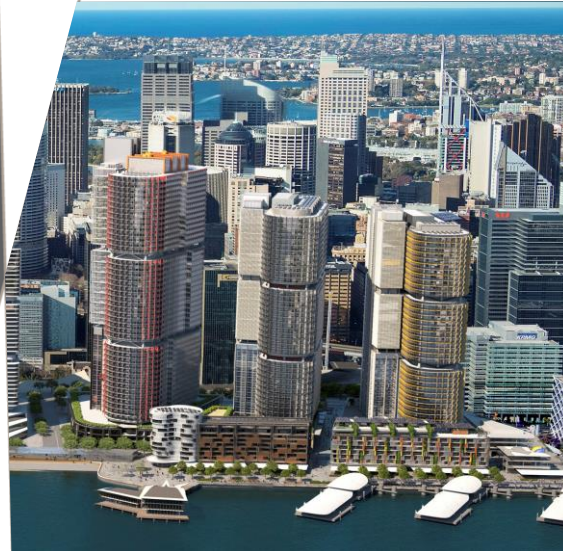


Barangaroo Central - Block 5 Remediation - Temporary Stormwater Drainage Diversion Works

NA50613044



Prepared for
Lend Lease (Millers Point) Pty Ltd

31 July 2014

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1 Introduction

This report supports a Development Application (SSD 6533-2014) prepared by Lend Lease pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act). The proposed works involve the remediation of part of NSW EPA Declared Remediation Site 21122 – specifically the portion of the EPA Declaration Area on Barangaroo Central (referred to as “Block 5”).

1.1 Site Location

Barangaroo is located on the north western edge of the Sydney Central Business District (CBD), bounded by Sydney Harbour to the west and north, the historic site of Millers Point (for the northern half), The Rocks and the Sydney Harbour Bridge approach to the east; and to the south by a range of new developments dominated by large CBD commercial tenants.

The Barangaroo site has been divided into three distinct redevelopment areas (from north to south) – Headland Park, Barangaroo Stage 2 (also known as Barangaroo Central) and Barangaroo South. The area of land within which diversion works are proposed generally includes the area highlighted in Figure 1-1 below, noted as Block 5, within Stage 2.

