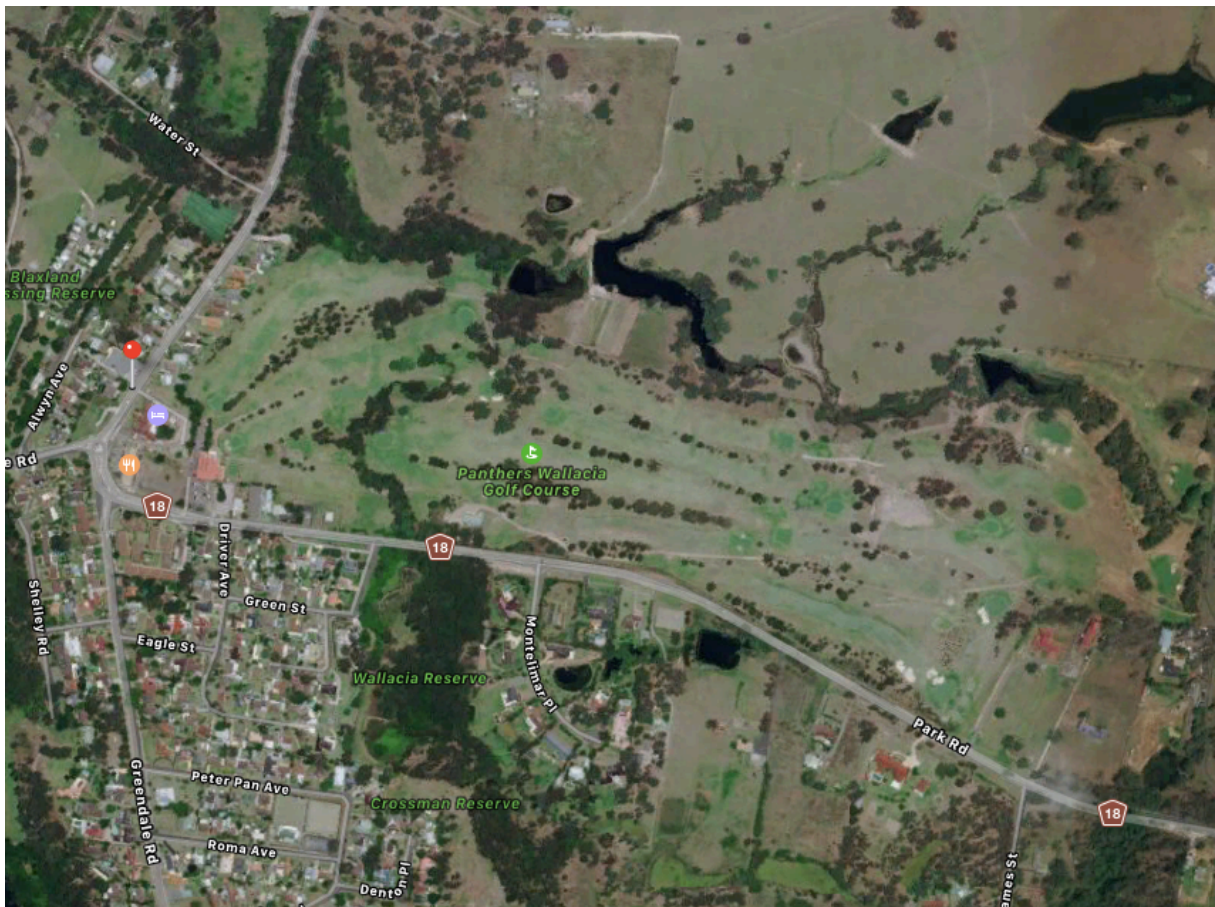


# WALLACIA PANTHERS GOLF & COUNTRY CLUB - PROPOSED RE-DEVELOPMENT - FLOOD IMPACT ASSESSMENT

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REPORT FOR CATHOLIC CEMETERIES BOARD



NOVEMBER 2019







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## WALLACIA PANTHERS GOLF & COUNTRY CLUB – PROPOSED REDEVELOPMENT - FLOOD IMPACT ASSESSMENT

