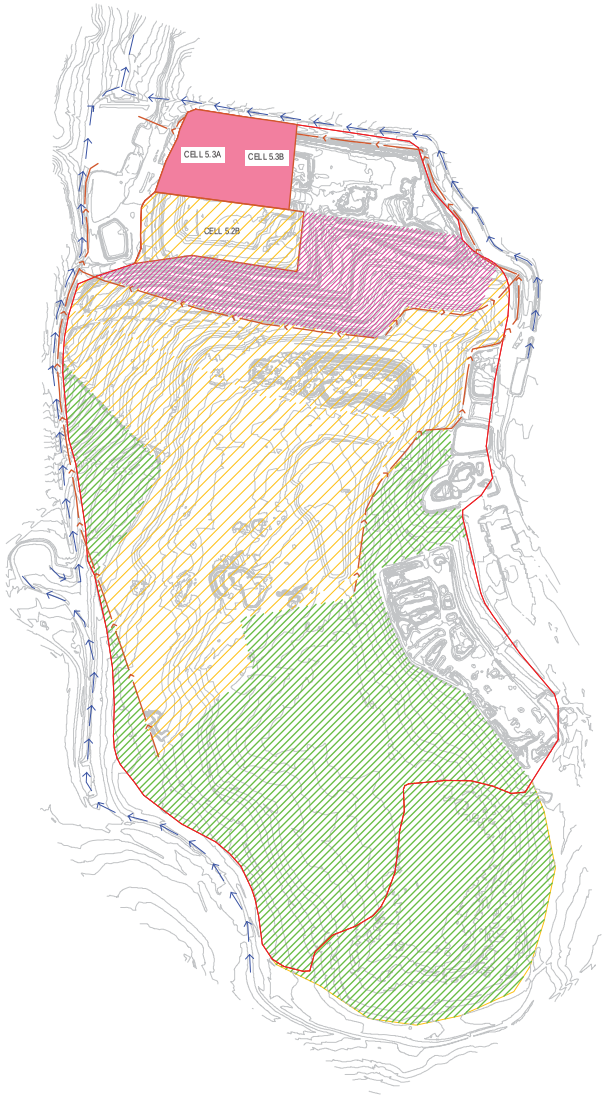
Appendices

Appendix A – Landfill reprofiling staging



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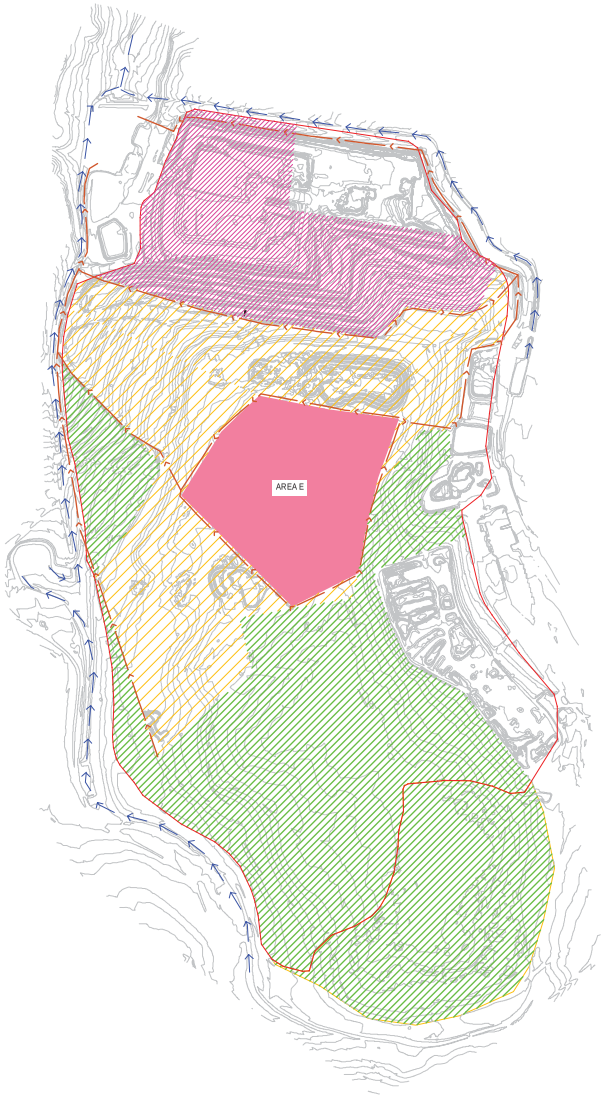


PHASE 1

LEGEND:

- PROPOSED RE-PROFILING BOUNDARY
- ACTIVE CELL
- INTERMEDIATE COVER - PLATFORM
- INTERMEDIATE COVER - SLOPES
- EXISTING CAP
- PROPOSED FINAL CAP - PLATFORM
- PROPOSED FINAL CAP - SLOPES
- PROPOSED POST-CLOSURE CAP - PLATFORM
- PROPOSED POST-CLOSURE CAP - SLOPES
- INDICATIVE SURFACE WATER DIVERSION DRAIN
- INDICATIVE SURFACE WATER COLLECTION DRAIN

N

0 50 100 150 200 250m

SCALE 1:5000 AT ORIGINAL SIZE

PRELIMINARY

rev	description	app'd	date
B	REVISED		05.03.15
A	INITIAL ISSUE		17.12.14

SITA AUSTRALIA
LUCAS HEIGHTS RRP

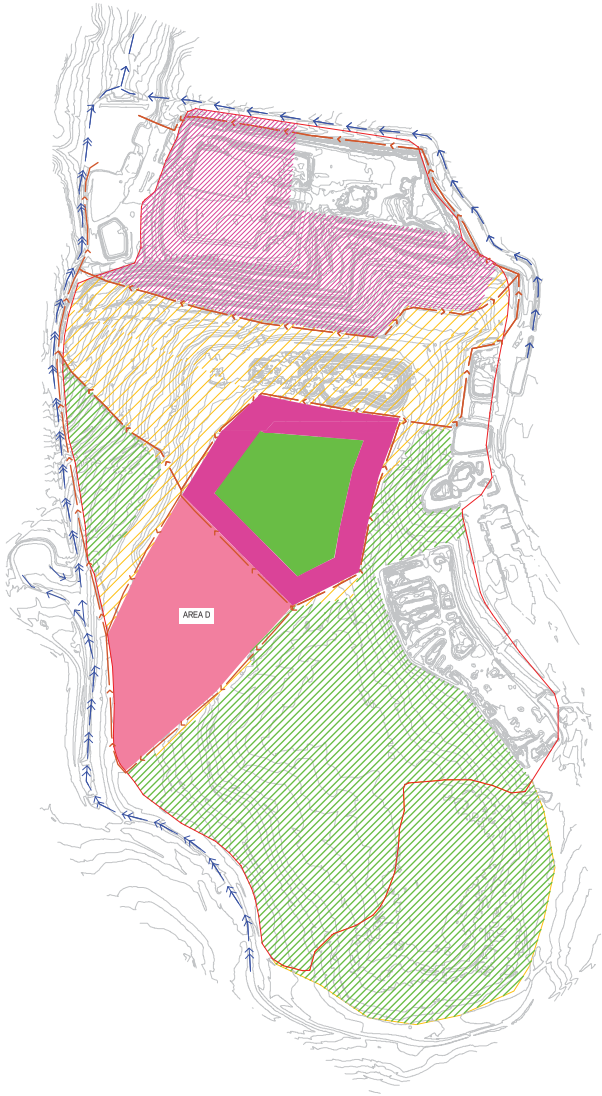
PROPOSED REPROFILING DEVELOPMENT PLAN

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia
T 61 2 9239 7100 **F** 61 2 9239 7199
E sydmail@ghd.com **W** www.ghd.com

scale 1:5000 for A1 job no. 21-23482
date MAR 2015 rev no. B

approved (PD) SK011

Plot Date: 5 March 2015 - 5:03 PM Plotted by: Alison Horlyck Cad File No: G:\21\23482\CADD\Drawings\21-23396-SK011-SK016.dwg



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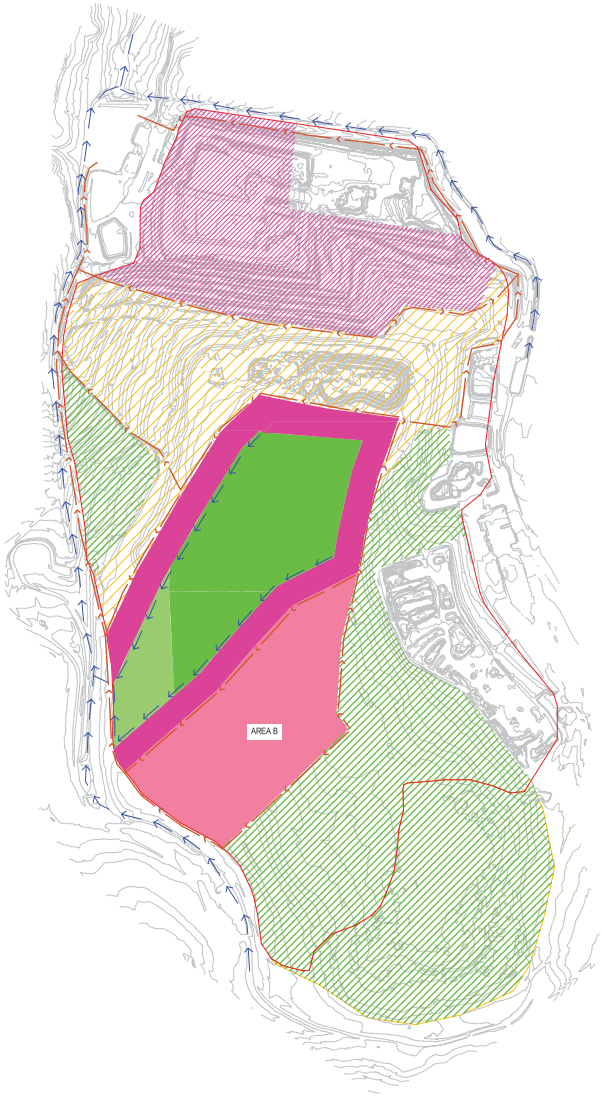

PHASE 3

LEGEND:

- PROPOSED RE-PROFILING BOUNDARY
- ACTIVE CELL
- INTERMEDIATE COVER - PLATFORM
- INTERMEDIATE COVER - SLOPES
- EXISTING CAP
- PROPOSED FINAL CAP - PLATFORM
- PROPOSED FINAL CAP - SLOPES
- PROPOSED POST-CLOSURE CAP - PLATFORM
- PROPOSED POST-CLOSURE CAP - SLOPES
- INDICATIVE SURFACE WATER DIVERSION DRAIN
- INDICATIVE SURFACE WATER COLLECTION DRAIN

