FLASH MOB – PREPARING A MUSIC FESTIVAL FOR FLOODS

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Splendour in the Grass (SITG) is one of Australia's largest music festivals featuring more than 100 artists and attracting 35,000 patrons over three days. Since 2013 it has been held at North Byron Parklands, 30km north of Byron Bay, which is a specially designed venue for SITG and other open air music and community events.

A feature of SITG is 20,000 campers on site for the three days of the festival. However, the camping area and other parts of the site have a flood risk so before the venue could have approval to operate it needed to demonstrate it had a detailed Flood Risk Management Plan (FRMP) which could be implemented to keep everyone safe if it flooded.

Molino Stewart worked with the venue owners and event organisers to develop a layered warning system from eight day rainfall forecasts to purpose built flood gauges to give operators real time information on actual rainfall and flooding and potential changes in conditions. This was then combined with an escalating alert level schema from Flood Watch through to Cancellation. Each alert level had a detailed suite of actions which were to be implemented depending on whether the alert level was triggered during the two week bump-in, the day before the event, during the event or during bump-out.

Molino Stewart also undertook detailed risk mapping of the site which took into account the frequency of flooding, the number of days per year that parts of the site would be used and the type of use that it would be put to. The venue's permanent and temporary infrastructure, site layout and supporting systems were then designed to take into account the flood risks and to support implementation of the FRMP.

The plan was exercised in the lead up to the first use of the venue in 2013 and proved to be an effective tool to keep on top of the potential range of eventualities. It has continued to be a key part of event preparation since then.

This paper provides insights into the analyses and logic applied to the development of the FRMP.

Introduction

The North Byron Parklands site is located at Yelgun on the eastern side of the Pacific Highway in the north east corner of Byron Shire, NSW. It is about 20 minutes' drive north of Byron Bay and approximately 25 minutes' drive south of Coolangatta (Figure 1).

The site is approximately 260 hectares of which 95 hectares have been developed as a purpose-built sustainable cultural arts and music venue, hosting a range of events such as music festivals, field days, jamborees, gymkhanas and conferences, together with smaller events such as outdoor movies and a wide range of community events. For most of the time the property operates as a farm (Figure 2).

Events range in size from 300 people to Splendour in the Grass (SITG) (Figure 3), which currently has approval capped at 35,000 patrons but has the capacity to grow to 50,000 patrons. In addition to the patrons there are more than 5,000 artists, workers and emergency service personnel on site for SITG.

SITG is held over three days in July each year but it takes two weeks to set-up the site for the event and another week to pack it up. The site caters for up to 20,000 patrons camping on site over four days with the balance of patrons commuting daily. There is public transport available to reach the venue but there is also parking on site for more than 10,000 cars and coaches, including cars which occupy the camping area.

