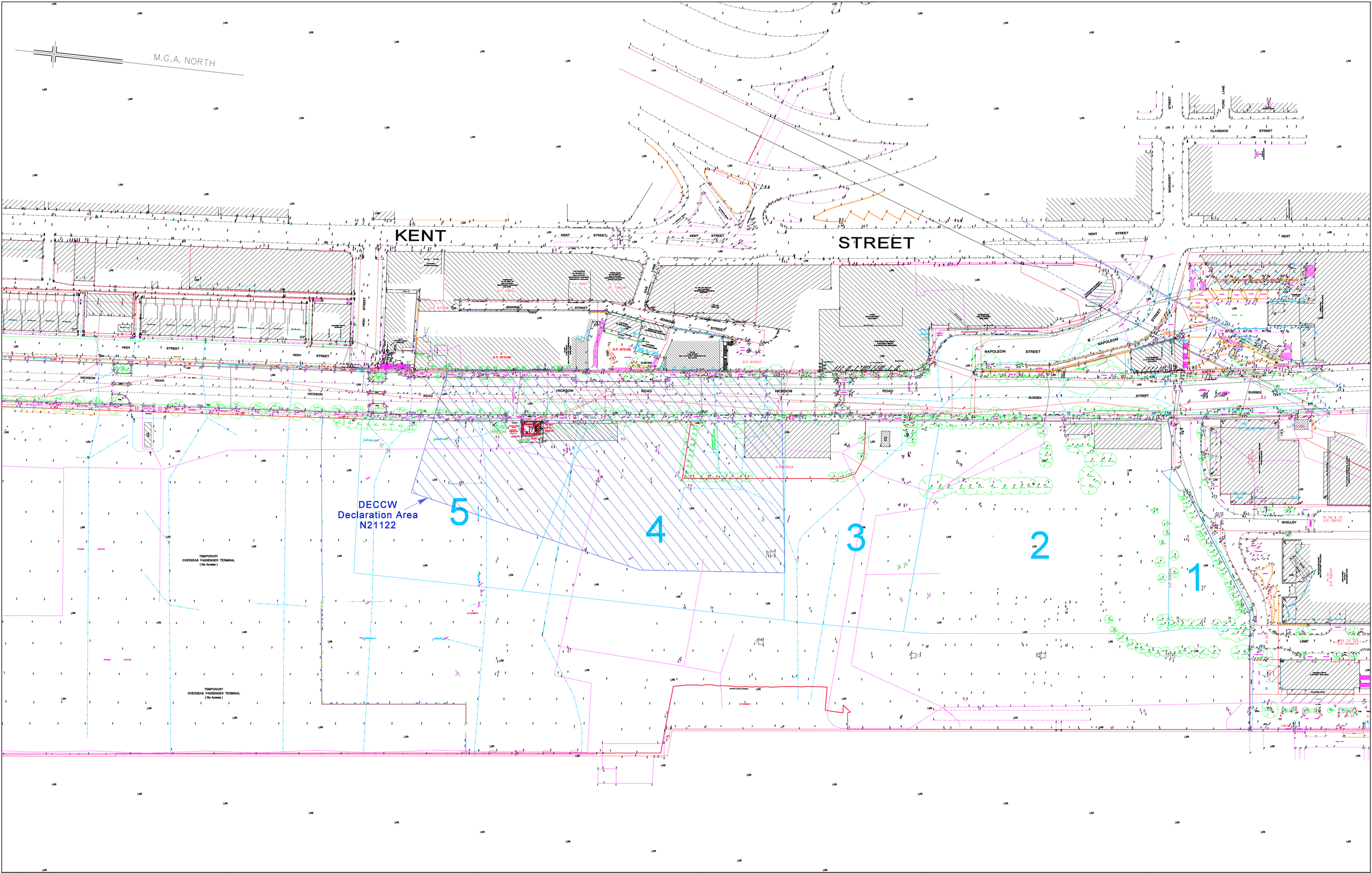

REV.	DATE	AMENDMENTS

0 100
REDUCTION RATIO 1: 1000 @ A1

THIS TITLE BLOCK AND NOTES FORM AN INTEGRAL PART OF THE PLAN AND MUST BE REPRODUCED IN ANY USE, DUPLICATION OR AMENDMENT.

DATUM : AUSTRALIAN HEIGHT DATUM
CONTOUR INTERVAL : N/A
ORIGIN OF LEVELS : S.S.M. 46693
R.L. 2.454 A.H.D.

RYGATE & COMPANY PTY. LIMITED
REGISTERED LAND SURVEYORS
81 YORK STREET, SYDNEY 2000
MEMBER OF ASSOCIATION OF CONSULTING SURVEYORS
PHONE 9262 6800
FAX 9262 6843
ABN 61 001 204897
www.rygate.com.au
Email: surveyors@rygate.com.au

SURVEYOR	DRAWN	CHECKED	APPROVED
SG	GD		

CLIENT: LEND LEASE (Millers Point) PTY. LTD.

LOCALITY: BARANGAROO

L.G.A.: CITY OF SYDNEY

PLAN

SHOWING DETAIL, LEVELS & SERVICES
LOTS 3 & 5 DP 876514
AND ALONG HICKSON ROAD

REFERENCE No.	PLAN No.	DATE	SHEET No. 1
74479	74479-1	18/10/2010	OF 1 SHEETS

Appendix C

Crown Development Plans (RAP Issue)

HICKSON RD

RL +2.42

RL +2.50

RL +2.55

RL +2.64

RL +2.85

RL +3.05

INDICATIVE PODIUM OUTLINE

R5 Hickson

R5 Tower

R5 Podium

H2

C8 (C3)

HICKSON PARK

DECCW LINE

PROPOSED ROAD CONNECTION TO HICKSON ROAD

4M 4M 18.00M

GLOBE STREET

C3

CITY WALK

BARANGAROO CENTRAL

BARANGAROO SOUTH

R4b Tower

R4a Tower

R4 Podium

STAGE 1B / STAGE 1C BOUNDARY

CROWN EASTERN BOUNDARY

CROWN SOUTHERN BOUNDARY (17M)

LIME STREET

BARANGAROO PUBLIC EVENT SPACE

CROWN WESTERN BOUNDARY (30M)

PROMENADE

GLOBE HARBOUR

BY OTHERS

BY CROWN

30000

R8

Key

Stage 1C(Remediation Action Plan) Extent

Licensed Dining Terraces

Issue	Date	Description	By	Chkd
-	01.05.2014	Remediation Report Issue	HP	AK

1:500

10m 0 10m 20m 30m 40m 50m

N

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Project: 915.11 Crown Hotel Sydney

Title: Site Plan - Ground floor
Remediation Report Issue

Scale @A1: 1:500
Scale @A3: 1:1000

Drawing and CAD File Number: 00915-11-SK-0967

Rev:

Issue	Date	Description	By	Chkd
-	01.05.2014	Remediation Report Issue	HP	AK

1:500
10m 0 10m 20m 30m 40m 50m

N

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Project: 915.11 Crown Hotel Sydney