N

0 50 100 150 200 250m

SCALE 1:5000 AT ORIGINAL SIZE

PRELIMINARY

rev	description	app'd	date
B	REVISED		05.03.15
A	INITIAL ISSUE		17.12.14

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date MAR 2015 | rev no. B

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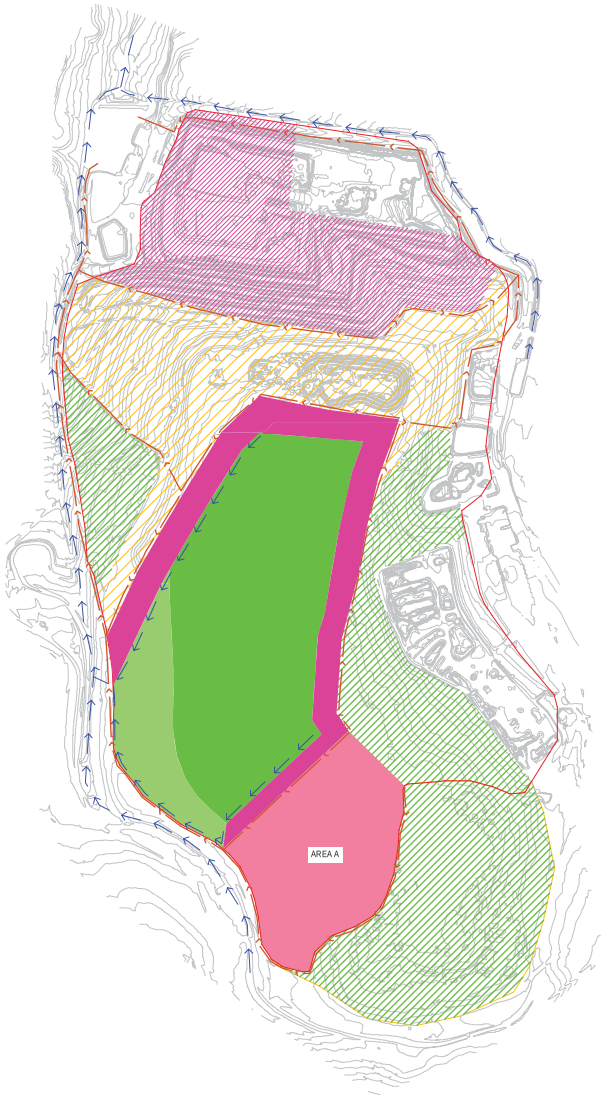

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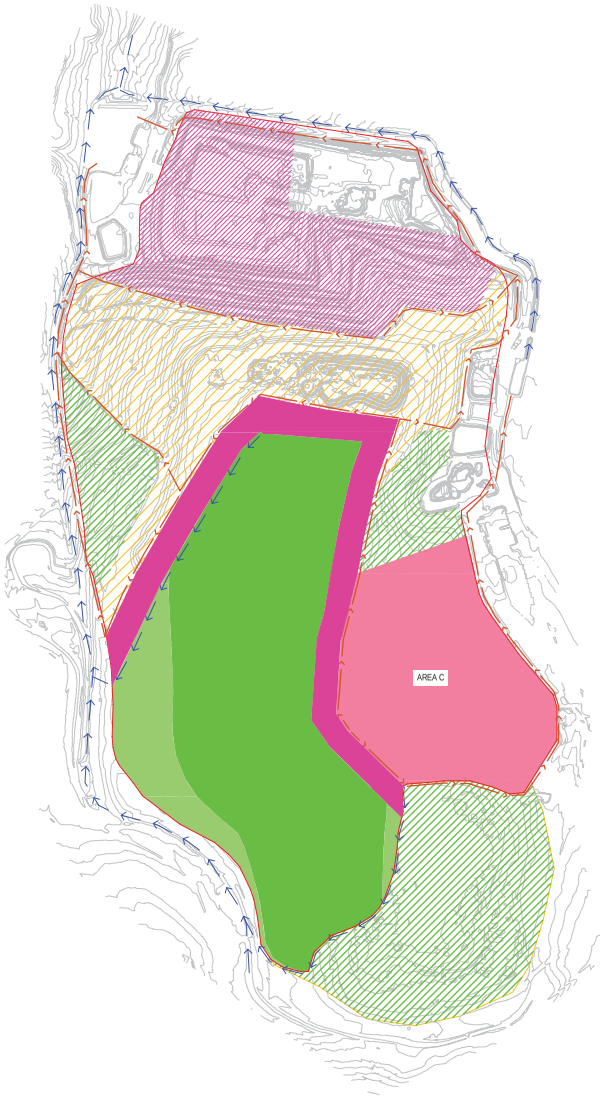

PHASE 5

LEGEND:

- PROPOSED RE-PROFILING BOUNDARY
- ACTIVE CELL
- INTERMEDIATE COVER - PLATFORM
- INTERMEDIATE COVER - SLOPES
- EXISTING CAP
- PROPOSED FINAL CAP - PLATFORM
- PROPOSED FINAL CAP - SLOPES
- PROPOSED POST-CLOSURE CAP - PLATFORM
- PROPOSED POST-CLOSURE CAP - SLOPES
- INDICATIVE SURFACE WATER DIVERSION DRAIN
- INDICATIVE SURFACE WATER COLLECTION DRAIN

N

0 50 100 150 200 250m

SCALE 1:5000 AT ORIGINAL SIZE

PRELIMINARY

rev	description	app'd	date
B	REVISED		05.03.15
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PROPOSED REPROFILING DEVELOPMENT PLAN

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scale 1:5000 for A1 | job no. 21-23482
date MAR 2015 | rev no. B

approved (PD) SK013

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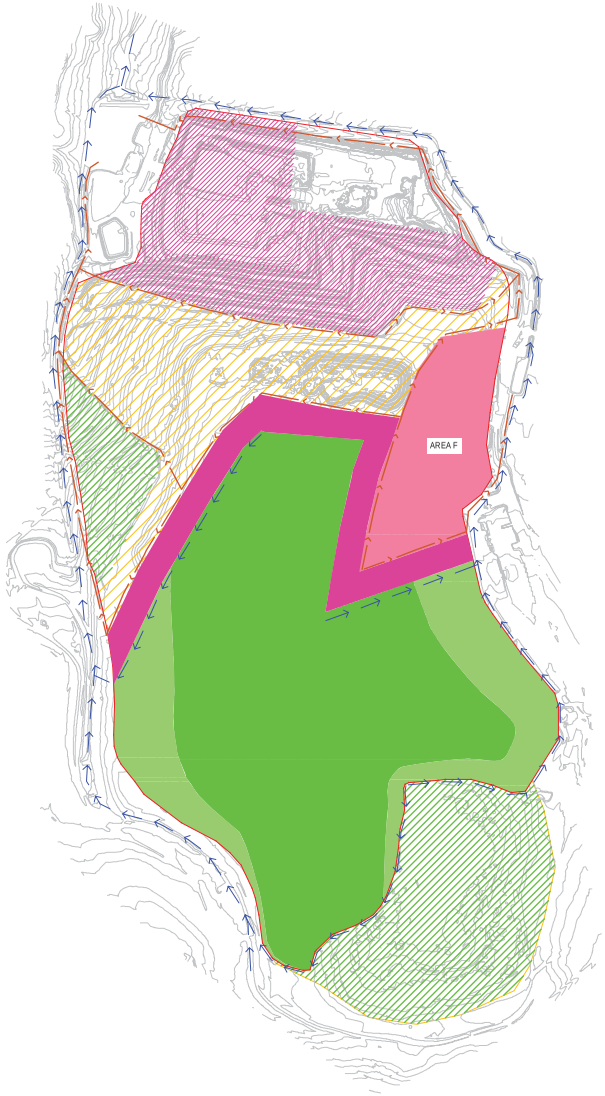
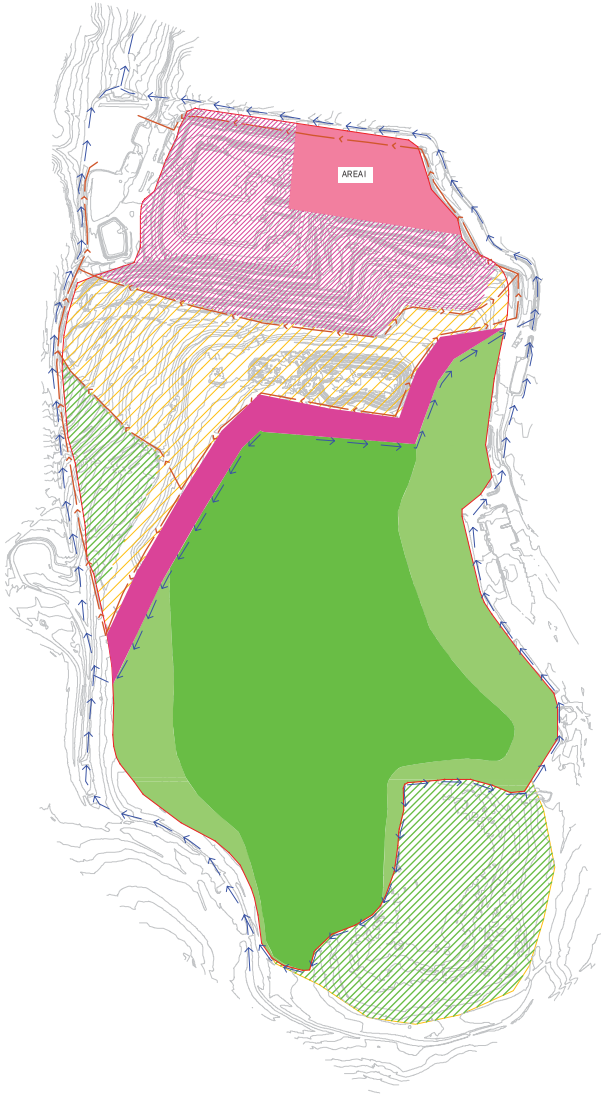
LEGEND:

- PROPOSED RE-PROFILING BOUNDARY
- ACTIVE CELL
- INTERMEDIATE COVER - PLATFORM
- INTERMEDIATE COVER - SLOPES
- EXISTING CAP
- PROPOSED FINAL CAP - PLATFORM
- PROPOSED FINAL CAP - SLOPES
- PROPOSED POST-CLOSURE CAP - PLATFORM
- PROPOSED POST-CLOSURE CAP - SLOPES
- INDICATIVE SURFACE WATER DIVERSION DRAIN
- INDICATIVE SURFACE WATER COLLECTION DRAIN



PHASE 6



PHASE 7

N

0 50 100 150 200 250m

SCALE 1:5000 AT ORIGINAL SIZE

PRELIMINARY

rev	description	app'd	date
B	REVISED		05.03.15
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date MAR 2015 rev no. B

