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FLOOD RISK MANAGEMENT REPORT

Northern Beaches Council (Manly)

Proposed Event

(The Drop Festival)

from

10/3/2020 – 16/3/2020

at

Keirle Park, Manly

Job No. 190163 – Revision C (2020 event)

Prepared for: Jeremy Stones (The Drop Festival)

Prepared by: Cameron Haack

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Contents

FLOOD RISK MANAGEMENT REPORT

DATE	4th December 2019
SITE	Keirle Park, Manly
ENGINEER	Cameron Haack
CLIENT	Jeremy Stones (The Drop Festival)
JOB No	190163 – Revision C (2020 event)

1.0 INTRODUCTION:

NB Consulting Engineers assessed the proposed site plan prepared by '*The Drop Festival, dated 17/09/2019* for the proposed live music event *(known as 'the drop festival')* at the above site address from 10/3/2020 – 16/3/2020 in reference to potential flooding issues. The proposed development generally meets the requirements of Northern Beaches Council (Manly DCP) subject to the recommendations outlined in this flood risk management report.

The venue has been assessed in accordance with the requirements of Manly Councils *Specification for Stormwater Drainage 2003* and *Interim Policy – Flood Prone Land 2013*, Council's Flood Advice information provided, the Manly Lagoon Flood Study (2013), The Manly to Seaforth Flood Study (2019) and the NSW Government Floodplain Management Manual (2005).

The site is located on Pittwater Road in Manly. The proposed venue is located within the vicinity of the flow extents (for the 1% AEP flood event) of the flood as predicted in the *Manly Lagoon Flood Study (2013).*

It should be noted that the *Manly Lagoon Flood Study (2013)* [MLFS herein] predicts the 1% AEP flood extends to a level of RL 3.21m AHD and will completely inundate the site. The MLFS also notes the PMF level as reaching a peak of RL 5.65m AHD.

Figure 1.01 – Manly Lagoon Flood Study 2013 – Catchment Boundary

1.1 - Catchment Summary:

The Manly Lagoon catchment's (refer figure 1.01) flood mechanism can be caused by a number of events, however severe storms and floods pose a major and high likelihood threat to flooding within the catchment.

The existing lagoon entrance policy allows for manual breakout of the entrance when the water reaches a defined trigger level of RL1.40m AHD, to help alleviate flooding, however significant flood inundation is still expected during the 1% and 5% AEP flood events.

Keirle Park is located directly adjacent to the Manly lagoon and is one of the worst flood affected areas of the catchment. The park is located in the 'lower reaches of all tributary catchments' and therefore the flood levels at the site will be dominated by the Lagoon flooding conditions. The worst-case flooding conditions within Manly Lagoon are typically a result of longer duration flooding events (6-9 hours). However similar flood levels are also expected during shorter durations such as the 2 hour 1% AEP event (refer figure 1.02). The critical 1% AEP storm duration for the site is the 9 - hour event (refer figure 1.1). The MLFS (2013) also indicates that the water level response at Kentwell Road, Brookvale is a *good representation of flood response in the catchment'*, according to figure 1.02 (below).

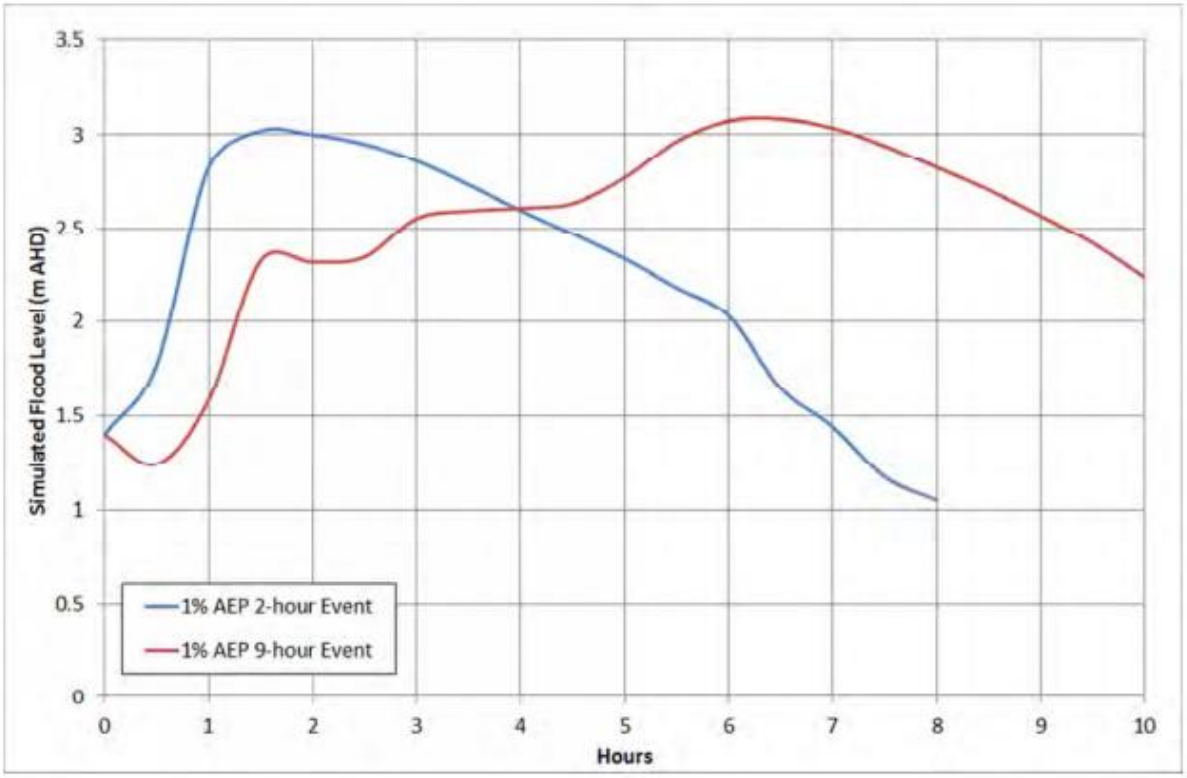


Figure 1.02 – Simulated Water Level Response at Kentwell Road, Brookvale Creek (MLFS 2013)

Flash Flooding in the catchment is common due to the main period of rise in the Lagoon occurring (in worst-case scenarios) *'over a few hours' (MLFS).*

It is also important to note that, according to the draft Manly Lagoon Floodplain Management Study and Plan (FMSP herein), there is no Local Flood Plan for the area. The FMSP has been used a guide for the development of this flood report and emergency response strategy.