Title: Site Plan - Ground floor
Remediation Report Issue

Scale @A1: 1:500
Scale @A3: 1:1000

Drawing and CAD File Number: 00915-11-SK-0968

Rev:

HICKSON RD

STAGE 1B BASEMENT EXTENTS

INDICATIVE PODIUM OUTLINE

R5 Hickson

R5 Tower

R5 Podium

HICKSON PARK

CROWN BASEMENT EXTENTS

SSL +2.2M
RL +3.5M

GLOBE STREET

H2

C8 (C3)

C3

CITY WALK

DECCW LINE

PARKING AREA WITHIN STAGE 1B

PROPOSED ROAD CONNECTION TO HICKSON ROAD

BARANGAROO CENTRAL
BARANGAROO SOUTH

SSL +2.5M
RL +3.5M

R4b Tower

R4a Tower

R4 Podium

SA STAGE 1B / STAGE 1C BOUNDARY

SB CROWN EASTERN BOUNDARY

S2 CROWN SOUTHERN BOUNDARY (17M)

RL +3.5M
SSL +2.6M
RL +3.5M
RL +3.5M
RL +3.6M
LIME STREET
RL +3.3M
SSL +2.1M
RL +3.3M
RL +3.4M

CROWN 1C BASEMENT EXTENTS

BARANGAROO PUBLIC EVENT SPACE

RL +3.8M

RL +3.5M

RL +3.8M

RL +3.4M

TOP OF EXISTING REVETMENT WALL

R8

SC CROWN WESTERN BOUNDARY (30M)

RL +3.2M

EDGE OF CAISSON

EDGE OF CAISSON

RL +3.8M
RL +3.3M
RL +3.8M
RL +3.7M
Bar Terrace
RL +3.3M
RL +3.5M

RL +2.18M
Existing Hardstand

RL +3.3M

RL +3.3M
RL +3.2M

PROMENADE
RL +3.2M

BY OTHERS

GLOBE HARBOUR

BY CROWN

BY OTHERS

Key

- Extent of Podium Elevated Slab Located Beyond Basement Over Reclaimed Land
- Extent of Licensed Dining Areas Located Beyond Basement Over Reclaimed Land
- Extent of Licensed Dining Areas Located Beyond Basement Over Caisson and Revetment Wall
- Stage 1B Basement Extents
- Crown Basement Extents
- Stage 1C (Remediation Action Plan) Extent
- Top of Existing Revetment Wall
- Edge of Existing Caisson

Issue	Date	Description	By	Chkd
-	01.05.2014	Remediation Report Issue	HP	AK

1:500
10m 0 10m 20m 30m 40m 50m

N

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Project: 915.11 Crown Hotel Sydney

Title: Site Plan - Ground floor
Remediation Report Issue

Scale @A1: 1:500
Scale @A3: 1:1000

Drawing and CAD File Number: 00915-11-SK-0969

Rev:


R4 Podium
LIME STREET
PROMENADE
BY OTHERS
STAGE 1B
STAGE 1C
CROWN EASTERN BOUNDARY
CROWN WESTERN BOUNDARY (30M)
CROWN SOUTHERN BOUNDARY (17M)
BARANGAROO CENTRAL
BARANGAROO SOUTH
EDGE OF CAISSON
START OF RAMP
SLAB CLEARANCE
Top of Existing Revetment Wall
EXISTING GROUND RL +2.18M
Entrance
Hotel Lobby RL +3.8M
VIP Lift Lobby
Guest Lift Lobby
BOH Loading
BOH Support
Lobby WC
Fire Command Centre
Gas Meter Room
Staff Entry
Plant
Store
RL +3.5M Retail Tenancy
RL +3.8M Retail Tenancy
Bar / Cafe RL +3.5M
Restaurant RL +3.8M
Lobby Bar RL +3.8M
RL +3.7M Restaurant
RL +3.7M Restaurant Bar
Bar Terrace
Terrace
Canopy Above
INCLINE 1:20
68 Sq. m
13 Sq. m
226 Sq. m
292 Sq. m
581 Sq. m
214 Sq. m
150 Sq. m
275 Sq. m
119°
Key
Extent of Podium Elevated Slab Located Beyond Basement Over Reclaimed Land
Extent of Licensed Dining Areas Located Beyond Basement Over Reclaimed Land
Extent of Licensed Dining Areas Located Beyond Basement Over Caisson and Revetment Wall
Stage 1B Basement Extents
Crown Basement Extents
Stage 1C (Remediation Action Plan) Extent
Top of Existing Revetment Wall
Edge of Existing Caisson

