Adco Constructions Pty Ltd

New Liverpool Primary School

New Liverpool Primary School (outline of new buildings in red)

Flood Emergency Response Plan

November 2021

FloodMit

Adco Constructions Pty Ltd

New Liverpool Primary School

Flood Emergency Response Plan

November 2021

FLOODMIT PTY LTD
Flood Management Consultants

ABN: 46 148 958 696

Postal: P O BOX 936 EPPING NSW 1710
E-mail: postmaster@floodmit.com.au
Web: www.floodmit.com.au

TABLE OF CONTENTS

Page

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF ILLUSTRATIONS

1 INTRODUCTION

FloodMit Pty Ltd was commissioned by Adco Constructions Pty Ltd to prepare a flood emergency response plan for 'New Liverpool Primary School'.

The new primary school is proposed to be located within the existing Liverpool Girls High School and Liverpool Boys High School site at 18 Forbes Street, Liverpool (Lot 1 DP 1137425). The new primary school will provide 44 mainstream teaching spaces, 4 support units, 4 special programs units, 2 preschool units and core facilities to Core 35 standard.

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.

Council's flood risk management policy includes a requirement for new school buildings to have a minimum floor level above the highest flood possible, which is known as the Probable Maximum Flood (PMF).

Council's policy serves two purposes:

i) To ensure that children are not exposed to dangerous conditions as a result of flooding that may be experienced at the site; and

ii) School buildings that have no risk of flooding may serve as important evacuation centres for both the school and local community when flooding is experienced in the general area.

It is understood that it is not feasible for all new buildings to be constructed with minimum floor levels above the PMF flood level. Consequently, this flood emergency response plan has been requested so that the risk of flooding in extreme events is appropriately managed. It should also be noted that most of the new buildings are two or three levels high, and only the ground floor level of these buildings would be inundated in a PMF flood.

This report provides the background and source information in which the flood emergency response plan has been prepared. A concise plan that outlines the actions to be taken before, during and after flooding is provided as an appendix to this report.

2 SITE DESCIPTION AND PROPOSED PRIMARY SCHOOL

2.1 SOURCE OF INFORMATION

The following information regarding the existing site and the new proposed primary school has been extracted from the following sources:

i) Detail Survey over Lot 1 in DP 1137425 (Liverpool Boys & Liverpool Girls High School), John Lowe & Associates, 3/12/2018;

ii) Architectural drawings of Proposed New Liverpool Public School, Fitzpatrick & Partners, 25/6/2021; and

iii) LiDAR Survey – Penrith, 1 metre resolution, acquired during 2019.

2.2 EXISTING SITE DESCRIPTION

The site is located at 18 Forbes Street, Liverpool (Lot 1 DP 1137425).

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 digitised and overlaid on an aerial photo of the site at Figure 2. Ground contours at 0.5m intervals have been derived from LiDAR survey acquired during 2019, and are also included on Figure 2. These contours are consistent with surveyed ground contours provided by John Lowe & Associates for the site.

The site occupies a total area of 7.50Ha, and is bounded by Forbes Street (to the west), Lachlan Street (to the north), Burnside Drive (to the east), and Liverpool Hospital (to the south). The existing site use is the Liverpool Boys High School (on the northern portion of the site) and the Liverpool Girls High School (on the southern portion of the site). The eastern portion of the site contains playing fields where the new primary school has been proposed.

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.

Buildings associated with Liverpool Boys High School range from single storey to 3 storeys in height. Most ground floor buildings are above RL 10.5m AHD.

Buildings associated with Liverpool Girls High School also range from single storey to 3 storeys in height. Most ground floor buildings are above RL 10.3m AHD.

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

The Liverpool Railway line is a key feature of the surrounding land, and located immediately to the east of Burnside Drive. The railway line is raised above the natural topography, and may act as a levee bank to shelter the school from potential flooding that can occur from the Georges River. The crest height of the railway is at RL 9.7m AHD adjacent to the school. The school site is not shown to be inundated in a 100 year flood from the Georges River, but could be inundated in more extreme flood events that overtop the railway line. Existing flood behaviour is reviewed in Section 3.