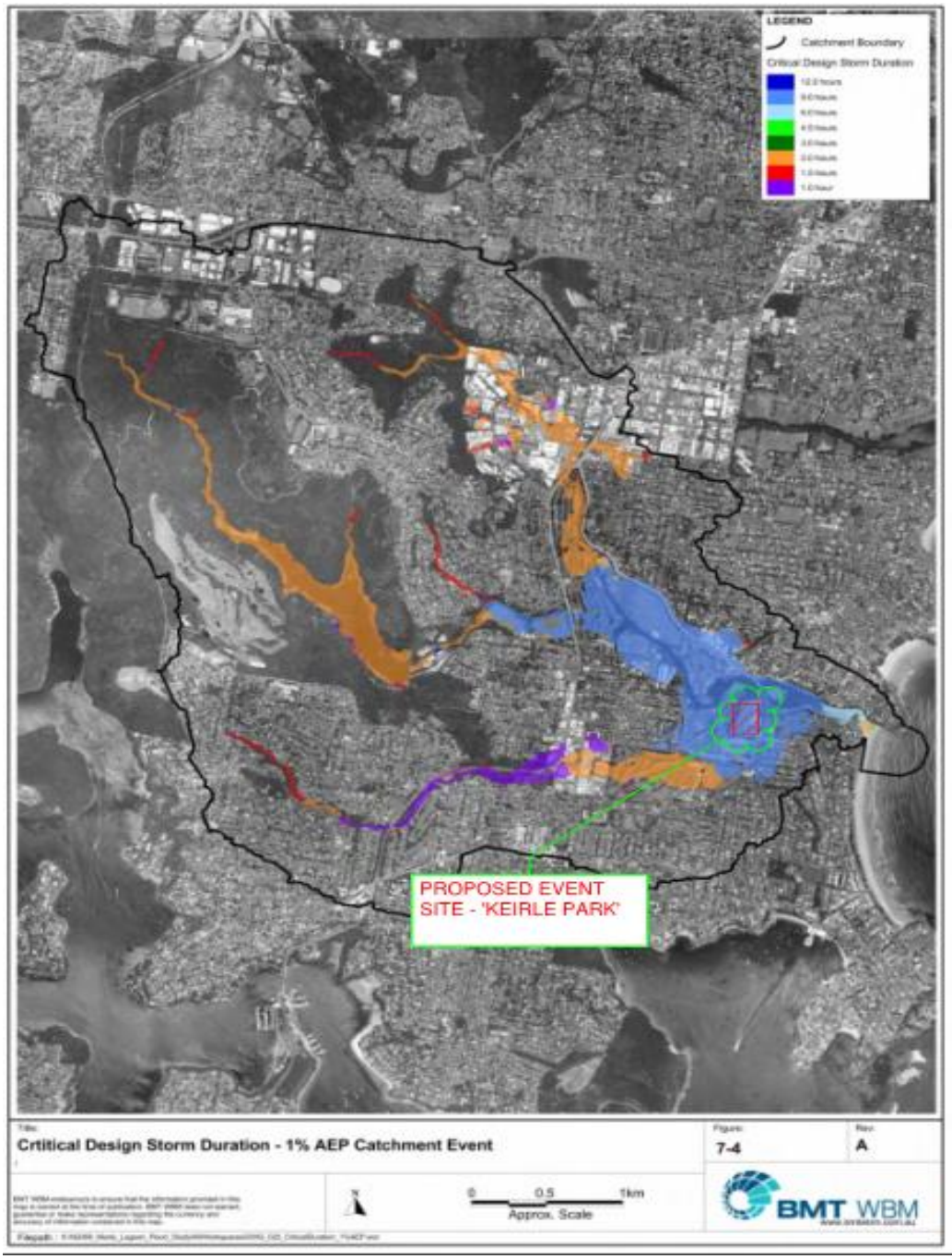


Figure 1.03– Critical Storm Duration – 1% AEP Catchment Event (MLFS 2013)

1.2 - Event Summary:

The drop festival is a music event to be held in Keirle Park, Manly on the 14/03/2020. Whilst the event only lasts for one day, the site will be in use from the 10/3/2020-16/3/2020 by staff and organisers to setup (bump in) prior to the event and pack down (bump out) following the event. There is expected to be 9,000 attendees and staff on site during the event, with a maximum capacity of 12,000.

The event is all ages and therefore children are expected at the site, during the event. Furthermore, for the purpose of this report, we assume that disabled and elderly persons will attend the event. The event organisers have advised NBCE that approximately 20% of the patrons are expected to fit into the above category (1800 – 2400 disabled, elderly and children attendees) Figure 1.21 below shows the site plan.

The event is licensed and therefore alcohol will be consumed by the patrons. It is the responsibility of security staff and other staff trained under Responsible Service of Alcohol (RSA) guidelines, to ensure the patrons are not intoxicated and will be able to follow instruction from staff in an emergency situation.

LiDAR (Light Detection and Ranging) survey data information has been utilised to determine level information for the site, and proposed evacuation routes. The lowest point at the proposed event site is located in the south-western corner of the site and is approximately RL 1.61m AHD. The site slopes gradually up towards Pittwater road to the highest point located at the north eastern corner at approximately RL 2.18m AHD.

Figure 1.21 – Proposed Site Plan – The Drop Festival

Below is a summary of flood information in reference to Northern Beaches Council (Manly) Flood Assessment report requirements and the *NSW Government Floodplain Management Manual* with reference to the 1% AEP storm event.

1.3 - Flood Risk summary:

- Flood Risk Precinct — High
- 1% AEP Flood Level — 3.16m AHD
- 1% AEP Flood Depth — 3.21m (within the lagoon)
  1.50m (approximately on-site)
- 1% AEP Velocity — 1.43 m/s (within the lagoon)
- Extreme Flood Level (PMF) — 5.65m AHD
- PMF Flood Depth — 5.71m
- Flood Planning Level (FPL) — 3.66m AHD (1% AEP + 500mm)
- Degree of inundation — 100%
- Hydraulic Category — Floodway

It should be noted that some of the information provided above is not representative of the proposed event site which does not encompass the entirety of the reserve at Keirle Park. Upon review of council flood maps and topography information it has been determined that the event site can be categorized as flood storage in the 1% AEP flood event, furthermore the 1% AEP peak flood depth is approximately 1.5m, and corresponding flood velocity is approximately 0.5 m/s

In addition to the summary information provided above (extracted from the common purpose flood information provided by council), a table has been formulated below (figure 1.22) indicating key information for the 20%, 10%, 5%, 2%, 1% and PMF events specifically relating to the site. This information is approximate, and was obtained from the Manly Lagoon Flood Study (2013)

KEIRLE PARK FLOOD INFORMATION SUMMARY			
Flood Event	**Depth**	**Hydraulic Categorisation**	**Flood Hazard**
20% AEP	0.5m	Flood Fringe	Low Hazard
10% AEP	0.8m	Not Provided	Not Provided
5% AEP	1.0m	Flood Storage	High Hazard
2% AEP	1.2m	Not Provided	Not Provided
1%AEP	1.5m	Flood Storage	High Hazard
PMF	4.0m	Floodway	High Hazard

Figure 1.31 Flood Information Summary

2.0 SITE EVACUATION CONSIDERATIONS

Due to the location of the proposed event site within the catchment and its isolation from high level refuge, the site is considered (as per the Draft Manly Lagoon FMSP) a 'low flood island' (refer figure 2.01). In 'low flood island' areas, evacuation is the necessary means of flood emergency response.

Classification	Response Required		
	Resupply	Rescue/Medivac	Evacuation
High Flood Island	Yes	Possibly	Possibly
Low Flood Island	No	Yes	Yes
Area with Rising Road Access	No	Possibly	Yes
Area with Overland Escape Routes	No	Possibly	Yes
Low Trapped Perimeter	No	Yes	Yes
High Trapped Perimeter	Yes	Possibly	Possibly
Indirectly Affected Areas	Possibly	Possibly	Possibly

Figure 2.01 – Response Required for Different ERP Classifications – Draft Manly Lagoon FMSP

2.1 Evacuation Locations:

This report has identified several evacuation destinations (refer figure 2.21) below. Considering the number of patrons potentially requiring evacuation, more than one destination has been considered.