### FINAL REPORT NOVEMBER 2019

<b>Project</b>  Wallacia Panthers Golf & Country Club - Proposed Re-development - Flood Impact Assessment		<b>Project Number</b>  170038	
<b>Client</b>  Catholic Cemeteries Board		<b>Client Representative</b>  David de Angelis	
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## INTRODUCTION AND SITE DESCRIPTION

This report provides a flood impact assessment for the proposed re-development of the Wallacia Panthers Golf & Country Club (the subject site). Figure 1 presents the location of the subject site which is north of Park Road, east of the Nepean River and south of Penrith CBD. The address of the subject site is 13 Park Road Wallacia, also referred to as:

- Lot 2/ DP1108408;
- Lot 1/ DP1254545;
- Lot 4/ DP18701; and
- Lot 3/ DP18701.

The overall size of the subject site 44,240 m<sup>2</sup> (44.24ha).

The Site currently accommodates the Wallacia Panthers Golf & Country Club. Comprising an 18-hole golf course, golf club, maintenance shed and car park. A telecommunications tower is located towards the eastern extent of the site.

## FLOOD LIABILITY

The subject site is subject to both Nepean River flooding and flooding via the local tributary known as Jerrys Creek.

The highest design flood depths impacting the subject site result from Nepean River flooding. However besides being flood liable due to Nepean River levels, the site is also traversed by Jerrys Creek and tributaries of the same. The upstream catchment of Jerrys Creek at the southern boundary of the subject site is 6 km<sup>2</sup>.

The combined 1% AEP flood liability of the site is shown in Figure 2. The flood behaviour on the site can be described as follows:

- 1% AEP Nepean River level is 45.8 mAHD – note this flood inundation is due to backwatering from the Nepean River and hence velocities and flow rates will be relatively low;
- 1% AEP flow in Jerrys Creek main flow path that runs south to north through the site is 51.3 m<sup>3</sup>/s with levels ranging from ~ 37 mAHD in the upstream end of the site to ~ 33 mAHD in the downstream end; and
- Owing to the vast volume and large depths of the Nepean River flood versus the Jerrys Creek 1% AEP event, the Jerrys Creek event is critical in regard to flood impact assessment for works proposed as part of the overall re-development.

## PROPOSED DEVELOPMENT

The DA seeks approval for the following specific uses and works for the site. Overall proposed development locations are indicated in Figure 3.

### Nepean Gardens

- Use and operation of a portion of the site for a 'cemetery' for 27,000 burial plots and associated publicly accessible parklands and recreation areas to operate Nepean Gardens;
- A new chapel building with ancillary mortuary and a new single-storey administration building;
- Provision of a new internal road within Nepean Gardens accessible from Park Road;



- Landscaping the entire Nepean Gardens site with associated planting strategy and provision of new ponds and wetland/ detention basin;
- Provision of a new electrical substation;
- Burial areas and memorialisation guides; and
- Provision of on-site formal car parking for up to fifty (50) cars and provision of kerbside shoulder carparking throughout the internal road network.

## Nepean Golf Course

- New 9-hole golf course; and
- Practice putting green and community putting course.

## Wallacia Country Club

Alterations and additions to the existing Wallacia Country Club building to include:

- Golf pro-store;
- Expanded gaming facilities, kitchen and dining area;
- Function rooms; and
- Additional parking area.
- Synthetic bowling green; and
- New swimming pool and gym complex.
- Tree removal associated with new golf course and Nepean Gardens;
- Stormwater infrastructure and other site services; and
- Subdivide Lot 2 in DP 1108408 into two allotments.

An existing maintenance building, and telecommunications tower are located on the site and will remain unchanged as part of this proposal.

## PREVIOUS STUDIES

Penrith City Council has relied on an unreferenced study to define the 1% AEP Nepean River at the subject site as being 45.8 mAHd. The certificate from Council in this regard is shown as Figure 4.

