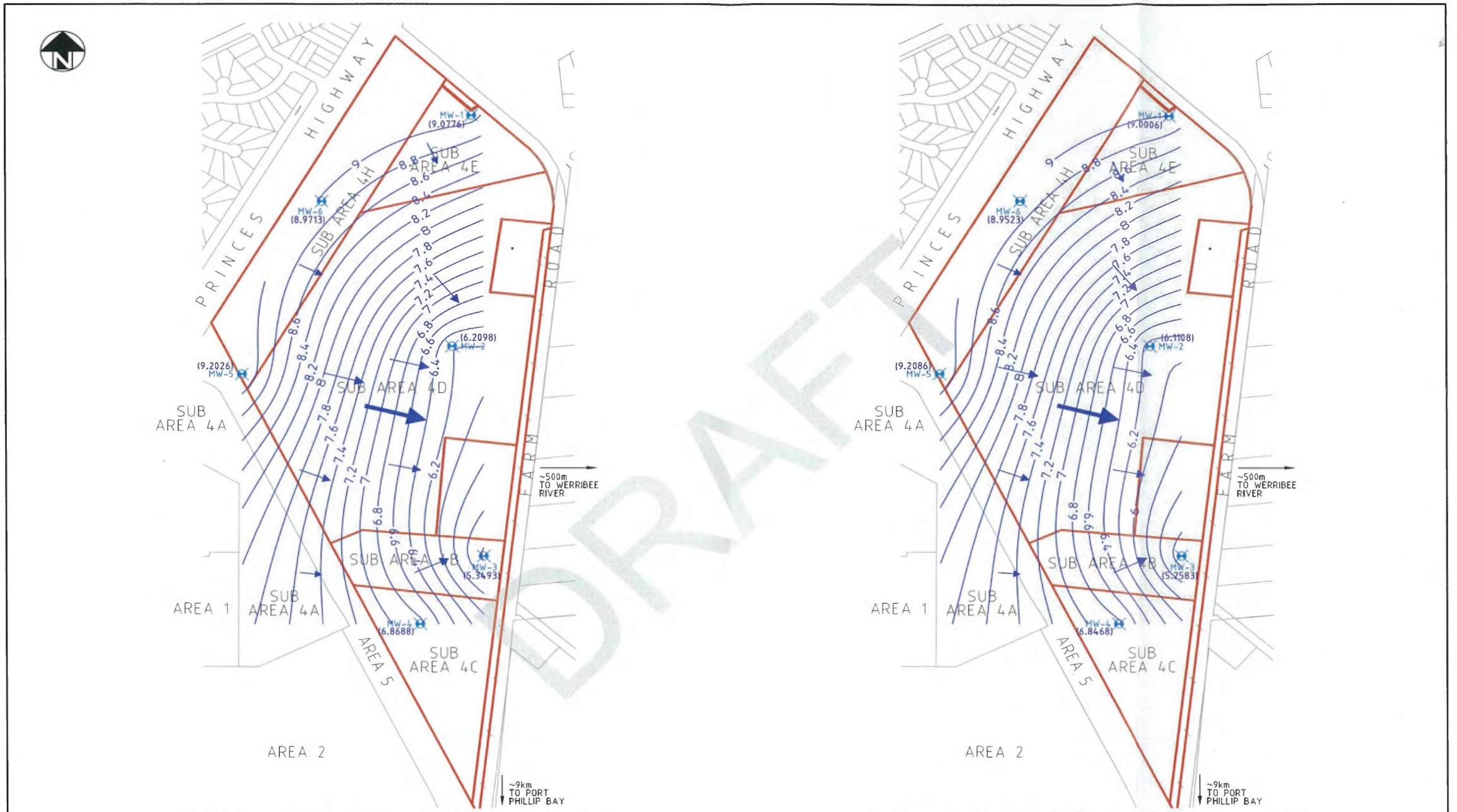
Report No. 222252
Rev No. 1

scale: Not to Scale | date: 6 May 2014

Figure 11
Riverwalk Estate Groundwater Monitoring Locations

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



Client: Melbourne Water
Project: Environmental Audit of Area 4B, Riverwalk Estate, Princes Highway, Werribee
Source: Remediation and Validation Report (Draft), Sub Area 4B, Werribee, Victoria (OTEK, 2012)
scale: Not to Scale | date: 6 May 2014