The following locations are proposed as flood refuges in the event of site evacuation due to flooding:

- Refuge A: Stella Maris College (Benedict Campus located on Pittwater Road)
- Refuge B: Stella Maris College (Main Campus located on Eurobin Avenue)
- Main Refuge: St Pauls College (124-126 Darley Road, Manly)

2.2 Evacuation Route:

Once the threshold is reached and evacuation triggered evacuees are to:

1. Proceed on foot to the southern end of the carpark in Keirle Park.
2. Under the instruction of traffic controllers and security staff (who will be required to stop traffic in both directions along Pittwater road [opposite Eurobin Avenue]) evacuees will cross the road in groups of 1,800 persons each (the required crossing width is 11 metres and will take approximately 2 minutes for each group to cross). The traffic controllers will then allow traffic to proceed in both directions for approximately 2 minutes. The process will repeat until all evacuees have exited Keirle Park.
3. After crossing Pittwater Road:
    a. all groups are to proceed on foot to the intersection of Collingwood street and Eurobin avenue

b. Disabled, Elderly, Children and injured patrons are to proceed to the designated refuge at Stella Maris Campus on Eurobin avenue (Refuge B).
c. The remaining evacuees are to head south-west along Collingwood street,
d. Then north-west along Iluka avenue,
e. Then south-west along the south-eastern footpath of Collingwood street (note: adequate security staff are to be stationed at this location to ensure evacuees are contained to the south-eastern footpath only, due to hazardous flooding conditions in the roadway and north-western footpath), then
f. South-east along Pacific street.
g. Then south along Malvern avenue
h. East along the southern footpath of Pine street to the intersection of North Steyne.
i. Traffic controllers are to stop and start vehicular traffic in both directions along North Steyne similarly to step 2 (above) to allow evacuees to cross the road and proceed,
j. South along the beachside footpath to the Manly surf club.
k. From the surf club evacuees are to proceed up the stairs located at the eastern end of the surf club to Bower street and
l. Proceed South-west along Bower Street
m. South-east along Reddall street
n. South-west along Addison road
o. South-east along Darley Road to the refuge at St Paul's Campus

Note: all roads outlined in steps a-o are to be closed to vehicular traffic when the 'flood watch' threshold is reached.

4. Leftover staff, patrons and disabled persons are to proceed on foot to the first-floor level of the Stella Maris college (refuge A) located at the roundabout intersection of Pittwater road and opposite Keirle Park.

2.2 Evacuation Timeline:

Due to the number of patrons, the extent of flooding and the likelihood of road closures and blockages, we are of the opinion that any reliance on vehicular transport will likely cause unacceptable delays to the evacuation timeline.

All evacuation routes will require patrons to pass through flood effected areas, therefore we recommend that all evacuees reach a point before a H2 hazard threshold is exceeded at the lowest point on the evacuation route.

LIDAR information (refer figure 2.21 below) indicates that the evacuation route will be H2 hazard or less at a point that is beyond Stella Maris Campus on Eurobin avenue (approximately 675m distance from the start of the evacuation route).

Since the lowest point along the evacuation route is at the intersection of Eurobin Avenue and Pittwater Road an evacuation trigger is to be implemented prior to any flooding occurring at this point (RL1.80m AHD) with a buffer to allow for time taken for the last evacuee to reach Stella Maris Campus located on Eurobin avenue.

According to graph in figure 1.02, the rate of rise of flood waters in the 2 hour duration of the 1% AEP flood event is approximately 1.4 meters per hour.

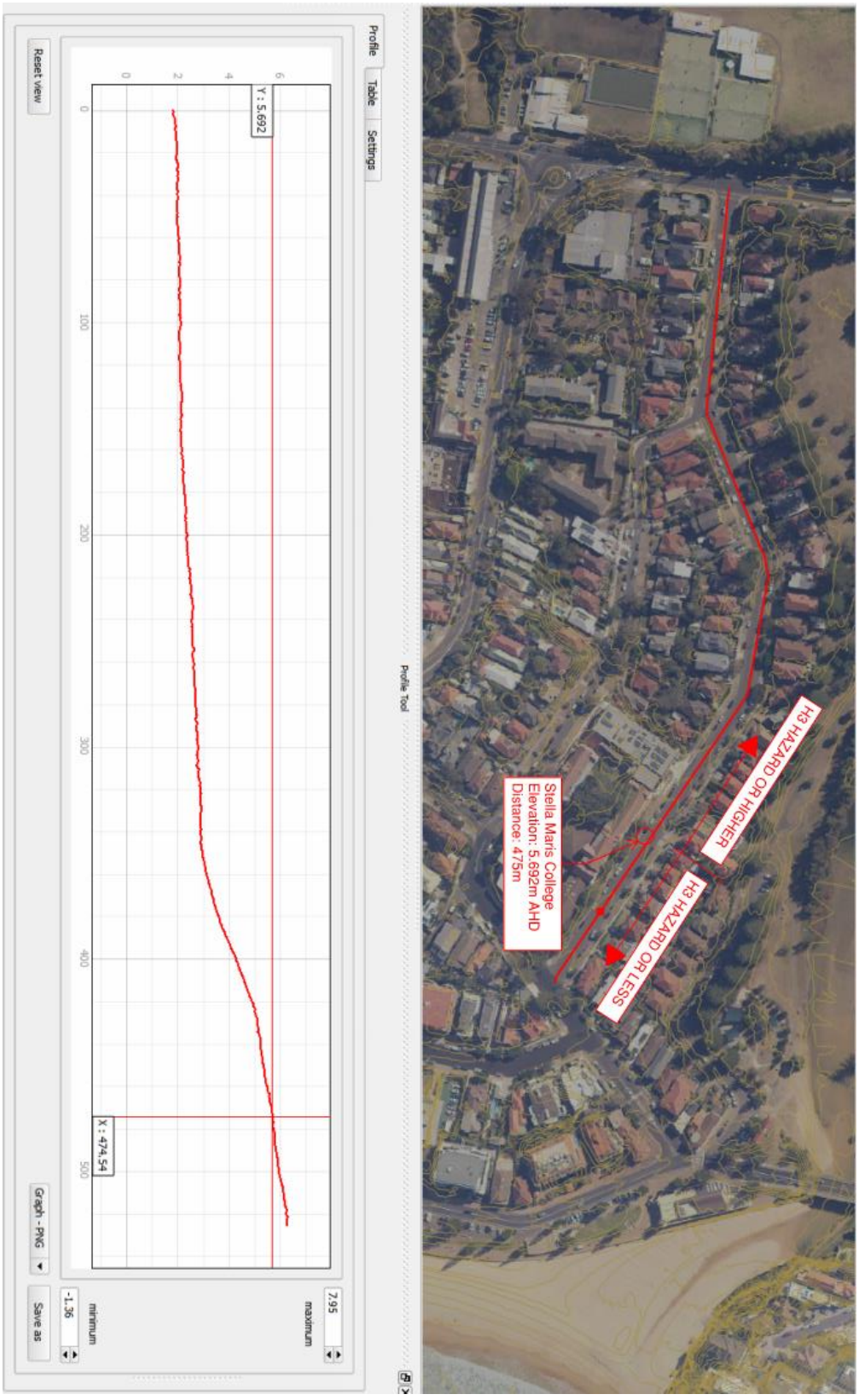


Figure 2.21 – Evacuation Route with cross section.

According to clause 10.6 of the 'green guide', the recommended rate of passage for egress and emergency evacuation is 82 people per metre width per minute on a level surface. Note: The 'green guide' is a UK document (not an Australian Standard), however it's relevance and application to this event has been referenced by the Risk and Compliance Manager at 'Isec', the security advisor for the event for the purpose of preparing this report and emergency response plan.

It is the client's responsibility to ensure that event staff are available and able to assemble patrons at the site evacuation point within 5 minutes of the 'flood warning' trigger. According to the security advisor, the site has a minimum emergency exit width of 28m available. Consequently, all attendees should theoretically be able to assemble at the evacuation point within this timeframe.

Based on the proposed evacuation route (see figure 2.2 below) there will be a pinch point at the intersection of Pittwater road and Eurobin avenue. At this location the evacuation route is approximately 11m in width. The crossing width provided by traffic controllers at Pittwater Road (opposite Eurobin avenue) will match this width to avoid any congestion at the intersection.