In regard to Jerrys Creek Council has carried out the Overland Flow Flood Overview Study in 2006 in order to:

- identify and map all major overland flow paths;
- define local flood behaviour in the study area;
- assess provisional flood hazard for properties at risk from flooding; and
- rank catchment areas in terms of severity of flooding to help prioritise catchment areas for further studies and risk management plans.

Flood extents based on the 2006 study by Council are also shown in Figure 4.

No other previous study have been identified for the subject site or the Jerrys Creek catchment.

## MODEL BUILD

To carry out the impact assessment GRC Hydro have built a modelling system to represent Jerrys Creek. This system is based on the use of a hydrological model (WBNM) to convert rainfall into runoff and then a hydraulic model (TUFLOW) to convert applied runoff into depths and levels. TUFLOW is a

hydraulic modelling tool that can utilise one and two dimensional model elements. Both WBNM and TUFLOW are commonly used in Australia for flood modelling and can be considered best practice.

The current study incorporates a high degree of detail particularly in regard to the hydrological model used, with the aim of best defining flood behaviour for the subject site. The overall extent of the hydrologic model and sub-catchment discretisation is shown in Figure 5.

Overall the modelling system is comprised of the following elements:

- Lidar data has been used to inform a 2 m finite difference grid. This data has a typical accuracy of +/- 0.15 m (1<sup>st</sup> confidence interval);
- Pipe elements are included in the developed case only at road locations subject to traversing flows;
- Roughness was applied universally as a value of 0.05 (Mannings). In the developed case model the road layer was given a roughness of 0.02;
- A free draining outlet was allowed at the hydraulic domains downstream boundary. Note this is placed well downstream of any proposed works and the subject site;
- Works associated with the proposed development were incorporated into the model to produce a developed case; and
- Proposed basins were implemented into the developed case model via the inclusion of break lines which represented the dam/earth bund.

Design rainfall inputs were provided by ARR 1987 and both the two and nine hour durations were run based on our past experience of critical durations for various catchment areas in the Sydney metropolitan area. Of these the two hour event produced peak flood levels on the site.

## FLOODING

### Results

Nepean River flood affectation at the property is shown in Figure 3.

The impact work focusses on Jerrys Creek flooding only owing to the fact that Jerrys Creek will be by far the more sensitive flood mechanism from a flood impact point of view. As such this section will refer to Jerrys Creek flooding only.

Figure 6 indicates the extent of Jerrys Creek flooding in the 1% AEP event on the subject site. Comments in regard to flooding in the 1% AEP event:

- Jerrys Creek main flow path traverses the subject site south to north in the area of the proposed Golf Course and has a peak flow of 51.3 m<sup>3</sup>/s in the 1% AEP event. Note tributaries of Jerrys Creek also lie to the east in the Nepean Gardens extent and these also have been modelled;
- Flood liability due to Jerrys Creek of the overall site is limited;
- Besides the road layout and proposed basins, none of the proposed development interacts with flood liable regions of the site; and
- Flood liability of the road layout has been relieved via implemented cross-flow drainage so as to not underestimate potential impacts.

### Impacts

The impact that the proposed development has on peak flood levels is examined in Figure 7. This figure indicates that proposed development causes negligible changes to the subject site's flood

liability in the 1% AEP event. Additionally, the proposed development generally causes no impacts on adjoining buildings. There is a small area within the downstream creek that does have slightly elevated levels however these do not occur in any proximity to any built structure and the magnitude of these increases in level is in the order of 20 mm, i.e. a trivial change in the context of the 1% AEP event given that Nepean River levels exceed the Jerrys Creek flood levels by ~ 13 m. To be clear then, whilst the works increase the 1% AEP flood level by approximately 20 mm immediately downstream, the flood level at this location for a Jerrys Creek event is in the order of 33 mAHD whereas in the Nepean event, the 1% AEP flood level at this location is 45.8 mAHD.

## CONCLUSIONS

Development of the subject site is proposed as per details provided herein and as described in Figure 3.

