Adco Constructions Pty Ltd

New Liverpool Primary School

New Liverpool Primary School at 18 Forbes Street, Liverpool

Flood Emergency Response Plan

March 2022

FloodMit

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TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF ILLUSTRATIONS

1 INTRODUCTION

FloodMit Pty Ltd was engaged to prepare a flood emergency response plan for a proposed new primary school to be located within the existing Liverpool Girls High School and Liverpool Boys High School site at 18 Forbes Street, Liverpool.

The site and surrounding land are potentially affected by flooding from the Georges River, Cabramatta Creek, and Brickmakers Creek. The school site itself is above the estimated 100 year average recurrence interval (ARI) flood, but could be inundated in larger, more extreme flood events. Nuisance flooding can also be experienced across the school grounds as a result of local overland stormwater flows.

The purpose of this plan is to provide a summary of the flood risk in the immediate vicinity of the proposed primary school, and the recommended measures to be taken in response to flooding.

2 SITE DESCIPTION AND PROPOSED PRIMARY SCHOOL

Architectural drawings showing the existing site and the location of the new primary school are shown on Figure 1.

Key features from the architectural drawing have been traced and overlaid on an aerial photo of the site at Figure 2. Ground contours at 0.5m intervals are also shown on Figure 2.

The site generally slopes from Forbes Street towards Burnside Drive. The highest ground levels occur in the north-west corner of the site, at RL 13.5m AHD. The lowest ground levels are adjacent to Burnside Drive, at RL 8.6m AHD.

The Liverpool Boys High School occupies the northern portion of the site. Buildings are a mixture of single storey to three storey buildings, with ground floor levels mostly at RL 10.5m AHD or higher.

The Liverpool Girls High School occupies the southern portion of the site. Buildings are similarly a mixture of single storey to three storey buildings, with ground floor levels mostly above RL 10.3m AHD.

There is also a common library and hall between the two high schools, which is shared between both facilities. The library is at RL 10.55m AHD and the hall is at RL 13.63m AHD.

The primary school is proposed to be located on existing playing fields on the eastern part of the site.

There are a total of four main building blocks that have been proposed, as shown on Figures 1 and 2. All buildings are proposed to be three storeys high, except for the school hall, which is single storey.

Proposed floor levels for all buildings are shown as:

i) Ground Floor Level = RL 9.3m AHD;

ii) Level 1 = RL 13.25m AHD; and

iii) Level 2 = RL 17.20m AHD.

The natural ground level in the vicinity of the new buildings range from RL 8.8m to RL 9.3m AHD.

A staff parking area is shown in the south-east corner of the site. The parking area is shown to vary from RL 9.2m to RL 9.6m AHD.

Figure 1
Architectural Site Plan

AMENDMENTS

REV.	DATE	DESCRIPTION	CHK
05	25/06/2021	SCHEMATIC DESIGN ISSUE	BDB
04	11/06/2021	DRAFT ISSUE	BDB
03	2/06/2021	PRELIMINARY ISSUE	BDB
02	19/04/2021	CONSULTANT ISSUE	KKJ

PROJECT
NEW LIVERPOOL PUBLIC SCHOOL
SOUTHERN SUBURBS CLUSTER
FORBES STREET LIVERPOOL NSW 2170

PROJECT NORTH

SCALE
1:1500 @A3
40mm ON ORIGINAL

DRAWING
SITE PLAN - PROPOSED

PRINT DATE
25/06/2021

ISSUE
05

PROJECT NO.
22102

DRAWING NO.
LWPS-AR-DRG-SD-0202

PHASE
PHASE 03 SCHEMATIC DESIGN

Legend

0.5m Contours (2019 LiDAR survey)

New Primary School Buildings

New Parking Area

Lachlan St

Liverpool Boys High School

New Primary School Buildings

Forbess St

Liverpool Railway Line

Burnside Dr

Liverpool Girls High School

New Parking

Liverpool Hospital

N

0 25 50

metres

FloodMit

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Date: 15/11/21

Figure 2
Site Plan showing Contours and Proposed New Liverpool Primary School

3 REVIEW OF FLOOD BEHAVIOUR

3.1 SOURCE OF INFORMATION

The following data sources have been used to review flood behaviour at the site, and in the vicinity of the site:

i) Georges River Flood Study (PWD, 1991);

ii) Georges River Floodplain Risk Management Study and Plan (Bewsher, 2004);

iii) Georges River Flood Study (BMT WBM, 2020);

iv) Cabramatta Creek Flood Study and Basin Strategy Review (Bewsher, 2011);

v) Brickmakers Creek Flood Mitigation Option Assessment (GHD, 2007)

The site is not shown to be inundated in floods up to the 100 year ARI event. However, more extreme floods on the Georges River could potentially overtop the Liverpool Railway line and inundate the site.