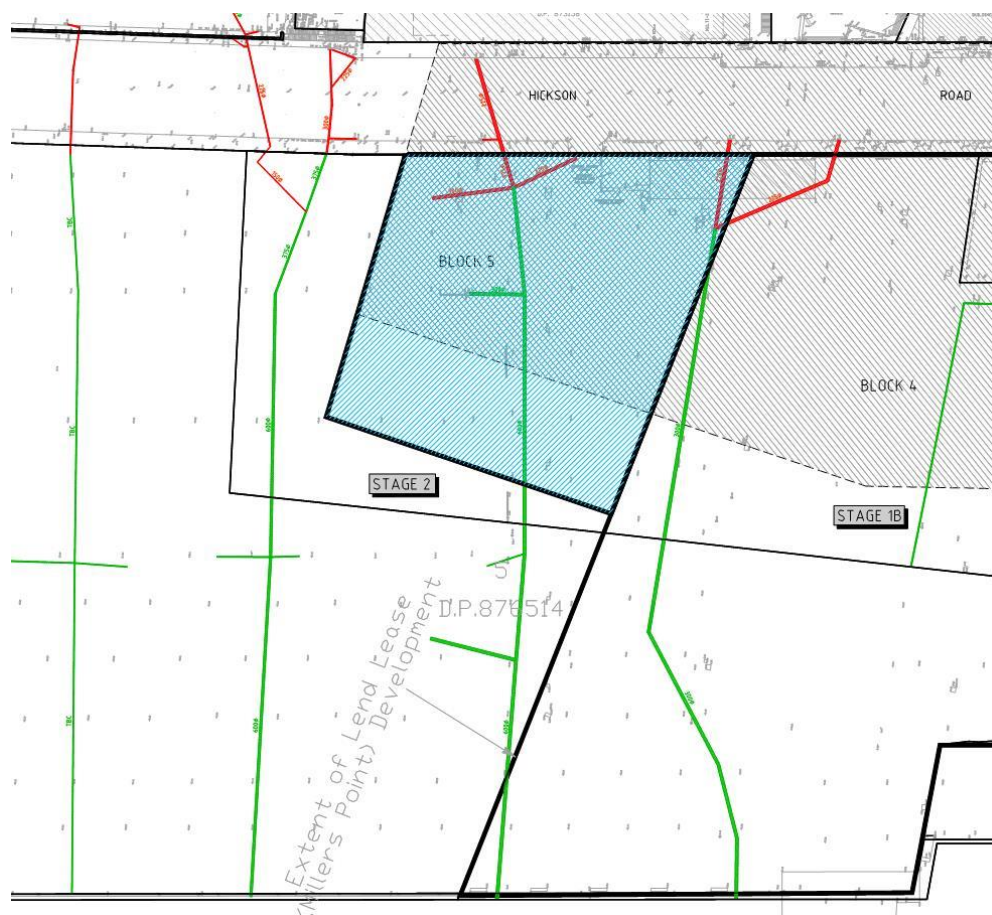


Figure 1-1 Locality Plan

2 Site Contamination

The contamination area and extent of remediation required is defined by the NSW EPA remediation area as presented in Appendix A. The remediation works will includes bulk excavation of contaminated materials, treatment and disposal.

The following Remedial Action Plan (RAP) has been approved in relation to the EPA Declaration Area;

- Remedial Action Plan, NSW EPA Declared Remediation Site 21122 and Block 4 (Stage 1b) Development Works, Barangaroo, Millers Point, NSW (AECOM, 24 July 2013) – prepared for the Declaration Area and Block 4 (Stage 1b).

To enable the Block 5 to be remediated, the existing stormwater drainage will need to be temporarily diverted around the remediation area.

3 Preferred Stormwater Diversion Options

Several temporary stormwater diversion options have been assessed to allow for the remediation works with the two preferred options presented in this report. The preferred options were determined from the following assessments:

- Existing Stormwater Drainage System;
- Upstream Catchment Analysis;
- Remediation Methodology.

3.1 Existing Stormwater Drainage System

There are three (3) stormwater pipes draining Hickson Road and other external catchments through the Barangaroo South site to Darling Harbour that are within the Block 5 area. These pipes are under the control of the City of Sydney Council and generally range from 300 dia to 600 dia. The drainage lines are described as follows:

- Northern pipeline: No conflict with contamination zone;
- Middle pipeline: Runs through the contamination zone (DECCW remediation area) and will need to be diverted;
- Southern pipeline: Will be diverted and decommissioned as part of Stage 1B works.

Studies conducted by Sydney Water indicate the drainage capacities of the drainage systems within the catchment to be in the order of between the 2 year ARI and 10 year ARI. Overland flows from the catchment collect in a number of low points along Hickson Road adjacent to The Bond Commercial and Residential buildings. Overland flow then tops the kerb on the western side of the road and flows through the site and into the harbour.

The existing drainage infrastructure is presented in **Appendix B**.

3.2 Upstream Catchment Areas

Based on interpretation of Area Laser Scan (ALS) data (as used by City of Sydney Council) and available survey data, the external catchment area draining to the Stage 1B and Block 5 development sites is approximately 5.28Ha. Details of the catchments are as follows:

- **Catchment A:** This catchment has a total contributing area of approximately 2.83Ha, which discharges into Gas Lane and Jenkins Street through a 750mm diameter pipe and then into an existing 1200mm diameter pipe which traverses the Stage 1B development site prior to ultimately discharging directly into Darling Harbour; and
- **Catchment B:** This catchment has a total contributing area of approximately 2.29Ha, which discharges into the existing Hickson Road in ground stormwater drainage network prior to ultimately discharging into Darling Harbour through a series of varying diameter pipes traversing the Stage 1B and Block 5 development sites.

The catchment layout is presented in **Appendix C**.

3.3 Stormwater Diversion Options

Options to divert existing stormwater drainage lines have been assessed to ensure there will be no detrimental impact on the operation of existing infrastructure as a result of the development. The temporary diversions have been assessed to generally comply with the following guidelines:

- a) Australian Rainfall and Runoff 2000;

- b) Maintain existing pipe network capacity; and
- c) Maintain existing 100 year ARI flood levels within Hickson Road.