Issue	Date	Description	By	Chkd
	01/05/2014	Remediation Report Issue	TI	AK

1:200 — 5m 0 5m 10m 15m 20m

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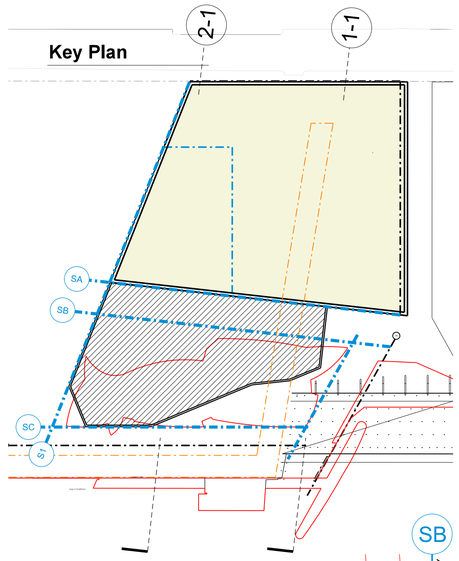
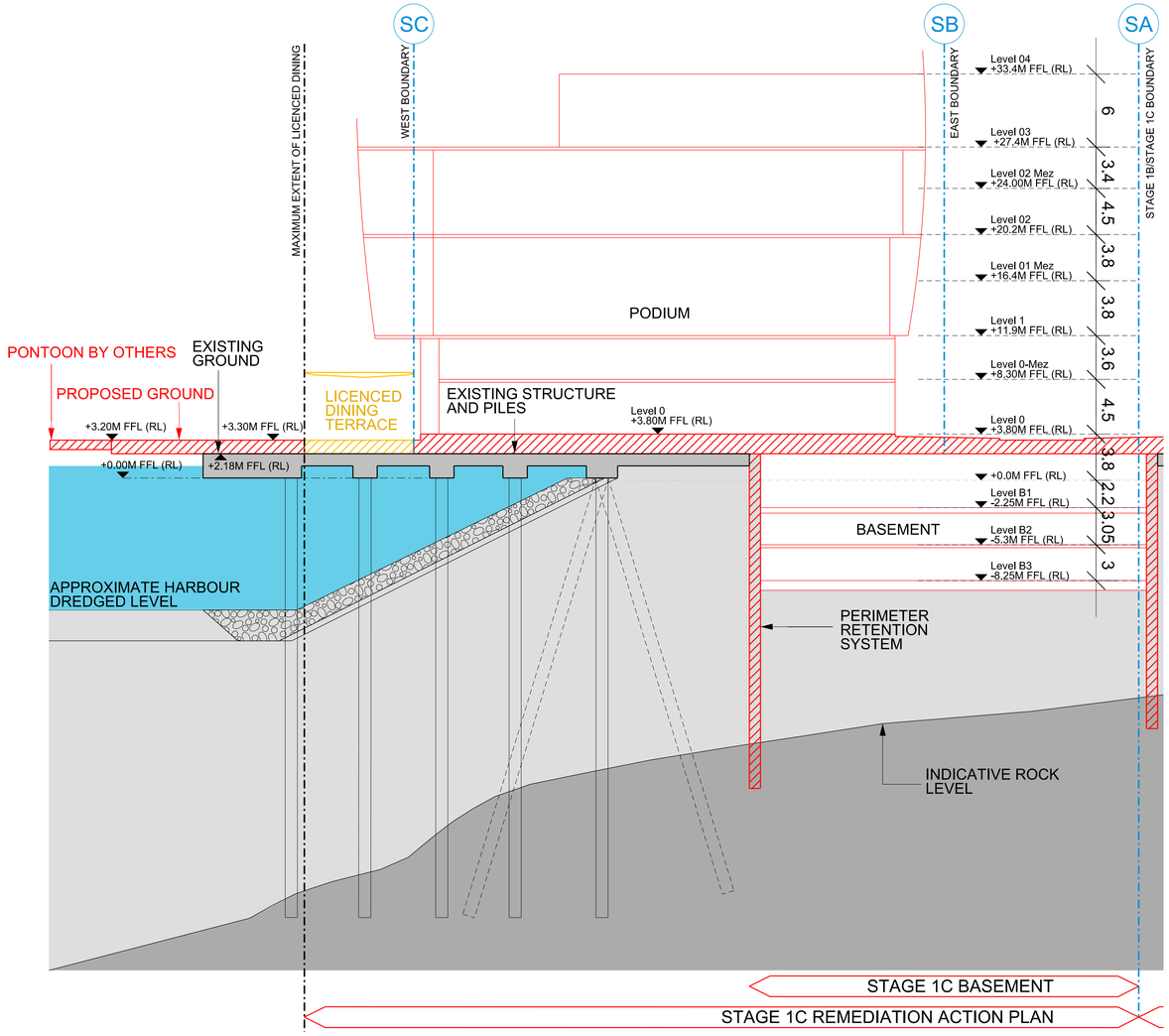
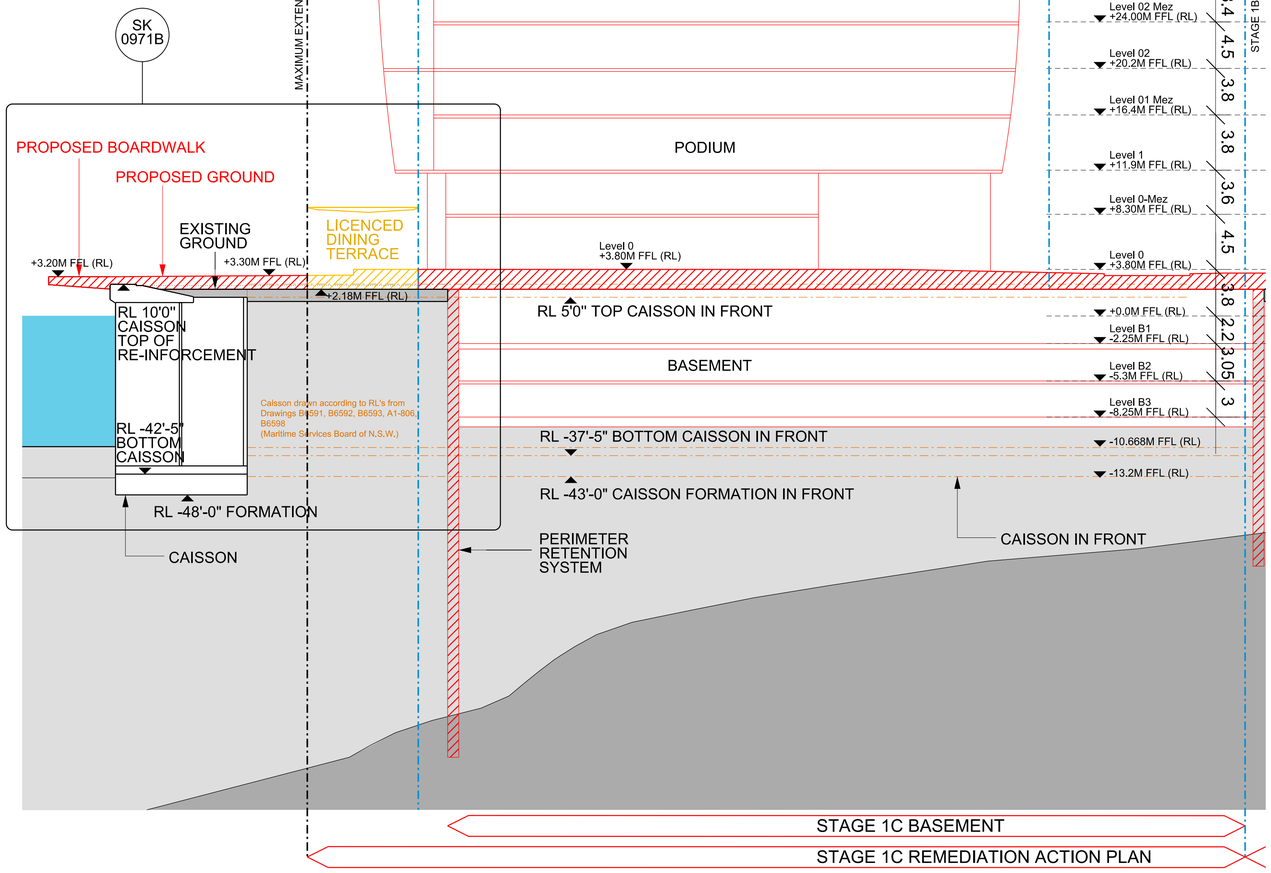
Project: 915.11 Crown Hotel Sydney
Title: Level 0 Plan - Lobby
Remediation Report Issue
Scale @A1: 1:200
Scale @A3: 1:400
Drawing and CAD File Number: 00915-11-SK-0970
Rev:

INDICATIVE LAYOUT ONLY





Cross Section 1-1



Cross Section 2-1

Issue	Date	Description	By	Chkd
	01.05.2014	Remediation Report Issue	TI	AK

Notes:
1. Rock contour model information in this drawing is made from data as provided in document 'B10_ASK_MP_0456_Contours.dgn'.
2. Levels, partition wall location and PRW outline based on drawing Pack 00915-11-ISSUE 040314 DRAFT.
3. Volume subject to site auditor requirements for a clean zone greater than the proposed formation RL of -9.75m.