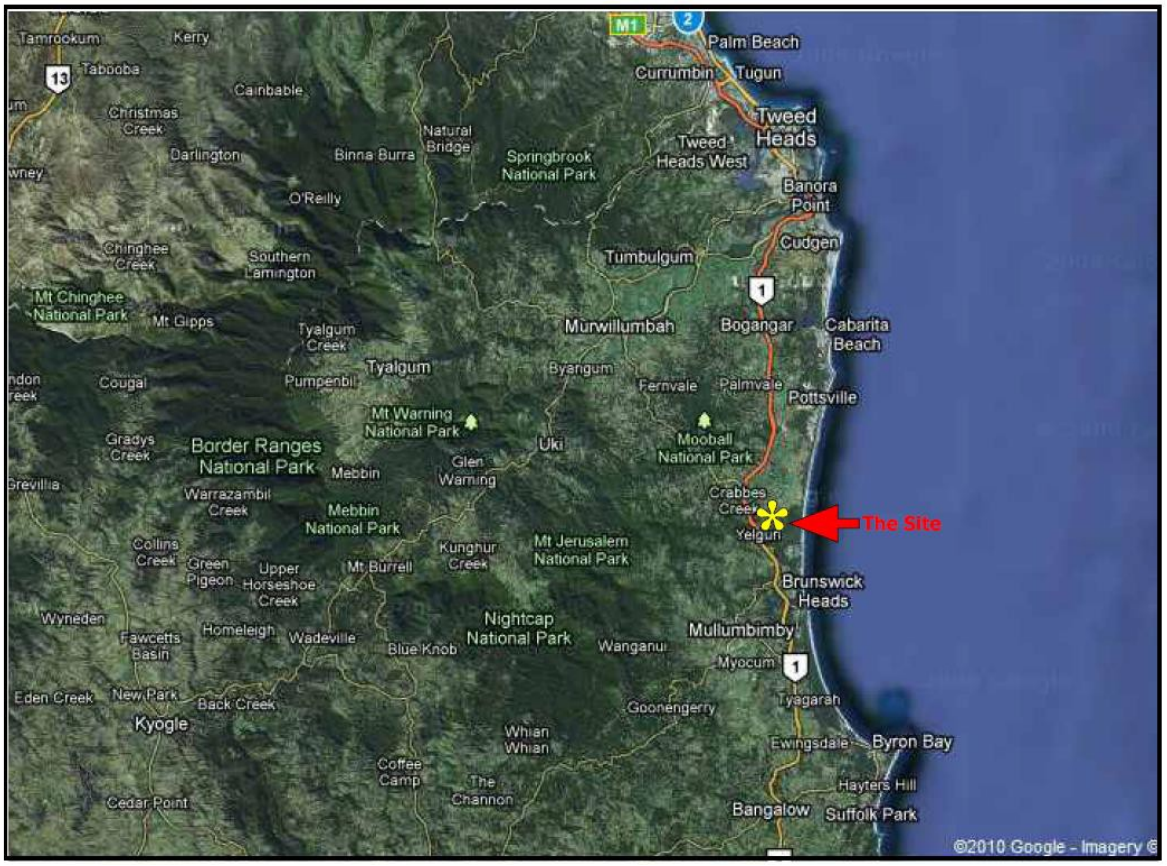

Figure 1: Site Location

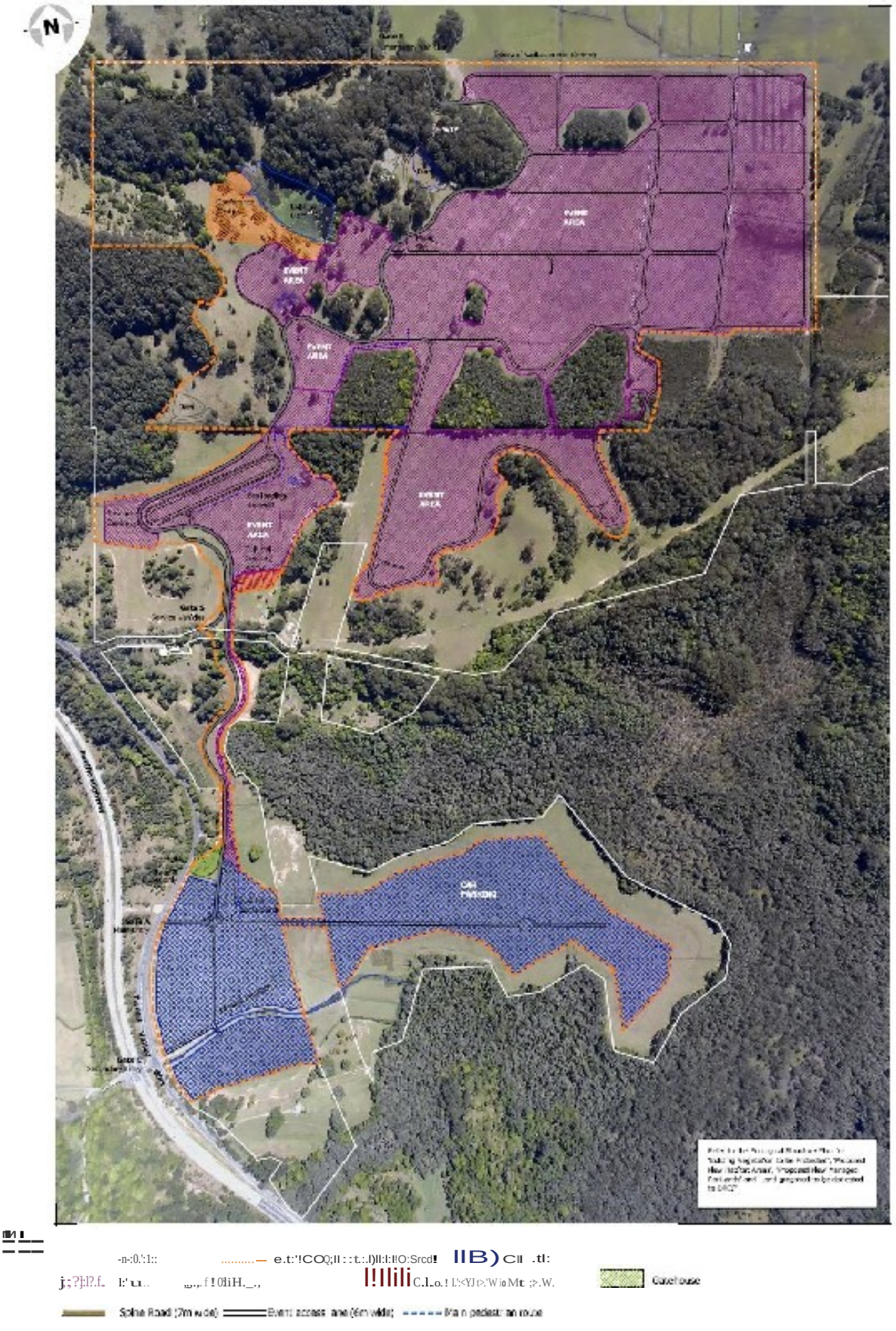

Figure 2: Site Layout

Figure 3: Splendour in the Grass 2017

Hydrology

Hydrologically, the site is split into two sections, divided by the east-west ridge along which Jones Road runs (Figure 3). To the north of Jones Road is the main entertainment area and camping grounds. The majority of the northern area is within the Crabbes Creek floodplain, which itself is part of the Mooball Creek catchment. To the south of Jones Road is a car parking area, patron registration facilities and shuttle bus zone. This southern area is located on the Billinudgel and Yelgun Creek floodplain, which is a tributary of Marshals Creek.

The northern area drains to the north and east towards the Crabbes Creek watercourse, which is itself a tributary of Mooball Creek. Mooball Creek flows towards the coastline in the east, and thence in a northerly direction and outlets to the ocean at Pottsville. A number of

man-made drainage swales have been excavated across the paddock areas to facilitate drainage.

Inundation due to floodwaters comes initially from overland flow along minor watercourses and open channels as a result of intense rainfall within the small catchment of the northern part of the site. Following this, or quite independently from it, flooding from the Crabbes/Moobal Creek system spreads out across those floodplains and backs up onto the site.

The backwater flooding takes longer to arrive at the site, as the flood storage downstream of the site would effectively have to "fill up" prior to the site being subject to major catchment flooding. Nevertheless flood risks in the northern part of the site are dominated by flooding within Crabbes Creek backing up onto the site