The options discussed are based on a preliminary capacity assessment, current architectural information, information provided by service authorities and existing road levels for Hickson Road. The preferred options are described below:

3.3.1 Stormwater Diversion Option 1

The remediation works for option 1 may be undertaken in two stages being split between the northern and southern zones of the Block 5 site, or stormwater diversion may occur prior to excavation. This enables remediation works to commence prior or concurrently with temporary stormwater diversion works. The temporary stormwater diversion works include:

- The northern line will be extended to the south to incorporate the existing pits within Hickson Road and downpipes from the adjacent buildings that currently drain to the middle pipeline. The extension will incorporate a 600mm dia pipe;
- If excavation is commenced prior to stormwater diversion, it may be undertaken in stages, commencing south of the middle pipeline. If diversion is completed prior to excavation, staging will be undertaken as required to facilitate excavation;
- The middle pipeline will be removed and an existing on-grade pit within Hickson road will also be removed;
- On removal of the middle pipeline that part of the site can be remediated. Hickson Road stormwater would be discharged via the northern pipeline; and
- The southern pipeline will be diverted and removed as part of Stage 1b remediation works.

Stormwater Diversion Option 1 is presented in **Appendix D**.

3.3.2 Stormwater Diversion Option 2

The remediation works for Option 2 may be undertaken in two stages being split between the northern and southern zones of the Block 5 site. This enables remediation works to commence prior or concurrently with temporary stormwater diversion works. The temporary stormwater diversion works include:

- The northern pipeline will remain in its current configuration with no alterations;
- If excavation is commenced prior to stormwater diversion, it may be undertaken in stages, commencing south of the middle pipeline. If diversion is completed prior to excavation, staging will be undertaken as required to facilitate excavation;
- On completion of the southern remediation works a new pipeline diversion will be constructed from Hickson Road, through the newly remediated zone, and connect to the existing middle pipeline downstream of the remediation zone;
- On completion of the new stormwater pipe the middle pipeline within the remediation area can be demolished and the remainder of the site can be remediated;
- The southern pipeline will be diverted and removed as part of Stage 1b remediation works; and
- The new temporary diversion pipeline will eventually be removed as part of the Stage 2 development.

Stormwater Diversion Option 1 is presented in **Appendix E**.

3.3.3 Flood Modelling

The existing and proposed temporary stormwater deviation flood behaviour and performance of the proposed temporary piped stormwater diversion systems were assessed by carrying out the following analysis:

1. 2D flood modelling using TUFLOW to analyse the existing condition overland flow paths and flow depths at Hickson Road;
2. DRAINS modelling to analyse the performance of the proposed temporary drainage pipe systems; and
3. 2D flood modelling using TUFLOW to analyse the proposed temporary development condition flow paths and flood depths at Hickson Road.

The 2D and DRAINS modelling was completed for the 100 year ARI event for existing, temporary and permanent conditions.

The results show that when the 100 year ARI existing condition is compared to the 100 year ARI proposed temporary development condition:

- Existing flood levels are maintained.

Advantages and disadvantages of the options are presented in Table 3-1 below:

Table 3-1: Stormwater Diversion Options Advantage and Disadvantages

OPTION	ADVANTAGES	DISADVANTAGES
Option 1	- Combines and utilises existing infrastructure to the north of Block 5. - Remediation and stormwater works are de-coupled. - Removes all drainage from remediated area. - Reduction in anticipated construction costs. - Increase flexibility for future Block 5 development works.	- Minor reduction in drainage capacity to Hickson Road from two (2) outlets to one (1). - New works within the remediation area in Hickson Road. - Increased work within Hickson Road including associated traffic management.
Option 2	- Reduces extent of works in Hickson Road.	- Results in drainage within Block 5 that will require relocation for future development. - New works within the remediation area in Hickson Road. - Anticipated cost of construction. - Timing and coordination issues with decommission and construction of new pipeline and remediation. - Risk of stormwater diversion works delaying remediation programme

4 Conclusion

This report supports a Development Application (SSD 6533-2014) prepared by Lend Lease pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act). The proposed works involve the remediation of part of NSW EPA Declared Remediation Site 21122 – specifically the portion of the EPA Declaration Area on Barangaroo Central (referred to as “Block 5”).