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Report No. 222252
Rev No. 1

Figure 12A
Area 4 Groundwater Elevation - GME 1 & 2

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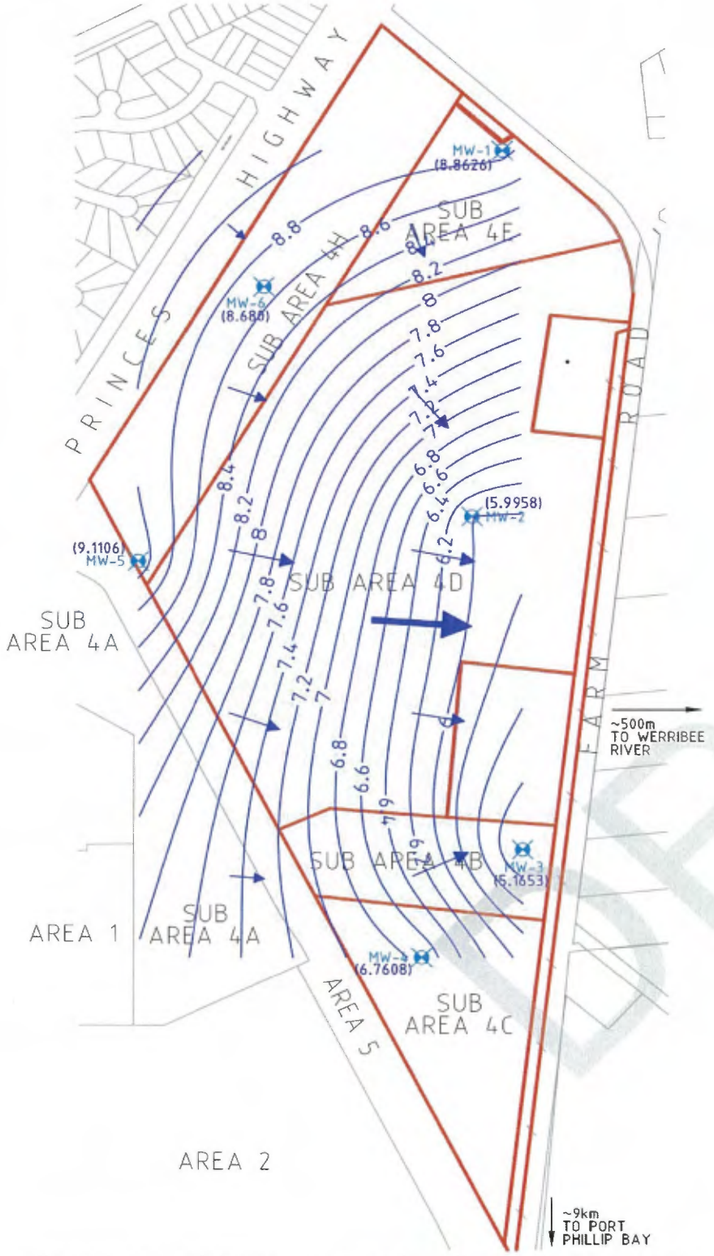
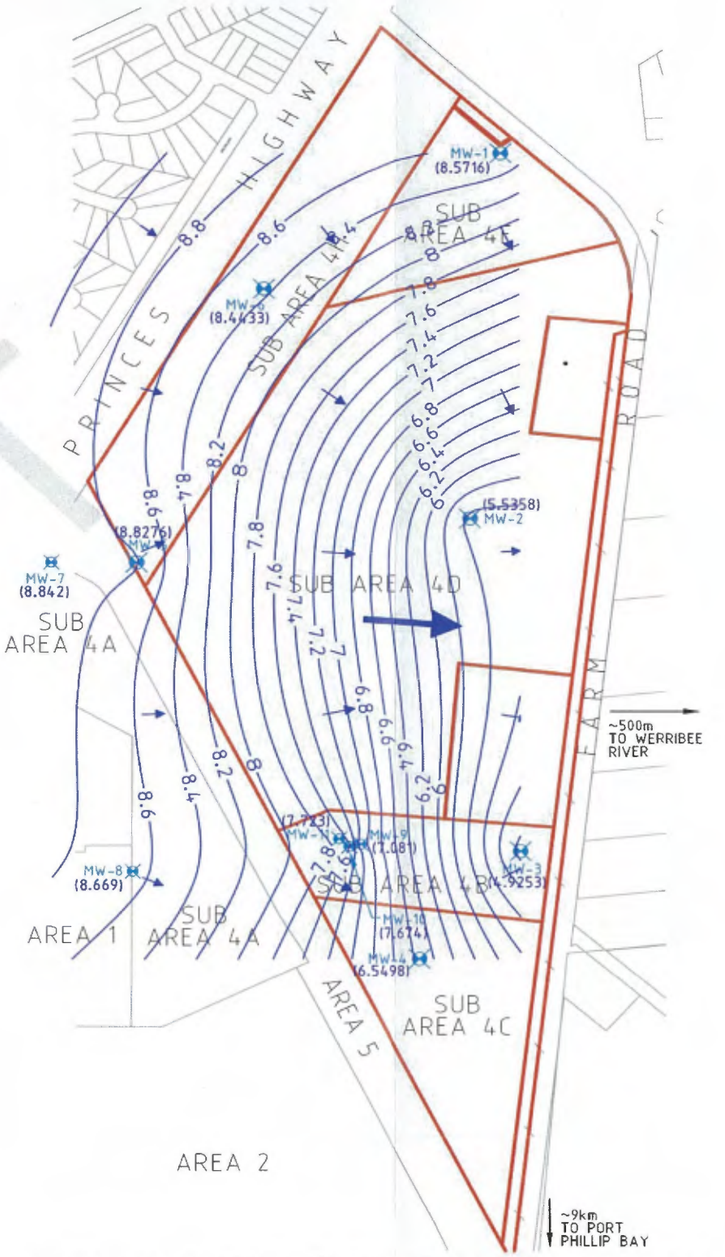