1:250
5m 0 5m 10m 15m 20m

N

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Project: 915.11 Crown Hotel Sydney

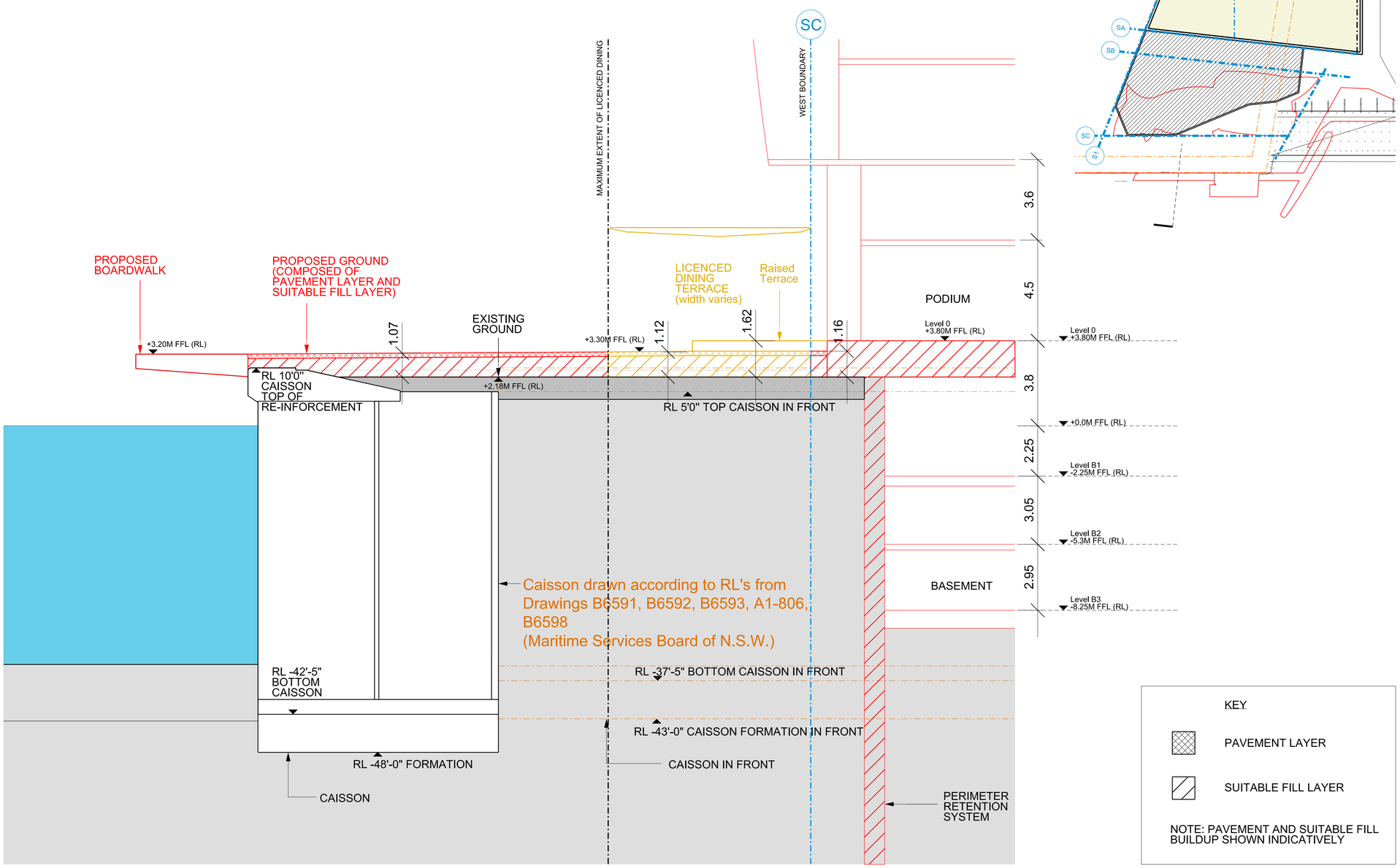
Title: Excavation and Land Forming Works Development Application
SSD 5897-2013 Cross Section 1-1 and 2-1
Stage 1C Subject To This Application,Remediation Report Issue

Scale @A1: 1:250
Scale @A3: 1:500

Drawing and CAD File Number: 00915-11-SK-0971A

Rev:

INDICATIVE LAYOUT ONLY



Cross Section 2-1 Blowup

Issue	Date	Description	By	Chkd
	01.05.2014	Remediation Report Issue	TI	AK

Notes:
1. Rock contour model information in this drawing is made from data as provided in document 'B10 ASK MP 0456 Contours.dgn'.
2. Levels, partition wall location and PRW outline based on drawing Pack 00915-11-ISSUE 040314 DRAFT.
3. Volume subject to site auditor requirements for a clean zone greater than the proposed formation RL of -9.75m.

1:250 5m 0 5m 10m 15m 20m

N

CROWN

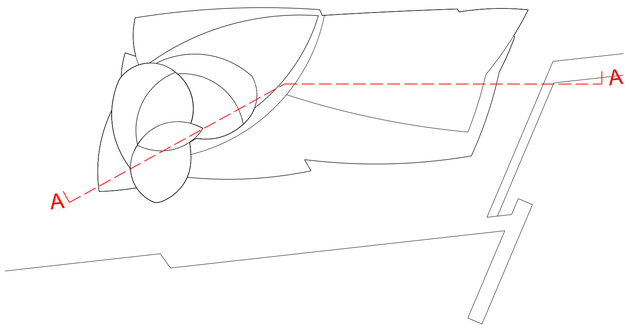
Project: 915.11 Crown Hotel Sydney

Title: Excavation and Land Forming Works Development Application
SSD 5897-2013 Cross Section 2-1 Blowup
Stage 1C Subject To This Application,Remediation Report Issue

Scale @A1: 1:100
Scale @A3: 1:200

Drawing and CAD File Number: 00915-11-SK-0971B

Rev:



275.0 RL		Roof		
9.35			Plant	
265.6 RL	Level 70	Lifts Plant		
3.45				
262.2 RL	Level 69	Sky Villa @ 5m	1 Key	Sky Villa **1 Key**
5				
257.2 RL	Level 68	Sky Villa @ 5m		
4				
253.2 RL	Level 67	Sky Villa @ 4m		
4			1 Key	Super Villa **1 Key**
249.2 RL	Level 66	Super Villa @ 4m		
4.6			Plant	
244.6 RL	Level 65	BMU Plant @4.6m		
3.7				
240.9 RL	Level 64	1 Apmt		
3.7				
237.2 RL	Level 63	1 Apmt		
3.7				
233.5 RL	Level 62	1 Apmt		
3.7				
229.8 RL	Level 61	1 Apmt		
3.7				
226.1 RL	Level 60	1 Apmt		
3.7				
222.4 RL	Level 59	1 Apmt		
3.7				
218.7 RL	Level 58	1 Apmt		
3.7				
215.0 RL	Level 57	1 Apmt		
3.4			Plant	Plant/ Resi Split
211.6 RL	Level 56	1 Apmt		
3.4				
208.2 RL	Level 55	2 Apmts		
3.4				
204.8 RL	Level 54	2 Apmts		
3.4				
201.4 RL	Level 53	2 Apmts		
3.4				
198.0 RL	Level 52	2 Apmts		
3.4				
194.6 RL	Level 51	2 Apmts		Apartments **68 Apartments**
3.4				
191.2 RL	Level 50	3 Apmts		
3.4				
187.8 RL	Level 49	3 Apmts		
3.4				
184.4 RL	Level 48	3 Apmts		
3.4				
181.0 RL	Level 47	3 Apmts		
3.4			Plant	Plant/ Resi Split
177.6 RL	Level 46	2 Apmts		
3.4				
174.2 RL	Level 45	3 Apmts		
3.4				
170.8 RL	Level 44	3 Apmts		
3.4				
167.4 RL	Level 43	3 Apmts		
3.4				
164.0 RL	Level 42	3 Apmts		
3.4				
160.6 RL	Level 41	3 Apmts		
3.4				
157.2 RL	Level 40	3 Apmts		
3.4				
153.8 RL	Level 39	3 Apmts		
3.4				
150.4 RL	Level 38	3 Apmts		
3.4				
147.0 RL	Level 37	3 Apmts		
3.4				
143.6 RL	Level 36	3 Apmts		
3.4				
140.2 RL	Level 35	3 Apmts		
3.4			Plant	Plant/ Resi Split
136.8 RL	Level 34	2 Apmts		
3.4				
133.4 RL	Level 33	5 Villas		Villas **25 Keys**
3.4				
130.0 RL	Level 32	5 Villas		
3.4				
126.6 RL	Level 31	5 Villas		
3.4				
123.2 RL	Level 30	5 Villas		
3.4				
119.8 RL	Level 29	5 Villas		
4			Plant	
115.8 RL	Level 28	Villa Plant		
4				
111.8 RL	Level 27	Sky Gaming Plant		
4			Sky Gaming	Sky Gaming
107.8 RL	Level 26	Sky Gaming		
4				
103.8 RL	Level 25	Sky Gaming		
4				
99.8 RL	Level 24	Crystal Club		Crystal Club
5.6			Plant	
94.2 RL	Level 23	Crystal Club Plant		
3.1				
91.1 RL	Level 22	Hotel		
3.1				
88.0 RL	Level 21	Hotel		
3.1				
84.9 RL	Level 20	Hotel		
3.1				
81.8 RL	Level 19	Hotel		
3.1				
78.7 RL	Level 18	Hotel		
3.1				
75.6 RL	Level 17	Hotel		
3.1				
72.5 RL	Level 16	Hotel		
3.1				
69.4 RL	Level 15	Hotel		Hotel **323 Keys**
3.1				
66.3 RL	Level 14	Hotel		
3.1				
63.2 RL	Level 13	Hotel		
3.1				
60.1 RL	Level 12	Hotel		
3.1				
57.0 RL	Level 11	Hotel		
3.1				
53.9 RL	Level 10	Hotel		
3.1				
50.8 RL	Level 9	Hotel		
3.1				
47.7 RL	Level 8	Hotel		
3.1				
44.6 RL	Level 7	Hotel		
3.1				
41.5 RL	Level 6	Hotel		
5			Plant	
36.5 RL	Level 5	Hotel Plant		
3.1				Gym / Salon
33.4 RL	Level 4	Spa @ 3.1m		
6				Function Rooms/ All Day Dining / Pool
27.4 RL	Level 3	@ 6m		
3.4				Plant
24.0 RL	Mezz 2	Mezzanine		
3.8				Restaurants / Gaming
20.2 RL	Level 2	@ 7.2m	Podium	
3.8				Plant
16.4 RL	Mezz 1	Mezzanine		
4.5				Restaurants / Gaming
11.9 RL	Level 1	@ 8.3m		
3.6				
8.3 RL	Mezz 0	Staff Facilities		
4.5				Retail / F&B @
3.8 RL	Ground	8.1m		
3.5				
0.3 RL	Mezz B1	Basement Mezzanine		
2.55				
-2.25 RL	B1	Basement		
3.05				
-5.3 RL	B2	Basement	Basement	
2.95				
-8.25 RL	B3	Basement		

Rev	Date	Description	By	Chkd
	01/05/2014	Remediation Report Issue	RR	AK

Notes:
1. Rock contour model information in this drawing is made from data as provided in document 'B10_ASK_MP_0456_Contours.dgn'.
2. Pile layout and substructure shown indicatively

1:300 5m 0 5m 10m 15m 20m

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CROWN

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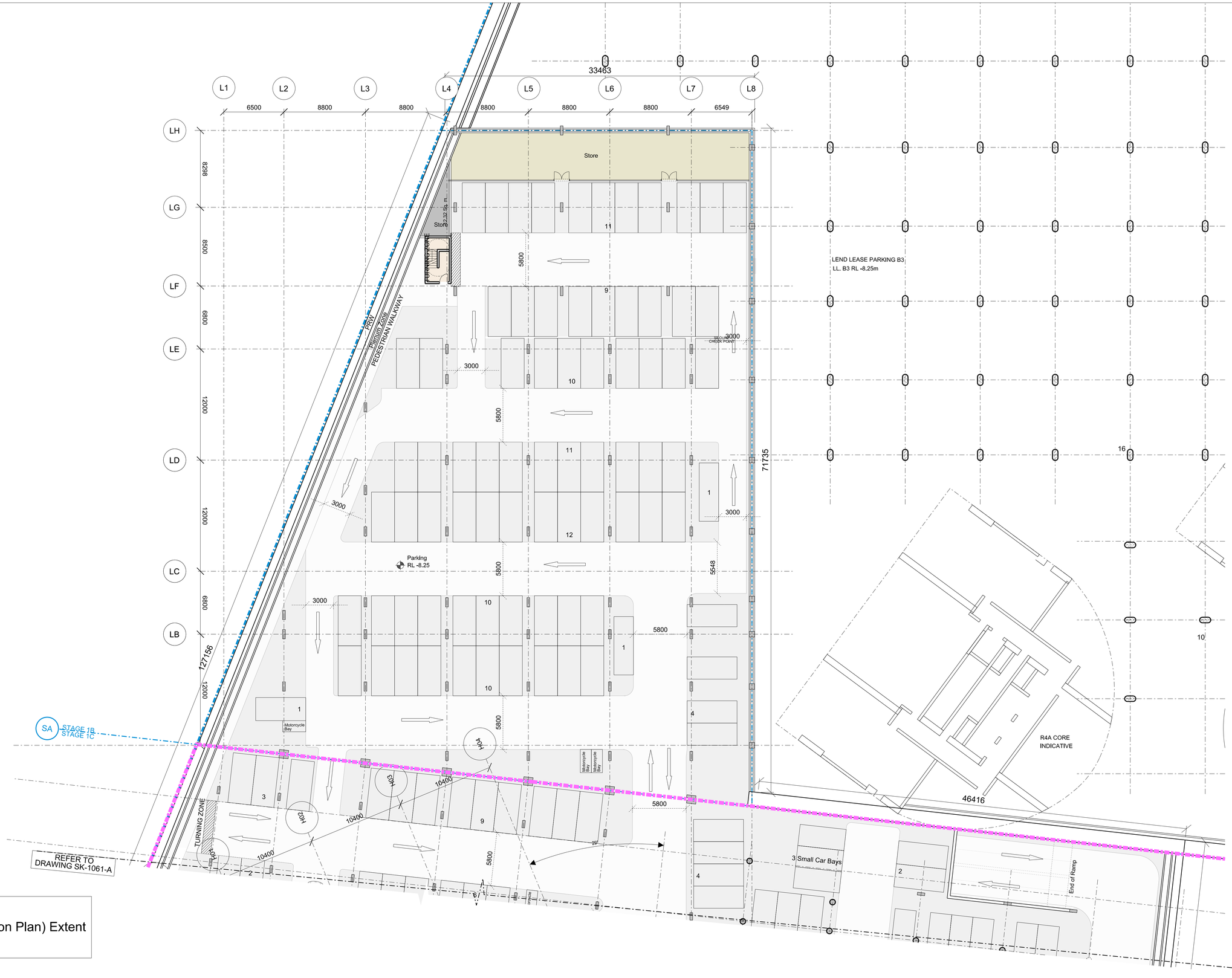
Project: 915.00 Crown Hotel Sydney