2.3 PROPOSED PRIMARY SCHOOL DEVELOPMENT

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. These buildings have been digitised from the available architectural plans, and are included on Figure 1. 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

Job No: J2113
File: J2113_Fig2.wor
Date: 15/11/21

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

3 REVIEW OF MAINSTREAM 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 also contribute to flooding problems in and around the school. The railway embankment could also tend to impound floodwater behind the railway embankment when the capacity of the stormwater pipe system is exceeded. Overland flow issues could contribute to additional nuisance flooding conditions.

3.2 DESIGN FLOOD LEVELS

Design flood levels from the Georges River that could potentially have an impact on the subject site 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)	
	Adopted by Council (PWD, 91)	Most Recent (BMT WBM 2020)
20 year Flood	7.6	7.4
50 year Flood	8.4	8.2
100 year Flood	8.6	8.4
500 year Flood	N/A	8.7
Probable Maximum Flood (PMF)	10.8	12.0

Flood levels that are currently adopted by Council are sourced from the Georges River Flood Study (PWD, 1991). Levels from the latest study (BMT WBM) are slightly lower than these levels up to the 100 year flood, but significantly higher for the PMF flood.

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, however, the railway embankment (at RL 9.7m AHD) may provide additional protection against inundation.

Proposed ground floor levels for the new primary school (at RL 9.3m AHD) would be inundated by 1.5m in the adopted 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 areas. These are:

High Flood Risk – Land below the 100 year flood that is subject to a high hydraulic hazard or where there are significant evacuation issues;

Medium Flood Risk – Land below the 100 year flood that is not subject to a high hydraulic hazard and where there are no significant evacuation issues;

Low Flood Risk – Land that is above the 100 year flood, but still potentially affected by floods up to the probable maximum flood (PMF).

The flood risk classification in the vicinity of the subject site is provided on **Figure 3**. This is a composite map derived from individual flood risk areas that apply for the Georges River, Cabramatta Creek and Brickmakers Creek.

The subject site is classified as having a *Low Flood Risk*.

3.4 FLOOD VELOCITIES

The best information on flood velocities in the PMF event is available from the Georges River Flood Study (BMT WBM, 2020).

The maximum velocity that applies to the site in the PMF event is estimated to occur along the eastern boundary of the site, with a maximum value of 0.4m/s. This reduces as you move away from Burnside Drive to higher ground. 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 affect from the railway embankment.

It is noted that the PMF levels from the 2020 study are about 1.2m higher than Council's adopted PMF flood level. Consequently, the velocity estimates are likely to be conservatively high when compared to the results from the earlier study (had these been available).

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 in the design 100 year flood has been extracted from the Georges River Floodplain Risk Management Study and Plan (Bewsher, 2004) for Liverpool Bridge. This is the same location in 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 applied to the Liverpool Bridge 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.