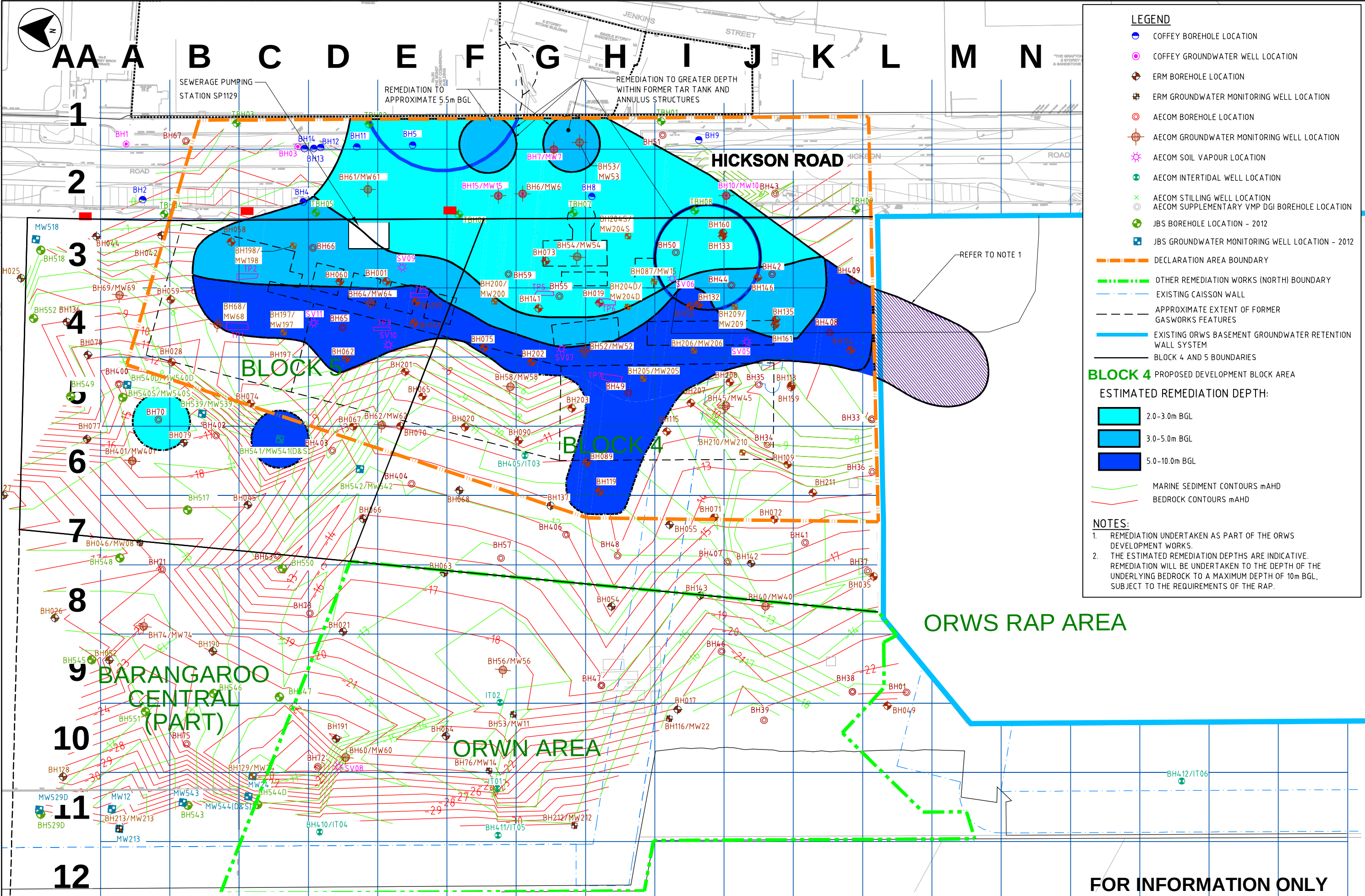
This report concludes that effective stormwater drainage diversions can be achieved in accordance with current engineering best practice to maintain the capacity of the existing stormwater drainage network within the vicinity of the remediation area. Based on these findings and the concept designs, there are no significant civil engineering factors that would preclude drainage adjustments within Block 5 and along Hickson Road to facilitate remediation of Block 5.