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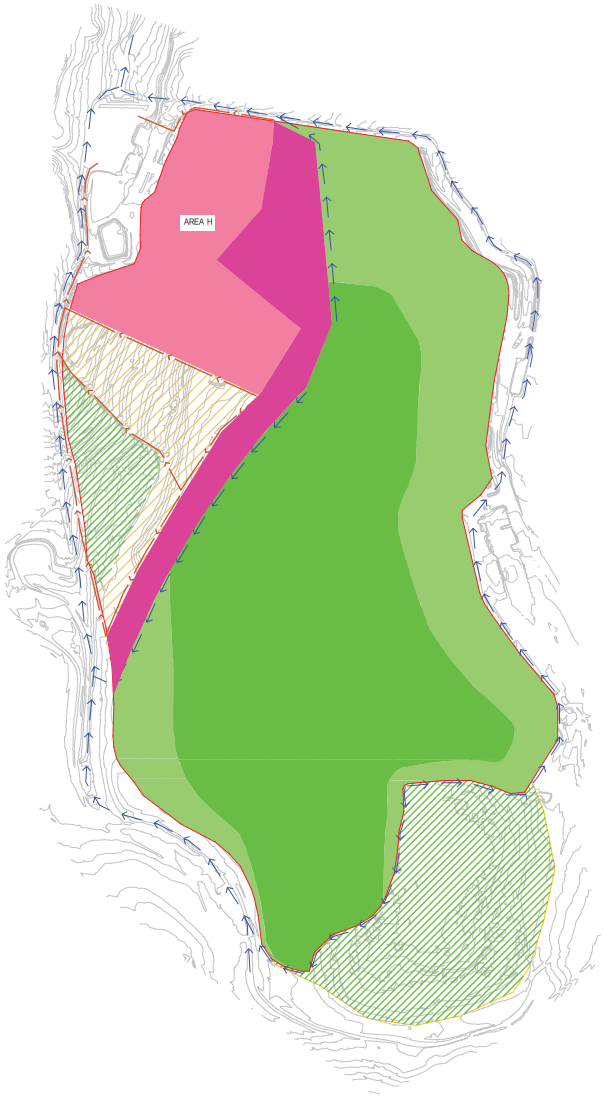
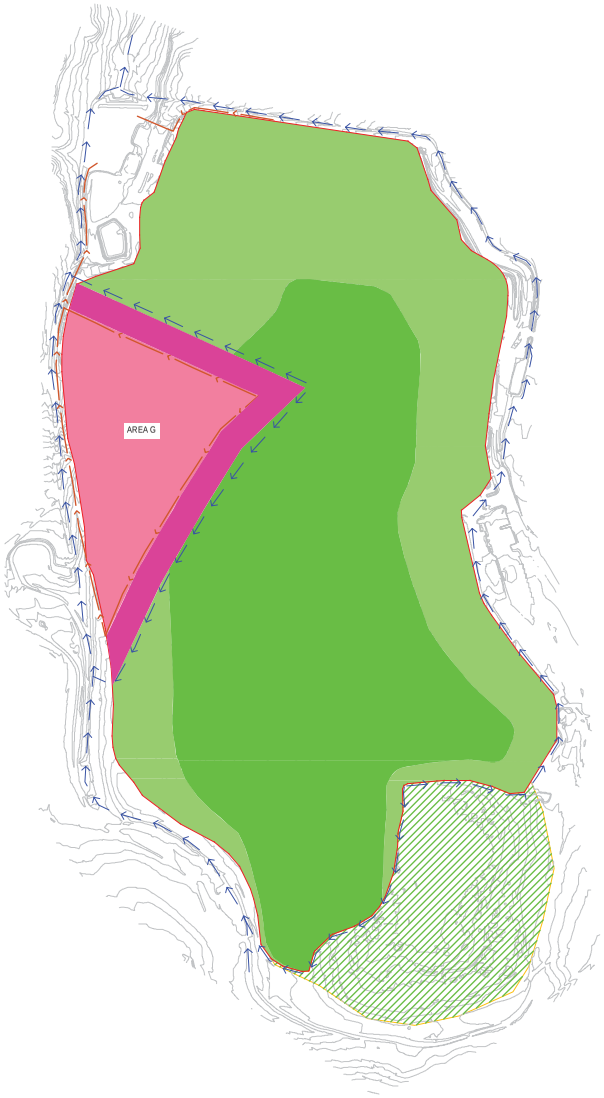


PHASE 8



PHASE 9

LEGEND:

- PROPOSED RE-PROFILING BOUNDARY
- ACTIVE CELL
- INTERMEDIATE COVER - PLATFORM
- INTERMEDIATE COVER - SLOPES
- EXISTING CAP
- PROPOSED FINAL CAP - PLATFORM
- PROPOSED FINAL CAP - SLOPES
- PROPOSED POST-CLOSURE CAP - PLATFORM
- PROPOSED POST-CLOSURE CAP - SLOPES
- INDICATIVE SURFACE WATER DIVERSION DRAIN
- INDICATIVE SURFACE WATER COLLECTION DRAIN

N

0 50 100 150 200 250m

SCALE 1:5000 AT ORIGINAL SIZE

PRELIMINARY

rev	description	app'd	date
B	REVISED		05.03.15
A	INITIAL ISSUE		17.12.14

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LUCAS HEIGHTS RRP

PROPOSED REPROFILING DEVELOPMENT PLAN

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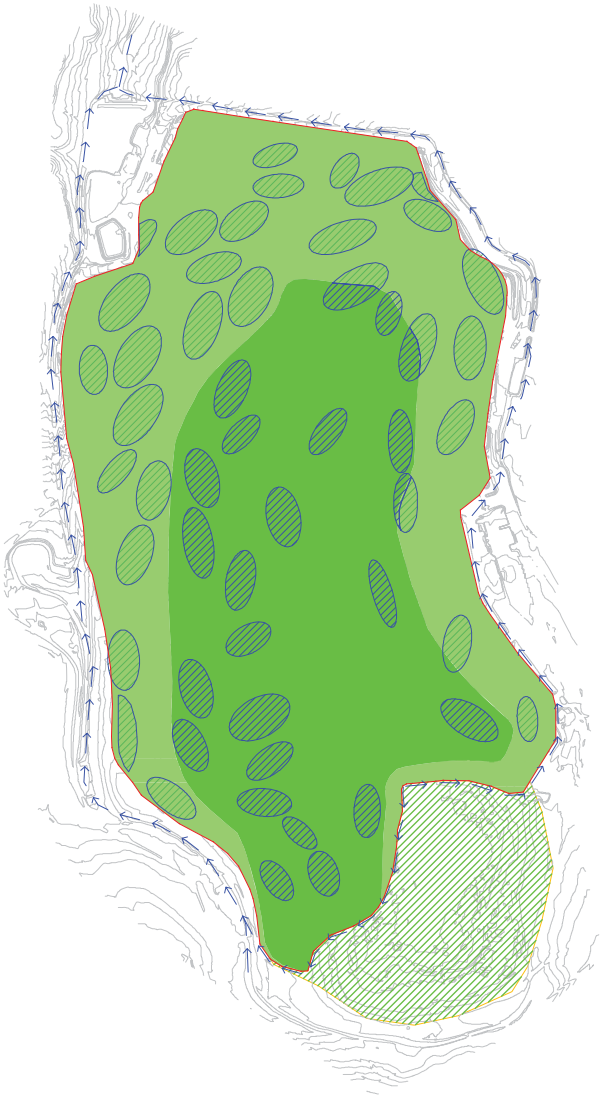
scale 1:5000 for A1 job no. 21-23482
date MAR 2015 rev no. B

approved (PD) SK015

Plot Date: 5 March 2015 - 5:04 PM Plotted by: Alison Horlyck Cad File No: G:\21\23482\CADD\Drawings\21-23396-SK011-SK016.dwg



FINAL POST-CLOSURE

LEGEND:

- PROPOSED RE-PROFILING BOUNDARY
- ACTIVE CELL
- INTERMEDIATE COVER - PLATFORM
- INTERMEDIATE COVER - SLOPES
- EXISTING CAP
- PROPOSED FINAL CAP - PLATFORM
- PROPOSED FINAL CAP - SLOPES
- PROPOSED POST-CLOSURE CAP - PLATFORM
- PROPOSED POST-CLOSURE CAP - SLOPES
- INDICATIVE SURFACE WATER DIVERSION DRAIN
- INDICATIVE SURFACE WATER COLLECTION DRAIN

N

0 50 100 150 200 250m

SCALE 1:5000 AT ORIGINAL SIZE

PRELIMINARY

rev	description	app'd	date
B	REVISED		05.03.15
A	INITIAL ISSUE		17.12.14

SITA AUSTRALIA
LUCAS HEIGHTS RRP
PROPOSED REPROFILING
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scale 1:5000 for A1 job no. 21-23482
date MAR 2015 rev no. B

approved (PD) SK016

Plot Date: 5 March 2015 - 5:04 PM Plotted by: Alison Horlyck Cad File No: G:\21\23482\CADD\Drawings\21-23396-SK011-SK016.dwg

Appendix B – Sample Ausplume output file

1

Lucas Heights Odour Assessment - Phase 6 - Scenario 3

Concentration or deposition	Concentration
Emission rate units	OUV/second
Concentration units	Odour_Units
Units conversion factor	1.00E+00
Constant background concentration	0.00E+00
Terrain effects	None
Smooth stability class changes?	No
Other stability class adjustments ("urban modes")	None
Ignore building wake effects?	No
Decay coefficient (unless overridden by met. file)	0.000
Anemometer height	10 m
Roughness height at the wind vane site	0.300 m
Use the convective PDF algorithm?	No

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high	Pasquill-Gifford
Vertical dispersion curves for sources <100m high	Pasquill-Gifford
Horizontal dispersion curves for sources >100m high	Briggs Rural
Vertical dispersion curves for sources >100m high	Briggs Rural
Enhance horizontal plume spreads for buoyancy?	Yes
Enhance vertical plume spreads for buoyancy?	Yes
Adjust horizontal P-G formulae for roughness height?	Yes
Adjust vertical P-G formulae for roughness height?	Yes
Roughness height	0.600m
Adjustment for wind directional shear	None

PLUME RISE OPTIONS

Gradual plume rise?	Yes
Stack-tip downwash included?	Yes
Building downwash algorithm:	PRIME method.
Entrainment coeff. for neutral & stable lapse rates	0.60,0.60
Partial penetration of elevated inversions?	No
Disregard temp. gradients in the hourly met. file?	No

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Rural" values (unless overridden by met. file)

AVERAGING TIMES
1 hour

1

Lucas Heights Odour Assessment - Scenario 7 FUTURE

SOURCE CHARACTERISTICS

STACK SOURCE: BIO

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
311966	6231135	0m	20m	2.00m	35C	27.4m/s

Effective building dimensions (in metres)

Flow direction	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°
Effective building width	130	137	141	140	135	140	142	138	131	120	105	0
Effective building height	15	15	15	15	15	15	15	15	15	15	15	0
Along-flow building length	120	105	87	66	44	64	85	103	118	130	137	0
Along-flow distance from stack	-107	-108	-107	-103	-95	-106	-116	-122	-124	-123	-118	0
Across-flow distance from stack	58	49	39	27	15	2	-11	-24	-36	-47	-56	0

Flow direction	130°	140°	150°	160°	170°	180°	190°	200°	210°	220°	230°	240°
Effective building width	0	0	0	0	0	118	130	137	141	0	0	0
Effective building height	0	0	0	0	0	15	15	15	15	0	0	0
Along-flow building length	0	0	0	0	0	131	120	105	87	0	0	0
Along-flow distance from stack	0	0	0	0	0	-30	-14	4	20	0	0	0
Across-flow distance from stack	0	0	0	0	0	-65	-58	-49	-39	0	0	0

Flow direction	250°	260°	270°	280°	290°	300°	310°	320°	330°	340°	350°	360°
Effective building width	0	138	131	120	105	0	0	0	0	0	0	118
Effective building height	0	15	15	15	15	0	0	0	0	0	0	15
Along-flow building length	0	103	118	130	137	0	0	0	0	0	0	131
Along-flow distance from stack	0	19	6	-7	-20	0	0	0	0	0	0	-101
Across-flow distance from stack	0	24	36	46	56	0	0	0	0	0	0	65

(Constant) emission rate = 1.98E+05 OUV/second
No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: MAT

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
311885	6230712	0m	6	2m	4m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	311885	6230712	2	311821	6230859
3	311860	6230877	4	311903	6230779
5	311881	6230770	6	311903	6230720

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	7.11E-01	7.11E-01	7.11E-01	7.11E-01	7.11E-01	7.11E-01
Stability B:	7.11E-01	7.11E-01	7.11E-01	7.11E-01	7.11E-01	7.11E-01
Stability C:	7.11E-01	7.11E-01	7.11E-01	7.11E-01	7.11E-01	7.11E-01
Stability D:	7.11E-01	7.11E-01	7.11E-01	7.11E-01	7.11E-01	7.11E-01
Stability E:	5.87E-01	5.87E-01	5.87E-01	5.87E-01	5.87E-01	5.87E-01
Stability F:	5.87E-01	5.87E-01	5.87E-01	5.87E-01	5.87E-01	5.87E-01

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: FINCOM

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
311898	6230693	0m	6	3m	6m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	311898	6230693	2	311987	6230673
3	312009	6230773	4	311942	6230788
5	311931	6230737	6	311908	6230742