In the southern area flooding is driven by water breaking out of Billinudgel and Yelgun creeks and entering the floodplain. The catchments of Billinudgel and Yelgun creeks upstream of the site are approximately 4.5km^2 and 0.5km^2, respectively. The response time of the southern catchment is significantly shorter than that of the Crabbes Creek catchment to the north.

Flood Risks

Large parts of the site can flood in a 5 year average recurrence interval (ARI) event with hazard increasing as frequency decreases (Figures 4-6). However, large parts of the site are flood free even in a PMF.

Flooding is caused by water flowing across the floodplain and pooling. Therefore the velocity of the floodwater is very low and so the relatively high hazard ratings are caused by the flood depths.

While large areas which are flood affected in the 5 year ARI event are used for SITG, smaller events and permanent infrastructure can be confined to areas above the 100 year ARI level. Furthermore, the site is only fully occupied for SITG for 4 days per year which means the chance of a 5 year ARI event actually occurring when it is full of people are about 1 in 450 and larger floods are even less likely to occur during the event. In fact, if the seasonality of rainfall in Northern NSW is taken into account, the probabilities are lower again because July, when SITG is held, is on average a drier time of year.

Nevertheless, floods can occur at any time and there could be more than 50,000 people on site in the future so it was important that an effective Flood Risk Management Plan (FRMP) was developed for the site. In fact, this was a condition of approval for the development and, as it so happened, the site flooded in the lead-up to the first SITG to be held on site and the FRMP was enacted. However, the flooding subsided prior to the event which went ahead and was a great success.

