

RNA DEVELOPMENT APPLICATION (DA) - COMMERCIAL

DEVELOPMENT OF SITE 2.04 &

MONGOLIAN RESTAURANT SITE

Traffic Engineering Report

PLANS AND DOCUMENTS
referred to in the PDA APPROVAL

10 SEP 2013

MEDQ

Date: 9/03/12

Prepared for: Lend Lease

Reference: 12BRT0003

TTM Consulting (Qld) Pty Ltd

ABN 65 010 868 621

**Brisbane | Gold Coast | Sunshine Coast
Melbourne | Sydney | Singapore**

PO Box 1310
Coorparoo BC 4151
129 Logan Road, Woolloongabba

t (07) 3327 9500
f (07) 3327 9501
ttmbris@ttmgroup.com.au
www.ttmgroup.com.au

© 2012 - TTM Consulting (Qld) Pty Ltd

ABN 65 010 868 621

Level 1/129 Logan Road, Woolloongabba

PO Box 1310 Coorparoo BC QLD 4151

T: (07) 3327 9500 F: (07) 3327 9501 E: ttmbri@ttmgroup.com.au

Document Status

Rev No.	Author	Reviewed / Approved		Description	Date
		Name	Signature		
1	Andrew Riddles	Brian Camilleri	BC	Final Submission	17/02/12
2	Andrew Riddles	Brian Camilleri	BC	Revised Final Submission	09/03/12

Table of Contents

1.	Introduction	1
1.1	Background	1
1.2	Site Location	1
2.	The Proposed Development	3
2.1	Development Details	3
2.2	Vehicular Access	3
3.	Car Parking Arrangements	4
3.1	Car Parking Requirement	4
3.2	Proposed Car Park Design	4
4.	Site Access Arrangements	5
4.1	Access Design & Location	5
5.	Service Vehicle Arrangements	6
5.1	Service Vehicle Bays	6
5.2	Refuse Collection	6
6.	Other Road Users	7
6.1	Bicycle Parking	7
6.2	PWD Access	7
7.	Summary & Conclusions	8
7.1	Development Access	8
7.2	Car Parking Arrangements	8
7.3	Service Vehicle Arrangements	8
7.4	Bicycle Facilities	8
7.5	Conclusions	8

Table Index

Table 2.1	Development Schedule	3
Table 3.1:	Car Park Design Criteria	4
Table 6.1:	Bicycle Parking Requirement	7

Figure Index

Figure 1.1: Site Location

2

Appendices

A Development Layout

1. Introduction

1.1 Background

TTM has been engaged by Lend Lease to provide information to support an Urban Development Area Development Application under the *Urban Land Development Authority Act 2007*, to establish the framework for a mixed used development comprising commercial office and retail/office uses. Specifically, the Development Application is for the purpose of a Development Permit for a Material Change of Use for Office, Business, Shop, Food Premises and Utility Installation uses and a Development Permit for Building Works (other than under the *Building Act 1975*). The Development Application has been lodged under the Bowen Hills Development Scheme 2009 – 1 April 2010 amendment.

The scope of this report, which forms part of a Development Application, includes an assessment of the following traffic aspects of the development:

- ▶ Parking supply;
- ▶ Access design and location;
- ▶ Service vehicle arrangements;
- ▶ Bicycle facilities.

The report has been prepared in accordance with the approved Master plan for the RNA Redevelopment and relevant standards such as 'AS2890.1:2001 Parking Facilities: Part 1 – Off-Street Parking'.

1.2 Site Location

The site is described as Site 2.04 and includes the Mongolian Restaurant site. The site is located in the south-east corner of the RNA as shown in Figure 1.1.

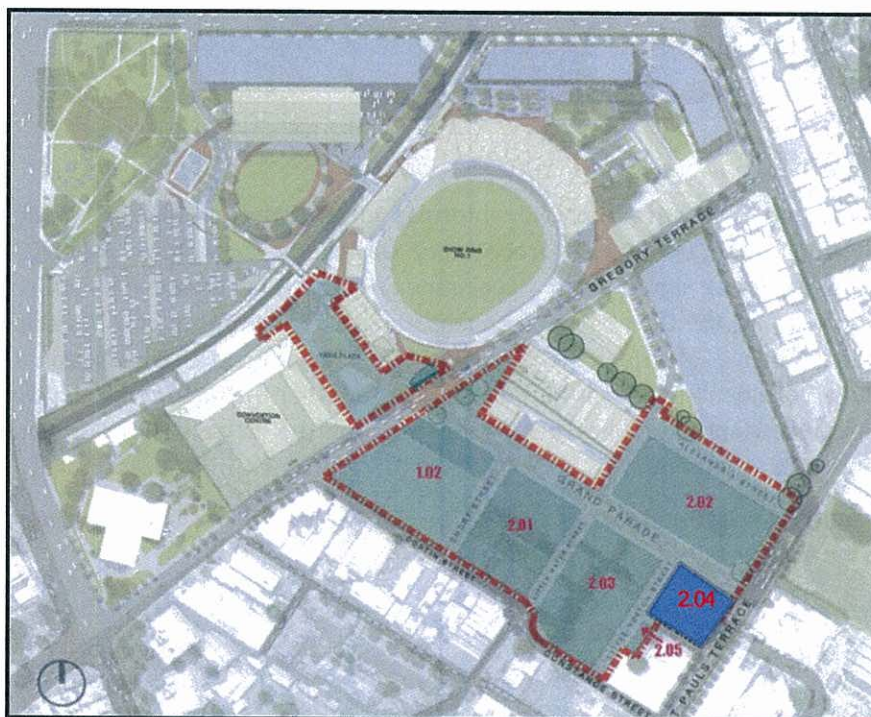


Figure 1.1: Site Location

2. The Proposed Development

2.1 Development Details

The development schedule for the site is shown in Table 2.1. The proposed ground plane is shown in Appendix A.

Table 2.1 Development Schedule

Maximum GFA	Site 2.04	Mongolian	Total
Office	23,240m ²	520m ²	
Retail	1000m ²		
Total	24,240m ²	520m ²	24,760m ²

2.2 Vehicular Access

Vehicular access/egress to the car park facility and the loading dock will be located on Symes Street, which will be extended as part of the redevelopment of the RNA.

3. Car Parking Arrangements

3.1 Car Parking Requirement

The approved Master plan requires a '*maximum*' parking rate of 1 space per 100m² of GFA (Gross Floor Area) for commercial development within the RNA. This equates to a maximum parking requirement of 238 spaces.

3.2 Proposed Car Park Design

'Australian Standard AS2890.1:2004' is adopted as a reference for car parking design. The key design parameters in accordance with 'AS 2890.1' for a Class 1A car parking facility are set out in Table 3.1 below.

Table 3.1: Car Park Design Criteria

Criteria	Minimum Required
Car Parking Spaces: Class 1A	2.4m x 5.4m
Small Car Parking Spaces	2.3m x 5.0m
Parking Aisle: Class 1A	5.8m
Ramp Grades	1:4 (up to 20m) or 1:5 (over 20m) (Maximum)

The design criteria shown in Table 3.1 .

4. Site Access Arrangements

4.1 Access Design & Location

Location

A driveway is to be provided on Symes Street, which is a minor road, to facilitate vehicular access/egress to the car park and the service vehicle loading area.

Inspection of 'AS2890.1:2004 Parking Facilities: Part 1 – Off-Street Parking' confirms that the driveway location accords with Australian Standards, which stipulates that driveways should be not located within 6.0m of the tangent point of the corner kerb radii at the adjacent intersections. The development plan complies with this requirement.

The design and location of the driveways are acceptable in terms of providing safe and efficient access to the site.

Access Design

'Australian Standard AS2890.1:2004' specifies that a Category 2 driveway (with a width of between 6.0m and 9.0m) is required to facilitate vehicular access from a local road to a Class 1/1A car park facility with a capacity of between 101 and 300 spaces. The proposed car park access satisfies this requirement.

The service vehicle access has been designed to the minimum width to accommodate service vehicle manoeuvres in / out of the site.

5. Service Vehicle Arrangements

5.1 Service Vehicle Bays

The service vehicle facility needs to accommodate the demands generated by the development.

As illustrated on the development plans included in Appendix A, it is proposed that 1 Medium Rigid Vehicle (MRV) bay and 2 Small Rigid Vehicle (SRV) bays. An additional 3 courier bays within also be located in basement level 1 car park.

5.2 Refuse Collection

The refuse collection function will need take place outside office opening hours when the remainder to dock is not in use. Hence the refuse collection vehicle (RCV) will be able to utilise the full extent of the dock.

It is considered that the layout of the loading dock in terms of the position of service bays will be further explored at the detailed design stage in order to ensure the satisfactory servicing of the development.

6. Other Road Users

6.1 Bicycle Parking

The minimum bicycle requirement in accordance with the RNA Redevelopment approval is set out in Table 6.1 below.

Table 6.1: Bicycle Parking Requirement

Allocation	Requirement	Area	Spaces Required
Employee	1 secure space per 200m ² of NLA	24,760 ²	124
Visitors	1 space per 1,000m ² of NLA	24,760m ²	25
Total			149

6.2 PWD Access

The detailed design of the development and its internal transport infrastructure will ensure that the completed development is fully inclusive and meets the needs of all users, including those with disabilities or temporary mobility impairments.

The requirement to design for disabled people will permeate all aspects of the design process and will include access to and movement within the site, but also the interface between the development and the surrounding road network, and in particular the pedestrian routes and public transport facilities.

As such the proposed development will be designed in accordance with relevant standards and will include measures to assist disabled people including the following: dropped kerbs; tactile paving; and ramps and handrails, where appropriate.

7. Summary & Conclusions

7.1 Development Access

The design and location of the driveways on Symes Street are considered acceptable in terms of providing safe and efficient access to the site.

7.2 Car Parking Arrangements

The maximum requirement in accordance with the Master plan approval is 238 spaces.

The minimum design requirements specified in 'AS2890.1:2004' for Class 1A car park facilities is to be adopted.

7.3 Service Vehicle Arrangements

The proposed service vehicle facilities are considered acceptable to service the demands of the development.

7.4 Bicycle Facilities

The minimum bicycle parking requirement is 149 bicycle spaces.

7.5 Conclusions

Based on the traffic engineering aspects of the proposal it is TTM's conclusion that this development should be granted the necessary approvals.

Appendix A

DEVELOPMENT LAYOUT

RNA Development Application Development of Site 2.04 and Mongolian Restaurant Site

Flooding Report

Project Number: A10697/016

PLANS AND DOCUMENTS
referred to in the PDA APPROVAL

10 SEP 2013

MEDQ

Prepared for Lend Lease

9 March 2012

Cardno (Qld) Pty Ltd
ABN 57 051 074 992

Level 11 Green Square North Tower
515 St Paul's Terrace
Fortitude Valley Qld 4006
Locked Bag 4006 Fortitude Valley
Queensland 4006 Australia

Telephone: 07 3369 9822
Facsimile: 07 3369 9722
International: +61 7 3369 9822

cardno@cardno.com.au
www.cardno.com.au



Document Control:					
Version	Date	Author		Reviewer	
		Name	Initials	Name	Initials
1	10 February 2012	Chris Smith	CS	Martin Giles	MG
2	16 February 2012	Chris Smith	CS	Martin Giles	MG
3	9 March 2012	Chris Smith	CS	Martin Giles	mg

"© 2012 Cardno All Rights Reserved. Copyright in the whole and every part of this document belongs to Cardno and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person without the prior written consent of Cardno."

TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	Background	1
1.2	Subject Site	2
2	EXISTING SITUATION.....	3
3	DEVELOPED CASE.....	5
3.1	Modelling	5
4	RECOMMENDATIONS	9
5	CONCLUSION	11

TABLES:

Table 1	Peak Water Levels and Peak Flows – Existing Case	3
Table 2	Peak Water Levels and Peak Flows – Developed Case	5
Table 3	TUFLOW Model Results – Afflux.....	7
Table 4	Minimum Development Standards.....	9

FIGURES:

Figure 1	Locality Plan
Figure 2	Modelling Points
Figure 3	Minimum Development Levels

APPENDICES:

Appendix A	TUFLOW Model Results
Appendix B	Development Plan

1 INTRODUCTION

1.1 Background

The RNA exhibition grounds at Bowen Hills are to be redeveloped. The location of the site is shown in Figure 1. The total area of the site is approximately 22 hectares.

The eastern half of the site is located in an overland flow path and as such the development of the site must allow for the conveyance of existing flow without adverse impacts to neighbouring properties.

According to the Brisbane City Council *Subdivision and Development Guidelines* (2008), the design events applicable to the site are:

- Minor Event 10 Year ARI
- Major Event 50 Year ARI

As part of Master Planning for the site, a detailed flooding investigation was undertaken to confirm the extent of flooding of the site that occurs at present and to develop a drainage solution that will allow development to proceed without adversely impacting on upstream or downstream areas. The report was approved as part of the Masterplan Approval dated 30 November 2011, which provides a framework for future development to be assessed against.

To model the flow through the site, and quantify the impacts of the development, a combined one-dimensional/two-dimensional TUFLOW model was setup of the study area.

Based on consultation undertaken with Council, the drainage solution developed for the site allows a non-worsening compared to the existing situation. In practice, this involves:

- no increase in water level at Water Street (upstream boundary of site);
- no increase in peak flow discharged across St Pauls Terrace;
- no increase in peak flood depth across St Pauls Terrace; and
- no increase in level in Gregory Terrace.

In addition to the need to achieve a non-worsening outcome, consideration was also given to the ability to provide a solution that will allow future relief drainage works to occur. Council has identified the need to complete relief drainage works in the Water Street catchment (which contains the RNA site). The proposed works for the catchment are defined in the report completed for Council by the Tod Group titled *Brisbane City Council, Water-Campbell Streets Catchment, Relief Drainage Investigation, Final Report* (circa 1997). The works include the construction of additional stormwater drainage works to improve flooding for minor events.

As part of the solution developed for the RNA site, the proposed drainage works were sized to achieve the same reduction in flood level for minor events at the upstream end of the site (i.e. in Water Street) as nominated in the Tod Group report.

The modelling completed in support of the original Master Plan application has been refined over time as part of the overall planning process for the site. The most recent version of the modelling is reported in the publication *RNA Redevelopment Flooding and Drainage Report - Stage 2 Compliance A* (Cardno, 31 January 2012) that was submitted to the Urban Land Development Authority in support of the Stage 2 Compliance A application. In addition to considering the 10 and 50 year events, the 100 year event was also modelled as a sensitivity case to confirm that the proposed solution would function acceptably for events in excess of the major design event.

The modelling reported in the January 2012 report was used as the basis of the modelling completed with respect to the subject site. To avoid unnecessary duplication, only those modelling aspects relevant to the site are discussed in this report.

1.2 Subject Site

The site is bounded by St Pauls Terrace (existing), Symes Street (existing), Little Sutton Street (future) and Grand Parade (future) (refer Figure 1).

The development plans for the site are provided in Appendix B.

Cardno has been engaged by Lend Lease to provide information to support an Urban Development Area Development Application under the Urban Land Development Authority Act 2007, to establish the framework for a mixed used development comprising commercial office and retail/office uses. Specifically, the Development Application is for the purpose of a Development Permit for a Material Change of Use for Office, Business, Shop, Food Premises and Utility Installation uses and a Development Permit for Building Works (other than under the Building Act 1975). The Development Application has been lodged under the Bowen Hills Development Scheme 2009 – 1 April 2010 amendment.

The supporting information provided in this report relates to flood level advice in relation to the development and the minimum flood levels applicable to the building.

This report presents the results of the flood modelling undertaken and the resultant flood levels obtained.

2 EXISTING SITUATION

The same methodology as outlined in Section 3 and Section 4 of Cardno's *RNA Flooding and Drainage Report – Stage 2 Compliance A* (31 January 2012, as submitted to the Urban Land Development Authority) has been used to undertake further detailed assessment to determine the existing and developed case flooding conditions around the site.

The TUFLOW model described in the January 2012 report was used to determine the 10, 50 and 100 year flood levels in the vicinity of the subject site.

The hydrology of the model was adjusted to provide a greater level of definition in the vicinity of the site, specifically the area draining to Symes Street.

The existing case was run for the 10, 50 and 100 year ARI 20, 30, 60 and 90 minute storm events. The combined resultant 100 year ARI peak depths from the three storms events are shown in Appendix A.

Points around the site area were selected (refer to Figure 2) so that the peak water levels, flows and velocities for the existing and developed cases could be easily compared. The resultant water levels and flows at each point are shown in Table 1. The points of interest bolded below are in close proximity to the site.

Table 1 Peak Water Levels and Peak Flows – Existing Case

Point of Interest	Location	Peak Flood Levels (mAHD)		
		10 Year Event	50 Year Event	100 Year Event
A	Corner of Royal and Quarry St	20.113	20.197	20.239
B	Intersection of Kennigo St and Water St	16.630	16.757	16.783
C	Brunswick St	14.334	14.454	14.516
D	Upstream of where Baxter St intersects with Water St	10.990	11.175	11.244
E	Upstream of where Costin St intersects with Water St	8.435	8.682	8.770
F	Intersection of Water of Constance St/ Costin St	8.317	8.591	8.714
G	Corner of Water and Costin St within the site boundary	8.315	8.553	8.655
H	Downstream of corner of Water and Costin St	7.774	7.905	7.963
I	Downstream of Agricultural Pavilion	7.430	7.434	7.430
J	Corner of Water & Grand Pde	6.702	6.778	6.878
K	Corner of Little Water Street and Alexandria St	6.459	6.779	6.879
L	Upstream of Corner of Alexandria & Water St	6.576	6.809	6.893

Point of Interest	Location	Peak Flood Levels (mAHD)		
		10 Year Event	50 Year Event	100 Year Event
M	Proposed Park Area	7.030	7.025	7.026
N	Intersection of Gregory Tce and current Alexandria St	6.654	6.781	6.884
O	Railway Underpass west of main oval	7.428	7.554	7.608
P	Corner of current Alexandria & St Pauls Tce	6.453	6.754	6.845
Q	St Pauls Tce	6.454	6.746	6.832
R	Downstream of the Railway Line East of the site	5.170	5.815	5.957
Point of Interest	Location	Flow Rates (m³/s)		
		10 Year Event	50 Year Event	100 Year Event
A	Corner of Royal and Quarry St	12.47	17.07	20.69
B	Intersection of Kennigo St and Water St	13.64	21.73	25.23
C	Brunswick St	9.24	17.57	22.96
D	Upstream of where Baxter St intersects with Water St	10.06	18.80	22.31
E	Upstream of where Costin St intersects with Water St	12.33	20.90	26.11
G	Corner of Water and Costin St within the site boundary	12.20	20.57	24.68
I	Downstream of Agricultural Pavilion	12.10	20.37	24.67
L	Upstream of Corner of Alexandria & Water St	0.75	1.17	1.80
N	Intersection of Gregory Tce and current Alexandria St	0.33	0.33	0.52
O	Railway Underpass west of main oval	1.12	1.53	1.72
Q	St Pauls Tce	2.53	11.23	14.86
R	Downstream of the Railway Line East of the site	0.26	5.91	10.28

3 DEVELOPED CASE

3.1 Modelling

The TUFLOW model of the developed site was used to determine the 10, 50 and 100 year flood levels in the vicinity of the subject site. It can be noted that the developed site considered for the analysis reflects the drainage and civil infrastructure associated with Stage 1 and Stage 2 of the development.

As was the case with the existing case, the developed case model hydrology was revised to provide greater detail with respect to the site, with it being assumed that half of the roof area of the building will drain to Symes Street.

As per the existing case, the developed case was run for the 10, 50 and 100 year ARI 20, 30, 60 and 90 minute storm events. The combined resultant 100 year ARI peak depths from the four storms events are shown in Appendix A.

Points around the site area were selected (refer to Figure 2) so that the peak water levels, flows and velocities for the existing and developed cases could be easily compared. These points match those adopted for the analysis of the existing case. The resultant water levels and flows at each point are listed in Table 2.

Table 2 Peak Water Levels and Peak Flows – Developed Case

Point of Interest	Location	Peak Flood Levels (mAHD)		
		10 Year Event	50 Year Event	100 Year Event
A	Corner of Royal and Quarry St	20.12	20.20	20.25
B	Intersection of Kennigo St and Water St	16.63	16.76	16.79
C	Brunswick St	14.34	14.47	14.52
D	Upstream of where Baxter St intersects with Water St	10.99	11.17	11.24
E	Upstream of where Costin St intersects with Water St	8.41	8.61	8.72
F	Intersection of Water of Constance St/ Costin St	8.21	8.35	8.69
G	Corner of Water and Costin St within the site boundary	8.12	8.40	8.73
H	Downstream of corner of Water and Costin St	-	-	-
I	Downstream of Agricultural Pavilion	-	8.20	8.40
J	Corner of Water & Grand Pde	-	-	-
K	Corner of Little Water Street and Alexandria St	-	6.75	6.88
L	Upstream of Corner of Alexandria & Water St	-	6.71	6.88
M	Proposed Park Area	-	7.02	7.02

Point of Interest	Location	Peak Flood Levels (mAHD)		
		10 Year Event	50 Year Event	100 Year Event
N	Intersection of Gregory Tce and current Alexandria St	-	6.71	6.88
O	Railway Underpass west of main oval	7.34	7.41	7.43
P	Corner of current Alexandria & St Pauls Tce	6.23	6.69	6.83
Q	St Pauls Tce	6.23	6.69	6.83
R	Downstream of the Railway Line East of the site	-	5.71	5.91
Point of Interest	Location	Flow Rates (m³/s)		
		10 Year Event	50 Year Event	100 Year Event
A	Corner of Royal and Quarry St	12.66	17.17	21.05
B	Intersection of Kennigo St and Water St	13.61	21.86	25.31
C	Brunswick St	9.49	17.13	22.14
D	Upstream of where Baxter St intersects with Water St	9.63	18.14	23.38
E	Upstream of where Costin St intersects with Water St	12.04	20.60	25.82
G	Corner of Water and Costin St within the site boundary	0.24	0.84	4.81
I	Downstream of Agricultural Pavilion	0.00	0.19	4.16
L	Upstream of Corner of Alexandria & Water St	0.00	0.27	0.61
N	Intersection of Gregory Tce and current Alexandria St	0.00	0.04	0.19
O	Railway Underpass west of main oval	0.44	0.65	0.73
Q	St Pauls Tce	0.68	8.88	14.28
R	Downstream of the Railway Line East of the site	0.00	3.77	8.85

A comparison of the above results to the existing conditions (as shown in Table 1) is shown in Table 3. The comparison indicates that the results obtained are acceptable. Further, the results confirm that the development will not have an adverse impact on adjoining properties.