Therefore, it will take 26 minutes for all groups to cross Pittwater Road in seven waves (groups). Traffic controllers are to block off Pittwater road for two minutes, allowing approximately 1,800 people to cross into Eurobin Avenue per wave. Each wave will be spaced 2 minutes apart, allowing motorists to travel along Pittwater Road between each wave. It will take an additional six (6) minutes for each group to reach Stella Maris College (located at Eurobin avenue/Collingwood street intersection) and be outside the extent of the H3 hazard. In total it will take 37 minutes from the 'flood warning' trigger until the

last evacuee is beyond the H3 hazard extent and 32 minutes from the 'flood evacuation' trigger.

From this location the flood life hazard risk to evacuees is considered acceptable (ie: H2 or lower) and evacuees will proceed along the designated route to the refuge location. Only minor, isolated, low depth and low velocity flood waters will be encountered along the remainder of the evacuation route.

We note that the Manly to Seaforth flood information (in QGIS format) was obtained by NBCE from council and provides output information (including hazard, depth and velocity) for the PMF event. The information is displayed on tiles that are approximately 6m^2. The output indicates that Collingwood street (in step e of the section 2.2) will be inundated in the PMF event and will have a H3 hazard classification. The H3 hazard partially extends over the south-eastern footpath. Because each piece of information is displayed over a 6m^2 tile, some topographical information (such as kerbs and steep slopes) if occurring within a given tile, may not be accounted for in that tile.

To verify the information NBCE performed a site inspection on 4/12/19 (refer figure 2.23) and used a dumpy level to survey the height of footpath in relation to the gutter invert at four (4) points which display a H3 hazard on council's flood information. The PMF depth, footpath height (above gutter depth), velocity, VD and corresponding hazard for each point is summarized below:

POINT*	PMF DEPTH (mm)	PMF VELOCITY (m/s)	VD	HAZARD (PROVIDED BY FLOOD STUDY	FOOTPATH HEIGHT OVER GUTTER	CALCULATED PMF DEPTH OVER FOOTPATH (mm)	VD OVER FOOTPATH	CALCULATED HAZARD OVER FOOTPATH
1	500	0.2589	0.13	H3	155	345	0.09	H2
2	690	0.2529	0.18	H3	320	370	0.09	H2
3	765.8	0.1648	0.13	H3	361	404.8	0.07	H2
4	688.7	0.3988	0.28	H3	311	377.7	0.15	H2
* NBCE have assumed that the maximum depth will occur in the gutter, where the GIS tile includes the gutter extent								

Figure 2.22 – NBCE calculated hazard over footpath in Collingwood street.

Figure 2.23 – NBCE Site Inspection results (4/12/19) to determine height of footpath over gutter

Considering the results in Figure 2.22 above NBCE confirm that the hazard level along the south-eastern footpath in Collingwood street (at the location surveyed and nominated in step e of section 2.2) is below the H3 threshold (due to the calculated VD being less than 0.6, depth less than 0.5m and velocity less than 2 m/s [refer figure 2.22 below for hazard curve) and that the risk to life is 'acceptable' for the evacuation route, provided evacuees proceed along the south-eastern footpath only at this location.

The footpath width in this location is approximately 2m in width (thus creating a 'bottleneck' in the evacuation route), therefore it will take 11 minutes for each wave of 1800 evacuees to pass this point. We further note that this will create a 'bottleneck' along the evacuation route. The last evacuee will pass the bottleneck an additional 44 minutes from the 'evacuation' trigger.

It will then take an additional 45mins (approximate) for the last evacuee to reach the refuge at the St Pauls College.

If the recommendations of this report are met this will ensure that the risk to life in the PMF event will be no greater than the H2 hazard (figure 2.2 below) which is considered safe for people of all ages.

The client is to ensure adequate staff can be strategically positioned along the evacuation route and at refuge locations to ensure patrons exit via the designated route, in a calm and efficient manner.

The client has provided confirmation from the relevant stakeholders at the proposed refuge locations that access to the buildings/grounds is granted for the duration of the event. This has been provided in Appendix C of this report.

Each Flood Refuge is to provide the following:

- Sufficient Clean water for all occupants
- Portable Radios with spare batteries
- Torches with spare batteries
- First Aid for all patrons

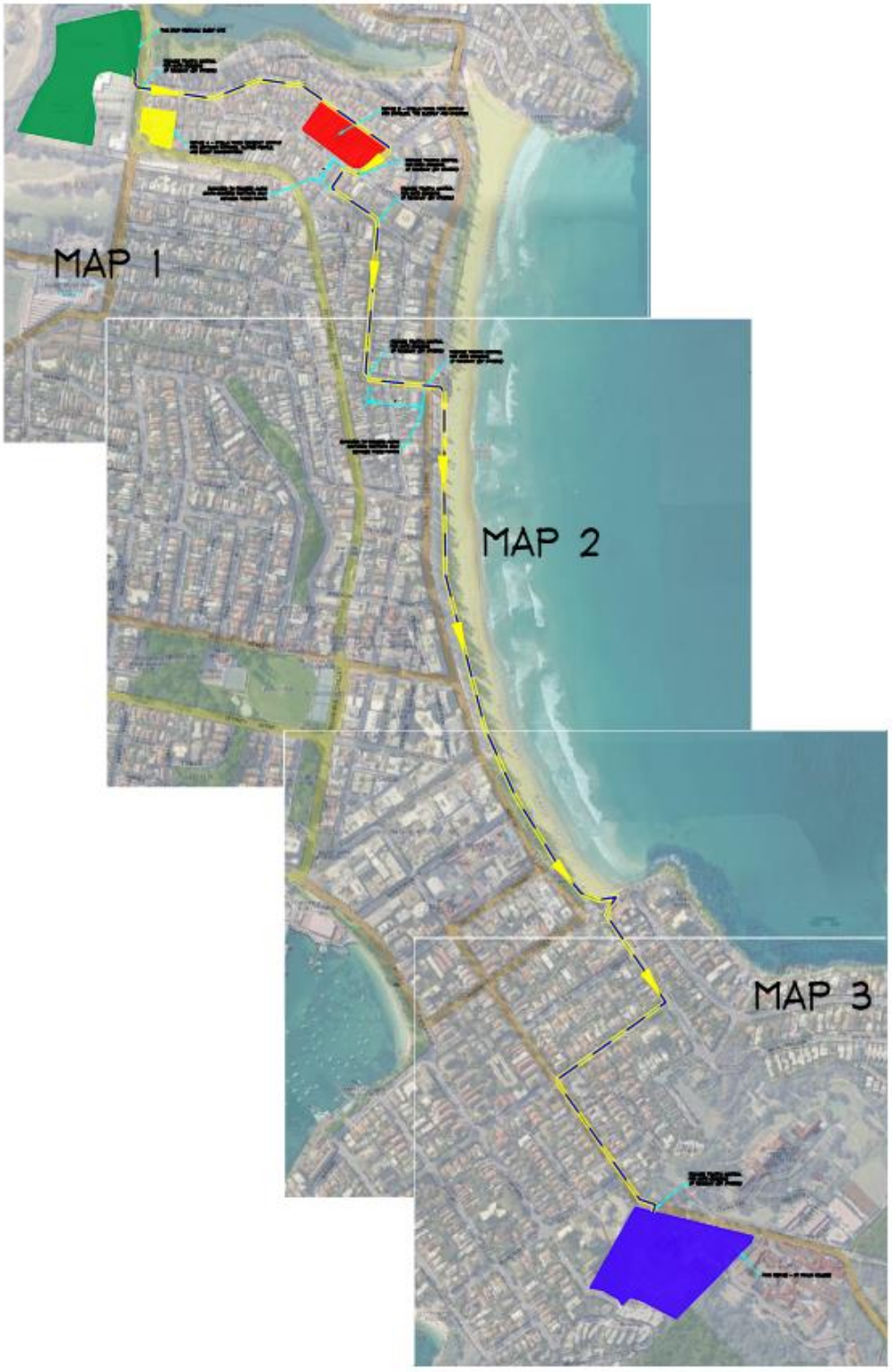


Figure 2.22 – Proposed Evacuation Route and Flood Refuge Locations (refer to Appendix D for A3 version and detailed maps 1-3)