GROUNDWATER ELEVATION 05/02/2008



GROUNDWATER ELEVATION 26/11/2009

Client: Melbourne Water
Project: Environmental Audit of Area 4B, Riverwalk Estate, Princes Highway, Werribee
Source: Remediation and Validation Report (Draft), Sub Area 4B, Werribee, Victoria (OTEK, 2012)
scale: Not to Scale | date: 6 May 2014

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Figure 12B
Area 4 Groundwater Elevation - GME 3 & 4

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Appendices

Appendix A – Certificate of Title

Appendix B – Proposed development plans and planning scheme information

Appendix C – Historical reports

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

Appendix E – Area 4B Environmental Site Assessment Report (OTEK, 2012a)

Appendix F – Area 4B Remediation and Validation Report (OTEK, 2012b)

Appendix G – Letter regarding OTEK liquidation

Appendix H - Groundwater database search

Appendix I - Auditor's QA/QC review

Appendix J – Issue register

J1 – Issues Register for ESA Report (OTEK, 2012a)

J2 – Issues Register for Remediation and Validation Report (OTEK, 2012b)

Appendix K - Extract of Superseded Remediation Action Plan (OTEK, 2009)

Appendix L - Laboratory report for auditor verification sample – former rubbish pile

Appendix M - Laboratory report for Hangar 5 validation samples

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	K McCallum F Abo	F Abo		F Abo		15/05/14