FRMP Philosophy

The philosophy which underpins the FRMP is that protection of life is paramount, protection of property is secondary and protection of profits must be managed by other measures (such as wet weather insurance) outside the FRMP. It sets out to keep people off the site if there is a high likelihood of flooding during an event, even if that means cancellation.

To assist in managing flood risks and communicating response actions, seven flood alert levels were developed for use in the FRMP. They were colour coded to further assist in communication.

- **Normal** - White – daily monitoring of weather forecasts and warnings
- **Flood Watch** – Blue - Flooding might be a possibility – more frequent weather and warning monitoring and preparatory actions.
- **Flood Warning** – Yellow – Flooding is expected to occur – Continuous weather and warning monitoring and get ready to evacuate.
- **Evacuation** – Orange – All patrons, artists, suppliers and staff to leave the site by vehicle. Continuous weather and warning monitoring.
- **Take Refuge** – Red –Flooding is an immediate threat to patrons and they must take refuge on flood free land. Continuous weather and warning monitoring.
- **Cancel** – Black – imminent flood threat or actual flooding makes it unrealistic for the event to be held or to continue.
- **All Clear** – White – Flooding has ceased. The event may continue or may be stopped depending on the circumstances.

These may be revised up or down depending on the changing forecasts and actual conditions. Once a decision is made to cancel an event this cannot be revised.