Table 3 TUFLOW Model Results – Afflux

Point of Interest	Location	Change in Peak Flood Levels (mm)		
		10 Year Event	50 Year Event	100 Year Event
A	Corner of Royal and Quarry St	5	6	8
B	Intersection of Kennigo St and Water St	4	2	2
C	Brunswick St	8	20	1
D	Upstream of where Baxter St intersects with Water St	2	-3	-3
E	Upstream of where Costin St intersects with Water St	-23	-76	-54
F	Intersection of Water of Constance St/ Costin St	-112	-237	-25
G	Corner of Water and Costin St within the site boundary	-198	-151	74
H	Downstream of corner of Water and Costin St	-	-	-
I	Downstream of Agricultural Pavilion	-	-	-
J	Corner of Water & Grand Pde	-	-	-
K	Corner of Little Water Street and Alexandria St	-	-27	0
L	Upstream of Corner of Alexandria & Water St	-	-97	-14
M	Proposed Park Area	-	-2	-3
N	Intersection of Gregory Tce and current Alexandria St	-	-70	-6
O	Railway Underpass west of main oval	-88	-148	-177
P	Corner of current Alexandria & St Pauls Tce	-225	-64	-17
Q	St Pauls Tce	-226	-61	-6
R	Downstream of the Railway Line East of the site	-	-104	-45
Point of Interest	Location	Change in Flow Rates (m³/s)		
		10 Year Event	50 Year Event	100 Year Event
A	Corner of Royal and Quarry St	0.2	0.1	0.4
B	Intersection of Kennigo St and Water St	0.0	0.1	0.1
C	Brunswick St	0.2	-0.4	-0.8
D	Upstream of where Baxter St intersects with Water St	-0.4	-0.7	1.1
E	Upstream of where Costin St intersects with Water St	-0.3	-0.3	-0.3
G	Corner of Water and Costin St within the site boundary	-12.0	-19.7	-19.9
I	Downstream of Agricultural Pavilion	-	-20.2	-20.5
L	Upstream of Corner of Alexandria & Water St	-	-0.9	-1.2

Point of Interest	Location	Change in Flow Rates (m³/s)		
		10 Year Event	50 Year Event	100 Year Event
N	Intersection of Gregory Tce and current Alexandria St	-	-0.3	-0.3
O	Railway Underpass west of main oval	-0.7	-0.9	-1.0
Q	St Pauls Tce	-1.9	-2.3	-0.6
R	Downstream of the Railway Line East of the site	-	-2.1	-1.4

Note: Dash (-) denotes areas that were not inundated within the developed case.

4 RECOMMENDATIONS

The required minimum development levels specified for the RNA site by the Urban Land Development Authority (ULDA) refer to the criteria listed in Part A of Chapter 1 of the Brisbane City Council *Subdivision and Development Guidelines* (February 2008).

Subsequent to the January 2011 flood event, Brisbane City Council invoked the *Temporary Local Planning Instrument 01/11- Brisbane Interim Flood Response*. Although nominally relating to residential development, the planning instrument (TLPI) also contains provisions for commercial development. However, the TLPI is not applicable to the site. In addition to the fact that the site is under the jurisdiction of the ULDA rather than Council, the TLPI does not relate to sites (such as the RNA site) which are not affected by river or creek flooding.

Consequently, the minimum development levels applicable to the site are those nominated in the *Subdivision and Development Guidelines*, with other requirements in accordance with the *Building Code of Australia*.

It should be noted that at the time of preparing this report, the Flood Commission of Inquiry is yet to deliver its findings. The recommendations made by the inquiry may affect design standards for Brisbane. At this point, it is not possible to provide advice in relation to whether the design standard or required level of freeboard will change in the future. The minimum development levels presented in this report reflect the currently applicable guidelines and the approval issued for the site by the RNA.

The guidelines and the TLPI both define minimum development levels relative to the building classifications adopted in the Building Code of Australia. According to the guidelines, commercial uses are expected to involve Class 5 and Class 6 building classifications.

The minimum design standards applicable to the site are listed in Table 4.

Table 4 Minimum Development Standards

Type of Area	
Floors for Commercial (including retail) Purposes	50 Year Event (no additional freeboard)
Points of entry to basement car park (ramps, doors etc)	100 Year Event (no additional freeboard)
Substation (If not Community Infrastructure)	100 Year Event

Table 4 also lists the level required with respect to electrical substations and communications equipment.

Energex has released a document entitled *Flood Resilience for Substations* (30 September 2011, StdsA220) which takes account of the Temporary Local Planning Instrument that affects the Brisbane City area (even though the document itself is not applicable to the site).

Based on the TLPI, the Energex document notes that new indoor substations should be installed above the 100 year flood level or the prescribed DFL, whichever is higher.

The DFL is the Defined Flood Level for the Brisbane River. The RNA site drains to the Brisbane River at Newstead and to a point near the mouth of Breakfast Creek. The highest level reached in the January 2011 flood at these locations was 2.7 mAHD. The 100 year level defined for the Brisbane River is 2.5 mAHD, and is produced by storm surge in Moreton Bay. Both the 2011 level and 100 year Defined Flood Level are metres below the flood level produced by local catchment flooding and are therefore irrelevant to the floor level. Recourse is therefore required to the 100 year flood level produced by the local catchment for determining the appropriate level for the substation (as listed in Table 4).

It can be noted that the report considers the substation is not classified as being community infrastructure, for which a higher level of flood immunity is applicable.

Based on the flood immunity requirements nominated in Table 4, the minimum levels applicable to various parts of the ground floor are shown on Figure 3.

With reference to the levels shown on Figure 3, it can be concluded that the levels nominated for each part of the building satisfy the minimum development standards with respect to flooding.

5 CONCLUSION

Based on modelling completed in support of the redevelopment of the RNA site, Cardno was commissioned by Lend Lease Project Management and Construction (Australia) Pty Ltd to complete detailed modelling with respect to Site 2.04. The location of the site is shown on Figure 1, with development plans included as Appendix B.

The modelling determined that the development, consistent with the redevelopment as a whole, will not produce an adverse impact on adjoining properties and can therefore proceed.

Following a review of the model results and applicable requirements with respect to flood immunity, appropriate development levels were assigned to each area of the ground floor. Figure 3 shows the required flood levels and the adopted floor levels across the ground floor of the building. In all cases, adopted floor levels either match or are greater than the nominated minimum. In particular, a high point has been created on the ramp leading to the basement car park to ensure that the basement is immune to flooding in the 100 year event, thereby satisfying the requirements of the *Building Code of Australia*. It is therefore considered that the building complies with all applicable flood immunity requirements.

Figures

- Figure 1 Locality Plan
- Figure 2 Modelling Points
- Figure 3 Minimum Development Levels



Cardno (QLD) Pty Ltd | ABN 57 051 074 992
Level 11, North Tower, 515 St Pauls Terrace
Locked Bag 4006, Fortitude Valley QLD 4006
Tel. 07 3369 9822 Fax: 07 3369 9722

© 2011 Cardno (Qld) Pty Ltd All Rights Reserved. Copyright in the whole and every part of this document belongs to Cardno (Qld) Pty Ltd and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person without the prior written consent of Cardno (Qld) Pty Ltd.

This document is produced by Cardno (Qld) Pty Ltd solely for the benefit of and use by the client in accordance with the terms of the retainer. Cardno (Qld) Pty Ltd does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by any third party on the content of this document.

LEGEND

-  Subject Site
-  RNA Showgrounds



**Figure 1
Locality Plan**

Flooding Report

Scale: 1:4,500

45 0 45 90 135
Metres

SHEET	A3
Project No:	A10697
Date:	16 February 2012
Revision Number:	
Designed by:	
Client Name:	Lend Lease



SHEET	A3
Project No:	A10697
Date:	16 February 2012
Revision Number:	
Designed by:	
Client Name:	Lend Lease

Figure 3 Minimum Development Levels

Flooding Report

LEGEND

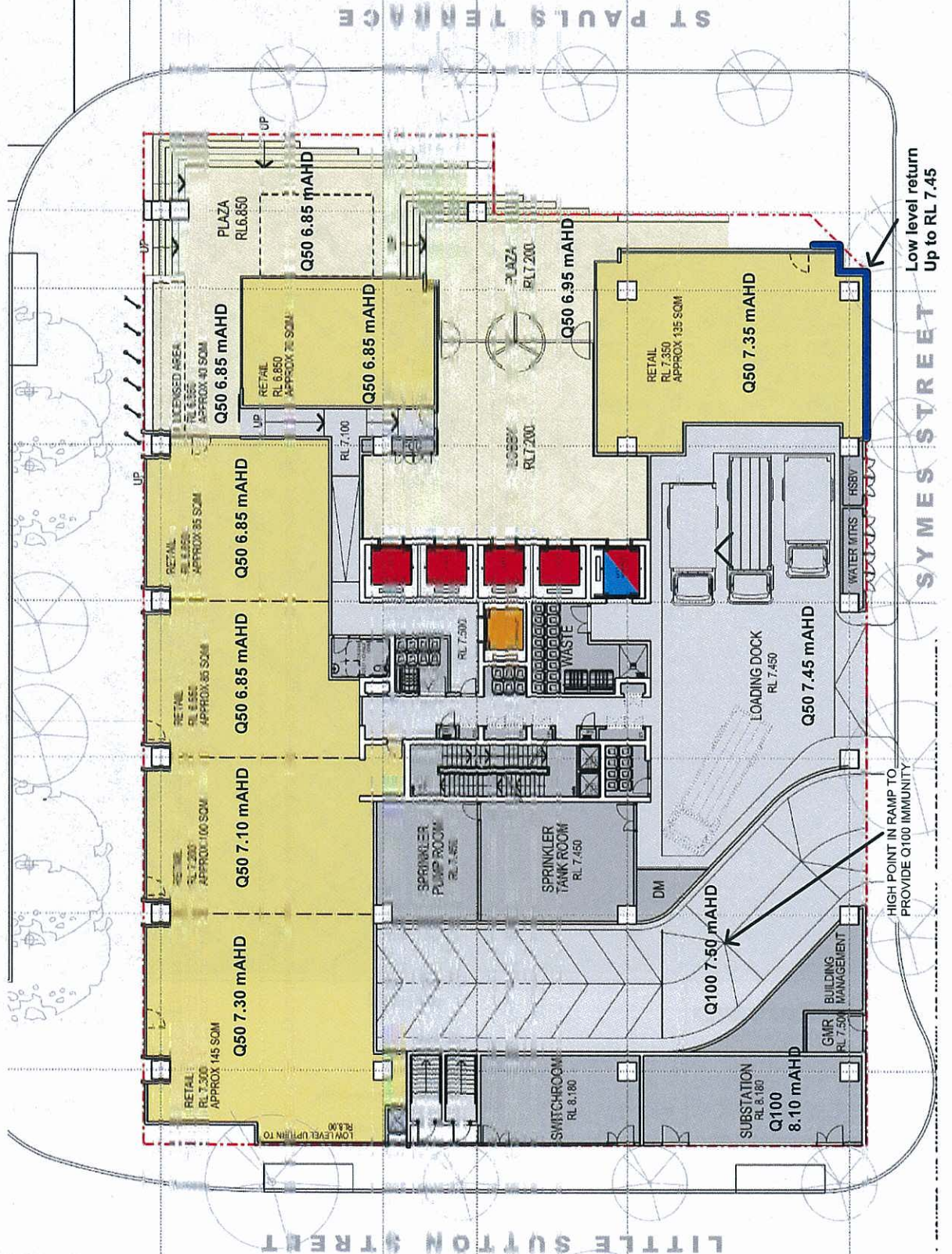


Cardno (Qld) Pty Ltd | ABN 57 051 074 992
Level 11, North Tower, 515 St Pauls Terrace
Locked Bag 4006, Fortitude Valley QLD 4006
Tel: 07 3369 9822 Fax: 07 3369 9722

"© 2012 Cardno (Qld) Pty Ltd All Rights Reserved. Copyright in the whole and every part of this document belongs to Cardno (Qld) Pty Ltd and may not be used, sold, transferred, copied or reproduced in whole or in part in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without the prior written consent of Cardno (Qld) Pty Ltd."