Title: Section AA
Remediation Report Issue

Scale @A0: 1:300

Drawing and CAD File Number: 00915-11-SK-0972

Rev: 00



Key

Stage 1C(Remediation Action Plan) Extent

Issue	Date	Description	By	Chkd
	01/05/2014	Remediation Report Issue	TI	AK

1:200

5m 0 5m 10m 15m 20m

N

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Project: 915.11 Crown Hotel Sydney

Title: Basement Level 3
Stage 1B Crown/ LL Extents Remediation Report Issue

Scale @A1: 1:200
Scale @A3: 1:400

Drawing and CAD File Number: 00915-11-SK-1061A

Rev:

Key

Stage 1C(Remediation Action Plan) Extent

Licensed Dining Terraces Above

Issue	Date	Description	By	Chkd
	01/05/2014	Remediation Report Issue	TI	AK

1:200

5m 0 5m 10m 15m 20m

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Project: 915.11 Crown Hotel Sydney

Title: Basement Level 3

Stage 1C Crown Extents

Remediation Report Issue

Scale @A1: 1:200
Scale @A3: 1:400

Drawing and CAD File Number: 00915-11-SK-1061B

Rev:

Issue	Date	Description	By	Chkd
	01/05/2014	Remediation Report Issue	TI	AK

1:200 — 5m 0 5m 10m 15m 20m

N

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Project: 915.11 Crown Hotel Sydney

Title: Basement Level 2
Stage 1B Crown/ LL Extents Remediation Report Issue

Scale @A1: 1:200
Scale @A3: 1:400

Drawing and CAD File Number: 00915-11-SK-1061C

Rev:

Key

Stage 1C(Remediation Action Plan) Extent

Licensed Dining Terraces Above

Issue	Date	Description	By	Chkd
	01/05/2014	Remediation Report Issue	TI	AK

1:200

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Project: 915.11 Crown Hotel Sydney

Title: Basement Level 2

Stage 1C Crown Extents

Remediation Report Issue

Scale @A1: 1:200
Scale @A3: 1:400

Drawing and CAD File Number: 00915-11-SK-1061D

Rev:

Key

Stage 1C(Remediation Action Plan) Extent

Issue	Date	Description	By	Chkd
	01/05/2014	Remediation Report Issue	TI	AK

1:200
5m 0 5m 10m 15m 20m

N

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Wilkinson Eyre. Architects

Project: 915.11 Crown Hotel Sydney

Title: Basement Level 1
Stage 1B Crown/ LL Extents Remediation Report Issue

Scale @A1: 1:200
Scale @A3: 1:400

Drawing and CAD File Number: 00915-11-SK-1061E

Rev:

Issue	Date	Description	By	Chkd
	01/05/2014	Remediation Report Issue	TI	AK

1:200 5m 0 5m 10m 15m 20m

N

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Project: 915.11 Crown Hotel Sydney

Title: Basement Level 1
Stage 1C Crown Extents
Remediation Report Issue

Scale @A1: 1:200
Scale @A3: 1:400

Drawing and CAD File Number: 00915-11-SK-1061F

Rev:

Key

Stage 1C(Remediation Action Plan) Extent

Licensed Dining Terraces Above

Issue	Date	Description	By	Chkd
	01/05/2014	Remediation Report Issue	TI	AK

1:200 — 5m 0 5m 10m 15m 20m

N

CROWN

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Project: 915.11 Crown Hotel Sydney

Title: Basement Level 1 - Mez
Stage 1C Crown Extents
Remediation Report Issue

Scale @A1: 1:200
Scale @A3: 1:400

Drawing and CAD File Number: 00915-11-SK-1061G

Rev:

Appendix D

Ex-Situ Remediation Works

1.0 Ex-Situ Remediation Works

1.1 Introduction

As described by **Section 8.0**, CIM has not been identified within the Site based on the previous intrusive investigations undertaken within the Site and it is considered unlikely that remediation will be required.

It is also noted that material excavated as part of the Stage 1C Basement may require treatment prior to disposal to landfill.

Section 21.6 present contingency actions that will be implemented in the event that:

- CIM requiring remediation is identified as an outcome of the validation of limited excavation works in Area A as detailed in **Section 16.4.1**; and/or
- treatment of excavated material as necessary to facilitate disposal to landfill.

This Appendix describes, in addition to the general excavation and materials management outlined in **Section 13.0** this section outlines the proposed additional controls that will be implemented to manage materials that require treatment at the Site as well as outlining the proposed treatment methodology.

1.2 Remediation Enclosure and Emissions Control System

It is proposed that ex-situ treatment of material excavated for construction of the intended Stage 1c Basement prior to disposal to landfill (if required) will be undertaken in an appropriately licenced off-site facility. In the unlikely event that on-site treatment is preferred, an on-site treatment facility (potentially including an RE and associated ECS, if required) will be established in a central location (approved by the Authority) and coordinated with the remediation works to be undertaken within the adjacent Block 4 (as described by the *VMP/Block 4 RAP* (AECOM, 2013a).