Flooding from Cabramatta Creek and Brickmakers Creek do not have the potential to inundate the site, but could inundate access roads to and from the school. Local stormwater inundation and overland flow may contribute to nuisance flooding problems in and around the school.

3.2 DESIGN FLOOD LEVELS

Design flood levels from the Georges River that could potentially have an impact on the primary school are summarised in Table 1.

Table 1
Design Flood Levels from the Georges River (18 Forbes Street, Liverpool)

Design Flood (ARI)	Design Flood Level (m AHD) [1]
20 year Flood	7.6
50 year Flood	8.4
100 year Flood	8.6
Probable Maximum Flood (PMF)	10.8

1 Formal flood levels adopted by Liverpool Council (PWD, 1991)

The lowest ground level within the school is RL 8.6m AHD. This is similar to the adopted 100 year ARI flood level for this site. Proposed ground floor levels for the new primary school (at RL 9.3m AHD) are above the 100 year ARI flood level, but would be inundated by 1.5m in the PMF flood. All upper floor levels are above the PMF estimate.

3.3 FLOOD RISK CLASSIFICATION

Liverpool City Council has adopted a flood risk classification that divides the floodplain into three different flood risk classifications (High, Medium and Low). The flood risk classification in the vicinity of the school is shown on **Figure 3**.

The subject site is classified as having a *Low Flood Risk*. This means that the site is above the 100 year flood, but still potentially affected by more extreme flood events.

3.4 FLOOD VELOCITIES

The maximum velocity that applies to the site in the PMF event occurs along the eastern boundary of the site, with a maximum value estimated at 0.4m/s (BMTWBM, 2020). The location of the proposed primary school buildings has a maximum velocity of 0.2 to 0.3m/s. The existing high school buildings experience a maximum velocity of less than 0.1m/s.

Flood velocities are relatively low due to the distance from the river, and the partial shielding of floodwater by the railway embankment.

3.5 RATE OF RISE OF FLOODWATER

An important consideration for the proposed development is the rate of rise of floodwater within the school, as this determines the time in which occupants have to safely leave the area, or to minimise their exposure to potential flooding.

A graph (Illustration 1) showing how flood levels are likely to vary over time for the 100 year ARI flood and the Probable Maximum Flood (PMF) have been extracted from the Georges River Floodplain Risk Management Study and Plan (Bewsher, 2004) for Liverpool Bridge. This is the same location at which the Bureau of Meteorology provides flood warnings for Liverpool during periods of flooding. It is noted that the Bureau provides warning levels as the height above the Liverpool weir, which is different to flood levels provided in this report (which are to Australian Height Datum or AHD). A correction of 2.8m should be added to the Liverpool gauge readings to convert these levels to AHD.

Based on the graph shown at Illustration 1, there could be:

i) of the order of 3.6 hours from a “major flood” level (ie 4.5m on the Liverpool gauge, or RL 7.3m AHD) being experienced within the Georges River to the time that the maximum flood level would be experienced within the school; and

ii) of the order of 1.7 hours or less from the time that the railway embankment overtops near the school until the maximum flood level is experienced within the school site.