The evacuation timeline relies on the following key alert thresholds (note: all alert thresholds are further explained in section 2.3):

1. **Flood Watch** – worst case (shortest response time) is triggered from a reading of 0.75m or higher at the water level gauge in Riverview parade.
2. **Flood Warning** – worst case (shortest response time) is triggered after a reading of 0.87m or higher at the water level gauge in Riverview parade. This means 'Flood Warning' will trigger after approximately 5 minutes after the 'Flood Watch' threshold is reached.
3. **Evacuation** – worst case (shortest response time) is triggered after a reading of 1.00m or higher at the water level gauge in Riverview parade. This means 'Evacuation' will trigger after approximately 5.0 minutes after the 'Flood Warning' threshold is reached. At this point there will be approximately 34 minutes evacuation time (includes a 2 minute buffer). It will take approximately 32 minutes for all evacuees to get from the event site to a point that is outside the H3 hazard extent. Refuge A (disabled, non-critical staff, coordinators) is approximately 2 minutes walk from the event site. Therefore, any staff/patrons required to access this refuge must leave the site no longer then 30 minutes after the 'Evacuation' threshold (includes a 2 minute buffer).
4. **Take Refuge** – Refuge will be triggered simultaneously with the 'evacuation' trigger and is the time allowed for evacuees to get from a point that is beyond the extent of the H3 hazard extent to the flood refuge; that is, once the patrons are safely beyond the extent of flooding.

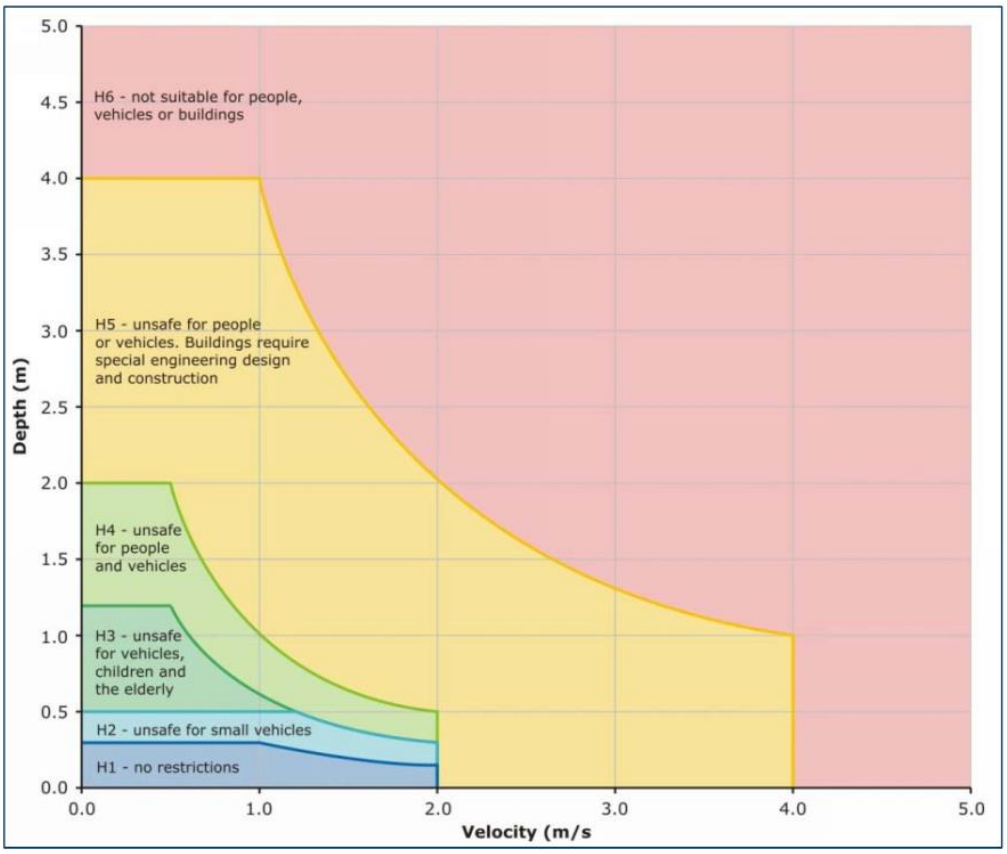


Figure 6-1 Combined Flood Hazard Curves

Figure 2.22 Flood Hazard Curves – (ARR2019)

2.3 Triggers For Site Evacuation:

Upon review of the document *"Flash Mob- Preparing A Music Festival For Floods (Molino Stewart)"* this report has divided the event into 3 phases with 5 individual alert thresholds. The phases include:

1. Bump In (10/3/2020 – 14/3/2020 [prior to gates opening]
2. Day of Event (14/3/2020)
3. Bump Out (14/3/2020 [after gates close] – 16/3/2020)

The 5 individual alert thresholds are as follows:

1. **Flood Watch** – FEC, FEA and other trained staff are warned and increase frequency of weather and flood monitoring. Begin to prepare for potential site evacuation (this may include stationing of security staff, traffic controllers, coordinators along evacuation routes. SES informed
2. **Flood Warning** – Flood Warning issued to all staff. Get ready to evacuate. Announcement over PA and all live events are ceased until further notice. All patrons are to proceed to the carpark at Keirle Park and await further instruction
3. **Evacuation** – All patrons evacuated along designated evacuation routes to a point that is beyond the H3 hazard extent. For the disabled, non-critical staff, coordinators that may be left behind on site and not involved with the site evacuation are to take refuge in 'Refuge A'. Note: disabled people will require assistance.
4. **Take Refuge** – All patrons evacuated, making their way (on foot) to flood refuge locations. Event staff, security coordinators to direct patrons to refuge locations and to close off each refuge once at capacity and direct patrons to next refuge. Overflow refuge to be utilised if duration of flood event is extended / or additional refuge is required.
5. **Cancel Event** – Flooding or flooding threat imminent, unrealistic to hold or continue the event. Event is officially cancelled.

2.4 - Individual Alert Thresholds:

The event coordinator and delegated officials are required to monitor the northern beaches flood warning website: http://new.mhl.nsw.gov.au/users/NBFloodWarning/ constantly over the course of the bump in, event day and bump out phases of the event.

In order to determine Individual alert thresholds, we recommend the following information on the website is monitored:

1 Water Level Summary at:
   a. Riverview Parade and
   b. Queenscliff
   c. Manly Creek
   d. Manly Dam
2. Rainfall Summary at:
   a. Manly CBD
   b. North Manly
   c. Manly Dam
3. Flood Warnings on Flood Watch (homepage)

We also recommend the BOM website is used: www.bom.gov.au over the course of the bump in, event day and bum out phases of the event. The following information should be monitored to determine individual alert thresholds:

1. 8 - day forecast
2. 4 - day forecast
3. 24 - hour forecast
4. 3 - hour forecast
5. Radar
6. Warnings

We recommend SMS alerts from MHL (usually issued to residents in the area) are issued to the relevant staff so that real time water level information is provided for the event. This will assist in maximising the response time on site in a flood event. The client is to provide a list of phone numbers to council of the nominated staff/event coordinators who will be associated with the implementation of this emergency response plan.

Furthermore, electronic on-site monitoring equipment such as rain gauges are required to check rainfall depths on site, assist in determining rain fallen in the 1 hour and 0.5 hour observational triggers of the alert thresholds.