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	5.42E-01	5.42E-01	5.42E-01	5.42E-01	5.42E-01	5.42E-01
Stability B:	5.42E-01	5.42E-01	5.42E-01	5.42E-01	5.42E-01	5.42E-01
Stability C:	5.42E-01	5.42E-01	5.42E-01	5.42E-01	5.42E-01	5.42E-01
Stability D:	5.42E-01	5.42E-01	5.42E-01	5.42E-01	5.42E-01	5.42E-01
Stability E:	4.48E-01	4.48E-01	4.48E-01	4.48E-01	4.48E-01	4.48E-01
Stability F:	4.48E-01	4.48E-01	4.48E-01	4.48E-01	4.48E-01	4.48E-01

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: LEACHG

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
311956	6230611	0m	4	1m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	311956	6230611	2	311904	6230687
3	311992	6230666	4	311992	6230616

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	3.34E-01	3.34E-01	3.34E-01	3.34E-01	3.34E-01	3.34E-01
Stability B:	3.34E-01	3.34E-01	3.34E-01	3.34E-01	3.34E-01	3.34E-01
Stability C:	3.34E-01	3.34E-01	3.34E-01	3.34E-01	3.34E-01	3.34E-01
Stability D:	3.34E-01	3.34E-01	3.34E-01	3.34E-01	3.34E-01	3.34E-01
Stability E:	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01
Stability F:	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: TIPFAC

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
312747	6231455	0m	4	1m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	312747	6231455	2	312758	6231488
3	312817	6231496	4	312806	6231444

Emission rates by hour of day in OUV/second per square metre:

1	6.90E-02	2	6.90E-02	3	6.90E-02	4	6.90E-02
5	6.90E-02	6	6.90E-02	7	2.99E+01	8	2.99E+01
9	4.60E+01	10	5.98E+01	11	5.98E+01	12	7.59E+01
13	9.20E+01	14	9.20E+01	15	9.20E+01	16	9.20E+01
17	6.90E-02	18	6.90E-02	19	6.90E-02	20	6.90E-02
21	6.90E-02	22	6.90E-02	23	6.90E-02	24	6.90E-02

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: LEACHL

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
312041	6231700	0m	5	1m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	312041	6231700	2	312049	6231781
3	312087	6231776	4	312105	6231751
5	312086	6231713			

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01
Stability B:	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01
Stability C:	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01
Stability D:	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01
Stability E:	4.94E-01	4.94E-01	4.94E-01	4.94E-01	4.94E-01	4.94E-01
Stability F:	4.94E-01	4.94E-01	4.94E-01	4.94E-01	4.94E-01	4.94E-01

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: MATTUR

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
311845	6230867	0m	4	2m	4m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	311845	6230867	2	311862	6230825
3	311877	6230831	4	311859	6230872

Emission rates by hour of day in OUV/second per square metre:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	0.00E+00
9	0.00E+00	10	0.00E+00	11	2.38E+00	12	2.38E+00
13	2.38E+00	14	2.38E+00	15	2.38E+00	16	2.38E+00
17	0.00E+00	18	0.00E+00	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: IN1

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
312054	6231594	0m	17	1m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	312054	6231594	2	312193	6231551
3	312318	6231518	4	312582	6231476
5	312630	6231537	6	312763	6231527
7	312802	6231613	8	312755	6231642
9	312735	6231668	10	312413	6231718
11	312427	6231878	12	312237	6231906
13	312221	6231899	14	312160	6231749
15	312136	6231727	16	312136	6231642
17	312124	6231617			

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	5.55E-02	5.55E-02	5.55E-02	5.55E-02	5.55E-02	5.55E-02
Stability B:	5.55E-02	5.55E-02	5.55E-02	5.55E-02	5.55E-02	5.55E-02
Stability C:	5.55E-02	5.55E-02	5.55E-02	5.55E-02	5.55E-02	5.55E-02
Stability D:	5.55E-02	5.55E-02	5.55E-02	5.55E-02	5.55E-02	5.55E-02
Stability E:	4.59E-02	4.59E-02	4.59E-02	4.59E-02	4.59E-02	4.59E-02
Stability F:	4.59E-02	4.59E-02	4.59E-02	4.59E-02	4.59E-02	4.59E-02

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: IN2

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
312357	6231371	0m	14	1m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	312357	6231371	2	312286	6231302
3	312130	6231042	4	312074	6230923
5	312054	6231010	6	312169	6231229
7	312169	6231261	8	312127	6231288
9	311988	6231432	10	311995	6231514
11	312017	6231579	12	312053	6231593
13	312324	6231515	14	312396	6231505

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	5.29E-02	5.29E-02	5.29E-02	5.29E-02	5.29E-02	5.29E-02
Stability B:	5.29E-02	5.29E-02	5.29E-02	5.29E-02	5.29E-02	5.29E-02
Stability C:	5.29E-02	5.29E-02	5.29E-02	5.29E-02	5.29E-02	5.29E-02
Stability D:	5.29E-02	5.29E-02	5.29E-02	5.29E-02	5.29E-02	5.29E-02
Stability E:	4.37E-02	4.37E-02	4.37E-02	4.37E-02	4.37E-02	4.37E-02
Stability F:	4.37E-02	4.37E-02	4.37E-02	4.37E-02	4.37E-02	4.37E-02

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: IN3

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
312802	6231613	0m	13	1m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	312802	6231613	2	312816	6231594
3	312824	6231564	4	312817	6231496
5	312696	6231478	6	312651	6231415
7	312619	6231326	8	312484	6231345
9	312357	6231370	10	312397	6231505
11	312582	6231476	12	312630	6231537
13	312763	6231527			

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	5.29E-02	5.29E-02	5.29E-02	5.29E-02	5.29E-02	5.29E-02
Stability B:	5.29E-02	5.29E-02	5.29E-02	5.29E-02	5.29E-02	5.29E-02
Stability C:	5.29E-02	5.29E-02	5.29E-02	5.29E-02	5.29E-02	5.29E-02
Stability D:	5.29E-02	5.29E-02	5.29E-02	5.29E-02	5.29E-02	5.29E-02
Stability E:	4.37E-02	4.37E-02	4.37E-02	4.37E-02	4.37E-02	4.37E-02
Stability F:	4.37E-02	4.37E-02	4.37E-02	4.37E-02	4.37E-02	4.37E-02

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: IN4

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
312745	6231109	0m	13	1m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	312745	6231109	2	312737	6231144
3	312737	6231156	4	312770	6231183
5	312792	6231215	6	312780	6231275
7	312664	6231302	8	312707	6231479
9	312696	6231478	10	312651	6231414
11	312580	6231217	12	312556	6231109
13	312544	6231039			

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01
Stability B:	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01
Stability C:	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01
Stability D:	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01
Stability E:	8.72E-02	8.72E-02	8.72E-02	8.72E-02	8.72E-02	8.72E-02
Stability F:	8.72E-02	8.72E-02	8.72E-02	8.72E-02	8.72E-02	8.72E-02

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: IN5

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
312084	6230829	0m	19	1m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	312084	6230829	2	312074	6230922
3	312134	6231049	4	312285	6231301
5	312356	6231371	6	312485	6231344
7	312619	6231326	8	312581	6231218
9	312543	6231040	10	312744	6231108
11	312757	6231060	12	312480	6230963
13	312507	6231120	14	312532	6231231
15	312551	6231284	16	312360	6231303
17	312325	6231269	18	312189	6231044
19	312175	6231020			

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	5.55E-02	5.55E-02	5.55E-02	5.55E-02	5.55E-02	5.55E-02
Stability B:	5.55E-02	5.55E-02	5.55E-02	5.55E-02	5.55E-02	5.55E-02
Stability C:	5.55E-02	5.55E-02	5.55E-02	5.55E-02	5.55E-02	5.55E-02
Stability D:	5.55E-02	5.55E-02	5.55E-02	5.55E-02	5.55E-02	5.55E-02
Stability E:	4.59E-02	4.59E-02	4.59E-02	4.59E-02	4.59E-02	4.59E-02
Stability F:	4.59E-02	4.59E-02	4.59E-02	4.59E-02	4.59E-02	4.59E-02

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: STRIP

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
312781	6231276	0m	7	1m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	312781	6231276	2	312663	6231302
3	312707	6231480	4	312758	6231487
5	312747	6231455	6	312806	6231443
7	312797	6231399			

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	3.14E-01	3.14E-01	3.14E-01	3.14E-01	3.14E-01	3.14E-01
Stability B:	3.14E-01	3.14E-01	3.14E-01	3.14E-01	3.14E-01	3.14E-01
Stability C:	3.14E-01	3.14E-01	3.14E-01	3.14E-01	3.14E-01	3.14E-01
Stability D:	3.14E-01	3.14E-01	3.14E-01	3.14E-01	3.14E-01	3.14E-01
Stability E:	2.59E-01	2.59E-01	2.59E-01	2.59E-01	2.59E-01	2.59E-01
Stability F:	2.59E-01	2.59E-01	2.59E-01	2.59E-01	2.59E-01	2.59E-01

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: RAWG

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
311905	6230812	0m	4	2m	4m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	311905	6230812	2	311956	6230835
3	311972	6230804	4	311919	6230781

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	6.27E+00	6.27E+00	6.27E+00	6.27E+00	6.27E+00	6.27E+00
Stability B:	6.27E+00	6.27E+00	6.27E+00	6.27E+00	6.27E+00	6.27E+00
Stability C:	6.27E+00	6.27E+00	6.27E+00	6.27E+00	6.27E+00	6.27E+00
Stability D:	6.27E+00	6.27E+00	6.27E+00	6.27E+00	6.27E+00	6.27E+00
Stability E:	5.19E+00	5.19E+00	5.19E+00	5.19E+00	5.19E+00	5.19E+00
Stability F:	5.19E+00	5.19E+00	5.19E+00	5.19E+00	5.19E+00	5.19E+00

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: LECHL2

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
312076	6231632	0m	5	1m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	312076	6231632	2	312062	6231681
3	312087	6231695	4	312104	6231660
5	312103	6231639			

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01
Stability B:	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01
Stability C:	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01
Stability D:	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01
Stability E:	4.94E-01	4.94E-01	4.94E-01	4.94E-01	4.94E-01	4.94E-01
Stability F:	4.94E-01	4.94E-01	4.94E-01	4.94E-01	4.94E-01	4.94E-01

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: LECHG2

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
311961	6231243	0m	8	1m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	311961	6231243	2	311945	6231260
3	311940	6231287	4	311922	6231282
5	311918	6231238	6	311915	6231208
7	311967	6231196	8	311968	6231203

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	3.34E-01	3.34E-01	3.34E-01	3.34E-01	3.34E-01	3.34E-01
Stability B:	3.34E-01	3.34E-01	3.34E-01	3.34E-01	3.34E-01	3.34E-01
Stability C:	3.34E-01	3.34E-01	3.34E-01	3.34E-01	3.34E-01	3.34E-01
Stability D:	3.34E-01	3.34E-01	3.34E-01	3.34E-01	3.34E-01	3.34E-01
Stability E:	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01
Stability F:	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: ACTCO1

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
311886	6230853	0m	4	2m	4m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	311886	6230853	2	311932	6230873
3	311920	6230901	4	311874	6230881

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	3.17E+00	3.17E+00	3.17E+00	3.17E+00	3.17E+00	3.17E+00
Stability B:	3.17E+00	3.17E+00	3.17E+00	3.17E+00	3.17E+00	3.17E+00
Stability C:	3.17E+00	3.17E+00	3.17E+00	3.17E+00	3.17E+00	3.17E+00
Stability D:	3.17E+00	3.17E+00	3.17E+00	3.17E+00	3.17E+00	3.17E+00
Stability E:	2.62E+00	2.62E+00	2.62E+00	2.62E+00	2.62E+00	2.62E+00
Stability F:	2.62E+00	2.62E+00	2.62E+00	2.62E+00	2.62E+00	2.62E+00