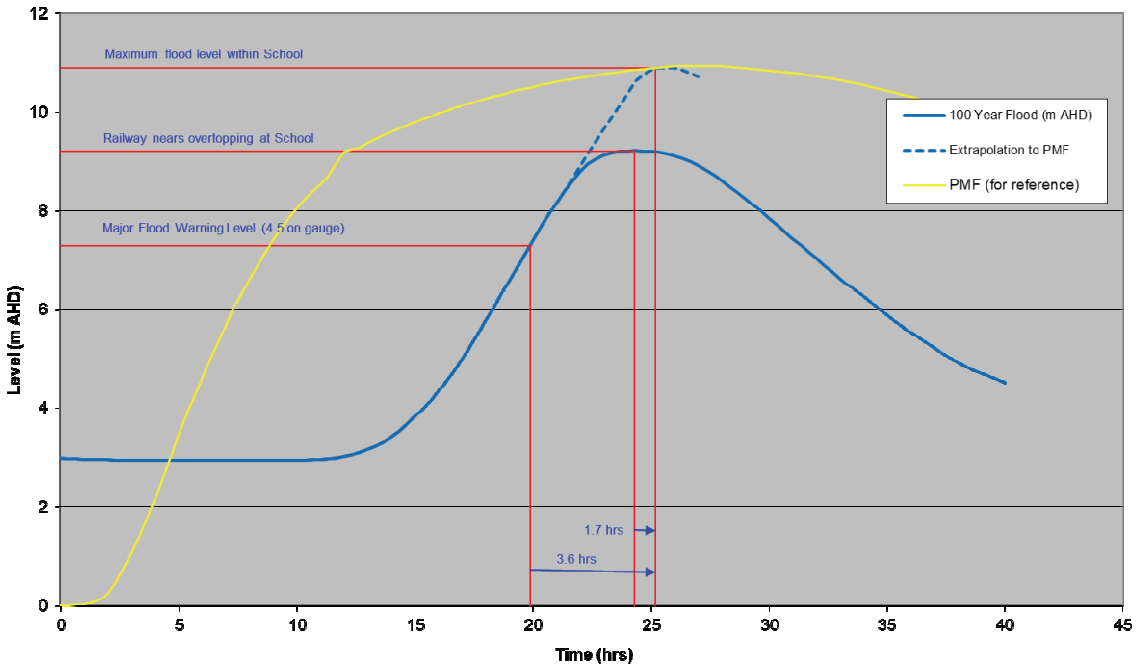

Illustration 1
Rate of Rise of Floodwater at Liverpool

Legend

High Flood Risk

Medium Flood Risk

Low Flood Risk

Cabramatta Ck

Brickmakers Ck

SITE

Georges River

N

0 200 400

metres

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Figure 3
Composite Flood Risk Map
Georges R, Cabramatta Ck, Brickmakers Ck

(Source: Liverpool Council, 2022)

4 FLOOD WARNING AND EVACUATION CONSIDERATIONS

4.1 FLOOD WARNINGS

The Bureau of Meteorology provides a formal flood warning service for the Georges River.

The scheme monitors rainfall and river gauges in the upper catchment and aims to provide up to 12 hours warning of impending flooding. Warnings are issued to the State Emergency Service (SES) who then has responsibility for evacuation and other emergency response actions.

The main warning is based on the predicted flood height at Liverpool weir, also known as Liverpool Bridge. Predicted flood heights may also be issued for:

i) Scrivener Street;

ii) Irelands Bridge (on Cabramatta Creek);

iii) Cutler Road;

iv) Lansdowne Bridge (on Prospect Creek);

v) Milperra Bridge; and

vi) East Hills

Readings and predicted flood heights at Liverpool weir are based on the gauge height, which is the height above the weir level. This needs to be converted to Australian Height Datum (AHD) when comparing levels to survey plans and contours that have been derived for the proposed primary school site. The conversion factor is to add 2.8m to levels issued for this site to provide the level to AHD. There is also a flood gradient adjustment when comparing flood levels between Liverpool weir and the school site.

Flood Warning Heights, and the relevance to the proposed primary school site, is shown in Table 2.

Table 2
Flood Warning Heights at Liverpool Weir

Description of Warning	Liverpool Weir Flood Height		Impact on School Site
	Gauge Height	RL (m AHD)	
Minor Flood Warning	2.0	4.8	Minor roads closed
Moderate Flood Warning	3.0	5.8	Main traffic routes affected
Major Flood Warning	4.5	7.3	Significant disruption & nearby flooding
100 year Flood at Liverpool	6.4	9.2	School grounds become inundated [1]
Probable Maximum Flood (PMF)	8.1	10.9	Ground floor buildings flooded to 1.5m

1 Corresponds to lowest ground level within the school site at RL 8.6m AHD.
Earlier flooding could be experienced through stormwater and local overland flow inundation

Flood warnings can be monitored at the bureau's web site: www.bom.gov.au under "NSW Weather and Warnings". Flood Heights can also be monitored in real time using the "FloodsNearMe" phone app (search for Liverpool weir).

4.2 ROAD CLOSURES

The ability to safely evacuate the primary school is an important consideration in developing a flood emergency response strategy for the school.

Many of the major traffic routes within Liverpool and surrounding suburbs are likely to be inundated by floodwater from the Georges River, Cabramatta Creek, and/or Brickmakers Creek. Many of these traffic routes will be inundated long before any signs of flooding within the school site are visible.

Major road closures that are anticipated during flood events are shown on Figure 4. It is also anticipated that there will be additional local road closures due to inadequate stormwater drainage. Main road closures, and the depth of flooding in an estimated 100 year flood, include:

i) The Hume Highway, to the north, which could be inundated by over 1.5m near Cabramatta Creek (Irelands Bridge);

ii) Governor Macquarie Drive (to the east) which could be inundated by up to 0.9m near Warwick Farm Racecourse;

iii) Newbridge Road (to the east), which could be inundated by up to 1.5m near Lake Moore.