Figures 2.41, 2.42, and 2.43 below provide the alert thresholds for each event phase. From the figures below, we note that the response triggers for the corresponding water level at the Riverview Parade gauge allows 39 minutes response time from the 'flood warning' trigger to a point at which the evacuation route will experience inundation and 34 minutes response time from the 'evacuation' trigger. This will allow attendees to evacuate to a point less than a H3 hazard before any inundation of the evacuation route occurs.

Forecast / Observation	Individual Alert Thresholds During Bump In (10/3/2020 - 14/3/2020 [prior to gates opening])				
	FLOOD WATCH	FLOOD WARNING	EVACUATION	TAKE REFUGE	CANCEL EVENT
8 day forecast	> 200 mm	NA	NA	NA	NA
4 day forecast	> 100 mm	NA	NA	NA	> 200 mm
24 hour forecast	> 50 mm	> 80 mm	> 100 mm	> 100 mm	>100 mm on day before event or day of event
3 hour forecast (10% chance of more than mm)	> 20 mm	> 30 mm	>37 mm	>37 mm	> 37 mm on day before event or day of event
Flood Warnings	MHL Flood Watch Website	Directive From SES	Directive From SES	Directive From SES	Directive from SES
Radar	Moderate/Heavy after > 50mm in 24 hours or Moderate/Heavy after 20mm in 3 hours	NA	NA	NA	NA
Fallen Rain in 24 hours	>110mm	>120mm	>130mm	> 130mm	NA
Fallen Rain in 6 hours	>60mm	>70mm	>80mm	>80mm	NA
Fallen Rain in 3 hours	>40mm	>45mm	>50mm	>50mm	NA
Fallen Rain in 1 hour	>15mm	>20mm	>25mm	>25mm	NA
Fallen Rain in 0.5 hour	> 5mm	>10mm	>15mm	>15mm	NA
Water Level Riverview Parade gauge	0.75m or higher	0.87m or higher	1.00m or more	>1.00m or more	>1.5M on day before event or day of event

Figure 2.41 - Bump In alert Thresholds

Forecast / Observation	Individual Alert Thresholds On Day Of Event (14/3/2020)				
	FLOOD WATCH	FLOOD WARNING	EVACUATION	TAKE REFUGE	CANCEL EVENT
8 day forecast	> 200 mm	NA	NA	NA	NA
4 day forecast	> 100 mm	NA	NA	NA	NA
24 hour forecast	> 50 mm	> 80 mm	> 100 mm	> 100 mm	>100 mm
3 hour forecast (10% chance of more than mm)	> 20 mm	> 30 mm	>37 mm	>37 mm	> 37 mm
Flood Warnings	MHL Flood Watch Website	Directive From SES	Directive From SES	Directive From SES	Directive from SES
Radar	Moderate/Heavy after > 50mm in 24 hours or Moderate/Heavy after 20mm in 3 hours	NA	NA	NA	NA
Fallen Rain in 24 hours	>110mm	>120mm	>130mm	> 130mm	>130mm plus more forecast
Fallen Rain in 6 hours	>60mm	>70mm	>80mm	>80mm	> 80mm plus more forecast
Fallen Rain in 3 hours	>40mm	>45mm	>50mm	>50mm	>50mm plus more forecast
Fallen Rain in 1 hour	>15mm	>20mm	>25mm	>25mm	If > 25 mm plus more forecast
Fallen Rain in 0.5 hour	> 5mm	>10mm	>15mm	>15mm	>15mm plus more forecast
Water Level Riverview Parade gauge	0.75m or more	0.87m or more	1.00m or more	1.00m or more	>1.00M

Figure 2.42 - Day of Event Alert Thresholds

Forecast / Observation	Individual Alert Thresholds During Bump Out (14/3/2020-16/3/2020)				
	FLOOD WATCH	FLOOD WARNING	EVACUATION	TAKE REFUGE	CANCEL EVENT
8 day forecast	> 200 mm	NA	NA	NA	NA
4 day forecast	> 100 mm	NA	NA	NA	NA
24 hour forecast	> 50 mm	> 80 mm	> 100 mm	> 100 mm	NA
3 hour forecast (10% chance of more than mm)	> 20 mm	> 30 mm	>37 mm	>37 mm	NA
Flood Warnings	MHL Flood Watch Website	Directive From SES	Directive From SES	Directive From SES	NA
Radar	Moderate/Heavy after > 50mm in 24 hours or Moderate/Heavy after 20mm in 3 hours	NA	NA	NA	NA
Fallen Rain in 24 hours	>110mm	>120mm	>130mm	> 130mm	NA
Fallen Rain in 6 hours	>60mm	>70mm	>80mm	>80mm	NA
Fallen Rain in 3 hours	>40mm	>45mm	>50mm	>50mm	NA
Fallen Rain in 1 hour	>15mm	>20mm	>25mm	>25mm	NA
Fallen Rain in 0.5 hour	> 5mm	>10mm	>15mm	>15mm	NA
Water Level Riverview Parade gauge	0.75m or more	0.87m or more	1.00m or more	1.00m or more	NA

Figure 2.43 - Bump out Alert Thresholds

3.0 FLOOD EMERGENCY RESPONSE STRATEGY:

- Risk Exposure — Very High
- Level of evacuation destination — Above the PMF event
- Triggers to action flood emergency response:

Refer Section 2.4 (Individual Alert Thresholds)

- Roles and Responsibility

  Below is a general list of roles and corresponding responsivity that are to be assigned to certain staff members in the unlikely event of a flood evacuation. The tasks and responsibilities outlined are not to be limited solely by this report.

  - Flood Evacuation Coordinator (FEC):
    - responsible for arranging regular staff meetings to provide ongoing training and education for flood emergency requirements
    - responsible ensuring that all staff are educated of flood evacuation requirements
    - responsible for all required flood warning signage
    - responsible for providing evacuation instructions
    - responsible for implementing flood evacuation (see below)
    - responsible for notifying all staff and customers present and ensuring all are accounted for
    - must be the last to evacuate to ensure everyone present has been accounted for and evacuated safely.
  - Flood Evacuation Assistant (FEA):
    - responsible for ensuring that sufficient copies of this Flood Risk Report and Emergency Response Plan are kept onsite and are to be made available on request

- to assist with maintenance of flood warning signage
- required to report to the FEC during heavy rainfall
- to assess rising floodwaters and notify FEC for instructions
- to assist with notifying all staff and customers present
- to assist with the evacuation of staff and customers
- to wait for the FEC prior to them both evacuating the premises.

- Flood warning and signage
  - Flood warning signage is recommended to outline the evacuation procedure and route.
  - A list of emergency contacts is to be provided that includes but not limited to; emergency services (000), the State Emergency Service (132 500), local Council, the local Police, ambulance and fire and rescues numbers and the Bureau of Meteorology.
  - A copy of this Flood Risk Report and the *Flood Emergency Response Plan* is to be kept on the premises at all times. The event coordinator, staff, security, traffic controllers and all other personnel on site are to be fully aware of these documents and requirements for the event in relation to flooding. Training should be provided to understand the Flood Watch, Flood Warning, Evacuation, Take Refuge and Cancel event triggers for the event.
- It is the responsibility of the event organisers to ensure adequate training undertaken so that all personnel are aware and proficiently educated in regard to this response plan. We recommend training is undertaken in accordance with AS3745 (planning for emergencies in facilities).

4.0 RECOMMENDATIONS / CONCLUSION:

- The proposed development is not envisaged to have an adverse effect on surrounding properties. The proposed development generally meets the requirements of *Northern Beaches Council (Manly) DCP* provided the recommendations within this report are implemented.

- Qualifications / experience

Rick Wray
Director NB Consulting Engineers
BE(Civil) MIEAust CPEng NER RPEQ
Over 30 years professional experience

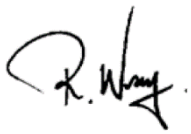
We trust that this report meets with your requirements. Please contact the author if further clarification is required.