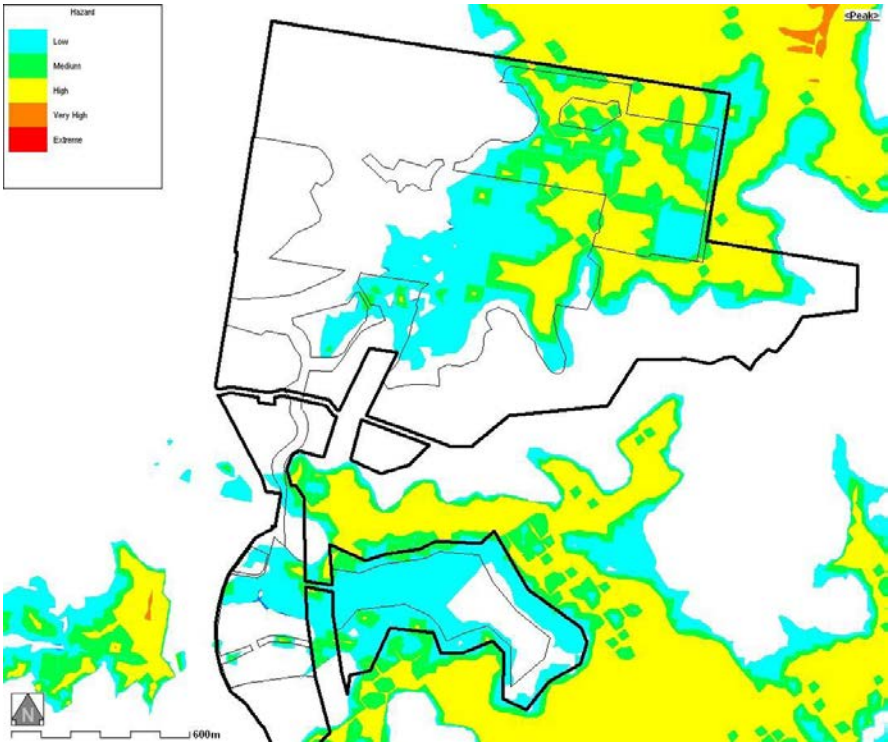

Figure 4: 5 Year ARI Flood Hazard

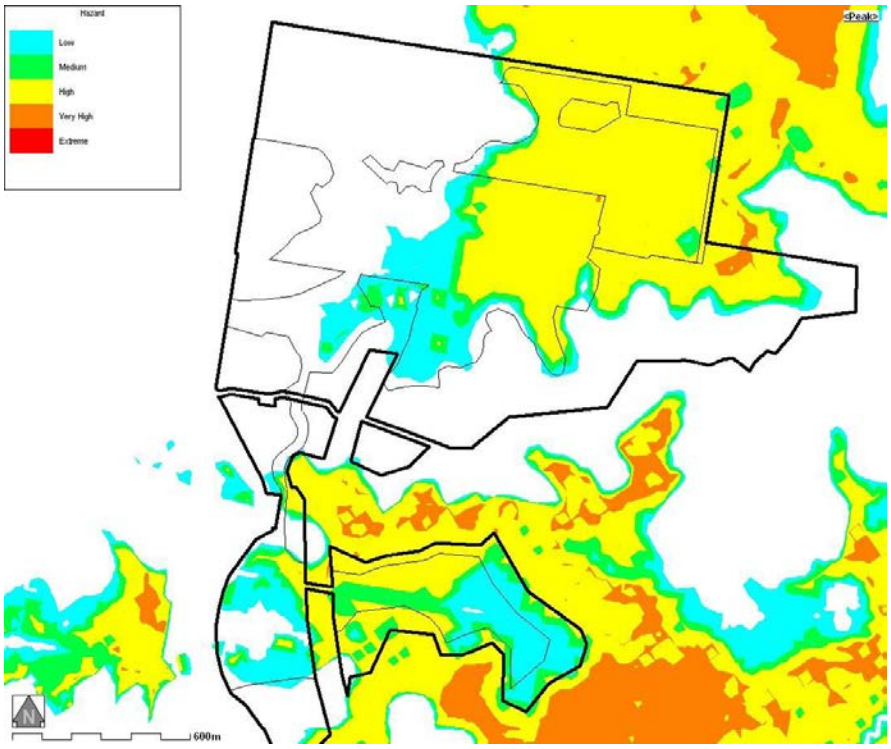

Figure 5: 100 Year ARI Flood Hazard

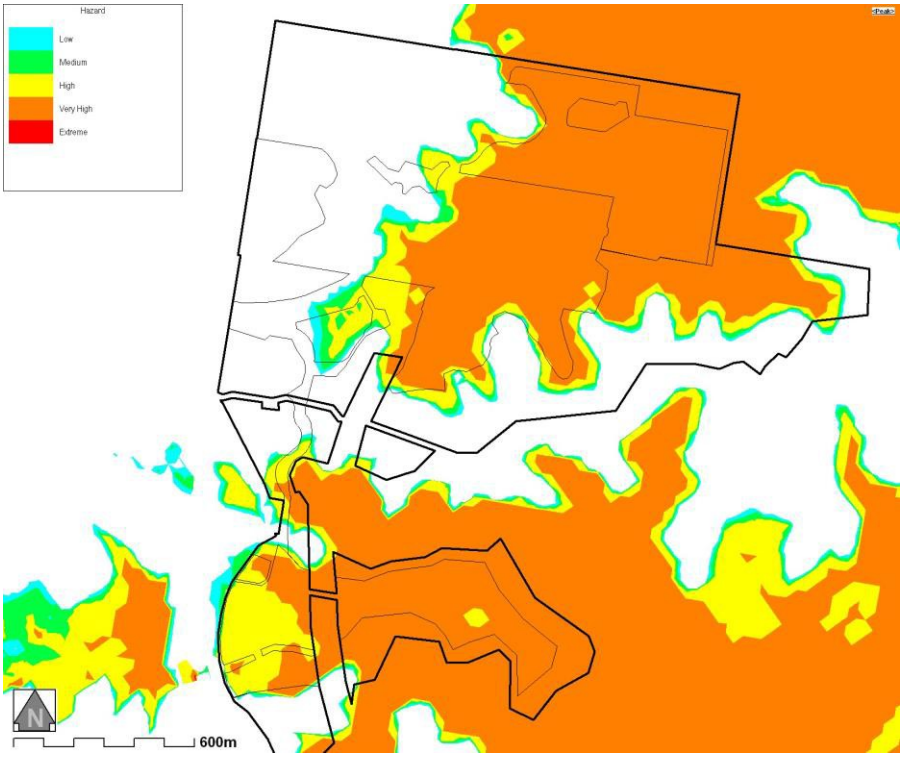

Figure 6: PMF Flood Hazard

Nine different means of monitoring flood forecasts or actual flooding were chosen.