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: ACTCO2

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
311932	6230873	0m	4	2m	4m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	311932	6230873	2	311978	6230893
3	311967	6230921	4	311921	6230901

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	1.63E+00	1.63E+00	1.63E+00	1.63E+00	1.63E+00	1.63E+00
Stability B:	1.63E+00	1.63E+00	1.63E+00	1.63E+00	1.63E+00	1.63E+00
Stability C:	1.63E+00	1.63E+00	1.63E+00	1.63E+00	1.63E+00	1.63E+00
Stability D:	1.63E+00	1.63E+00	1.63E+00	1.63E+00	1.63E+00	1.63E+00
Stability E:	1.35E+00	1.35E+00	1.35E+00	1.35E+00	1.35E+00	1.35E+00
Stability F:	1.35E+00	1.35E+00	1.35E+00	1.35E+00	1.35E+00	1.35E+00

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: ACTCO3

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
311903	6230817	0m	4	2m	4m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	311903	6230817	2	311949	6230836
3	311937	6230864	4	311891	6230844

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	1.19E+00	1.19E+00	1.19E+00	1.19E+00	1.19E+00	1.19E+00
Stability B:	1.19E+00	1.19E+00	1.19E+00	1.19E+00	1.19E+00	1.19E+00
Stability C:	1.19E+00	1.19E+00	1.19E+00	1.19E+00	1.19E+00	1.19E+00
Stability D:	1.19E+00	1.19E+00	1.19E+00	1.19E+00	1.19E+00	1.19E+00
Stability E:	9.87E-01	9.87E-01	9.87E-01	9.87E-01	9.87E-01	9.87E-01
Stability F:	9.87E-01	9.87E-01	9.87E-01	9.87E-01	9.87E-01	9.87E-01

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: ACTCO4

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
311949	6230837	0m	4	2m	4m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	311949	6230837	2	311995	6230858
3	311982	6230885	4	311937	6230865

Emission rates by stability and wind speed, in OUV/second per square metre:

Wind speeds (m/s):	< 1.5	1.5_ 3.1	3.1_ 5.1	5.1_ 8.2	8.2_10.8	>10.8
Stability A:	1.10E+00	1.10E+00	1.10E+00	1.10E+00	1.10E+00	1.10E+00
Stability B:	1.10E+00	1.10E+00	1.10E+00	1.10E+00	1.10E+00	1.10E+00
Stability C:	1.10E+00	1.10E+00	1.10E+00	1.10E+00	1.10E+00	1.10E+00
Stability D:	1.10E+00	1.10E+00	1.10E+00	1.10E+00	1.10E+00	1.10E+00
Stability E:	9.07E-01	9.07E-01	9.07E-01	9.07E-01	9.07E-01	9.07E-01
Stability F:	9.07E-01	9.07E-01	9.07E-01	9.07E-01	9.07E-01	9.07E-01

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: ALECHG

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
311956	6230611	0m	4	1m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	311956	6230611	2	311904	6230687
3	311992	6230666	4	311992	6230616

Emission rates by hour of day in OUV/second per square metre:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	0.00E+00
9	0.00E+00	10	0.00E+00	11	0.00E+00	12	2.30E+00
13	2.30E+00	14	0.00E+00	15	0.00E+00	16	0.00E+00
17	0.00E+00	18	0.00E+00	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: ALCHG2

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
311961	6231243	0m	8	1m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	311961	6231243	2	311945	6231260
3	311940	6231287	4	311922	6231282
5	311918	6231238	6	311915	6231208
7	311967	6231196	8	311968	6231203

Emission rates by hour of day in OUV/second per square metre:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	0.00E+00
9	0.00E+00	10	0.00E+00	11	0.00E+00	12	2.30E+00
13	2.30E+00	14	0.00E+00	15	0.00E+00	16	0.00E+00
17	0.00E+00	18	0.00E+00	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: ALCHL2

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
312076	6231632	0m	5	1m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	312076	6231632	2	312062	6231681
3	312087	6231695	4	312104	6231660
5	312103	6231639			

Emission rates by hour of day in OUV/second per square metre:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	0.00E+00
9	0.00E+00	10	0.00E+00	11	0.00E+00	12	4.10E+00
13	4.10E+00	14	0.00E+00	15	0.00E+00	16	0.00E+00
17	0.00E+00	18	0.00E+00	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

INTEGRATED POLYGON AREA SOURCE: ALECHL

X0(m)	Y0(m)	Ground El	No. Vertices	Ver. spread	Height
312041	6231700	0m	5	1m	0m

Integrated Polygon Area Source Vertice Locations (in metres)

No.	X	Y	No.	X	Y
1	312041	6231700	2	312049	6231781
3	312087	6231776	4	312105	6231751
5	312086	6231713			

Emission rates by hour of day in OUV/second per square metre:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	0.00E+00	8	0.00E+00
9	0.00E+00	10	0.00E+00	11	0.00E+00	12	4.10E+00
13	4.10E+00	14	0.00E+00	15	0.00E+00	16	0.00E+00
17	0.00E+00	18	0.00E+00	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: SCREEN

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
312003	6230791	0m	5m	2m	1m

Emission rates by hour of day in OUV/second:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	1.14E+04	8	1.14E+04
9	1.14E+04	10	1.14E+04	11	1.14E+04	12	1.14E+04
13	1.14E+04	14	1.14E+04	15	1.14E+04	16	1.14E+04
17	0.00E+00	18	0.00E+00	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

VOLUME SOURCE: SHRED

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
311977	6230820	0m	4m	2m	1m

Emission rates by hour of day in OUV/second:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	1.32E+04	8	1.32E+04
9	1.32E+04	10	1.32E+04	11	1.32E+04	12	1.32E+04

13	1.32E+04	14	1.32E+04	15	1.32E+04	16	1.32E+04
17	0.00E+00	18	0.00E+00	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

1

Lucas Heights Odour Assessment - Scenario 7 FUTURE

RECEPTOR LOCATIONS

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	315291	6230476	0.0	0.0					

METEOROLOGICAL DATA : LucasHeights2011

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1 Peak values for the 100 worst cases (in Odour_Units)
Averaging time = 1 hour

Rank	Value	Time Recorded hour,date	Coordinates (* denotes polar)		
1	4.59E+00	07,01/05/12	(315291,	6230476,	0.0)
2	3.54E+00	15,12/07/12	(315291,	6230476,	0.0)
3	2.85E+00	07,23/05/12	(315291,	6230476,	0.0)
4	2.72E+00	05,21/12/11	(315291,	6230476,	0.0)
5	2.69E+00	24,12/09/12	(315291,	6230476,	0.0)
6	2.68E+00	10,26/07/12	(315291,	6230476,	0.0)
7	2.64E+00	22,17/09/12	(315291,	6230476,	0.0)
8	2.40E+00	07,29/06/12	(315291,	6230476,	0.0)
9	2.12E+00	05,11/12/11	(315291,	6230476,	0.0)
10	2.06E+00	07,04/08/12	(315291,	6230476,	0.0)
11	2.05E+00	02,04/11/11	(315291,	6230476,	0.0)
12	2.05E+00	05,09/03/12	(315291,	6230476,	0.0)
13	2.01E+00	07,03/08/12	(315291,	6230476,	0.0)
14	1.90E+00	09,30/06/12	(315291,	6230476,	0.0)
15	1.77E+00	24,04/03/12	(315291,	6230476,	0.0)
16	1.76E+00	01,02/06/12	(315291,	6230476,	0.0)
17	1.75E+00	08,23/02/12	(315291,	6230476,	0.0)
18	1.75E+00	05,16/09/12	(315291,	6230476,	0.0)
19	1.75E+00	08,04/02/12	(315291,	6230476,	0.0)
20	1.73E+00	05,07/11/11	(315291,	6230476,	0.0)
21	1.73E+00	23,01/04/12	(315291,	6230476,	0.0)
22	1.71E+00	08,03/08/12	(315291,	6230476,	0.0)
23	1.68E+00	07,21/06/12	(315291,	6230476,	0.0)
24	1.66E+00	01,02/05/12	(315291,	6230476,	0.0)
25	1.64E+00	08,02/05/12	(315291,	6230476,	0.0)
26	1.63E+00	04,14/04/12	(315291,	6230476,	0.0)
27	1.63E+00	05,19/10/11	(315291,	6230476,	0.0)
28	1.56E+00	07,27/07/12	(315291,	6230476,	0.0)
29	1.56E+00	05,19/06/12	(315291,	6230476,	0.0)
30	1.56E+00	09,22/11/11	(315291,	6230476,	0.0)
31	1.51E+00	01,22/08/12	(315291,	6230476,	0.0)
32	1.50E+00	08,29/06/12	(315291,	6230476,	0.0)
33	1.49E+00	15,10/07/12	(315291,	6230476,	0.0)
34	1.49E+00	08,29/08/12	(315291,	6230476,	0.0)
35	1.48E+00	08,09/03/12	(315291,	6230476,	0.0)
36	1.46E+00	07,09/03/12	(315291,	6230476,	0.0)
37	1.45E+00	08,05/08/12	(315291,	6230476,	0.0)
38	1.43E+00	03,24/10/11	(315291,	6230476,	0.0)
39	1.41E+00	05,15/11/11	(315291,	6230476,	0.0)
40	1.41E+00	24,30/04/12	(315291,	6230476,	0.0)
41	1.40E+00	07,09/07/12	(315291,	6230476,	0.0)
42	1.39E+00	06,09/03/12	(315291,	6230476,	0.0)
43	1.38E+00	22,04/08/12	(315291,	6230476,	0.0)
44	1.37E+00	20,24/05/12	(315291,	6230476,	0.0)
45	1.37E+00	08,14/04/12	(315291,	6230476,	0.0)
46	1.30E+00	02,10/03/12	(315291,	6230476,	0.0)
47	1.29E+00	08,15/07/12	(315291,	6230476,	0.0)
48	1.29E+00	07,05/09/12	(315291,	6230476,	0.0)
49	1.28E+00	08,08/04/12	(315291,	6230476,	0.0)
50	1.26E+00	03,15/08/12	(315291,	6230476,	0.0)
51	1.24E+00	11,10/05/12	(315291,	6230476,	0.0)