NORTHERN BEACHES CONSULTING ENGINEERS P/L

Author:

Cameron Haack
BE Civil MIEAust

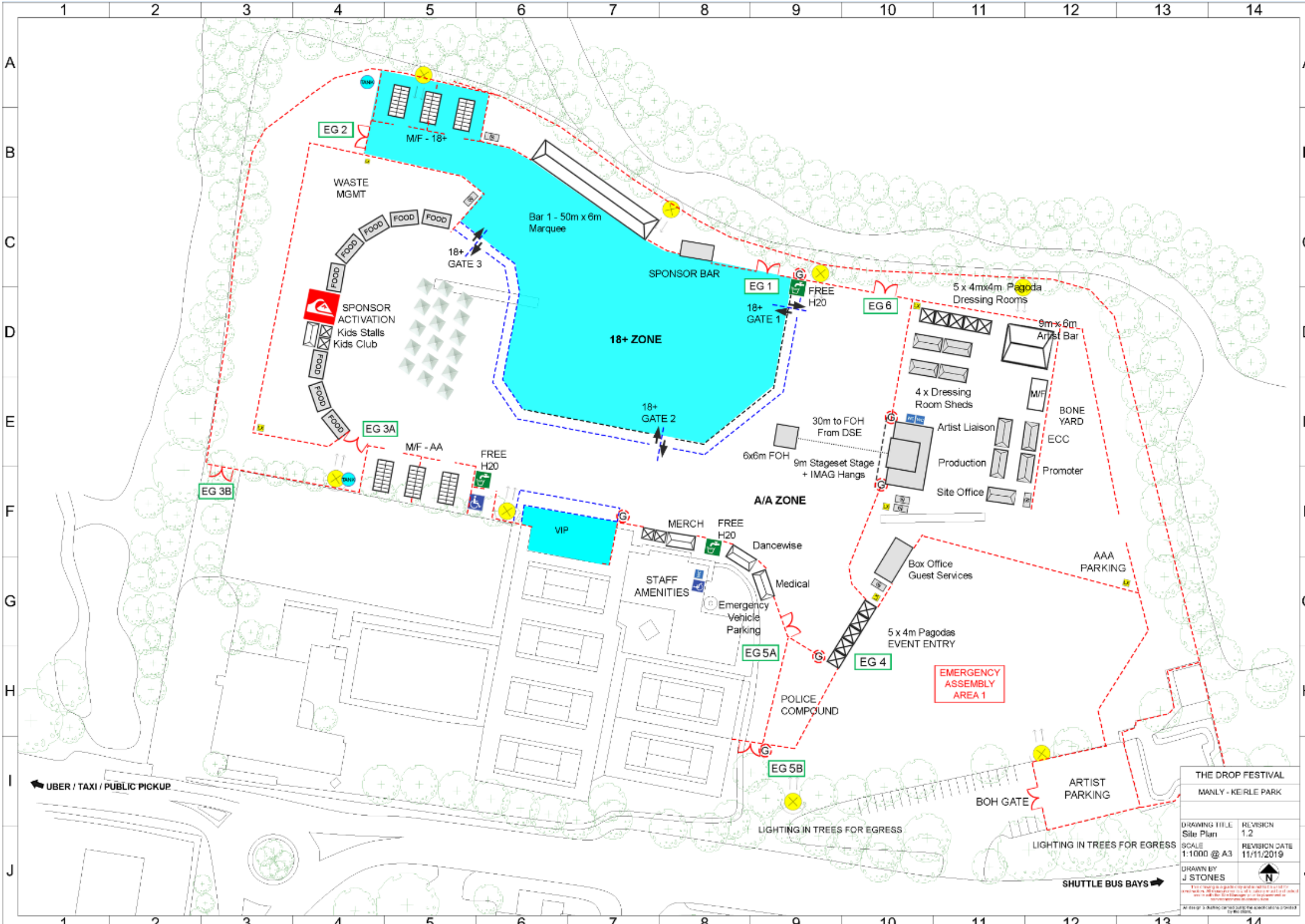
Reviewed By:



Rick Wray
BE CPEng NER RPEQ Director

X:\Synergy\Projects\190163 THE DROP FESTIVAL - MANLY 2019, KEIRLE PARK, MANLY\ENG Design\flood report.docx

APPENDIX A – PROPOSED SITE PLAN


EG 2
M/F - 18+
WASTE MGMT
Bar 1 - 50m x 6m Marquee
18+ GATE 3
SPONSOR BAR
EG 1
FREE H20
18+ GATE 1
EG 6
5 x 4mx4m Pagoda Dressing Rooms
9m x 6m Artist Bar
SPONSOR ACTIVATION
Kids Stalls
Kids Club
18+ ZONE
4 x Dressing Room Sheds
M/F
BONE YARD
ECC
Promoter
18+ GATE 2
30m to FOH From DSE
6x6m FOH
9m Stageset Stage + IMAG Hangs
Artist Liaison
Production
Site Office
EG 3A
M/F - AA
FREE H20
EG 3B
A/A ZONE
VIP
MERCH
FREE H20
Dancewise
Medical
STAFF AMENITIES
Emergency Vehicle Parking
Box Office Guest Services
AAA PARKING
5 x 4m Pagodas EVENT ENTRY
EG 5A
EG 4
EMERGENCY ASSEMBLY AREA 1
POLICE COMPOUND
EG 5B
UBER / TAXI / PUBLIC PICKUP
LIGHTING IN TREES FOR EGRESS
BOH GATE
ARTIST PARKING
LIGHTING IN TREES FOR EGRESS
SHUTTLE BUS BAYS
THE DROP FESTIVAL
MANLY - KEIRLE PARK
DRAWING TITLE
Site Plan
REVISION
1.2
SCALE
1:1000 @ A3
REVISION DATE
11/11/2019
DRAWN BY
J STONES
N

APPENDIX B – EVACUATION DESTINATION WRITTEN CONFIRMATIONS

Stella Maris
COLLEGE MANLY

6th November 2019

To whom it may concern,

This letter is to confirm that Stella Maris College is able to provide the Flood Refuge point for The Drop Festival Event 2020, granting access to our Main Campus at 52 Eurobin Avenue, Manly if required as an evacuation destination in case of a flood emergency.

If you have any further questions or information you require about this, please do not hesitate to contact me.

Warm Regards

Petra Morrell

Community Relations and Communications Officer –
petra_morrell@stellamaris.nsw.edu.au
Phone Ext: 9976 1804

1 November 2019

The Drop Festival
Attn: Mr Ken O'Brien

Dear Ken

Further to your e-mail request today, this confirmation that St. Paul's Catholic College is prepared for "The Drop" to have access to the outside grounds of St Pauls Catholic College on Darley Road, Manly in 2020 for the purpose of an emergency assembly point in case of flooding of Keirle Park.

Keirle Park is the venue where the Drop Music festival will be held.

Please contact me with any questions or further enquiries you have.