1. Bureau of Meteorology 8 day total rainfall forecast
2. Bureau of Meteorology 4 day total rainfall forecast
3. Bureau of Meteorology 24 hour total rainfall forecast
4. Bureau of Meteorology flood warnings
5. Bureau of Meteorology radar
6. Bureau of Meteorology fallen rain in 24 hours
7. North Byron Parkland stream gauge readings
8. Water on site
9. External road conditions

North Byron Parklands had stream gauges installed in each of the two catchments which can flood the site and these have been linked to the local Enviromon System and are the basis of the stream gauge readings. Each gauge has boards which can be safely read from flood free locations in the event that the gauges' electronic readings or communications fail.

The NSW Northern Rivers Regional Organisation of Councils (NOROC), which includes Byron Shire, has a web-based tool called RoadInfo that allows consistent regional road information during floods to be published online. The website includes a map of the Northern Rivers Region with markers on roads that are closed, those that motorists should exercise caution on, those undergoing road works and those which have been re-opened. This can be supplemented with actual observations of road low points which are a short distance from the site.

SITG was then divided into six phases which represented different risks to people and property based on the number of people likely to be on site and the practicality of different flood management responses.

1. Bump in (set up)
2. One week before (includes final week of bump in)
3. One day before (final day of bump in and first day of campers arriving on site)
4. Days one and two
5. Day three
6. Bump out (packing up)

For each phase an alert matrix was developed which sets out the thresholds for each of the nine rainfall or flood observations which would trigger a particular alert level. The closer to the event being held and the greater the number of people on site, the lower the threshold required to trigger a particular alert level. Exceedance of any one of the thresholds is sufficient to escalate the alert level. Figure 7 is the matrix for one week before the event.

FRMP Responsibilities and Actions

The FRMP sets out clear responsibilities for maintaining and implementing the FRMP and these are divided between the Venue Manager and the Event Producer. The FRMP also recognises the NSW SES role as the lead combat agency for floods and states:

"Any flood response directive issued by the SES or by delegated authority to others acting on its behalf must be followed by North Byron Parklands staff, event staff, artists, suppliers and patrons. This includes any order to evacuate the site or not evacuate the site, irrespective of what decisions have been made by management in accordance with this Plan."

Forecast/Observation	Individual alert thresholds during week before the event				
	FLOOD WATCH	**FLOOD WARNING**	**EVACUATION**	**TAKE REFUGE**	**CANCEL**
8 days forecast	>300mm	NA	NA	NA	NA
4 days forecast	>150mm	NA	NA	NA	>500mm including the event days
24 hour forecast	>50mm	>150mm	>250mm	NA	NA
Flood warnings	Flood Watch, Severe Weather Warning or Flood Warnings from BOM/SES	Directive from SES	Directive from SES	Directive from SES	Directive from SES
Radar	Moderate or heavy after >50mm in 24hrs	NA	NA	NA	NA
Fallen rain in 24 hours	>50mm plus more forecast	>100mm plus >50mm forecast or >150mm fallen	>150mm plus >50mm forecast or >200mm fallen	NA	NA
Stream gauge readings	Northern Drain >1.3m and rising Yelgun (Marshalls) Creek >1.3m and rising	Northern Drain >1.8m and rising Yelgun (Marshalls) Creek >1.8m and rising	Northern Drain >2.3m Yelgun (Marshalls) Creek >4.0m	Northern Drain >3.5m Yelgun (Marshalls) Creek >4.3m	NA
Water on site	100mm anywhere on site	More than 100mm depth in areas being used	More than 100mm depth in areas being used	Within 200mm of lower parts of spine road.	NA
External Roads	Any local roads cut by floodwaters	NA	NA	North and South routes cut and Orange Alert threshold reached	NA