Depending on staging requirements, either option 1 or 2 can be implemented to allow the remediation of the subject site.

Barangaroo Central – Block 5
Remediation

APPENDIX A
EXTENT OF REMEDIATION PREPARED
BY AECOM

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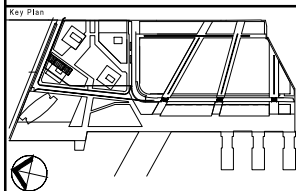
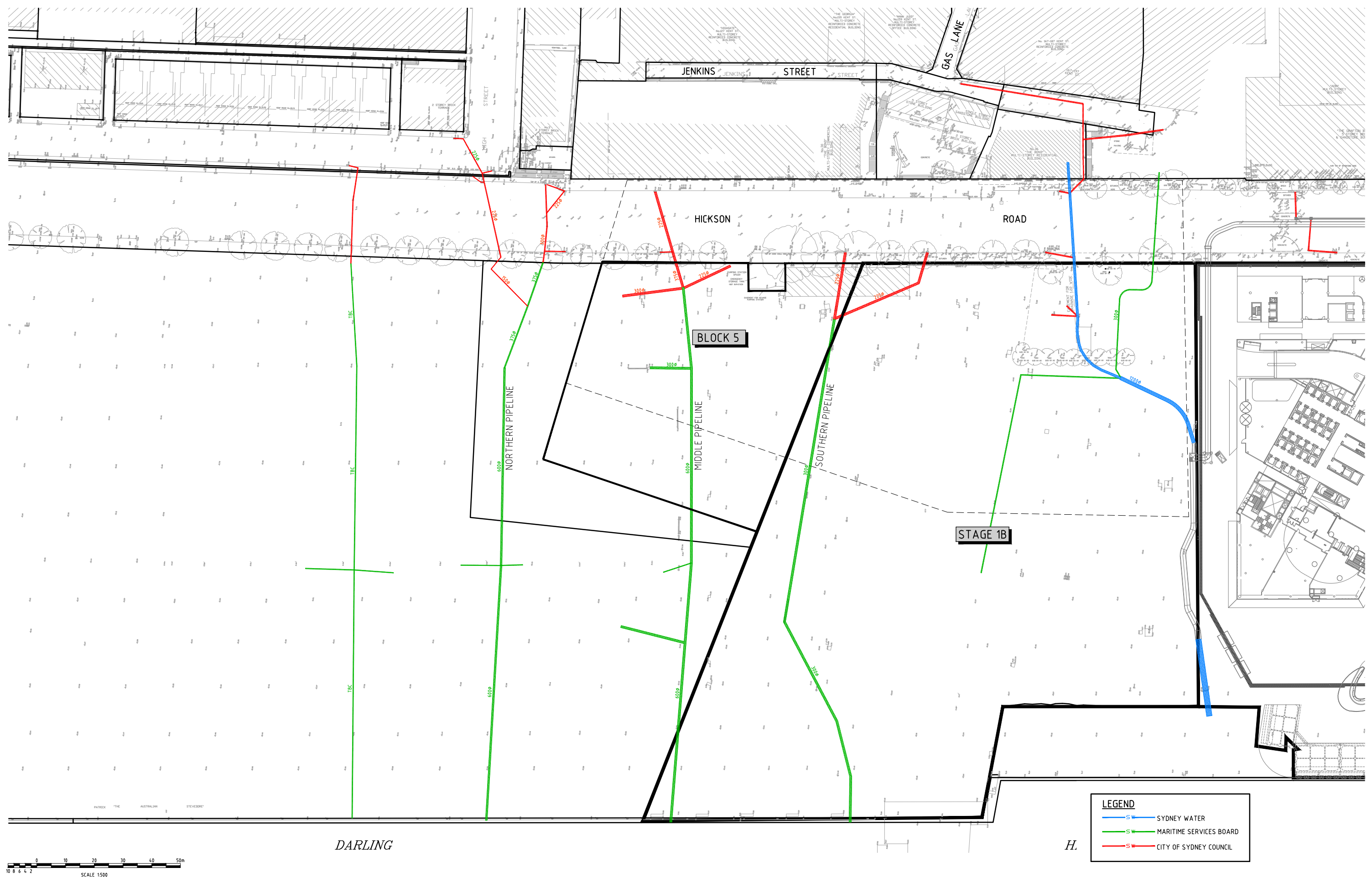