Kind regards,

Mr Frank van Bokhoven
Business Manager
E-mail: frank.vanbokhoven@dbb.catholic.edu.au
Ph: 9977 5111

APPENDIX C – PROPOSED EVACUATION ROUTE AND REFUGE LOCATIONS

'THE DROP FESTIVAL' EVENT SITE

PROVIDE TRAFFIC CONTROL FOR SAFE CROSSING OF ROADWAY (BY OTHERS)

REFUGE A - STELLA MARIS 'BENEDICT CAMPUS' FOR LEFTOVER PATRONS, INJURED PEOPLE, AND EVENT COORDINATORS

REFUGE B - STELLA MARIS 'MAIN CAMPUS' FOR DISABLED, THE ELDERLY AND CHILDREN

PROVIDE TRAFFIC CONTROL FOR SAFE CROSSING OF ROADWAY (BY OTHERS)

EVACUEES TO PROCEED ALONG SOUTH-EASTERN FOOTPATH ONLY BETWEEN THESE POINTS

PROVIDE TRAFFIC CONTROL FOR SAFE CROSSING OF ROADWAY (BY OTHERS)

MAP 1

PROVIDE TRAFFIC CONTROL FOR SAFE CROSSING OF ROADWAY (BY OTHERS)

PROVIDE TRAFFIC CONTROL FOR SAFE CROSSING OF ROADWAY (BY OTHERS)

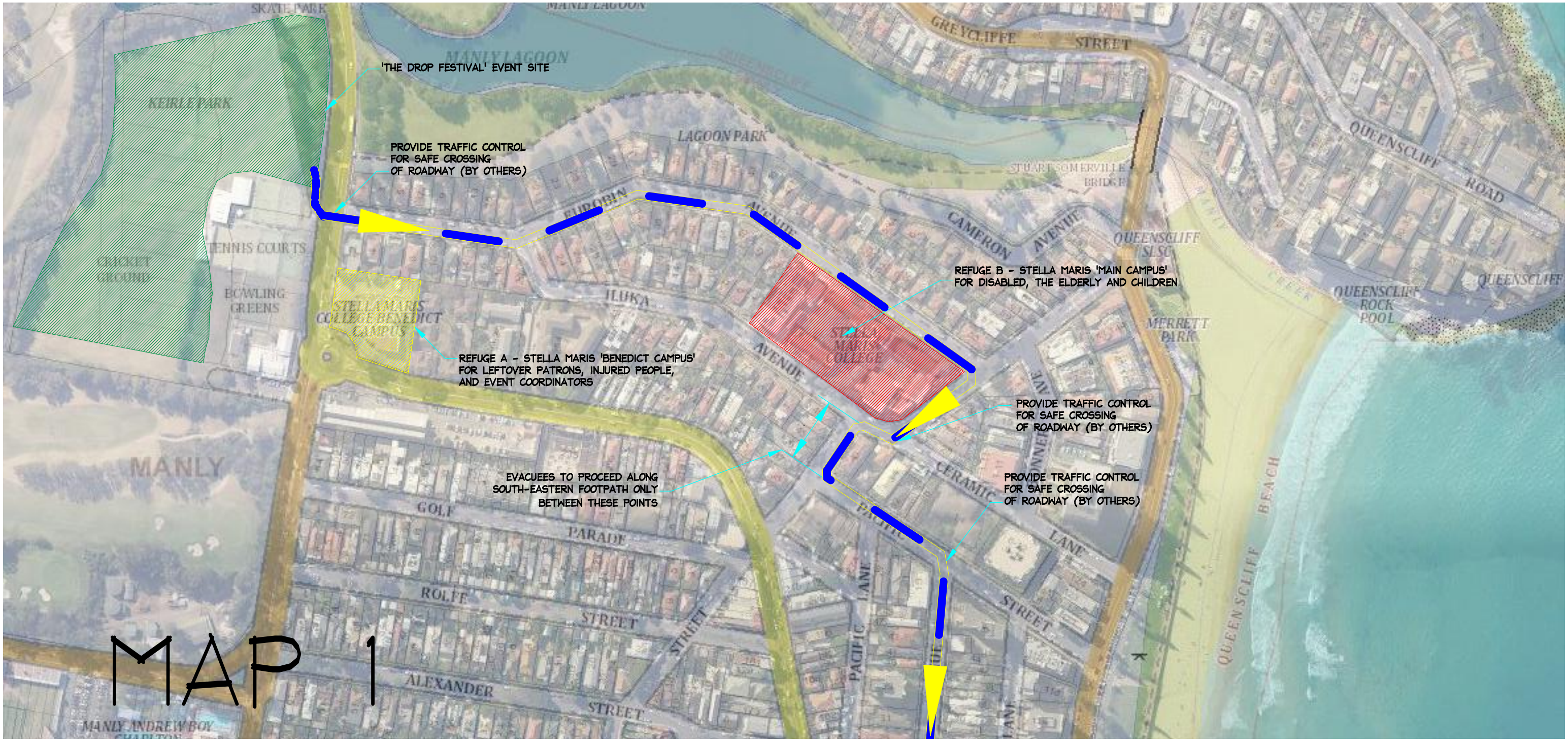
EVACUEES TO PROCEED ALONG SOUTHERN FOOTPATH ONLY BETWEEN THESE POINTS

MAP 2

PROVIDE TRAFFIC CONTROL FOR SAFE CROSSING OF ROADWAY (BY OTHERS)

MAIN REFUGE - ST PAULS COLLEGE

MAP 3


'THE DROP FESTIVAL' EVENT SITE
PROVIDE TRAFFIC CONTROL FOR SAFE CROSSING OF ROADWAY (BY OTHERS)
REFUGE A - STELLA MARIS 'BENEDICT CAMPUS' FOR LEFTOVER PATRONS, INJURED PEOPLE, AND EVENT COORDINATORS
REFUGE B - STELLA MARIS 'MAIN CAMPUS' FOR DISABLED, THE ELDERLY AND CHILDREN
PROVIDE TRAFFIC CONTROL FOR SAFE CROSSING OF ROADWAY (BY OTHERS)
EVACUEES TO PROCEED ALONG SOUTH-EASTERN FOOTPATH ONLY BETWEEN THESE POINTS
PROVIDE TRAFFIC CONTROL FOR SAFE CROSSING OF ROADWAY (BY OTHERS)
KEIRLE PARK
MANLY LAGOON
LAGOON PARK
GREYCLIFFE STREET
QUEENSCLIFF ROAD
CAMERON AVENUE
QUEENSCLIFF SLSC
QUEENSCLIFF ROCK POOL
QUEENSCLIFF
MERRETT PARK
TENNIS COURTS
CRICKET GROUND
BOWLING GREENS
STELLA MARIS COLLEGE BENEDICT CAMPUS
STELLA MARIS COLLEGE
ILUKA AVENUE
MANLY
GOLF PARADE
ROLFE STREET
ALEXANDER STREET
PACIFIC LANE
QUEENSCLIFF BEACH
MANLY ANDREW BOY CHARLTON

MAP 1


PROVIDE TRAFFIC CONTROL
FOR SAFE CROSSING
OF ROADWAY (BY OTHERS)
PROVIDE TRAFFIC CONTROL
FOR SAFE CROSSING
OF ROADWAY (BY OTHERS)
EVACUEES TO PROCEED ALONG
SOUTHERN FOOTPATH ONLY
BETWEEN THESE POINTS
MAP 2
NORTH STEYNE
STREET
STEINTON STREET
WHISTLER STREET
FRANCIS LANE
ST MARY'S CATHOLIC PRIMARY SCHOOL
CATHOLIC CHURCH
MANLY POST OFFICE
CENTRAL AVENUE
HENRIETTA LANE
MANLY LIBRARY
ANGLICAN CHURCH
DRUMMOND HOUSE
SOUTH STEYNE
PARADE
MANLY BEACH
NORTH STEYNE BEACH


MAP 3
PROVIDE TRAFFIC CONTROL
FOR SAFE CROSSING
OF ROADWAY (BY OTHERS)
MAIN REFUGE - ST PAULS COLLEGE
FAIRY BOWER BEACH
CABBAGE TREE BAY
FAIRY BOWER ROCK POOL
MONTPELIER PLACE
FAIRY BOWER ROAD
BEAR COTTAGE
INTERNATIONAL COLLEGE OF MANAGEMENT
CERRETTI CRESCENT
ST PAULS CATHOLIC COLLEGE
MANLY HOSPITAL
HIGH STREET
SPRING COVE ROAD