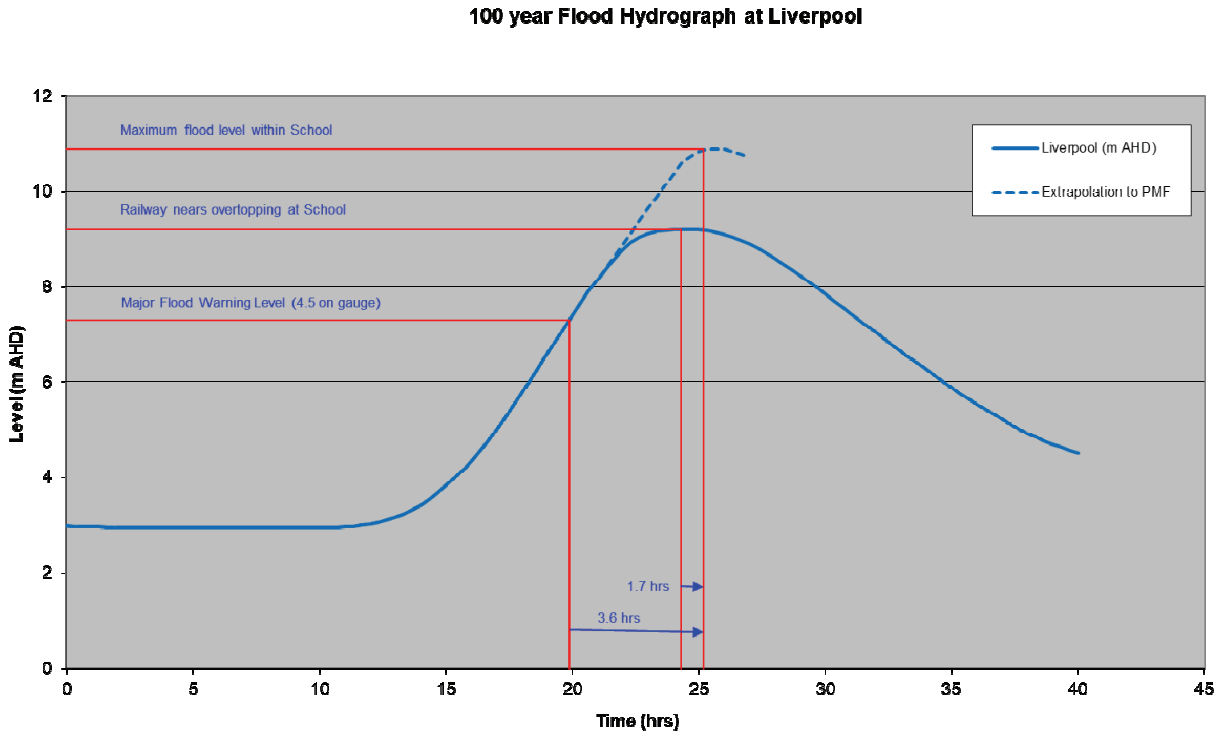

Illustration 1
Rate of Rise of Floodwater at Liverpool

Legend

High Flood Risk

Medium Flood Risk

Low Flood Risk

Cabramatta Ck

Brickmakers Ck

SITE

Georges River

N

0 200 400

metres

FloodMit

Job No: J2113
File: J2113_Fig3.wor
Date: 15/11/21

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

4 FLOOD WARNING AND EVACUATION CONSIDERATIONS

4.1 FLOOD WARNINGS

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

The scheme monitors rainfall and river gauges in the upper catchment and aims to provide at least 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 EVACUATION CONSIDERATIONS

Evacuation is an important consideration for pupils and staff of the proposed primary 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 is 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.

Preferred 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.

Where pupils and staff have not evacuated the site, and flood levels start to inundate the school grounds, it is recommended that any remaining occupants shelter within the upper floor levels of the school buildings. This might also occur due to local stormwater ponding within the school grounds, prior to flooding being experienced from the Georges River.

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 levels are estimated to have no risk of inundation. It could typically take 12 - 24 hours for the flood risk to subside.

4.3 RECOMMENDED RESPONSE MEASURES

The recommended strategy is to evacuate, or close the school, at an early stage of a developing “major flood” on the Georges River. By the time that flooding is experienced within the school, it is likely to be too late to evacuate the site, and it will be safer to seek shelter in one or more of the upper level school buildings. Flood warnings that are issued by the Bureau of Meteorology will assist in monitoring the evolving flood situation.

The recommended flood response measures form part of a concise flood emergency response plan that has been included as an appendix to this report.

The plan details actions to be taken before, during, and after flooding.

The plan should be considered an evolving document, which should be updated as additional information on flooding becomes available. The plan should also be reviewed as lessons are learnt from future flood events.

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

FloodMit

Job No: J2113
File: J2113_Fig4.wor
Date: 16/11/21

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

5 REFERENCES

Bewsher Consulting (2004), "*Georges River Floodplain Risk Management Study and Plan*", prepared for Liverpool, Fairfield, Bankstown and Sutherland Councils

Bewsher Consulting (2011), "*Cabramatta Creek Flood Study and Basin Strategy Review*", prepared for Liverpool City Council

BMT WBM (2020), "G*eorges River Flood Study*", prepared for Liverpool City Council and Canterbury Bankstown City Council

Fitzpatrick & Partners, "*New Liverpool Public School – Southern Suburbs Cluster, Forbes Street Liverpool NSW 2170*", Architectural drawings prepared for Department of Education NSW

FloodMit Pty Ltd (2020), "Liverpool Collaboration Area Place Strategy – Flood Constraints Study", prepared for Liverpool City Council

GHD (2007), "*Brickmakers Creek Flood Modelling and Review of Flood Mitigation Options*", prepared for Liverpool City Council