This document is produced by Cardno (Qld) Pty Ltd solely for the benefit of and use by the client in accordance with the terms of the retainer agreement and no liability whatsoever to any third party arising out of any use or reliance by any third party on the content of this document.

SHEET	A4
Project No:	A10697
Date:	9 March 2012
Revision Number:	
Designed by:	
Client Name:	Lend Lease



Appendix A

TUFLOW Model Results



Figure A1. – Extent of Flooding 100 Year Event – Existing Case

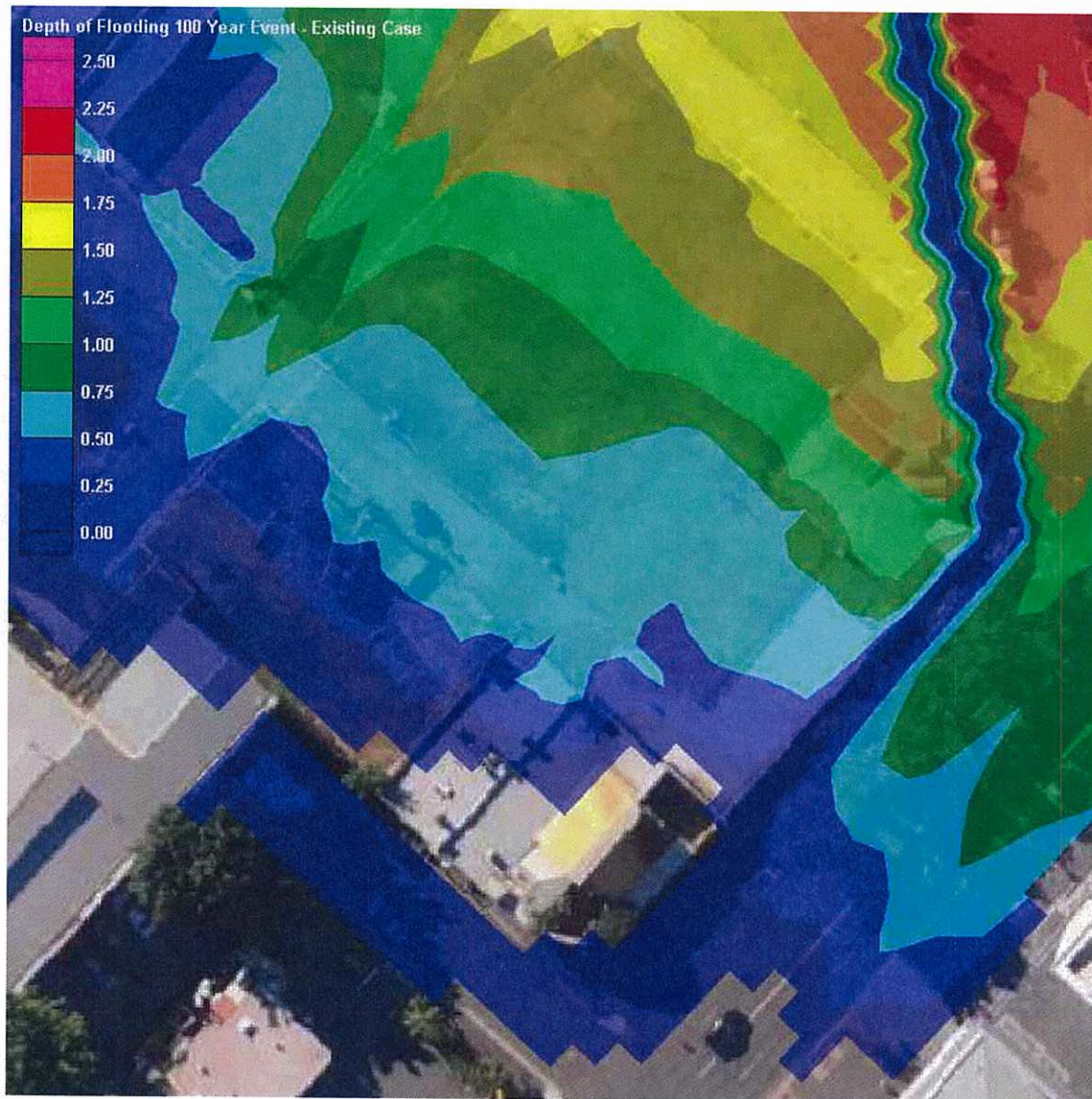


Figure A2. – Depth of Flooding 100 Year Event – Existing Case

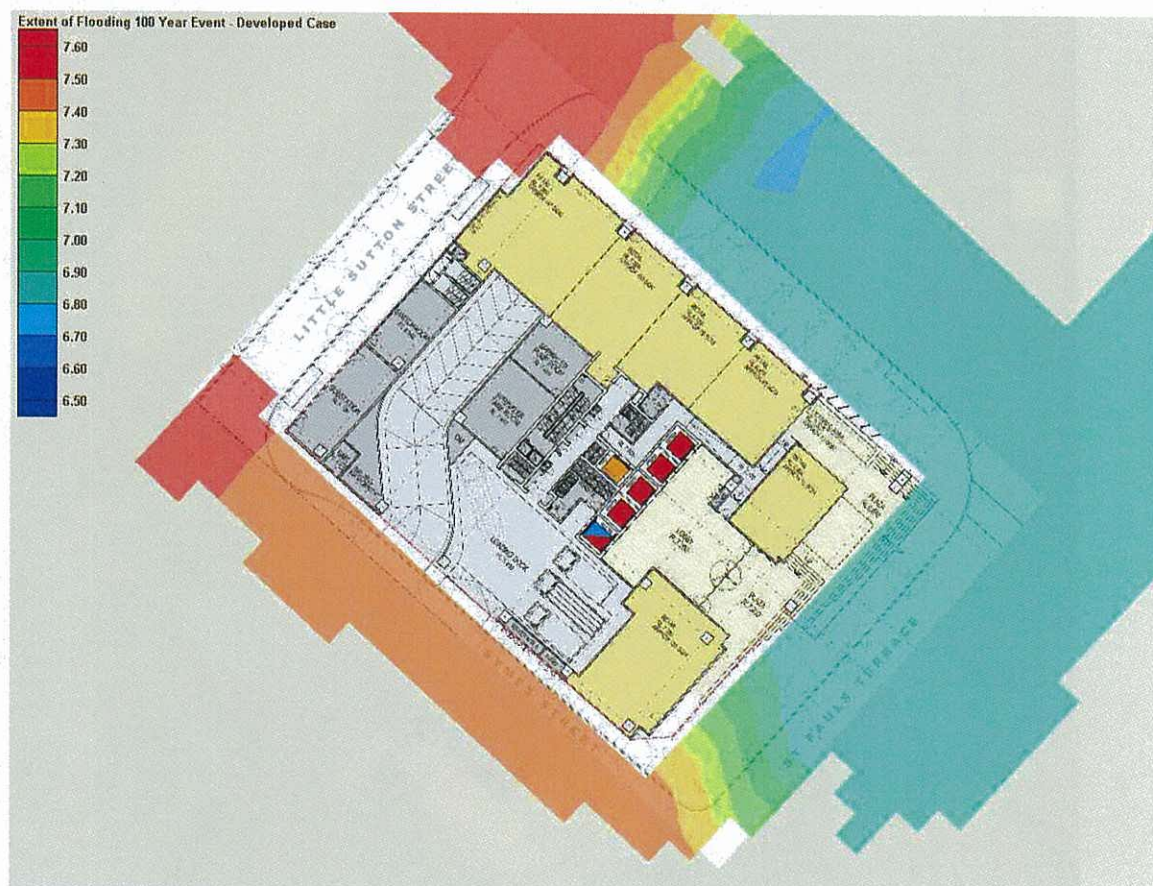


Figure A3. – Extent of Flooding 100 Year Event – Developed Case

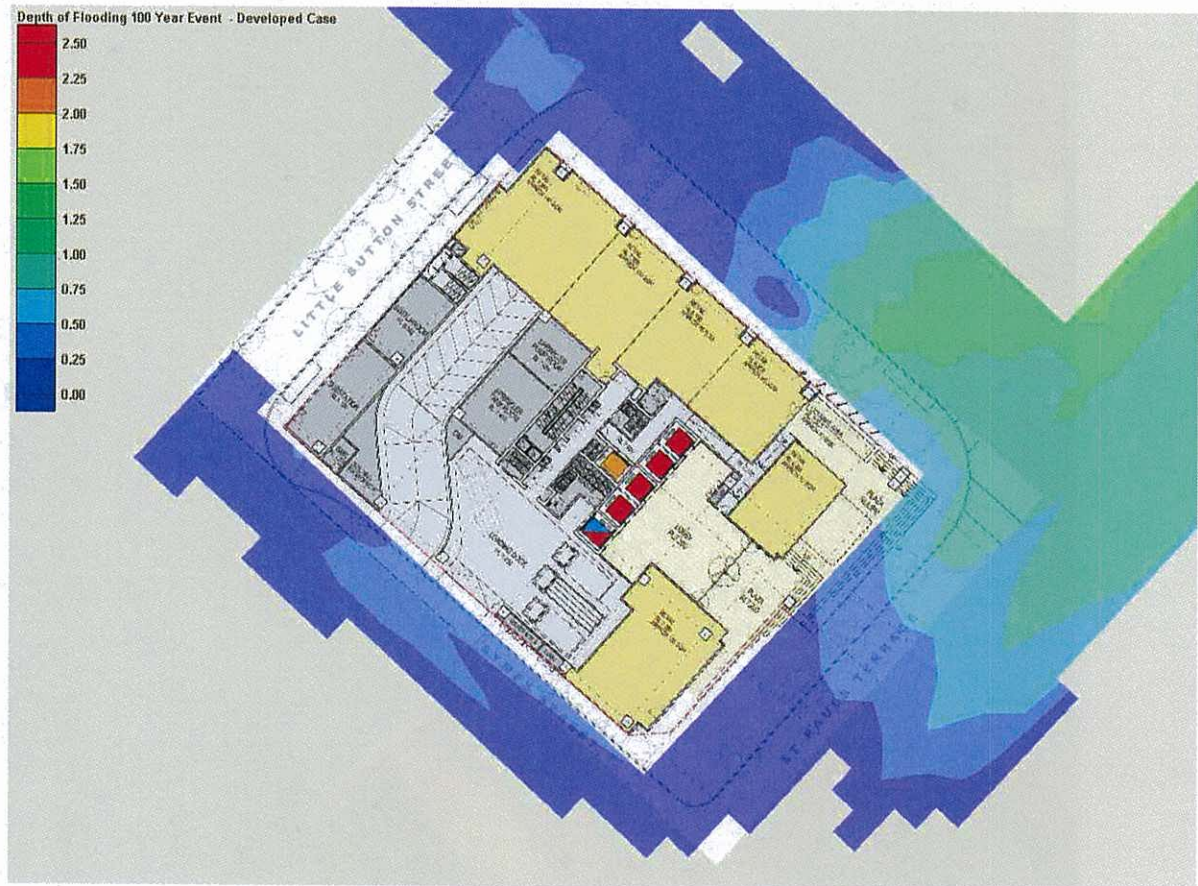


Figure A4. - Depth of Flooding 100 Year Event - Developed Case

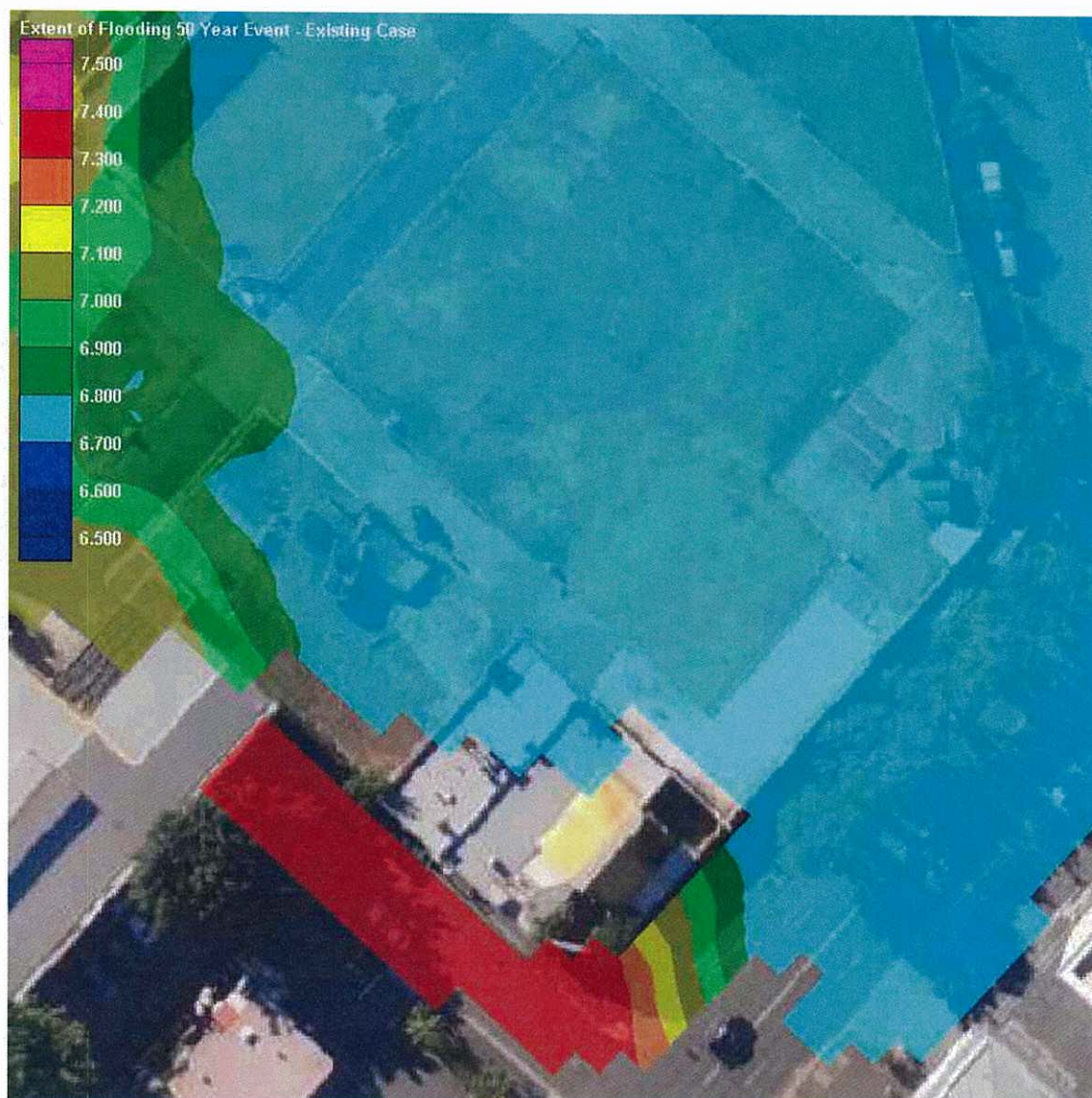