52	1.20E+00	04,22/04/12	(315291, 6230476, 0.0)
53	1.20E+00	06,16/06/12	(315291, 6230476, 0.0)
54	1.20E+00	02,28/02/12	(315291, 6230476, 0.0)
55	1.19E+00	09,29/06/12	(315291, 6230476, 0.0)
56	1.18E+00	04,25/07/12	(315291, 6230476, 0.0)
57	1.17E+00	19,11/07/12	(315291, 6230476, 0.0)
58	1.15E+00	10,04/09/12	(315291, 6230476, 0.0)
59	1.15E+00	04,24/10/11	(315291, 6230476, 0.0)
60	1.14E+00	02,15/08/12	(315291, 6230476, 0.0)
61	1.13E+00	23,19/12/11	(315291, 6230476, 0.0)
62	1.13E+00	12,10/06/12	(315291, 6230476, 0.0)
63	1.13E+00	07,07/11/11	(315291, 6230476, 0.0)
64	1.13E+00	08,22/11/11	(315291, 6230476, 0.0)
65	1.11E+00	05,22/08/12	(315291, 6230476, 0.0)
66	1.11E+00	24,04/08/12	(315291, 6230476, 0.0)
67	1.09E+00	09,22/04/12	(315291, 6230476, 0.0)
68	1.07E+00	08,13/03/12	(315291, 6230476, 0.0)
69	1.06E+00	10,03/09/12	(315291, 6230476, 0.0)
70	1.04E+00	04,09/03/12	(315291, 6230476, 0.0)
71	1.04E+00	05,01/01/12	(315291, 6230476, 0.0)
72	1.02E+00	09,13/07/12	(315291, 6230476, 0.0)
73	1.01E+00	13,26/07/12	(315291, 6230476, 0.0)
74	1.01E+00	05,18/01/12	(315291, 6230476, 0.0)
75	1.01E+00	10,02/05/12	(315291, 6230476, 0.0)
76	1.01E+00	09,19/06/12	(315291, 6230476, 0.0)
77	9.95E-01	07,16/09/12	(315291, 6230476, 0.0)
78	9.93E-01	07,09/05/12	(315291, 6230476, 0.0)
79	9.89E-01	22,10/07/12	(315291, 6230476, 0.0)
80	9.83E-01	09,01/05/12	(315291, 6230476, 0.0)
81	9.83E-01	10,08/06/12	(315291, 6230476, 0.0)
82	9.74E-01	01,18/07/12	(315291, 6230476, 0.0)
83	9.62E-01	08,15/08/12	(315291, 6230476, 0.0)
84	9.60E-01	10,21/06/12	(315291, 6230476, 0.0)
85	9.50E-01	03,26/09/12	(315291, 6230476, 0.0)
86	9.48E-01	24,11/07/12	(315291, 6230476, 0.0)
87	9.46E-01	01,10/03/12	(315291, 6230476, 0.0)
88	9.46E-01	09,24/04/12	(315291, 6230476, 0.0)
89	9.40E-01	07,18/11/11	(315291, 6230476, 0.0)
90	9.31E-01	04,28/11/11	(315291, 6230476, 0.0)
91	9.21E-01	16,12/07/12	(315291, 6230476, 0.0)
92	9.13E-01	05,24/10/11	(315291, 6230476, 0.0)
93	9.12E-01	10,11/05/12	(315291, 6230476, 0.0)
94	8.95E-01	06,22/08/12	(315291, 6230476, 0.0)
95	8.92E-01	09,02/05/12	(315291, 6230476, 0.0)
96	8.82E-01	09,04/08/12	(315291, 6230476, 0.0)
97	8.80E-01	05,18/07/12	(315291, 6230476, 0.0)
98	8.75E-01	07,12/09/12	(315291, 6230476, 0.0)
99	8.72E-01	05,30/09/12	(315291, 6230476, 0.0)
100	8.45E-01	07,29/08/12	(315291, 6230476, 0.0)

Appendix C – Odour emission rates justification memo

12 May 2015

To	SITA Australia		
Copy to	Greg Marshall, David Gamble, and Anna Montgomery		
From	Evan Smith, Anthony Dixon	Tel	92397695
Subject	Odour Emission Rates Justification - Lucas Heights Resource Recovery Park Air Quality Assessment	Job no.	2123482

1. Introduction

GHD reviewed the specific odour emission rates (SOERs) proposed to be used for the air quality assessment at the Lucas Heights Resource Recovery Park (LHRRP). The SOER is then multiplied by the appropriate area of the source to determine the odour emission rate (OER).

This memorandum provides a summary of the odour emission rate for each odour source, including:

- the landfill (section 2)
- the existing and proposed garden organics (GO) facility (section 3)
- proposed advanced resource recovery technology (ARRT) facility (section 4)

This memorandum provides an assessment and justification of the emission rates' appropriateness which underpins the odour prediction modelling used in the air quality assessment.

2. LHRRP landfill – site specific sampling

With the approval of SITA, GHD engaged Ektimo to collect samples of gaseous emissions from the existing landfill operations at the LHRRP. A total of 62 odour samples were collected between May and June 2014. The odour analysis of the samples was conducted by The Odour Unit in their NATA registered laboratory in Sydney. All samples were analysed on the day the samples were collected and well within the recommended 24 hour window from the time of sample collection.

The odour sampling program was developed based on feedback from a meeting with the EPA on 1 May 2014 where the EPA advised that odour variability across the site would need to be considered. The sampling program was therefore designed to address potential variability in the odour emission rates from each of the odour emission sources at the landfill. Odour sampling was conducted over approximately a three week period in order to obtain site data for all significant odour sources. Experienced staff from Ektimo repeatedly traversed the LHRRP landfill to identify odour emission variability to enable targeting for sample collection. The details of the odour sampling and analysis program are provided in the attached report from Ektimo.

In the summary, two sampling techniques were used:

- SOER determination using an Isolation Flux chamber (IFC)
- OER determination using downwind transects of odour, the local wind conditions and a back-calculation procedure. The OER obtained can then be divided by the estimated source area to determine the mean SOER for that source

The IFC method is more sensitive (it can measure to much lower SOERs due to the low sweep rate used) however the area sampled is small (~0.13 m^2) so that many sub-samples are required if spatial variation in SOER is suspected.

The transect method can sample the complete odour plume, but its resolution is dependent on the upwind odour level being less than the odour levels in the downwind transect. This method requires light winds to get maximum sensitivity. This method is measured directly downwind of the source – this is an advantage for sources with mechanical activity such as a landfill active tipping face. Were IFCs to be used then the machinery on the tipping face (swamp dozers, compactors) must be stopped for safety reasons during the IFC sampling. The IFC result then does not reflect the full emission from the source.

The majority of the landfill odour emissions to be used in the assessment have been based on the results of this recent odour sampling conducted onsite and the results are summarised in Table 2-1 which outlines the odour source, the odour release mechanism, the sample collection technique and the number of samples. A map showing an overview of the odour sampling locations is presented in the Ektimo report.

Table 2-1 Summary of odour sampling program at the LHRRP landfill

Odour Source	Odour release mechanism	Collection technique	Number of samples taken*
Final capped area and background not over waste	Gas diffusion through surface	IFC	7
	Gas leakage via fissures (localised emission points)	IFC	3
Intermediate covered area south of excavated void (and therefore south of the landfill batters) and background not over waste	Gas diffusion through surface	IFC	7
	Gas leakage via fissures (localised emission points and localised emission areas)	IFC	5
		upwind & downwind transect	4
Test pits of the intermediate covered, final capped and background area. The test pits were south of Stage 5 (the excavation void) and the background area was not over landfilled waste	Direct odour emissions from exposed surface	IFC	11
Active tipping face & daily and intermediate cover (within Stage 5)	Direct odour emissions from exposed waste material	IFC	3
		upwind & downwind transect	4
Leachate pond	Quiescent surface	IFC	2
	Aeration of leachate	upwind & downwind transect	2
Stage 4 Batter** (the western portion of the batter into the excavation void)	Gas diffusion through surface	IFC	3
	Gas leakage via fissures (localised emission points)	IFC	3
		upwind & downwind transect	4
SITA Batter** (the eastern portion of the batter into the excavation void)	Gas leakage via fissures (localised emission points)	upwind & downwind transect	4
Total			62

*Additional samples were collected by Ektimo however these results were discarded as they were considered to be non-representative of the site's odour emission profile. For example an upwind odour sample was influenced by an elevated odour

source on the upwind transect, resulting in an elevated upwind odour concentration compared to the downwind concentration. Such results were unrepresentative and the upwind sampling transects were readjusted and the samples were redone.

**Due to the steepness and elevation of the batter leading into the excavation void, it not was not possible to obtain representative upwind and downwind measurements from this area of the landfill.

Odour emission rates for the landfill batters were estimated from the work previously undertaken by Homes Air Sciences (reference 14). This work measured the odour emission from the batter at the LHRRP. GHD has adopted a conservative approach for the proposal and applied an increased odour emission rate compared to Homes Air Sciences to the current batter area.

Two different emission rates were adopted for the intermediate cover areas:

- **Emission rate for the intermediate cover from areas with active gas extraction**. GHD modelled the median value of the intermediate cover grid measurements on all old intermediate cover areas in the existing and future scenarios. In the case of the future scenarios SITA has commenced progressively upgrading the landfill gas capture system at the v section and rectangular area south of the excavation stockpile to reduce their odour contribution.

It is important to note that the majority of the grid measurements were of the same character reported for the background measurements which are of areas not on waste. Where the one sample identified in the grid measurements was an odour of waste character, its location was part of the rectangular section south of the excavation stockpile.

The intact intermediate cover area is not a contributor of odour from landfill waste. These results demonstrate the overall effectiveness of the active landfill gas extraction system for the intact intermediate cover area to prevent the emission of odour.

Nevertheless a conservative approach was applied and an odour contribution was applied to this area (taking into account for the future scenarios the rectification of the v section and rectangular area south of the excavation stockpile).

Three additional localised emission points were identified outside of the v section and rectangular area south of the excavation stockpile. SITA has since rectified these emissions.

- **Emission rate for the intermediate cover from areas without active gas extraction**. GHD modelled this value on all new intermediate cover areas in the existing and future scenarios to represent emission from areas of relatively newly placed waste where gas extraction has not yet been commenced.

2.1 Upwind and downwind odour transects,

A summary of the upwind and downwind odour transects, as well as the weather conditions at the time of the measurement are provided in Table 2-2. This information was used in the back calculations to determine the specific odour emission rate of the variable emission sources. The tipping face material is not homogeneous in nature and machinery is constantly moving around giving rise to significant spatial variation in odour emission rates. The leachate pond also undergoes times of varying emissions due to aeration whereby surface disturbance will be uneven. Sampling included odour measurements along a transect placed up and downwind of these variable sources. This enabled the source odour emission rates to be back calculated using the AUSPLUME model and the meteorological conditions at the time of the monitoring.

The landfill batters were also found to have significant variation of odour from localised odour emission points and cracks (however it was not possible to utilise the transect method for these areas due to their steep and elevated geometry).

Table 2-2 Summary of upwind and downwind odour samples and weather conditions

Location	Time	Upwind (OU)	Downwind (OU)	Contribution (OU)	WS m/s	Wind direction	Pasquill-Gifford Stability class	SOER OUm/s
Intermediate cover v section	12th June 0825 - 0845	38	70	32	1.3	SSW-SW	F	11
Intermediate excavation area south of the excavation stockpile	12th June 0958 - 1015	32	152	120	1.8	SWW-W	D	5.5
Leachate pond	13th June 1230 - 1245	16	41	25	1.2	W	D	1.8
Tip face morning	16th June 940 - 1000	19	91	72	1.6	W	C	26
Tip face afternoon	16th June 1310-1330	19	41	22	2.5	SWW	C	40

3. GO facility – Australian data for similar operations

The following odour emission data is proposed to be used for the existing eastern GO facility and the proposed western GO facility:

- **Existing GO facility** – it is proposed to use measurements at the ANL site at Coldstream which had similar large static stockpiles for the pasteurisation stage and from the Veolia Bangholme site for maturation stockpiles and matured product. The latter measurements were taken using a total enclosure of two maturation windrows at different elapsed times since formation (0, 1, 2, 3 and 4 weeks). These results will be more accurate than that obtained from IFCs.

  Odour sampling was conducted of LHRRP greenwaste compost operations in 2006 as part of the landfill odour audit (Holmes Air Sciences, 2006). The results reported as part of this assessment are very low (nearly 20 times less) than the data GHD are using in this assessment for the existing GO facility and over 8 times lower than the data GHD are using for the proposed western GO facility. The measured odour levels from 2006 are also many times lower than the SOERs used in other greenwaste composting odour studies and therefore GHD has chosen not to use this site measured data in this assessment.

- **Proposed western GO facility** - it is proposed to use conservative odour emission data from another SITA (SITA Brooklyn) windrow garden / green waste composting site that had a similar 12 week process (4 weeks pasteurisation and 8 weeks maturation). SITA Brooklyn did not cover the windrows

during pasteurisation and usage of this data for assessment purposes would therefore be considered conservative as the GO facility proposed at the LHRRP includes covered windrows.

Other sites were also considered but the selected sites above were considered to be representative of existing and future proposed operations.