John Lowe and Associates Pty Ltd (2018), "*Detail Survey over Lot 1 in DP 1137425 (Liverpool Boys & Liverpool Girls High)*", prepared for the Department of Education NSW

Meinhardt Bonacci (2021), "*Proposed New Liverpool Primary School Development, Forbes Street, Liverpool, NSW*", SD Report

Public Works Department, NSW (1991), *"Georges River Flood Study"*, prepared by the University of NSW Water Research Laboratory

APPENDIX

FLOOD EMERGENCY RESPONSE PLAN

Flood Emergency Response Plan
New Liverpool Primary School, at 18 Forbes Street

Preamble

This Plan is an evolving document. It should be continually reviewed and updated as new or additional information comes to hand. It should also be reviewed following any experience of flooding at the site.

Purpose

The Plan is a requirement of Council as building floor levels could be inundated in a large flood event. The Plan aims to reduce the personal risk from flooding that pupils and staff could encounter within the school.

Responsibilities

The school principal should assume overall responsibility for implementing the plan. A staff member should be delegated responsibility for monitoring and reporting on the flood situation as it evolves.

The Flood Risk

The school is potentially impacted by flooding from the Georges River, with many of the access routes also impacted from Cabramatta Creek and Brickmakers Creek. Local overland flooding can also contribute to nuisance flooding within the school grounds. The flood risk within the general region is shown on Figure 3 of the accompanying report. The school grounds are classified as having a “Low Flood Risk”.

The school is not directly impacted from a 100 year flood in the Georges River, but could be inundated in more extreme flood events that overtop the railway embankment on the eastern side of Burnside Drive. Design flood levels are provided in Table 1 of the main report. Ground floor buildings could be inundated by up to 1.5m in the Probable Maximum Flood (PMF). The site could also be impacted by nuisance flooding conditions as a result of overland flooding across the school grounds from severe thunderstorm events.

Flood Warning and Critical Flood Heights

Flooding from the Georges River typically occurs after 24-48 hours of prolonged heavy rainfall over the catchment. Local overland flows can also be generated from short duration, severe thunderstorms, for which there is no flood warning.

The Bureau of Meteorology provides up to 12 hours warning of an impending flood on the Georges River. Predicted flood levels are provided at the Liverpool weir (also known as Liverpool Bridge). Flood warnings that may be issued, and their relevance to the school, are tabulated below:

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
Probable Maximum Flood (PMF)	8.1	10.9	Ground floor buildings flooded to 1.5m

Once a “Major Flood” level is reached (at 4.5m on the Liverpool gauge), there could be less than 4 hours before the peak height of a PMF type event is experienced within the site.

Once the railway line overtops, there could be less than 2 hours before the peak height of a PMF type event is experienced.

Evacuation Strategy

The recommended strategy is to evacuate, or close the school, at an early stage of a developing “major flood” on the Georges River. By the time that flooding is experienced within the school, it is likely to be too late to evacuate the site, and it will be safer to seek shelter in one or more of the upper level school buildings.

Actions to take before a flood occurs

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 school building block.

Actions to take during a flood

iv) Flood conditions should be carefully monitored should any formal flood warning advice be issued by the Bureau of Meteorology for the Georges River, or other advice is received from the State Emergency Service. Flood conditions can be monitored at www.bom.gov.au (under warnings present) or with the phone app “FloodsNearMe”.

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 parents are contacted and urged to collect pupils at their earliest convenience.

vii) Preferred access routes to and from the school are shown on Figure 4 of the accompanying report. Areas likely to be inundated by floodwater include The Hume Highway (near Cabramatta Creek); Governor Macquarie Drive (near Warwick Farm Racecourse); 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 pupils and staff seek shelter in one or more of the upper level school buildings, and wait until the flood risk abates. Any parents in the process of collecting children should be encouraged to remain with their children in the upper level school buildings.

ix) It could typically take 12-24 hours until the flood risk abates.

Actions to take after a flood

x) Thoroughly clean and disinfect floors, furniture, and any equipment that has been immersed.

xi) Inspect all electrical outlets and electrical equipment for signs of immersion, and where evident, have a safety check carried out by a licensed electrician.

xii) Review and update this Plan to account for experiences and lessons learnt.