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Barangaroo Central – Block 5
Remediation

APPENDIX B

EXISTING STORMWATER DRAINAGE INFRASTRUCTURE

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Barangaroo Central – Block 5
Remediation

APPENDIX C

UPSTREAM CATCHMENT LAYOUT



STORMWATER DRAINAGE SUMMARY			
CATCHMENT No.	FLOW (100yr ARI) (m ³ /s)	AREA (ha)	DESCRIPTION
Ⓐ	Q ₁₀₀ = 2.35	2.83	CATCHMENT DISCHARGES INTO GAS LANE THROUGH A Ø600 PIPE, THEN INTO AN EXISTING Ø1200 PIPE THROUGH THE STAGE 1B DEVELOPMENT SITE DIRECTLY INTO DARLING HARBOUR. OVERLAND FLOW SPLITS AT THE INTERSECTION OF GAS LANE AND JENKINS STREET AND DISCHARGES INTO HICKSON ROAD DRAINAGE.
Ⓑ	Q ₁₀₀ = 1.69	2.29	CATCHMENT DISCHARGES INTO HICKSON ROAD DRAINAGE AND THEN DRAINS TO EXISTING STORMWATER SYSTEM, THROUGH THE STAGE 1B DEVELOPMENT SITE.
Ⓒ	Q ₁₀₀ = 0.2	0.16	CATCHMENT DISCHARGES INTO HICKSON ROAD DRAINAGE, THEN DRAINS TO EXISTING STORMWATER SYSTEM THROUGH THE STAGE 1B DEVELOPMENT SITE.

CATCHMENT Ⓐ

CATCHMENT Ⓑ

CATCHMENT Ⓒ

APPROXIMATE OVERLAND FLOW PATH

JENKINS STREET

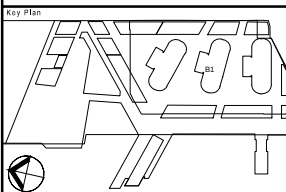
STREET

NAPLOEON STREET

HICKSON ROAD

KENT STREET

STREET



Rev.	Rev. Description	Date
01	ISSUED FOR INFORMATION ONLY	28.11.17

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Consultant	

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Design	Land Lease
30 The Bond 30 Hickson Road Mills Point NSW 2000	www.landlease.com

MP

BARANGAROO SOUTH

STAGE 1B EXTERNAL CATCHMENT PLAN				
Drawn By	Designed	Checked	Approved By	Date
AE	PL		MKH	
Scale	INFORMATION ONLY			
1:500				
Project No.	Site No.	Drawing No.	Revision	
161804	210079-SKC221		01	