- **Proposed western GO facility with Gore covers** – the use of Gore® or similar covers during the active composting stage (weeks 1 to 4) will substantially reduce odour emissions from this process. GHD do not have access to New South Wales odour sampling data for composting windrows with Gore® or similar covers but we are aware that such data exists and demonstrates that covers are very effective in reducing the emission of odour from compost. We have undertaken a literature review of publically available data to confirm this finding and to justify a suitable odour emission reduction which would be achieved by their application.

4. ARRT facility

The ARRT facility will be operated under negative pressure and this will prevent any uncontrolled odour emissions from the facility. All air from the operation of the ARRT will be emitted via a biofilter ventilation air discharge portal. The proposed odour emission rate applied to the biofilter is based on an odour emission which in GHD's experience would be suitably representative and readily achievable. The Victorian EPA have accepted 250 OU x Flowrate (OER) whilst in NSW a range of values have been accepted by the regulators based on the performance of well-maintained and operated bioilters.

GHD undertook a review of similar approved alternative waste treatment projects in NSW. Table 4-1 provides a summary of the OERs applied for modelling biofilters for two approved alternative waste technology projects in NSW.

The adopted OER for the SAWT-Biowise facility's biofilter was acknowledged in the project's impact assessment to be likely conservatively high. The evidence for this view is backed up by GHD's recent work on behalf of the New South Wales Department of Planning and Infrastructure. GHD was engaged by the Department in 2013 to undertake a peer review of the performance of biofilters and odour modelling for the Bedminster Waste Facility at Raymond Terrace.

Table 4-1 Comparison of OERs used to model biofilter

Project	Adopted OER	Report reference	Prepared by	Approval
SAWT–Biowise facility Elizabeth Drive, Kemps Creek	300 OU	10	Holmes Air Sciences	16 April 2008
Woy Woy Waste Facility	250 OU	13	URS	22 November 2009

The monitoring of odour levels from the two Bedminster biofilters was conducted by The Odour Unit. The odour emissions from the biofilters were measured on 5 separate occasions between April 2009 and April 2011. The measurements resulted in a mean value of 185 OU (with a lower value if the medium of the results was applied). This demonstrates that a well operated biofilter does achieve odour levels of less than 250 OU.

5. Summary

Table 5-1 provides a list of the SOER data for the different odour sources in the proposed odour assessment including the landfill, the existing the proposed GO facility and the ARRT facility. This table also provides further justification for applying this data.

Table 5-1 Lucas Heights Landfill, Garden Organics (uncovered) and ARRT Facilities SOER's proposed to be used in the Air Quality Assessment

Process/ Odour Source	Report reference	Applied SOER OUm/s	Method	Justification for modelled OER
Landfill Daily cover	7	Tipping face under daily cover – SOER of **0.03** OUm/s.	IFC	Refer Ektimo samples 115
Landfill Intermediate cover (old), south of the excavated void which includes active gas extraction With gas extraction	7	**0.023**	IFC	Site specific measured emissions. This is the median of the intermediate cover grid. GHD modelled this value (0.023) on all old intermediate cover areas in the existing and future scenarios. This is considered to be very conservative as the majority of the area was of the same odour character as the character reported for the background measurements which are of areas not on waste. Where the one sample identified in the grid measurements was an odour of waste character, its location was part of the rectangular section south of the excavation stockpile. Refer Ektimo samples 45, 14, 172, 25 and 58.
Landfill Intermediate cover (new) Without gas extraction was assumed to be conservative	7	**0.05**	IFC	IFC sample taken from 300mm cover over waste north of active tip face. This area of relatively newly placed waste had no gas extraction. Refer Ektimo sample 117

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Process/ Odour Source	Report reference	Applied SOER OUm/s	Method	Justification for modelled OER
Landfill Intermediate cover Larger emission point termed the 'v section'.	7	**11**	Transect	Site specific measured emissions. This area (50 m^2) displayed signs of staining and cracks. The odour sample was undertaken at 8.25 am. The OER was determined by back calculation of up and downwind measurements. GHD has modelled this source in the existing scenario. Refer Ektimo samples 60 and 98.
Landfill Intermediate cover Larger emission point 2 – rectangular area south of excavation stockpile.	7	**5.5**	Transect	Site specific measured emissions. This area (7,000 m^2) displayed signs of staining and cracks. The odour sample was undertaken at 10 am. The OER was determined by back calculation of up and downwind measurements. GHD has modelled this source in the existing scenario. Refer Ektimo samples 56 and 150.
Landfill Final cap localised emission point 1	7	**0.17**	IFC	Site specific measured emissions. This was included in the scenario 1 model Refer Ektimo sample 47
Landfill Final cap localised emission point 2	7	**0.73**	IFC	Site specific measured emissions. This was included in the scenario 1 model Refer Ektimo sample 180

Process/ Odour Source	Report reference	Applied SOER OUm/s	Method	Justification for modelled OER
Landfill Final cap localised emission point 3	7	**0.02**	IFC	Site specific measured emissions. This was included in the scenario 1 model Refer Ektimo sample 117
Landfill Intermediate cover localised emission point 1	7	**18.3**	IFC	Site specific measured emissions. This was included in the scenario 1 model in addition to the intermediate cover (old) emission rate and is considered conservative. These were not included in the other scenarios as SITA has rectified these emission points. Refer Ektimo sample 76
Landfill Intermediate cover localised emission point 3	7	**56.7**	IFC	Site specific measured emissions. This was included in the scenario 1 model in addition to the intermediate cover (old) emission rate and is considered conservative. These were not included in the other scenarios as SITA has rectified these emission points. Refer Ektimo sample 27
Landfill Intermediate cover localised emission point 4	7	**10.7**	IFC	Site specific measured emissions. This was included in the scenario 1 model in addition to the intermediate cover (old) emission rate and is considered conservative. These were not included in the other scenarios as SITA has rectified these emission points. Refer Ektimo sample 70
Landfill Final Capped Area	7	**0**	IFC	Site specific measured emissions. Odour sampling shows that the median of the grid measurements on the final cap is in fact lower than the background measurements not on the landfill area. The odour character was also defined as

Process/ Odour Source	Report reference	Applied SOER OUm/s	Method	Justification for modelled OER
				the same as the background (musty) with no ammonia or waste related odours detected with these measurements. Therefore an SOER of 0 is applied. Refer Ektimo samples 132, 115, 16, 60, 57. For background measurements, refer Ektimo samples 3, and 176.
Landfill batter "Stage 4 batter west"	7 & 14	**1.8**	IFC	This area (approx. 2,000 m^2) displayed signs of staining and cracks. The odour sample was undertaken at 13.10 pm. Ektimo advised that there were areas where landfill gas was seeping out however was variable across the batter. The OER was determined by applying approximately 2 times the odour emission rate (to be conservative) measured at eight locations on the batter by The Odour Unit and adopted by Homes Air Science for the odour audit conducted at the LHRRP in 2006. This batter was modelled for the existing scenario (1). Future scenarios modelled this batter with an emission rate equivalent to intermediate cover with gas extraction.

Process/ Odour Source	Report reference	Applied SOER OUm/s	Method	Justification for modelled OER
Landfill batter "SITA batter north"	7 & 14	**1.4**	IFC	This area (approx. 3,600 m^2) displayed signs of staining and cracks. The odour sample was undertaken at 12.30 pm. Ektimo advised that there were areas where landfill gas was seeping out however was variable across the batter. Ektimo advised that odour from this batter may have been a little lower than the other batters on the site. The OER was determined by applying approximately 1.5 times the odour emission rate (to be conservative) measured at eight locations on the batter by The Odour Unit and adopted by Homes Air Science for the odour audit conducted at the LHRRP in 2006. This batter was modelled for the existing scenario (1). Future scenarios modelled this batter with an emission rate equivalent to intermediate cover with gas extraction.
Landfill Landfill batters	7	**0.1**	IFC	Site specific measured emissions. Median of the batter grid IFC measurements. This value was not utilised in the modelling as it is not representative of the variability in odour on the batters. Refer Ektimo samples 47, 73 and 140 (2/6/2014).
Landfill Intermediate test pits depth 150 mm	7	**0**	IFC	Site specific measured emissions. For intermediate cover measurements the character of the odour from the samples differed at the two depths. At 150 mm the character of the odour was described as grass, dirt and mould, while at 450 mm there was a notable ammonia odour. Given that there was no ammonia odour detected at 150 mm these measurements have not been included in the model for all future scraped back works. Therefore an SOER of 0 is applied. Refer Ektimo samples 150 and 43.

Process/ Odour Source	Report reference	Applied SOER OUm/s	Method	Justification for modelled OER
Landfill Intermediate test pits depth 450 mm	7	**1.0**	IFC	Site specific measured emissions. For intermediate cover measurements the character of the odour from the samples differed at the two depths. At 150 mm the character of the odour was described as grass, dirt and mould, while at 450 mm there was a notable ammonia odour. An average of the 2 odour samples at 450 mm have been used in the modelling for scraped back areas. Refer Ektimo samples 89 and 38.
Landfill Final cap test pits 500 mm	7	**0**	IFC	Site specific measured emissions. For final cover odour samples at all depths the character of the odour from all samples were described as grass, dirt and mould. Given that there was no ammonia or waste related odour detected these have not been included in the model. Refer Ektimo samples 98 and 73
Landfill Final cap test pits 1000 mm	7	**0**	IFC	Site specific measured emissions. For final cover odour samples at all depths the character of the odour from all samples were described as grass, dirt and mould. Given that there was no ammonia or waste related odour detected these have not been included in the model. Refer Ektimo samples 55 and 123

Process/ Odour Source	Report reference	Applied SOER OUm/s	Method	Justification for modelled OER
Landfill Final cap test pits 1300 mm	7	**0**	IFC	Site specific measured emissions. For final cover odour samples at all depths the character of the odour from all samples were described as grass, dirt and mould. Given that there was no ammonia or waste related odour detected these have not been included in the model. Refer Ektimo samples 15 and 56
Strip back area (over existing intermediate cover (old))	7	**1**		The strip back area that will potentially increase odour levels will likely only be undertaken over an area of approximately 2,500 m. A larger area of this will be pre-prepared however will only initially be excavated to a depth where the odour emissions are not elevated and in accordance with the VPA odour complaints process (should it be triggered). Refer the 450 mm intermediate cover test pit.