Higher level evacuation routes are shown on Figure 4, and include:

i) West along Campbell Street, and south on George Street, to Liverpool CBD;

ii) West along Campbell Street, north on the Hume Highway to the Cumberland Highway, and then north towards Cabramatta Road;

iii) West along Campbell Street, south on the Hume Highway to the M5 Motorway.

4.3 SHELTER-IN-PLACE

It is safer to stay within the school grounds rather than attempt to evacuate the school once flooding is encountered. Ground floor levels could be inundated by up to a maximum of 1.5m in an extreme flood event from the Georges River, but all upper floor levels are estimated to have no risk of inundation. It could typically take 12 - 24 hours for the flood risk to subside.

The most appropriate building to seek shelter in is the “Shared Hall” that is located between the Girls’ and Boys’ High School. This is a preferred location because:

i) The site is readily accessible from the Primary School, and rises steadily in the direction of egress;

ii) The Hall is located over the Library, and is well above the PMF flood level;

iii) It is a common area that could safely accommodate a large number of people;

iv) Only minor inundation (less than 0.4m) occurs between the library/hall and Forbes Street in an extreme flood event;

v) Forbes Street is not inundated in an extreme flood event at this location, providing safe vehicular access to the Liverpool CBD area, where additional supplies of food and water can be sought;

vi) It is understood that neither High School rely on the Hall for flood evacuation purposes.

4.4 RECOMMENDED STRATEGY

The recommended flood emergency response strategy, in priority order, is to:

i) Close the school (before the start of the day) if the Bureau of Meteorology issues a flood warning for "**Major Flooding**" at Liverpool. The Bureau typically provides 6-12 hours warning of future flooding.

ii) If school is already in progress and "**Major Flooding**" is predicted to occur before the end of the school day, then early closure of the school should be considered. This would include contacting parents to pick up students immediately if it is safe to do so. Remaining students should seek refuge within one of the upper floor levels within the school.

iii) If flooding on site is experienced, then it is too late to evacuate, and all remaining students and staff should seek refuge within one of the upper floor levels within the school. The preferred location to seek shelter is the shared Hall between the Girls' and Boys' High School.

The recommended flood emergency response measures are detailed in Section 5.

To Cabramatta Road

Cabramatta Ck

Inundated up to 1.5m
in 100 year Flood

Inundated up to 0.9m
in 100 year Flood

SITE

Liverpool CBD

Georges River

Brickmakers Ck

Inundated up to 1.5m
in 100 year Flood

To M5 Motorway

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Date: 16/11/21

Figure 4
Major Road Closures due to Flooding and Preferred Evacuation Routes

5 RECOMMENDED RESPONSE MEASURES

5.1 RESPONSIBILITIES

The ***Bureau of Meteorology*** has formal responsibility for monitoring rainfall and river levels within the Georges River catchment, and for providing a formal flood warning service for the Georges River. The Bureau aims to provide at least 6 hours warning of flooding at Liverpool based on actual rainfall within the catchment, and up to 12 hours warning based on predicted rainfall. Predictions provided by the Bureau will include a predicted flood height at Liverpool, and a classification as either "Minor Flooding", "Moderate Flooding", or "Major Flooding".

The ***State Emergency Service*** is responsible for disseminating flood warnings provided by the Bureau of Meteorology; taking action to coordinate and evacuate residents at risk; and attending to other hazards. Further information on preparing for flooding is provided on their web site at www.ses.nsw.gov.au . In a flood emergency phone 132 500.

Local Police provide assistance to the State Emergency Service, and are likely to assist with road closures and coordinating evacuation procedures.

The ***School Principal*** should assume overall responsibility for implementing this flood emergency response plan. This includes nominating a staff member to monitor flood conditions; deciding whether there is early closure of the school; which upper level buildings will be used as refuge areas in times of flood; and when students should be moved to these refuge areas.

A ***Flood Monitor*** should be assigned responsibility for monitoring flood conditions, and advising the principal on the evolving flood situation. This should include monitoring of river levels and flood level predictions provided by the Bureau of Meteorology; any additional advice issued by the State Emergency Service; and any visual signs of flooding in the immediate vicinity of the school grounds.

A ***Parent Liaison Officer*** should be appointed by the Principal to contact parents; advise of the school's position regarding early closure; and the availability of school buildings to act as refuge centres for both students and parents.