No off-site flood impacts result from the works. In summary:

- Wallacia Golf Club – as shown in Figure 2 the extent of the lot is only just impacted by the Nepean River 1% AEP flood extent. No works are proposed in the north-eastern corner of the lot where the flood liability exists. In regards to Jerrys Creek the re-development of the clubhouse is occurring outside the 1% AEP flood extent and as such impacts are a non-issue. Proposed floor levels are well above the 1% AEP flood level of 45.8 mAHD (see Figure 4) and there is no change of use;
- Nepean Gardens – the development for all intents and purposes makes only trivial changes to the current land form. Proposed changes have been modelled and as indicated in the results, no off-site impacts occur; and finally
- Nepean Golf Course – the development is comprised of some relatively minor topography changes and as modelled, these changes are shown to have no impact on 1% AEP design flood levels for adjoining private property. A small area within the downstream creek does have slightly elevated levels however these do not occur in any proximity to any built structure and the magnitude of these increases in level is in the order of 20 mm, i.e. a trivial change in the context of the 1% AEP event given that Nepean River levels exceed the Jerrys Creek flood levels by ~ 13 m.

Based on the work presented herein it is our assessment that:

- The proposed developments integrate well with subject site flood liability;
- No building floor levels are required to be informed by these results; and
- No impacts off-site occur due to proposed development.

# FIGURES



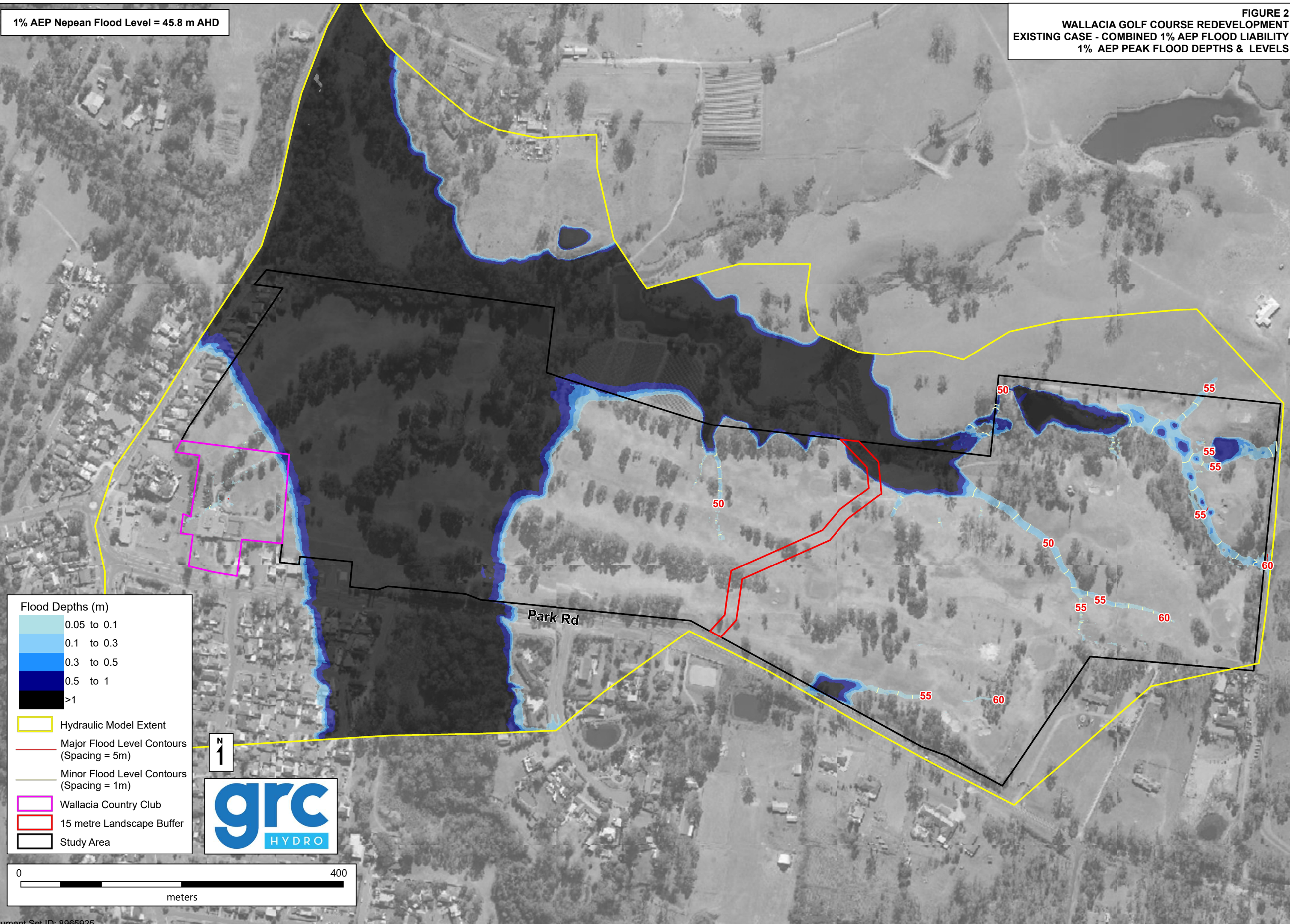
**FIGURE 1**  
**WALLACIA GOLF COURSE REDEVELOPMENT**  
**SUBJECT SITE LOCATION**