Figure 7: Example of Alert Thresholds

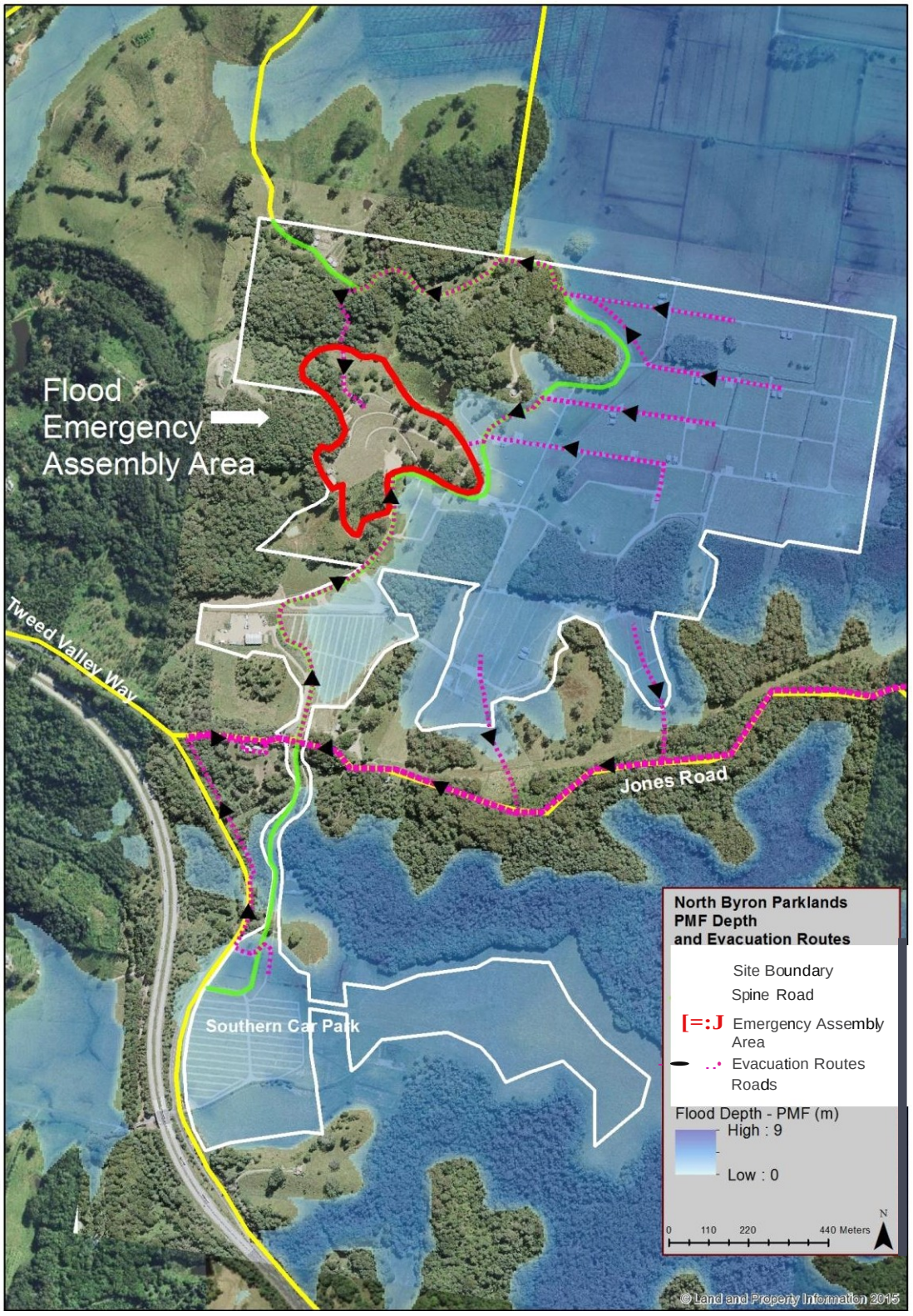

Figure 8: On Site Refuge Arrangements

The FRMP includes actions which need to be undertaken throughout the year to maintain the plan, train personnel and keep necessary infrastructure and equipment in good working order. It sets out clear actions which need to be taken for each alert level at each phase of the event, who is responsible for each action, what resources are needed to implement the actions and how actions are to be communicated to staff, patrons or emergency services. This is all done by means of easy-to-follow tables and check lists.

It includes maps of off-site evacuation routes and on-site evacuations routes and refuge areas (Figure 8) along with how permanent and temporary infrastructure is to be adapted or relocated to cater for evacuation or refuge on site for up to three days.

Conclusion

The flood risk assessment demonstrated that there is a low probability of people being exposed to flooding during an event at the North Byron Parklands site. The detailed flood risk management plan sets out clear guidelines and actions for managing the residual risk should flooding occur before or during an event. The flood risk management plan was used to monitor flooding in the lead up to the inaugural Splendour in the Grass music festival on the site and proved to be an effective tool for decision making although the flood threat eventually passed before the event took place.