Operation of the RE (and ECS if required) would be in accordance with operation and maintenance management systems developed on completion of the final system design. An overview of the controls to be designed as part of the RE and ECS system is provided in **Section 1.4.3** below. Supporting infrastructure will be required for the proposed partial top down excavation methodology (refer to **Section 13.2** of the main report) potentially including an air circulation system to appropriately manage air quality within the basement excavation, and/or an ECS.

1.3 Ex-situ Stabilisation Trials

The following section describes bench scale trials that were undertaken for the purpose of assessing the suitability (or otherwise) of ex-situ stabilisation for treatment of gasworks related impacted material from the Barangaroo site.

1.3.1 Introduction

Enviropacific Services Pty Limited (EPS) conducted a series of Ex-situ Stabilisation Trials to assess the feasibility of treating the PAH and TPH impacted material from the Site to a standard which would facilitate either disposal to landfill or reuse at Headland Park. These works are detailed in the *Ex-situ Stabilisation Trials – DECC Declaration Area, Barangaroo* (Enviropacific Services, 2012).

The stabilisation trials were conducted on bulk soil samples obtained from test pits excavated in Blocks 4 and 5 and a coal tar collected from the Hickson Road tar tank (BH53) in February 2010. The test pits were excavated in areas identified by historic investigations as containing gasworks contamination.

Four types of material were targeted for the *Ex-situ Stabilisation Pilot Trial* based on field observations:

- Lightly impacted material (LI);
- Moderately impacted material (MI);
- Heavy impacted material (HI); and
- Coal tar material (CT).

The main contaminants of concern considered by the trial were PAH and TPH. PAH, including benzo(a)pyrene (BaP), and TPH are also the contaminants on which waste classification of the material is determined as per the *Waste Classification Guidelines* (DECCW, 2009).

1.3.2 Methodology

After collection, the bulk soil samples within each material type were composited, air-dried and mechanically mixed in order to achieve a homogeneous starting material for the stabilisation trials.

The laboratory analysis (total concentrations) indicated that all untreated material (LI, MI, HI and CT) would be classified as hazardous waste, according to the *Waste Classification Guidelines* (DECCW, 2009). This classification is based largely on exceedances of the specific contaminant concentration 2 (SCC 2) criteria of 23 mg/kg for BaP. The material types were identified as: LI = 29.6 mg/kg, MI = 70.6 mg/kg, HI = 234 mg/kg, CT = 194 mg/kg). The analytical results indicate that total BaP concentrations in the coal tar sample are lower than in the highly impacted material, which may be a result of the higher water content of the coal tar sample.

Leachate tests were also performed on the untreated soil samples. The leachate tests included:

- Toxicity Characteristic Leaching Procedure (TCLP);
- Australian Standard Leaching Procedure (ASLP); and
- Multiple Extraction Procedure (MEP).

The four material types were subjected to a range of treatment regimes. The treated samples were then subject to leachate testing (TCLP, ASLP and MEP) as well as being assessed for unconfined compressive strength (UCS).

1.3.3 Discussion of Results

The general effect of treatment on contaminant leachate concentrations (compared to untreated soil leachate concentrations) and UCS are summarised following:

- Addition of Portland cement (PC) - leachate contaminant concentrations either showed no reduction or an increase. The UCS showed an increase to > 1 MPa with 5% PC (LI, MI) and with 10% PC (HI);
- Addition of 10% fly-ash - no significant effect on leachate concentrations was reported. An UCS of 3.1 MPa was achieved with the addition of 10% PC (the UCS was not determined on the fly-ash alone treatment); and
- Addition of the chemical fixative, RemBind-FO[1] - a significant reduction in leachate contaminant concentrations was reported (5% RemBind-FO achieved an 80% reduction in ASLP concentrations and a 50% reduction in TCLP concentrations). The UCS of the RemBind-FO/PC blend was significantly lower than PC alone (HI material treated with 5% RemBind-FO 10% PC had a UCS of 0.4 MPa compared to a USC of 1.1 MPa for HI material treated with 10% PC alone).

The treatment trials indicated that the optimum pre-treatment with respect to leachate contaminant reduction would be the addition of 5% RemBind-FO. RemBind-FO treatment was only trialled on the HI material, however, a reduction in leachate concentrations would be expected similarly with the LI and MI material.

Conversely, the optimum pre-treatment for achieving the NSW EPA General Immobilisation Approval specification for UCS of greater than 1 MPa would be 5%PC for LI and MI materials and 10%PC for HI material.

1.3.4 Conclusions and Recommendations

Waste can be disposed of to a NSW EPA Licensed Landfill subject to classification of the material in accordance with the *Waste Classification Guidelines* (DECCW, 2009). Based on the SCC BaP criteria the material would be classified as Hazardous Waste, however, the NSW EPA General Immobilisation Approval # 2005/14 (IA) provides specific requirements for the stabilisation of coal tar contaminated soil for the purpose of disposal to an off-site NSW EPA licensed landfill facility.

The IA specifies that if the total concentrations are within specified criteria and a UCS of greater than 1 MPa is achieved, the treated soil can be assessed on TCLP leachability alone. Of the key contaminants of concern, the waste guidelines include a TCLP leachability criterion for BaP only. Based on the TCLP BaP concentrations

[1] RemBind-FO is a proprietary product developed by Ziltek Pty Ltd for the chemical fixation and stabilisation of hazardous waste.

(below the analytical detection limit for all material), the material (LI, MI, HI and CT) would be classified as General Solid Waste, providing the minimum UCS requirement is met. A UCS of greater than 1 MPa, could be achieved by the following treatments:

- Material classified as LI and MI: 5% cement;
- Material classified as HI: 10% cement; and
- Material classified as CT: 40% - 80% fly-ash, 10% cement.

As described above, the TCLP BaP concentrations were all reported below the laboratory LOR. Therefore, these treatments would also be expected to achieve the required leachate criteria prescribed by the *Waste Classification Guidelines* (DECCW, 2009).

The final fly-ash percentage for the treatment of coal tar impacted material will depend on the consistency of the material and the amount of fly-ash required to achieve a spadeable consistency. EPS anticipated that the UCS requirement for CT would likely be met with a 40% -50% fly-ash treatment.

1.4 Treatment Operations – Ex-situ Stabilisation

1.4.1 Background

The contingency actions described by **Section 20.6** include nomination of ex-situ stabilisation as the preferred remedial technologies for ex-situ treatment of material (including SPGWT / CIM) which requires treatment prior its offsite disposal (if required).

This section describes the methodologies to be employed for preparing and treating materials using ex situ stabilisation onsite (if required, refer to **Section 1.2**). Materials requiring treatment may also be treated at an offsite facility in accordance with applicable regulations and NSW EPA requirements.

1.4.2 Pre-Treatment of Materials

If onsite treatment works are conducted, pre-treatment works, if required, will be undertaken in two stages.

- Initially, the excavated material may be blended at the excavation face to make the material ‘spadeable’ (as detailed in **Section 13.8.3**); and
- Material requiring treatment will be transported to the RE, where further screening and testing of this material will take place.