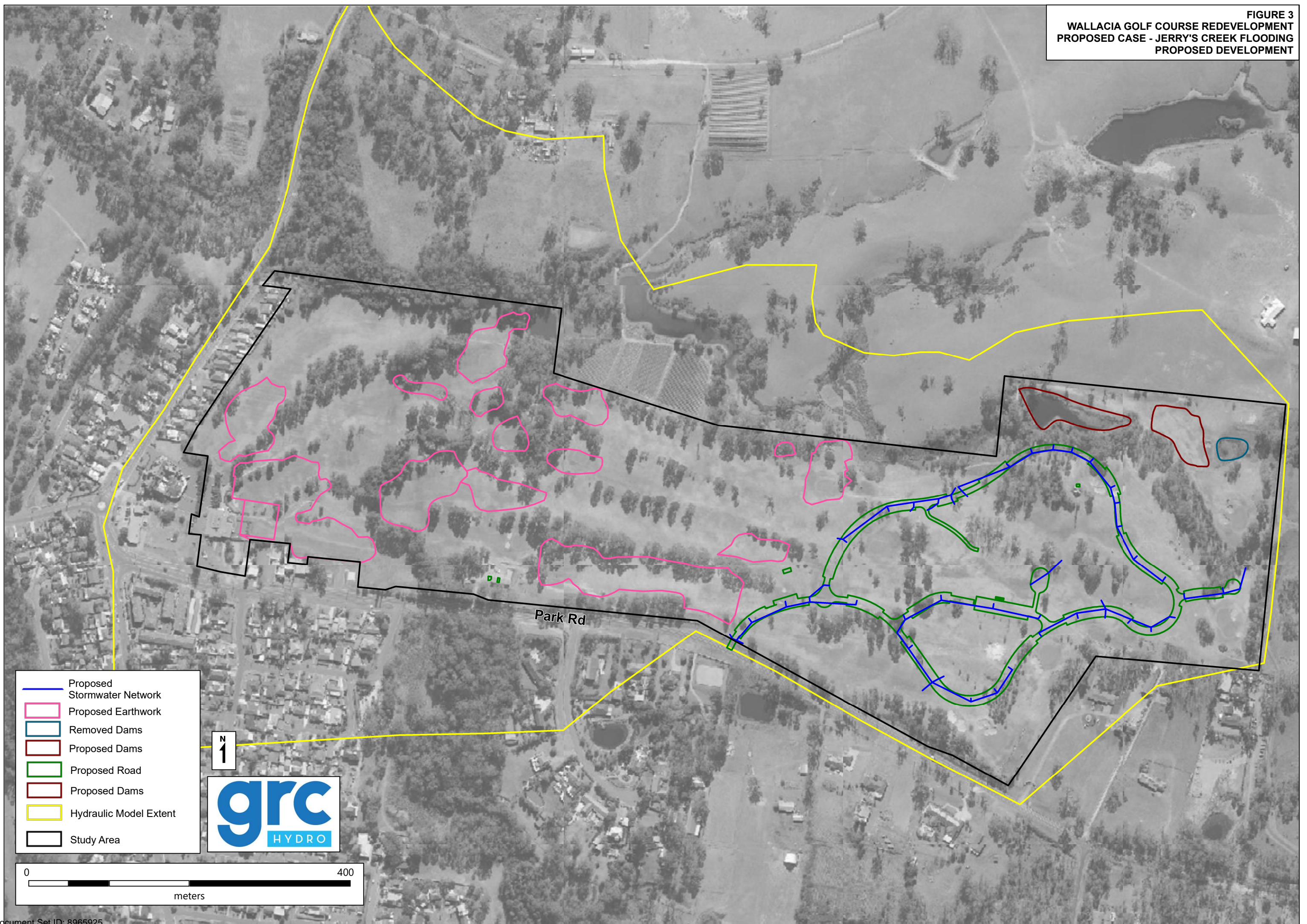
1% AEP Nepean Flood Level = 45.8 m AHD

**FIGURE 2**  
**WALLACIA GOLF COURSE REDEVELOPMENT**  
**EXISTING CASE - COMBINED 1% AEP FLOOD LIABILITY**  
**1% AEP PEAK FLOOD DEPTHS & LEVELS**





**FIGURE 3**  
**WALLACIA GOLF COURSE REDEVELOPMENT**  
**PROPOSED CASE - JERRY'S CREEK FLOODING**  
**PROPOSED DEVELOPMENT**



- Proposed Stormwater Network
- Proposed Earthwork
- Removed Dams
- Proposed Dams
- Proposed Road
- Proposed Dams
- Hydraulic Model Extent
- Study Area

N  
1



0 400  
 meters



# Figure 4 Council Provided Flood Information

PENRITH

## Flood Information Lot 2 DP 1108408 - No. 13 Park Road Wallacia

**Date of issue: 2 April 2019**

The 1% AEP mainstream flood level affecting the above property is estimated to be 45.8 m AHD.

In addition, the 1% AEP local overland flow flood levels affecting the above property are as indicated on the map below in white colour

Property less than 0.5m above the 1% AEP flood level is subject to Penrith Development Control Plan 2014 Section C3.5 Flood Planning. The Penrith Development Control Plan 2014 is available from Council's website [www.penrithcity.nsw.gov.au](http://www.penrithcity.nsw.gov.au).



### Definitions

**AEP** – *Annual Exceedance Probability* – the chance of a flood of this size occurring in any one year.

**AHD** – *Australian Height Datum* – A standard level datum used throughout Australia, approximately equivalent to mean sea level.

### Legend

Extent of 1% AEP local catchment overland flow path. Generally depths less than 150mm is not shown.

### Notes:

1. The contours shown above in yellow numbering are at 0.5m intervals and are based on Aerial Laser Scanning (ALS) Survey undertaken in 2002. The contour levels are approximate and for general information only. Accurate ground levels should be obtained by a Registered Surveyor.
2. The flood level is based on current information available to Council at the date of issue. The flood level may change in the future if new information becomes available. The 1% AEP flood is the flood adopted by Council for planning controls. Rarer and more extreme flood events will have a greater effect on the property.
3. You are strongly advised if you propose to carry out development upon the property, that you retain the assistance of an experienced flooding engineer and have carried out a detailed investigation.
4. Council accepts no liability for the accuracy of the flood levels (or any other data) contained in this certificate, having regard to the information disclosed in Notes "1", "2". As such you should carry out and rely upon your own investigations.