Figure A5. – Extent of Flooding 50 Year Event – Existing Case

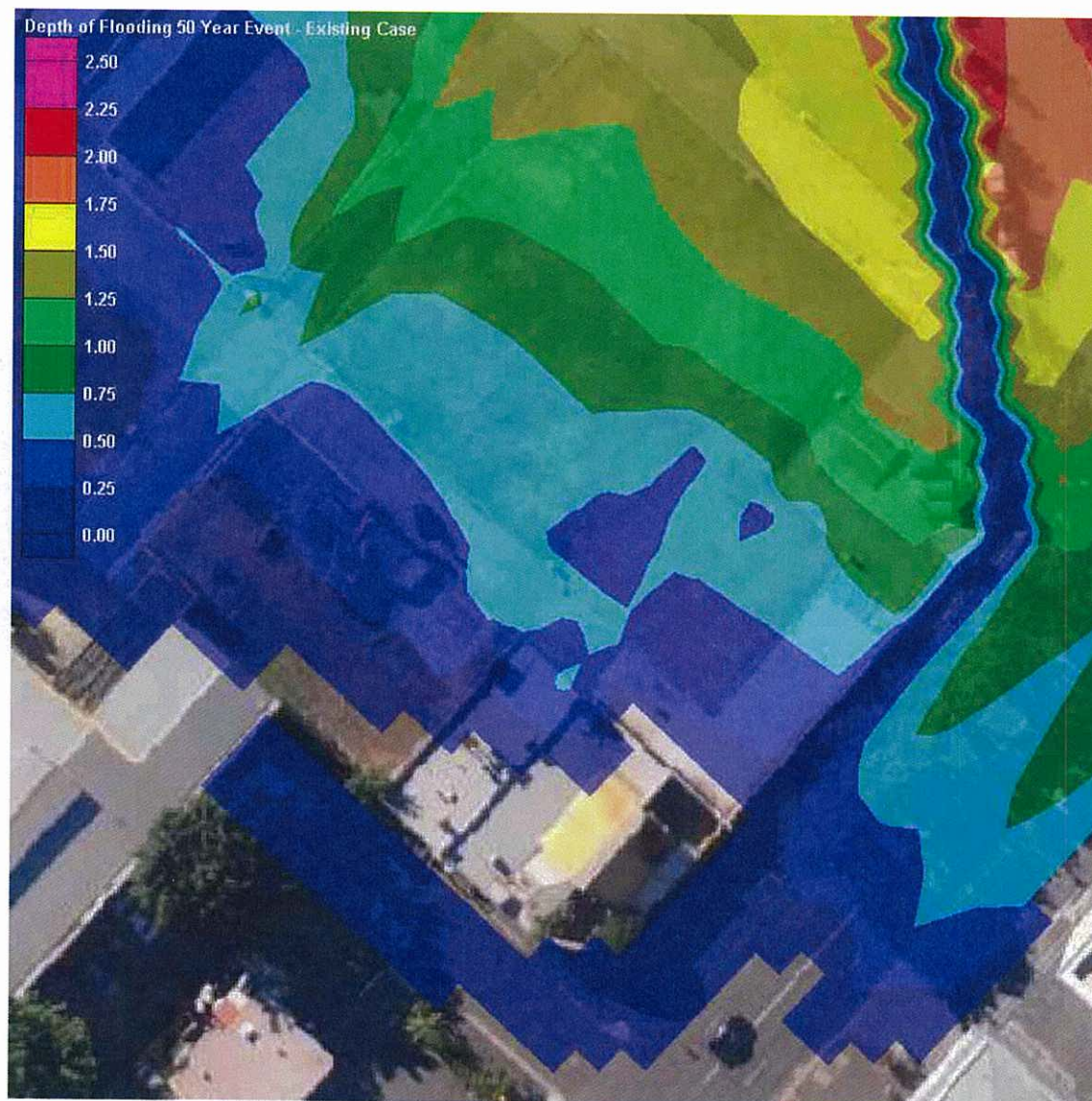


Figure A6. – Depth of Flooding 50 Year Event – Existing Case

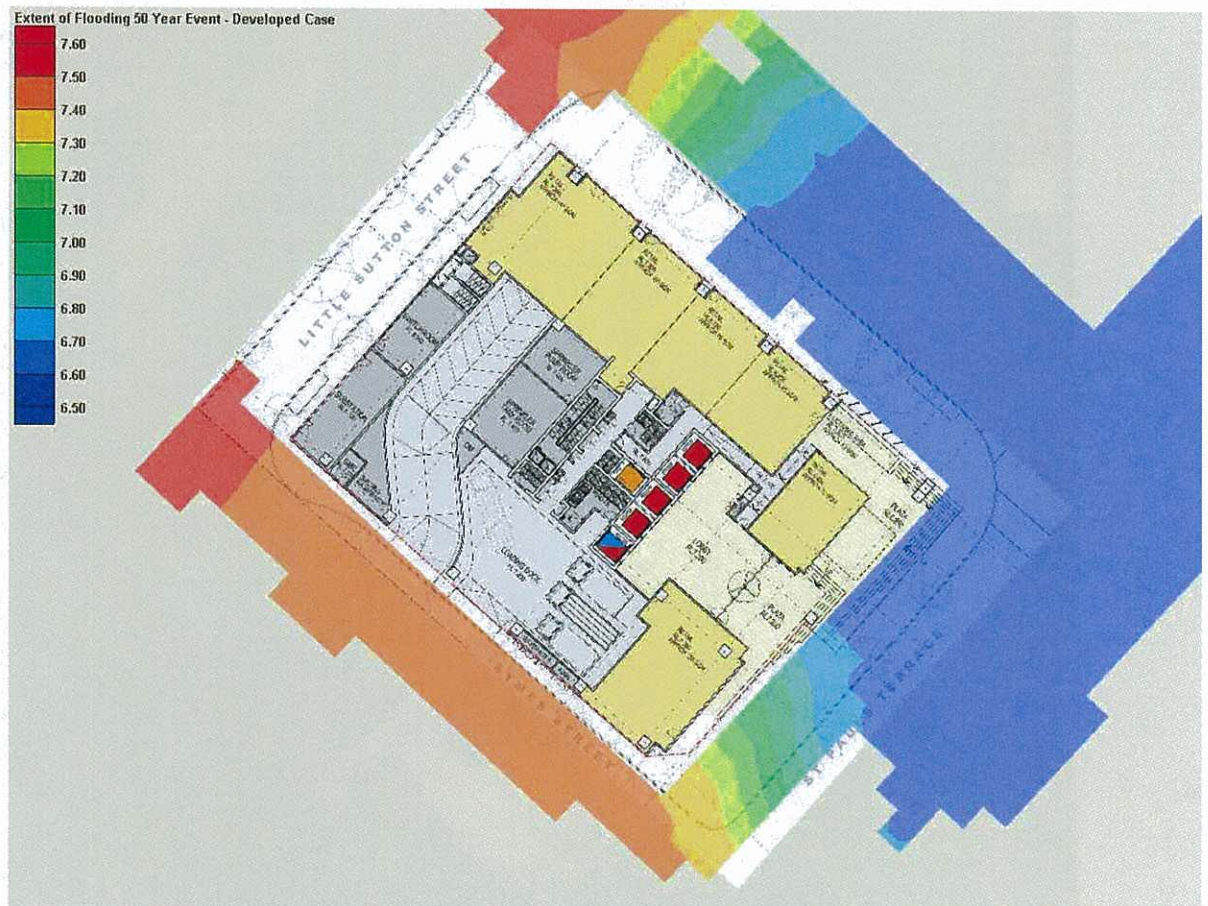


Figure A7. – Extent of Flooding 50 Year Event – Developed Case

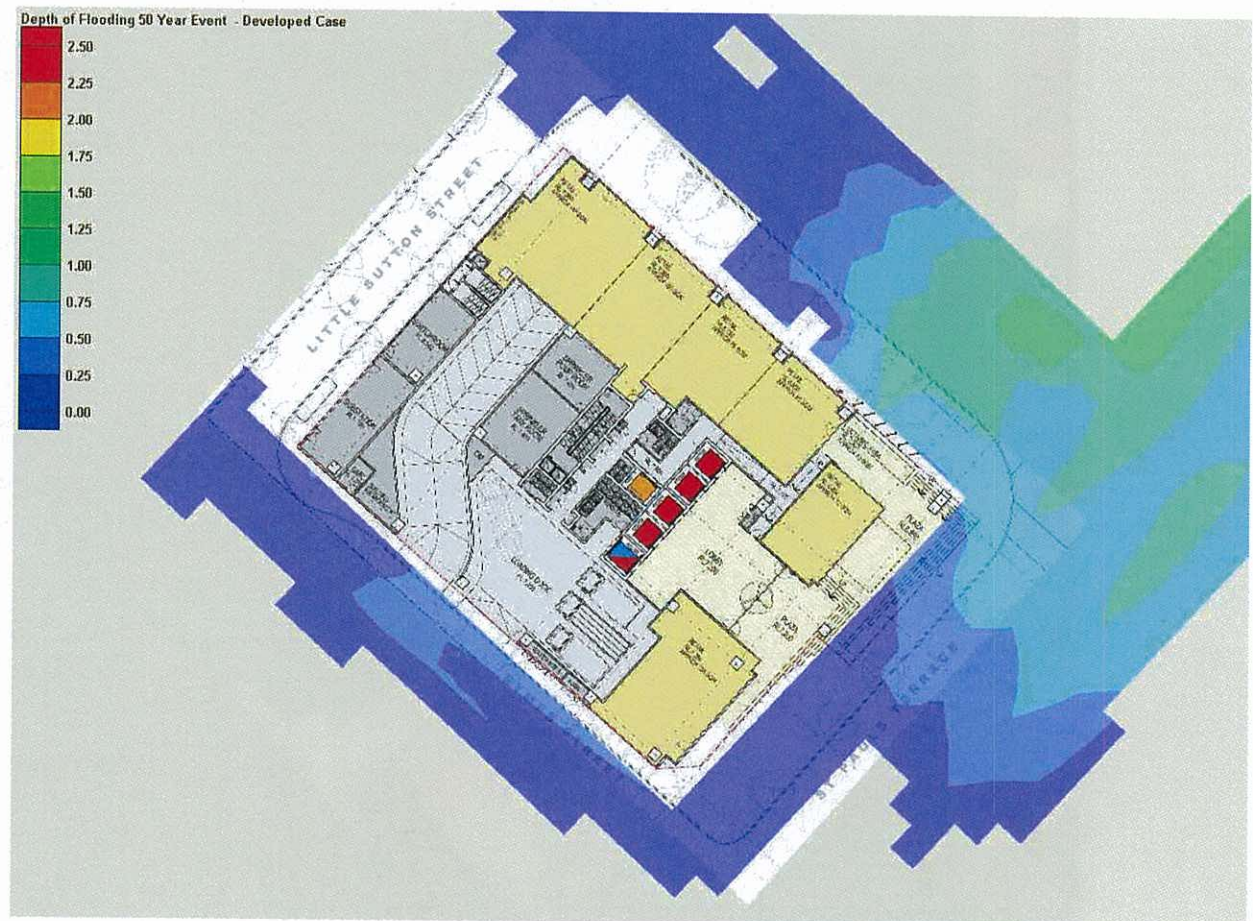


Figure A8. – Depth of Flooding 50 Year Event – Developed Case

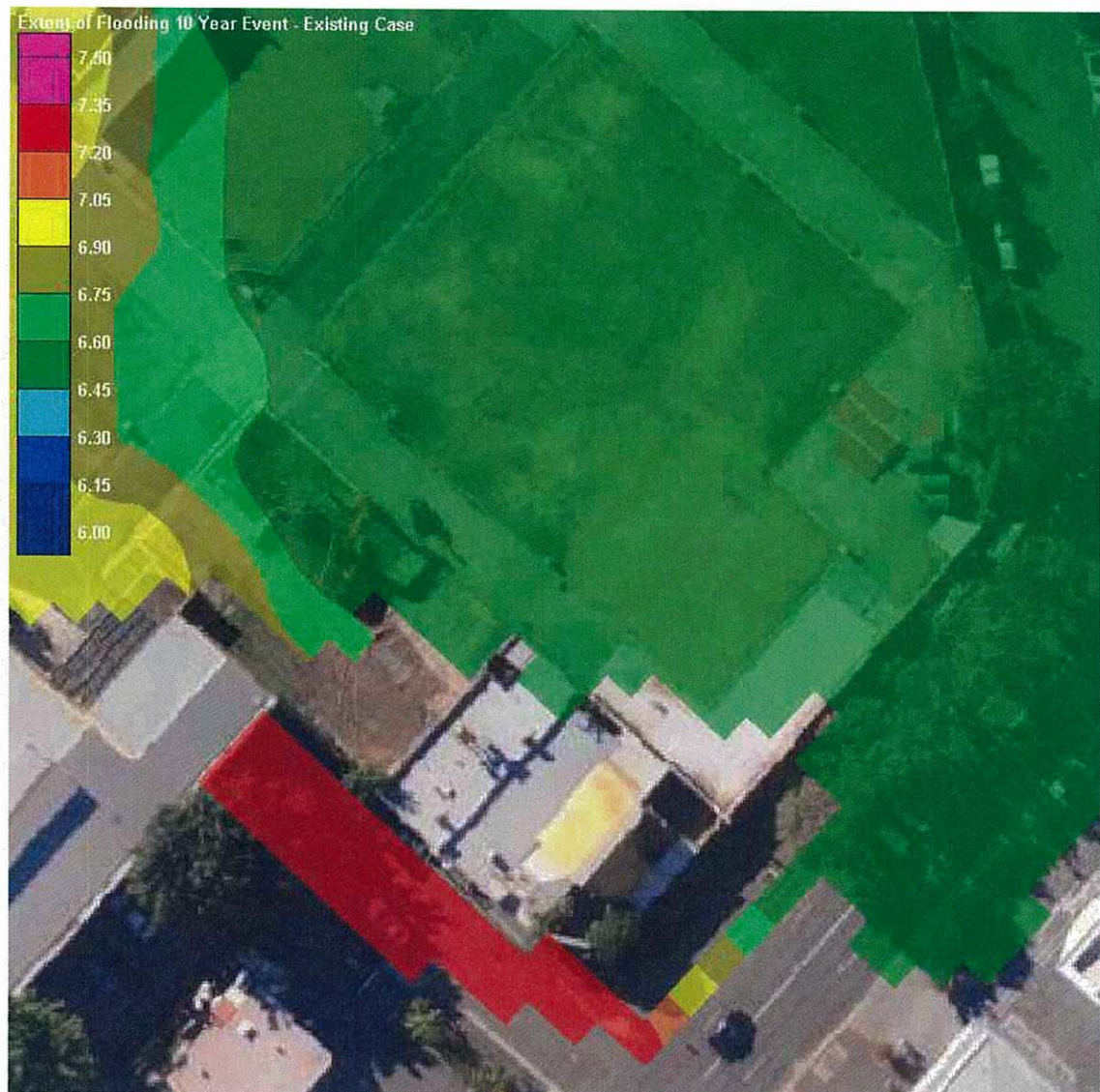