The material will be stockpiled in the RE using a front end loader before undergoing secondary screening through a screen to achieve a grade of 40 mm minus. This is the minimum size requirement for material to feed into a pug mill. All screened overburden material will be set aside into type for potential crushing/recycling. The screening of the contaminated material will achieve a relatively homogenous feed material prior to being loaded into the feed hopper of the pug mill and minimise the quantity of material which requires treatment.

1.4.3 Remediation Enclosure and Emission Control System

As described by **Section 1.2**, ex-situ stabilisation equipment may be enclosed within a RE. The purpose of the RE is to control emissions during remediation treatment activities and ensure these emissions are vented to atmosphere through an ECS. Operation of the RE and associated ECS will be in accordance with operation and maintenance management systems developed on completion of the final design of the system. An overview of the controls to be designed into the system is provided below:

- The RE will be a clear span shed constructed of a steel frame with metal sheeting (or equivalent). The building will be sized to contain a screen and pugmill and have sufficient room for truck access, machinery and stockpiles. It will include doors, lights, electrical, adjustable louvers and other ancillary facilities that are required for safe and efficient operation.
- The building will contain approximately a 2-3 day working inventory of feed soil plus a sufficient buffer for soil curing and other pre-treatment activities. This inventory volume is designed to provide adequate storage capacity to feed the treatment plant during periods when unforeseen conditions interfere with normal excavation activities.

- ECS will consist of a ductwork system, induced draft fan, particulate control device, activated carbon adsorption system and stack. The ECS would be designed with sufficient capacity to provide a safe working environment within the RE.
- The final design of the RE will be developed prior to the start of the remediation works. The structure is likely to include a negative pressure working enclosure with an air-lock doorway and an air extraction system for the control of odours and diesel exhaust.
- The air exhausted from the RE will first pass through a particulate control device (bag-house or pleated paper filter system) to remove fugitive dust. The particulate control system will include a system to remove particulates from the filter media. Dust removed will be collected in enclosed drums or hoppers.
- After the exhaust gas exits the particulate filter, it will pass through an activated carbon adsorption system. The activated carbon system will be equipped with a number of monitoring ports. A monitoring protocol will be developed for the various ports along the activated carbon adsorption system. This protocol will form the basis for deciding when activated carbon beds need to be replaced. Air would be exhausted to the atmosphere via a stack.
- Emissions from the ECS stack will be required to be licensed as part of the EPL for the Barangaroo site (refer to **Section 12.1.2**).

1.4.4 Pug Mill Treatment Plant

Ex situ stabilisation is intended to be accomplished by using a pugmill fed by a loader/excavator. The nature and quantity of agents used for stabilisation was the subject of a stabilisation trial (refer to **Section 9.3**).

The pugmill mixing chamber and computer controlled weight cells will allow the complete mixing of the additives with the soil matrix. A pugmill has been selected in recognition that the NSW EPA prefers aggressive mixing techniques (such as a pugmill) because they provide for complete mixing of the materials.

Analytical results will be used to demonstrate that the treated material is suitable for disposal to an appropriately licensed off-site landfill (in accordance with the *Waste Classification Guidelines* (DECCW, 2009)).

Pug mill plants typically have a rated capacity of 600-1,000 tons per hour. This rate will vary depending on the physical properties of the soil, amount and type of additive, and the desired production rate.

The type of treatment plant will be based on the final design by the treatment contractor. Below is a description of the potential major components that may comprise a plant system.

Self-erecting Silo

The silo is filled pneumatically from bulk tankers. Additives such as cement, fly ash, lime and bentonite are blown into the silo.

The silo is equipped with a dust control system.

Material feed hopper

This hopper is fed with the soil(s) to be processed. It may be divided so as to accommodate two types of soil or aggregate. The hopper and may be fed one of three ways. First, a front-end loader can feed the hopper directly by building a ramp perpendicular to the hopper. Second, material may be conveyed into the hopper. Third, a screen can process directly into the hopper.

Twin shaft paddle pugmill

The pugmill is designed to achieve a violent mixing action throughout its length resulting in a well-mixed homogeneous product. This type of mixing, with no slump or low moisture products, is more effective than a drum type mixer that merely folds the product.

Hydrostatic cleated belt additive feeder

The additive is fed to the pugmill at the beginning of the mixing operation by means of the computer controlled cleated belt. Accuracies of better than plus/minus 2% of the design proportioning of the additive are achieved.

Water tank

The water requirement is determined by the mix design and the native water in the material to be mixed. Water is fed from an outside source into the plant's onboard water tanks. This water is fed at the design rate into the mixing chamber by two hydraulic pumps which are computer controlled.

Discharge belt

The mixed product is discharged from the pugmill on this conveyor belt. The finished product is continuously and cumulatively weighted on a Ramsey belt scale.

Gob Hopper

The gob hopper is utilized to interrupt the continuous flow of mixed material allowing trucks to enter and exit the loading area. If trucks are used to transport the mixed material away from the plant, the direction of travel of the trucks should be with the driver's side closest to the plant so that he/she may see the plant operator. The gob hopper maybe left open continuously so that a conveyor may be used to remove the finished product from the mixing plant.

Particulate Additive

Fine particulate additives such as cement, fly ash, lime and bentonite are pneumatically transferred from bulk tankers and stored in the self-erecting silo. If more than one type of additive is required, an optional self-erecting auxiliary silo may be set up next to the plant. The silos are equipped with negative pressure dust control systems, which filter and evacuate the pressurized air entering the silo. This process maintains constant silo pressure so as not to affect the consistency of the feeder.

Mixing Chamber

All ingredients enter simultaneously at the beginning of the mixing chamber allowing them maximum mixing time. The mixing chamber houses an interlaced twin shaft variable speed paddle pugmill designed to achieve a violent mixing action throughout its length resulting in a well-mixed homogeneous product. This type of mixing, with no slump or low moisture products, is greatly more effective and efficient than a drum type mixer that merely folds the product.

Control System

The Programmable Logic Controller and colour active matrix Operator Interface is directed by control software. Designed for harsh industrial environments, this versatile and reliable system has extensive self-diagnostics and is completely modular, making diagnosing and repairing problems as easy as plugging in a new module.

The software provides fully automated plant control and monitoring of all plant systems including engine, flow meters, sensors and switches. Displays indicate all flow rates, set points, feeder speeds, totals and status of all feeds and processes. All critical mechanical systems are monitored to alleviate damage and prevent down time. Inventory of fine particulate and admixture are computed and tracked.

1.4.5 Treated Soil

The RE will have a base capacity to stockpile between 2-3 days of treated soils from the pug mill. Treated materials stored in this area will undergo validation testing and classification to determine whether the treatment process has been effective. Materials that have not been treated to an acceptable level will be retreated.

Stockpiles would be then moved outside of the RE to a main stockpile area. Where required, stockpiles will be managed in accordance with the requirements of **Section 13.8.7**.