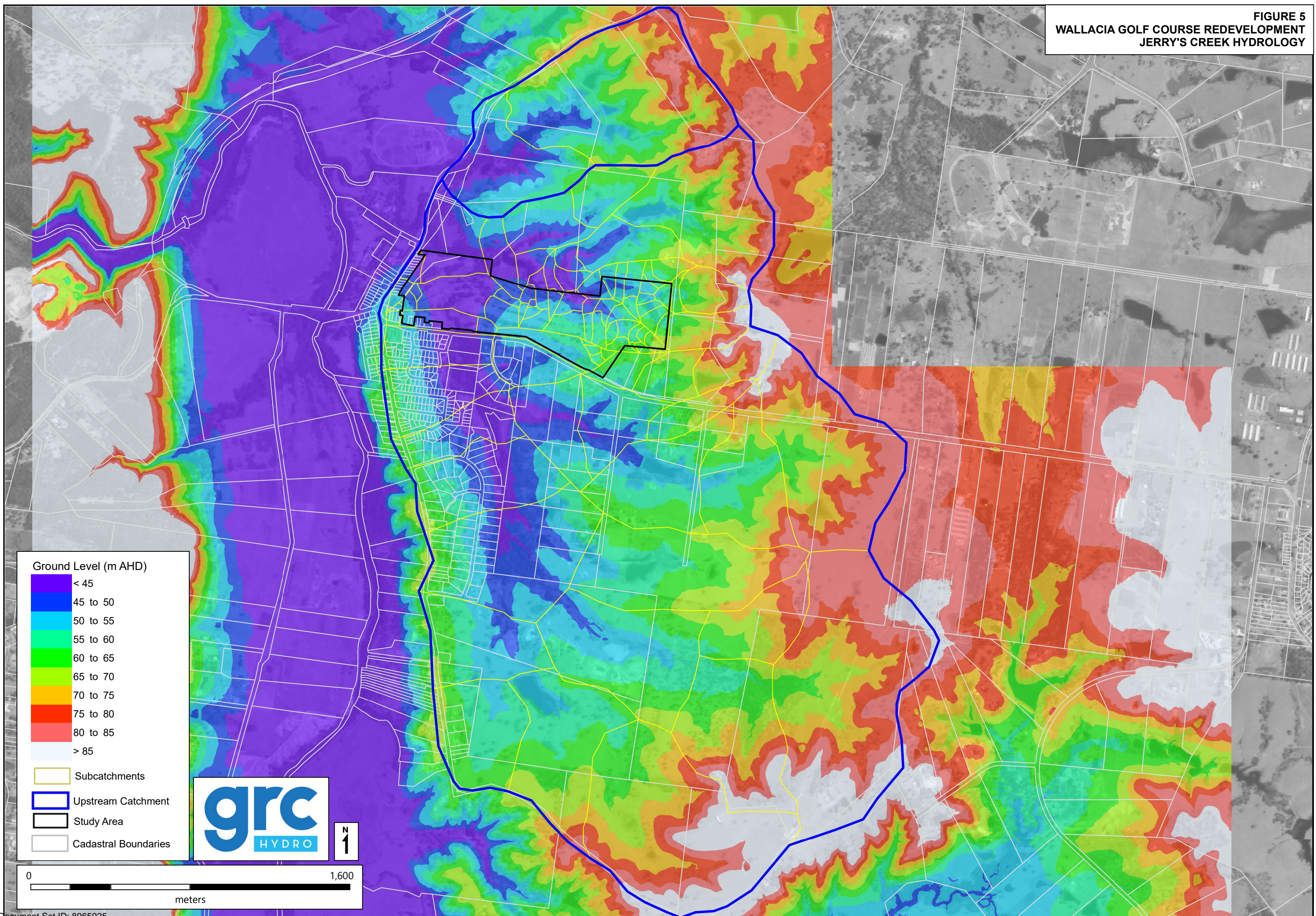
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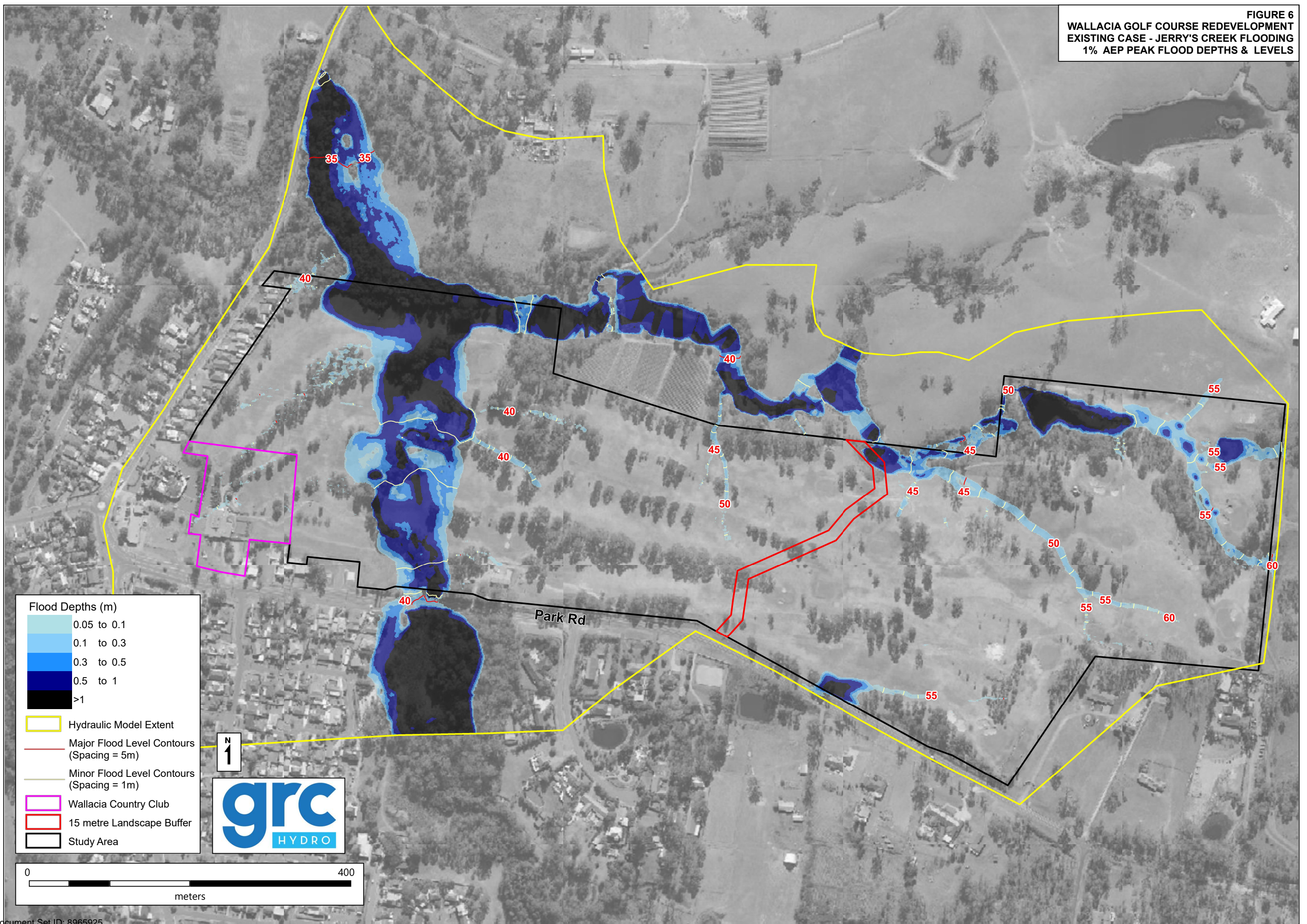


FIGURE 5  
WALLACIA GOLF COURSE REDEVELOPMENT  
JERRY'S CREEK HYDROLOGY





**FIGURE 6**  
**WALLACIA GOLF COURSE REDEVELOPMENT**  
**EXISTING CASE - JERRY'S CREEK FLOODING**  
**1% AEP PEAK FLOOD DEPTHS & LEVELS**





**FIGURE 7**  
**WALLACIA GOLF COURSE REDEVELOPMENT**  
**PROPOSED CASE - JERRY'S CREEK FLOODING**  
**1% AEP PEAK FLOOD IMPACTS**