Barangaroo Central – Block 5
Remediation

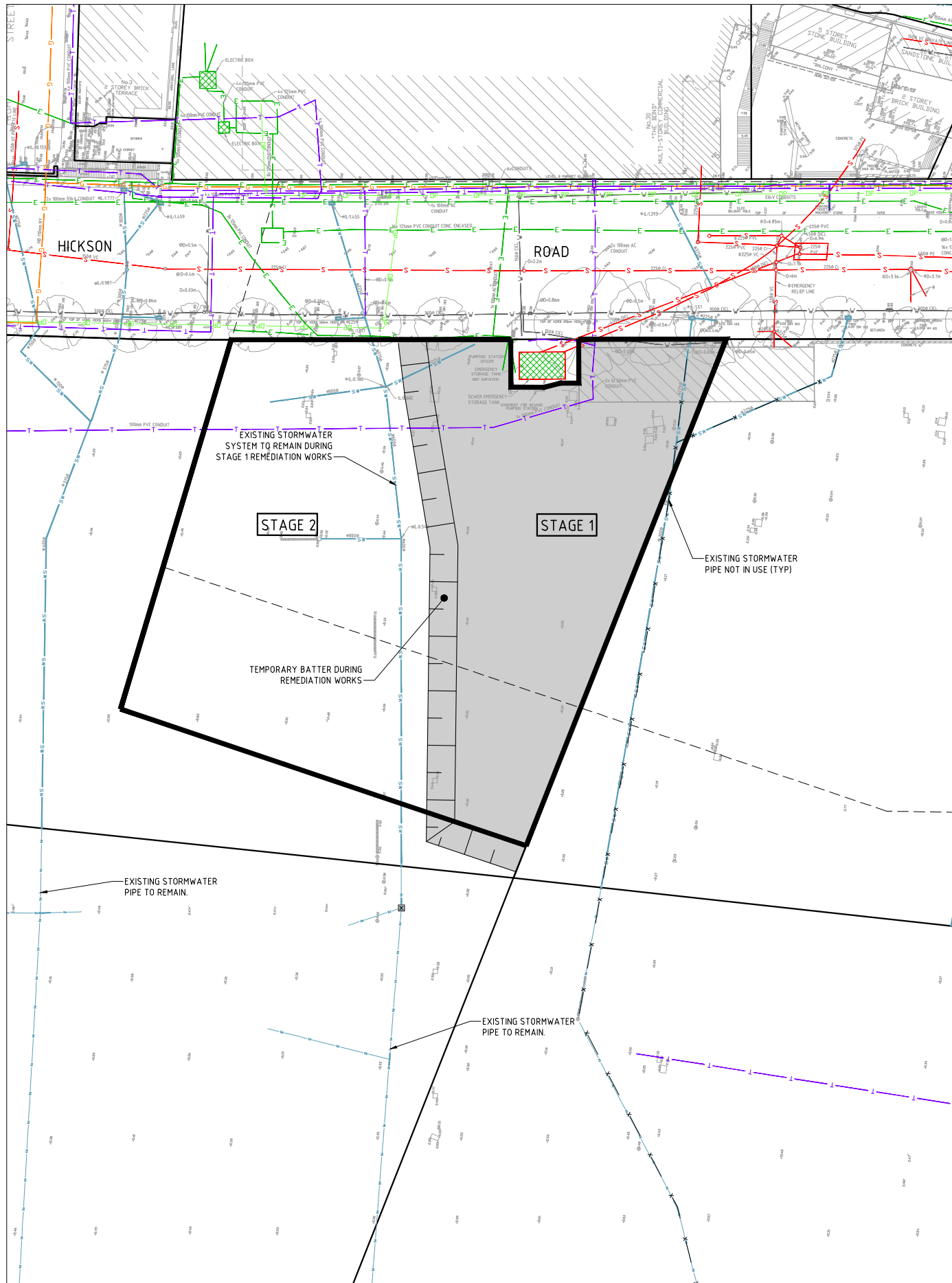
APPENDIX D

TEMPORARY STORMWATER DIVISION PLAN – OPTION 1

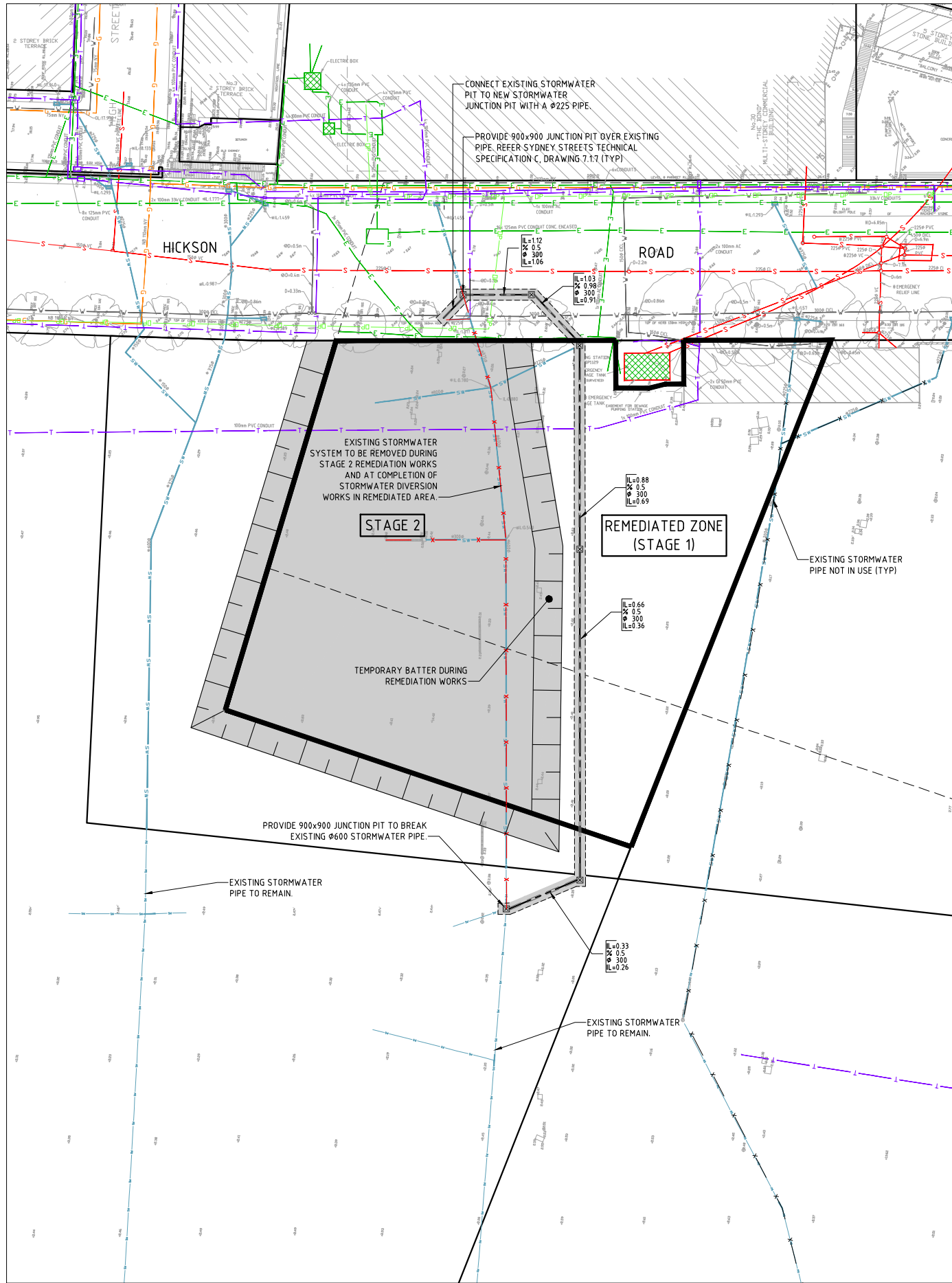
Barangaroo Central – Block 5
Remediation

APPENDIX E

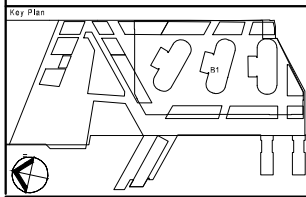
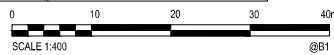
TEMPORARY STORMWATER DIVISION PLAN – OPTION 2



REMEDATION STAGE 1



REMEDATION STAGE 2



Rev.	Item	Revision Description	Date	Rev.	Item	Revision Description	Date
3	ISSUED FOR INFORMATION ONLY		21.05.14				
2	ISSUED FOR INFORMATION ONLY		15.05.14				
1	ISSUED FOR INFORMATION ONLY		13.05.14				

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Collaborating Architect Land Lease Graham W Jones Principal Architect FRAAS NSW ARB 4005 ABN 97 000 098 182	Consultant Land Lease 30 The Bend 30 Hickson Road Hickson Point NSW 2002 www.landlease.com	Drawn By MP Designed MV Checked MKH Approved By MKH Date MAY14	Scale AS SHOWN FOR INFORMATION ONLY
Project No. 161939		Site No. NA50613044 - SK003	Revision 03