Process/ Odour Source	Report reference	Applied SOER OUm/s	Method	Justification for modelled OER
Landfill Active tip face	7	**6am 0.03** **7am 13** **8am 13** **9am 20** **10am 26** **11am 26** **12pm 33** **1pm 40** **2pm 40** **3pm 40** **4pm 40** 5pm 0.03	Transect	Site specific measured emissions. Variable level depending on time of day with size of 2,500 m^2. Measured values of 26 OUm/s in the morning at 9.40 am and 40 OUm/s In the afternoon at 1310 pm. The others were interpolated. The OER was determined by back calculation of up and downwind measurements. The tip face was modelled in all scenarios.
Landfill Leachate pond	7	**1.8 (aerated)** **0.26 (quiescent)**	Transect IFC	Site specific measured emissions. Odour samples of this area (2,750 m^2) were undertaken at 1230 pm. The OER was determined by IFC and back calculation of up and downwind measurements. This leachate pond was modelled for all scenarios applying the 2 hours of aeration in the day time period each day. Refer Ektimo samples 32 and 132

Process/ Odour Source	Report reference	Applied SOER OUm/s	Method	Justification for modelled OER
Existing garden organics Raw green waste	2	ANL Lilydale (URS Report 17 July 2007) **4**	IFC	Measured ANL Coldstream data was used. A value of 4 OU/m/s was used based on pro rataing 1 day old and 1 week old green waste to give a 2 day old SOER.).
Existing garden organics Shredder	3	ANL (URS Report 28/8/2008) **5740 OUm^3/s (OER)**	UW / DW	This value is considered to be representative of the existing green waste shredding operations at Lucas Heights.
Existing garden organics Loading	2	ANL (URS Report 17 July 2007) Mobile source assuming break apart source emission **8**	-	The 8 OUm/s is an assumption based on doubling the value of 4 $OUv/m^2/s$ for raw green waste.
Existing garden organics Static windrows 1 month	9	ANL, (Sustainable Infrastructure Australia, 29 March 2007) **4.4**	IFC	Based on measured data from ANL Coldstream Site which had static stockpiles similar to the existing eastern GO. A correction factor of 2.1 has been applied to make up for the under estimation of IFC and is considered conservative. Have modelled each month in the assessment. Areas have been modelled as per the site plan.
Existing garden organics Static windrows 2 month	9	ANL, (Sustainable Infrastructure Australia, 29 March 2007) **2.9**	IFC	Based on measured data from ANL Coldstream Site which had static stockpiles similar to the existing eastern GO. A correction factor of 2.1 has been applied to make up for the potential under estimation of IFC and is considered conservative. Have modelled each month in the assessment. Areas have been modelled as per the site plan.
Existing garden organics	9	ANL, (Sustainable Infrastructure Australia, 29 March 2007)	IFC	Based on measured data from ANL Coldstream Site which had static stockpiles similar to the existing eastern GO. A correction

Process/ Odour Source	Report reference	Applied SOER OUm/s	Method	Justification for modelled OER
Static windrows 3 - 4 month		**1.7**		factor of 2.1 has been applied to make up for the potential under estimation of IFC and is considered conservative. Have modelled each month in the assessment. Areas have been modelled as per the site plan.
Existing garden organics Maturation windrows	10	Veolia Bulla In-Vessel Composting Facility (GHD, 2011) **1.7**	Draped tunnel	Based on measured data from Veolia Bulla Site. Tests undertaken at different times during a 4 week maturation process so the combined OER from the windrow array could be quantified. Measurements were undertaken using a greenhouse enclosure method with odour samples taken at the inlet and outlet and are considered to be more accurate than IFC measurements at other sites. Areas have been modelled as per the site plan.
Existing garden organics Matured stockpile	10	Veolia Bulla In-Vessel Composting Facility (GHD, 2011) **0.6**	Draped tunnel	Based on measured data from Veolia Bulla Site. Tests undertaken at different times during a 4 week maturation process so the combined OER from the windrow array could be quantified. Measurements were undertaken using a greenhouse enclosure method with odour samples taken at the inlet and outlet. Areas have been modelled as per the site plan.
Existing garden organics Leachate pond	7	**1.8 (aerated)** **0.26 (quiescent)**	IFC	This leachate pond was modelled for all scenarios applying the 2 hours of aeration in the day time period each day. Note the landfill leachate odour pond emission rate was applied in this case and is conservatively high.
Proposed garden organics Raw	2	ANL Lilydale (URS Report 17 July 2007) **4**	IFC	Measured ANL Coldstream data was used. A value of 4 OU/m/s was used based on pro rataing 1 day old and 1 week old green waste to give a 2 day old SOER.).

Process/ Odour Source	Report reference	Applied SOER OUm/s	Method	Justification for modelled OER
Proposed garden organics Shredder	3	ANL (URS Report 28/8/2008) **5740 OUm^3/s (OER)**	UW / DW	This value is considered that it would be representative of the proposed green waste shredding operations at Lucas Heights.
Proposed garden organics Loading	2	ANL (URS Report 17 July 2007) Mobile source assuming break apart source emission **8 OU/m/s**	-	The 8 OU/m/s is an assumption based on doubling the value of 4 OU/m/s for raw green waste.
Proposed garden organics Fermentation (weeks 1 -4)	4,9	Week 1 – 1.95 Week 2 - 1.12 Week 3 – 0.97 Week 4 – 0.89 **With gore or similar cover:** Week 1 - 0.20 Week 2 – 0.11 Week 3 - 0.10 Week 4 – 0.09	Draped tunnel	Based on measured data from SITA Brooklyn Site. Refer to Section 7.5 of the Air Quality Impact Assessment Report. Have modelled each week in the assessment. Areas have been modelled as per the GHD Air Quality Assessment Report (GHD 2015). OER measurements of windrows including greasetrap and those of just green waste were taken, from the results it was concluded that the removal of greasetrap waste from the windrows lead to a substantial ~ eight-fold reduction in windrow OER. Odour sampling was undertaken at 4 points in time (windrow ages 1 day, 1 week, 4 weeks and 12 weeks) to determine the mean windrow OER of the windrow array at Brooklyn. These measurements when plotted enable an approximate OER at every week in the process to be interpolated. The adopted OERs before scaling and applying gore are: Week 1 – 16.55

Process/ Odour Source	Report reference	Applied SOER OUm/s	Method	Justification for modelled OER
				Week 2 - 8.5 Week 3 – 7.4 Week 4 – 6.8
Proposed garden organics Turning (weeks 1 -4)	4,9	**20.5**	Plume	Based on measured data from SITA Brooklyn Site. Refer to Section 7.4 of the GHD Air Quality Impact Assessment Report (GHD 2015). Assumed turning once every week with a duration of 5 hours. So for a 80 m windrow time to break apart is 5 hours Time to turn with a top turn @10 m/min is 8 mins (Brooklyn SITA) So SOER breakapart / SOER quiescent =100 x (8/(5 x 60)) = 2.7 : 1 Factor of 2.7 applied to the average value from weeks 2 to 4 = 2.7 x 7.6 = 20.5
Proposed garden organics Maturation (weeks 5 - 8)	4,9	**Week 5 – 6.1** **Week 6 – 5.6** **Week 7 – 5.1** **Week 8 – 4.6**	Draped tunnel	Based on measured data from SITA Brooklyn Site. Refer to Section 7.4 of the Air Quality Impact Assessment Report. Have modelled the average of week 5, 6 ,7 and 8 (5.3 OU/m/s)

Process/ Odour Source	Report reference	Applied SOER OUm/s	Method	Justification for modelled OER
Proposed garden organics Turning 2 (weeks 5 -8)	4,9	**14.3**	Plume	Based on measured data from SITA Brooklyn Site. Refer to Section 7.4 of the Air Quality Impact Assessment Report. Assumed weekly turning with a duration of 5 hours So for a 80 m windrow time to break apart is 5 hours Time to turn with a top turn @10 m/min is 8 mins (Brooklyn SITA) So SOER breakapart / SOER quiescent =100 x (8/5 x 60) = 2.7 : 1 Factor of 2.7 applied to the average value from weeks 5 to 8= 2.7 x 5.3= 14.3
Proposed garden organics Maturation (weeks 9 - 12)	4,9	**Week 9 – 4.3** **Week 10 – 3.9** **Week 11 – 3.3** **Week 12 – 2.9**	Draped tunnel	Based on measured data from SITA Brooklyn Site. Refer to Section 7.4 of the Air Quality Impact Assessment Report. Have modelled average of week 9, 10 ,11 and 12 (3.6 OU/m/s)
Proposed garden organics Turning 3 (weeks 9 - 12)	4,9	**9.7**	Plume	Based on measured data from SITA Brooklyn Site. Refer to Section 7.4 of the Air Quality Impact Assessment Report. Assumed weekly turning with a duration of 5 hours So for a 80 m windrow time to break apart is 5 hours Time to turn with a top turn @10 m/min is 8 mins (Brooklyn SITA) So SOER breakapart / SOER quiescent =100 x (8/5 x 60) = 2.7 : 1 Factor of 2.7 applied to the average value from weeks 9 to 12 = 2.7 x 3.6 = 9.7
Proposed garden organics	4,9	**2.6**	Draped tunnel	Based on measured data from SITA Brooklyn Site. Refer to Section 7.4 of the GHD Air Quality Impact Assessment Report (GHD 2015).

Process/ Odour Source	Report reference	Applied SOER OUm/s	Method	Justification for modelled OER
Matured product				
Proposed garden organics Screening	1	GHD Study for ANL Coldstream March 2008 **1600 OUm^3/s (OER)**	UW / DW	This assumes screening of matured green waste. The ANL data is 1600 Ouv/s based entirely on matured product.
Proposed garden organics Leachate	14	**1.00 (aerated)** **0.145 (quiescent)**	IFC	The leachate dams were modelled for all scenarios assuming 2 hours of aeration in the day time period each day. The SOER was selected from the compost pond IFC measurements taken from the composting leachate pond at the LHRRP in 2006 and the aerated rate was derived by apply the same increased factor measured for the landfill leachate pond (see above).
Proposed garden organics Pre-composted Turkey Manure Stockpile	8	**867**	Draped tunnel	GHD has adopted dried chicken manure values in lieu of pre-composted turkey manure data. This is considered to be appropriate.
Proposed ARRT Receival area	6	**0 as enclosed**		This process is enclosed and has not been modelled as a separate source of odour as the building will be under negative pressure.
Proposed ARRT Biofilters	-	VIC EPA accepted level and experience **250 OU x Flowrate (OER)**	Various	See Section 4 above.
Proposed ARRT Leachate pond	N/A	0		No pond is proposed.

6. References

Reference reports of odour measurements considered in this memorandum are summarised in .

Table 6-1 Odour reference reports

Ref	Report	Author	Waste Types Accepted
1	Odour Impact from Composting Operations – ANL Coldstream Green Waste Composting Facility. Report #131899. March 2008	GHD with ETC odour measurements	100% garden organics
2	Odour Assessment of the ANL Composting Facility, Lilydale. 17 July 2007	URS with EML odour measurements	100% garden organics
3	Odour assessment of proposed composting process at the ANL Premise, Lillydale. 28 August 2008	URS with EML odour measurements	100% garden organics
4	Odour Impact Survey for SITA Brooklyn – Greenwaste composting facility. February 2009	GHD with ETC odour measurements	Separate measurements were conducted on different windrows. (i) 100% garden organics (ii) Mixture of Greenwaste plus greasetrap and food wastes
5	Lucas Heights Alternative Waste Technology Facility Air Quality Impact Assessment. 27 July 2009	PAE Holmes	Municipal solid waste
6	ETC report No. 140107r 2014 (Lucas Heights). Back Calculations by GHD.	Ektimo with Back Calculations by GHD	Municipal solid waste
7	Odour Impact Assessment – Casaccio Egg Farm for Lendlease and Wyndham City Council. September 2012	GHD with ETC odour measurements	Dried chicken manure from Egg layer farm
8	Report on Odour Survey and Improvement Plan, ANL, Sustainable Infrastructure Australia. 29 March 2007	ETC odour measurements	100% garden organics
9	Report for Bulla In-Vessel Composting Facility Air Quality Assessment. July 2011	GHD with EML odour measurements	Green (garden) organics with 3-4% grease trap waste
10	Appendix D: Air Quality Assessment Proposed SAWT–BIOWISE facility Elizabeth Drive, Kemps Creek. June 2007	Holmes Air Sciences	Municipal waste and garden organics (with tunnel composting)
11	Appendix F: Air Quality Modelling Report Jacks Gully Alternative Waste Technology Facility, March 2006	Holmes Air Sciences	Municipal waste
12	Technical Report No. 4 Air Quality Assessment, June 2011 Remondis Integrated Recycling Park	PAE Homes	Source separated food and green waste

Ref	Report	Author	Waste Types Accepted
13	Appendix D: Woy Woy Waste Management Facility Air Quality Impact Assessment August 2007	URS	Municipal waste
14	Odour audit: Lucas Heights Waste & Recycling Centre 2006	Holmes Air Sciences	Municipal waste

Regards

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