Figure A9. – Extent of Flooding 10 Year Event – Existing Case

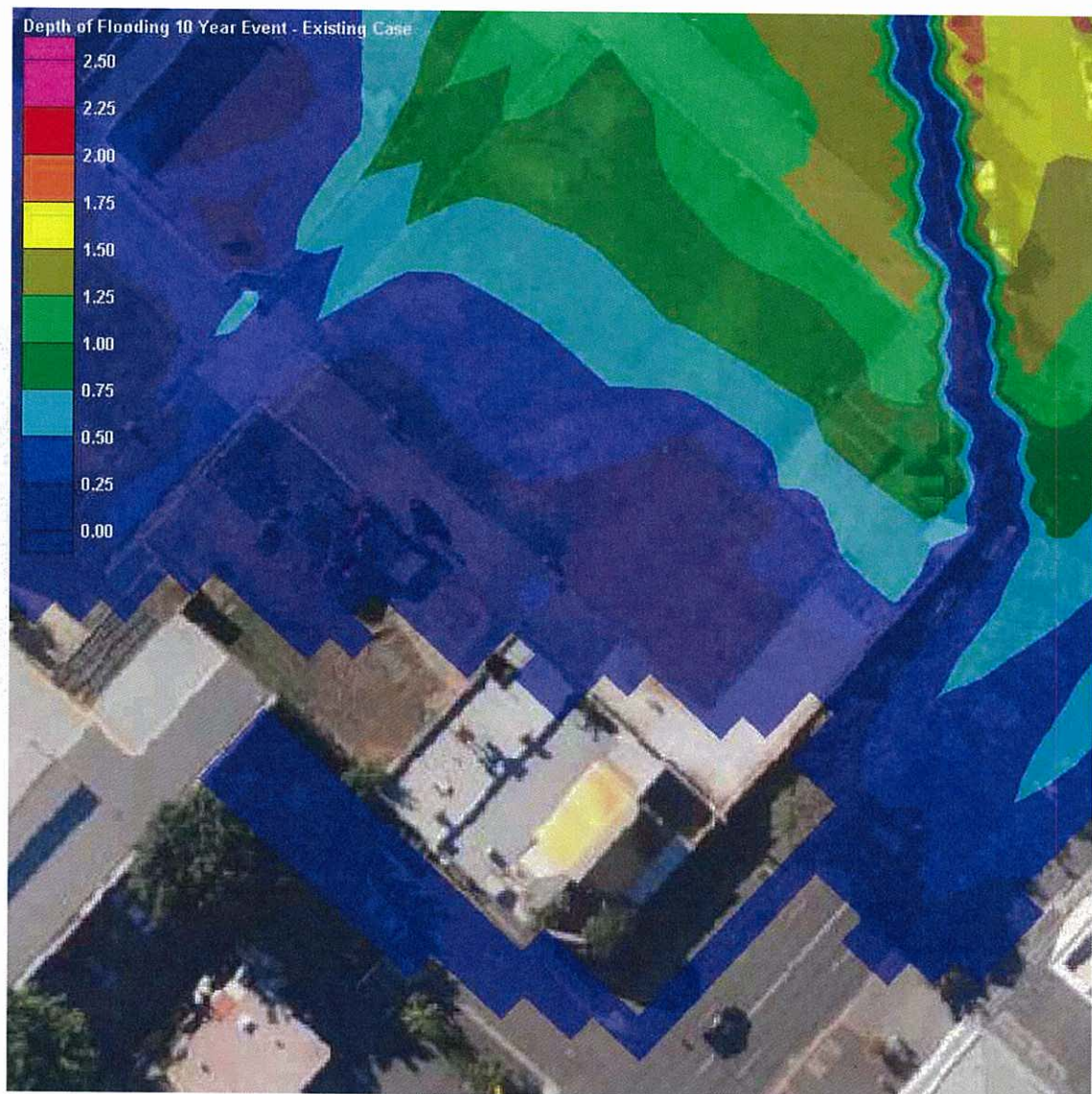


Figure A10. – Depth of Flooding 10 Year Event – Existing Case

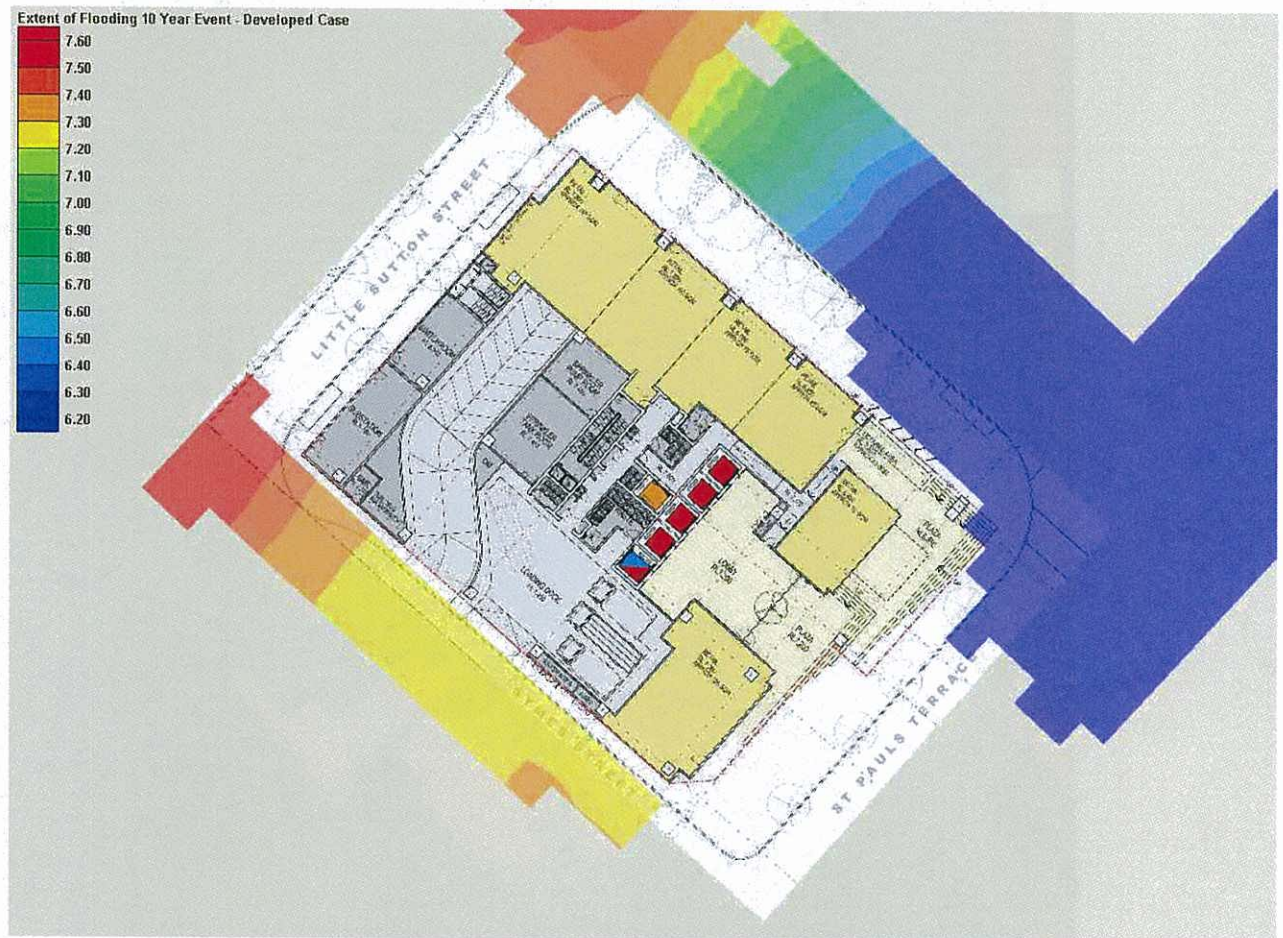


Figure A11. – Extent of Flooding 10 Year Event – Developed Case

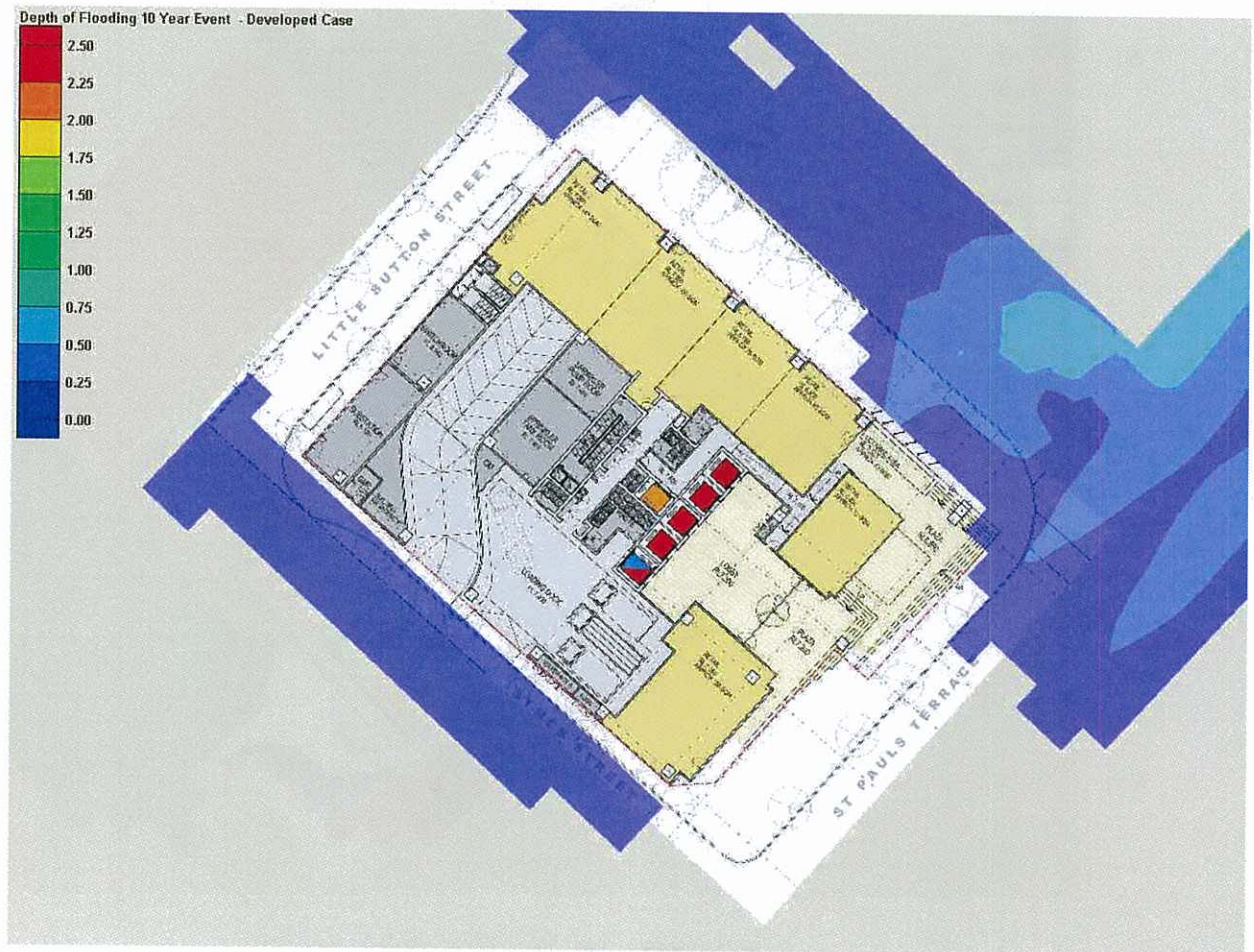


Figure A12. – Depth of Flooding 10 Year Event – Developed Case

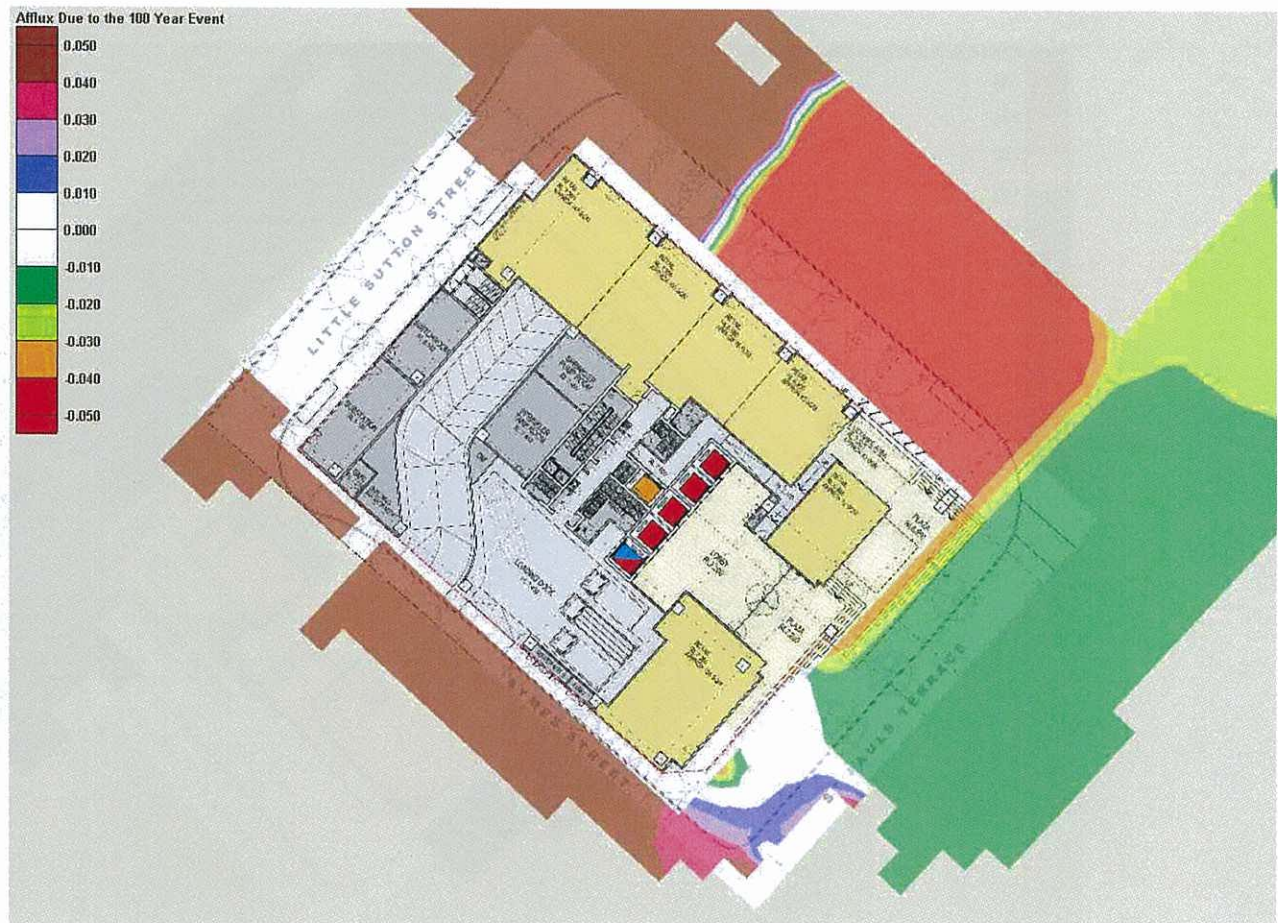