Teachers will be responsible for the coordinated movement of students to the refuge rooms when instructed by the Principal or whenever there is visual indication of flooding within the school grounds.

5.2 MONITORING FLOOD CONDITIONS

Flood Warning predictions can be monitored at www.bom.gov.au under "Warnings Current". Real time river conditions at Liverpool Bridge can also be monitored under "Rainfall & River Conditions" on the opening web page.

The Public Works and Advisory phone app: "FloodsNearMe" can also be used to monitor real time river conditions at Liverpool.

Visual monitoring of floodwater in the vicinity of the school should also be regularly made, particularly along the eastern boundary of the school and in the vicinity of the railway embankment.

5.3 KEY TRIGGERS

Key flood warning levels and their impact on the school are provided in Table 2. Key levels include:

Prediction for "***Minor Flooding***" at Liverpool – Liverpool gauge height will exceed 2.0m
Flood Conditions should be closely monitored.

Prediction for "***Moderate Flooding***" at Liverpool – Liverpool gauge height will exceed 3.0m
Main traffic routes are likely to be affected and road closures are likely once this level is reached.

Prediction for "***Major Flooding***" at Liverpool – Liverpool gauge height will exceed 4.5m
The decision to close the school should be made as soon as "Major Flooding" is predicted. Where the school day is in progress and "Moderate Flooding" is currently occurring, it is recommended that students and staff seek shelter within one or more of the upper level school buildings.

"***Major Flooding***" is occurring at Liverpool and the Liverpool gauge height exceeds 6.4m
The school grounds are likely to become inundated once the Liverpool gauge exceeds a level of 6.4m. All students and staff remaining within the school should seek shelter within one or more of the upper level school buildings, or as directed by the Principal.

5.4 SUITABLE REFUGE LOCATIONS WITHIN THE SCHOOL

All buildings within the school grounds that have upper floor levels will provide suitable refuge that is above the level of an extreme flood. However, the most appropriate building is considered to be the common Hall between the Girls' and Boys' High School, for the reasons provided in Section 4.3. The preferred refuge location is shown on illustration 2.

Illustration 2 – Preferred Refuge Location

5.5 ACTION TO TAKE BEFORE A FLOOD OCCURS

The following action should be taken prior to a flood occurring:

i) This Plan should be kept up to date; key staff should be aware of the Plan; and the actions to be taken during an impending flood.

ii) All electrical outlets should be protected by appropriate earth leakage devices to avoid the risk of electrocution.

iii) Emergency kits, including first aid, torch, battery powered radio, spare batteries, etc should be located within each building where refuge may be sought.

5.6 ACTION TO TAKE DURING A FLOOD

The following action should be taken whenever flood conditions arise:

iv) Flood conditions should be carefully monitored once any formal flood warning advice is received from the Bureau of Meteorology for the Georges River, or other advice is received from the State Emergency Service.

v) Where the school day has not yet commenced, and a “major flood” warning has been issued, it is recommended that the school is closed for the day.

vi) Where the school day is in progress, and a “major flood” warning has been issued, it is recommended that early closure of the school is considered. This would include contacting parents to pick up students early from school where it is safe to do so, and prior to the flood level exceeding 3.0m on the Liverpool gauge (ie “moderate flooding”).

vii) Preferred access routes to and from the school are shown on Figure 4. Areas likely to be inundated by floodwater once “moderate flooding” occurs includes The Hume Highway (near Cabramatta Creek); Governor Macquarie Drive (near Warwick Farm); and Newbridge Road (near Lake Moore).

viii) Should the grounds of the school become inundated, or floodwater overtops the railway line, then it is recommended that all remaining students and staff seek shelter in the shared Hall above the library between the two High Schools, and wait until the flood risk abates. Any parents in the process of collecting students should be encouraged to remain with their children at this location.

ix) It could typically take 12-24 hours until the flood risk abates. Reasonable access to the Liverpool CBD (and Westfields) is available from the School Hall, along the preferred route shown on Figure 4, where supplies can be obtained for any extended period of sheltering.

5.7 ACTION TO TAKE AFTER A FLOOD

The following action is recommended after a flood occurs:

x) All floors, furniture and any equipment that has been immersed should be thoroughly cleaned and disinfected.

xi) All electrical outlets and electrical equipment should be inspected for signs of immersion, and where evident, a safety check should be carried out by a licensed electrician.

xii) This Plan should be reviewed on a regular basis, and after past flood events to account for experiences and lessons learnt.

6 REFERENCES

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