Figure A13. – Afflux Due to the 100 Year Event

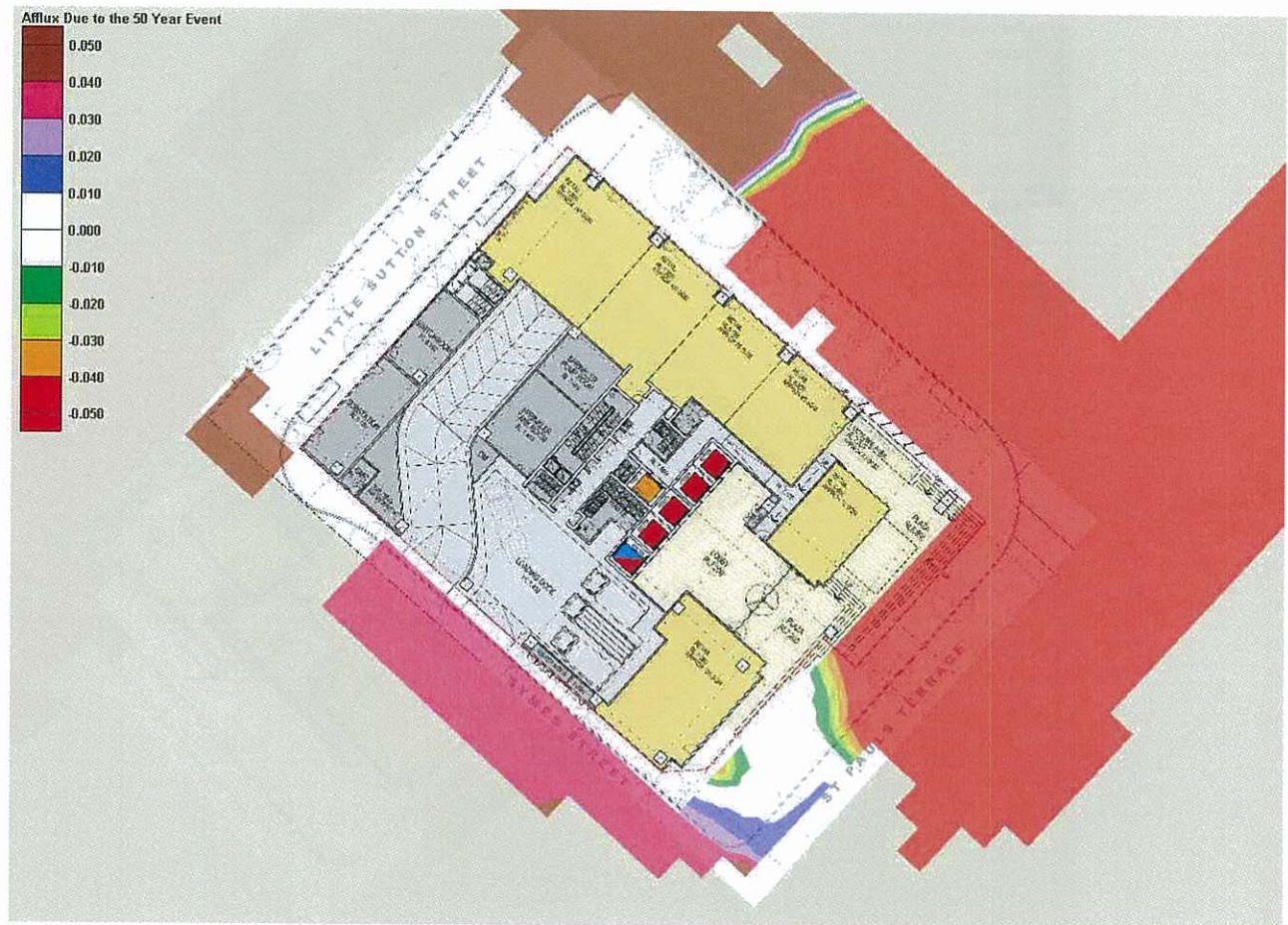


Figure A14. – Afflux Due to the 50 Year Event

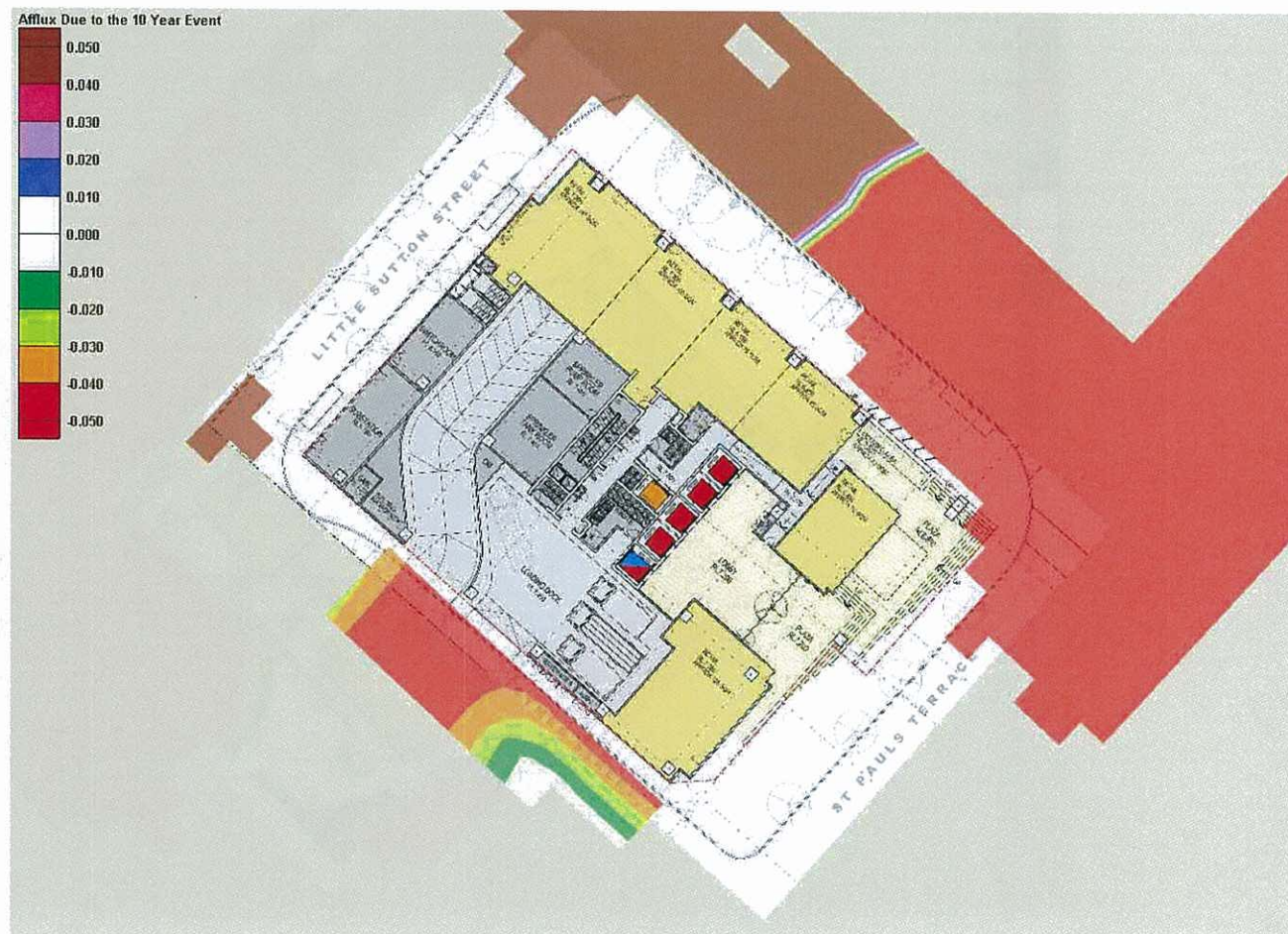
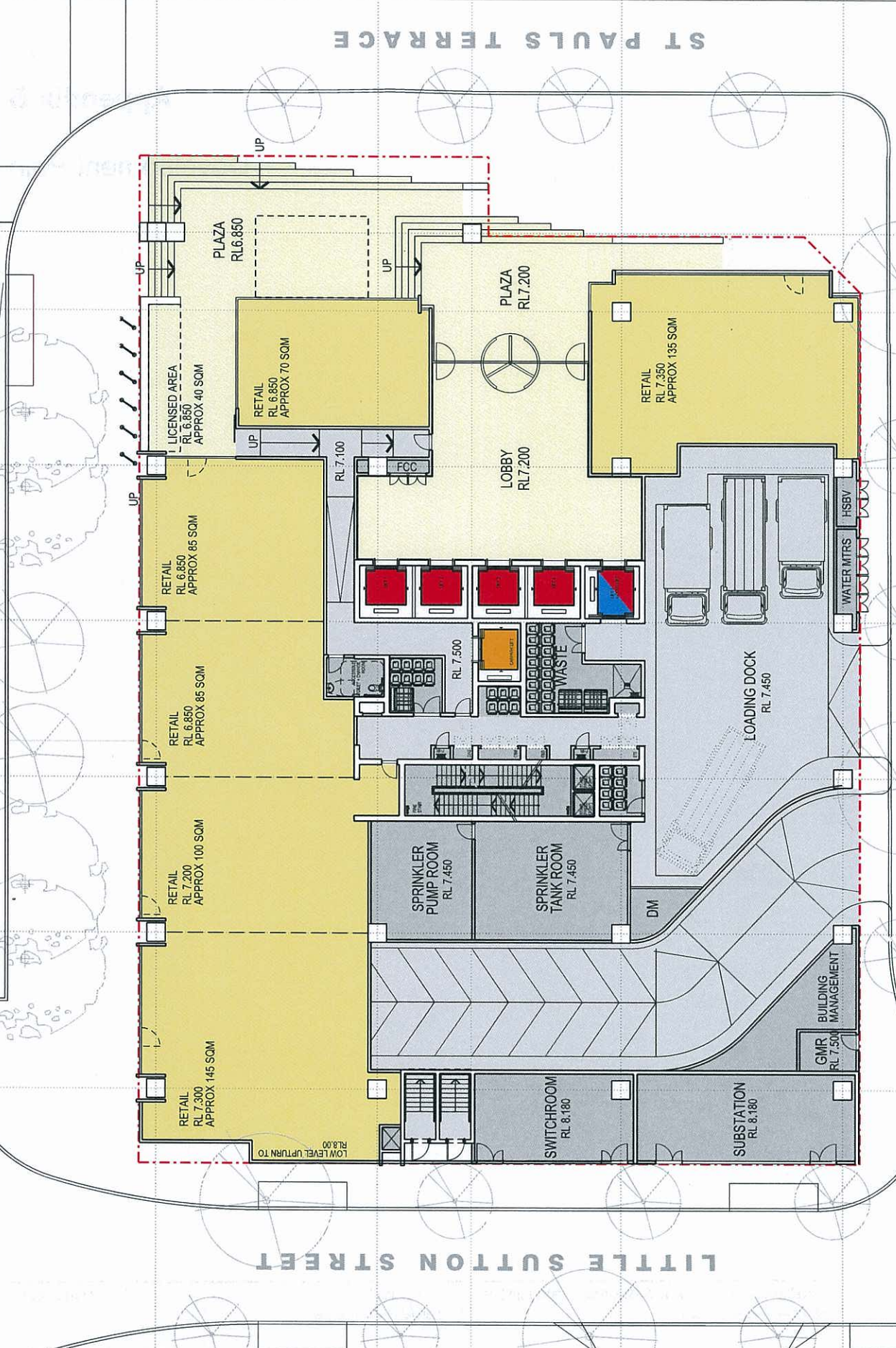


Figure A15. – Afflux Due to the 10 Year Event

Appendix B

Development Plan

OPTION 16D



(NOTE: ALL FIGURES AND DIMENSIONS SHOWN ARE INDICATIVE ONLY - SUBJECT TO DESIGN DEVELOPMENT)