Tamworth Regional Aquatic Centre and Northern Inland Centre of Sport and Health

Flood Impact Assessment

Prepared by Rain Consulting for

Creo Structures

RAIN

Deep Thinking for Better Water Outcomes

Document Control

Project Name	Tamworth Regional Aquatic Centre and Northern Inland Centre of Sport and Health – Flood Impact Assessment
Client	Creo Structures
Rain ID	504_01
Document Name	504_01_R01V01a_TamworthHydraulicModelling.docx

Version Number	Status	Date	Authors	Reviewer
v01	Final	31/3/25	SYC	LJC

Legal & Disclaimer

By receiving or reviewing this document, you agree:

1. The intellectual property (including copyright) subsisting in this document (IP) is owned, controlled and/or licenced by Rain Consulting and protected by Australian and international laws. This document may also contain know-how, ideas, concepts and other information that are confidential to Rain Consulting (Confidential Information).
2. The IP and Confidential Information contained in the document are strictly for your personal use only.
3. No rights in the IP or Confidential Information transfer to you.
4. You are only permitted to use and disclose the IP and the Confidential Information for the purposes you instructed us to contemplate when preparing the document. You are not permitted to adapt or interpret the IP and the Confidential Information for any other purpose or allow any third party to use the IP and Confidential Information.
5. We provide the services to you based on your specific instructions and circumstances. We cannot be held responsible for loss or damage you suffer where we provide advice to you based on information supplied by you that is inaccurate or incomplete.
6. Subject to your rights under the Australian Consumer Law, any recommendations, strategies and opinions provided by us are made on the basis of our experience and professional judgment and are not guarantees we will achieve certain results.
7. You indemnify Rain Consulting in relation to any loss or damage Rain Consulting may suffer or incur in relation to any unauthorised use of the IP or Confidential Information by you or your representatives.

Cover Image

Mount Paris Dam – Derby, Tasmania – Rain Consulting

Custodians

Rain respectfully acknowledges the Traditional Owners of the lands on which we work, live and play. We also pay our respects to their Elders, past and present, and Aboriginal Elders of other communities.

Carbon Offset

Rain Consulting deeply recognise our responsibility to address the environmental impacts of our businesses and those we are associated with. Human induced climate change has increased average and extreme temperatures, changed rainfall patterns and created more severe and less predictable storms. That's why we're striving for net negative carbon.

Carbon produced in the generation of this report has been offset.

0.046 tonnes of CO_2 have been emitted in the creation of this project. In line with the 2C pathway, we have offset **2.5 times this (0.114 tonnes offset)**.

Contents

Tables

Figures

1 Introduction

Rain Consulting was engaged by Creo Structures to undertake a hydraulic modelling assessment of the existing and proposed design conditions of the Tamworth Regional Aquatic Centre (RAC) and Northern Inland Centre of Sport and Health. A key driver behind this hydraulic assessment is to determine whether Greg Norman Basin is impacted by the changes proposed for the development in the 1% AEP rainfall event, which is of high interest to Tamworth Regional Council, the local government authority in the area.

The hydraulic assessment was conducted through a TUFLOW model and covers:

- Characteristics of flow across the *existing brownfield site* as a basis for comparison against proposed conditions. This includes:
  - peak flow rates found along the natural channel (swale) running directly through the site
  - extent of flooding (if any) within and immediately surrounding the swale and site area
  - known patterns of ponding or flooding in upstream/downstream locations
  - flow rates immediately upstream Greg Norman Basin
  - Water Surface Elevation (WSE) of Greg Norman Basin
- Characteristics of flow across the *proposed developed site*. This includes:
  - comparisons against the existing conditions characteristics listed above
  - understanding whether the new channels and culverts re-directing flows can sufficiently accommodate both upstream flows and site stormwater flows
  - understanding whether Greg Norman Basin has sufficient capacity in the developed conditions and if its capacity needs to be upgraded to suit

This Flood Impact Assessment has been prepared as a standalone study, conducted independently of any civil, drainage, or structural design packages. While the outcomes of the flood modelling presented in this report may inform discussions, support development applications, or assist in the planning approval process, this report does not specifically address planning permit requirements. Furthermore, it is not intended to serve as a comprehensive stormwater management plan.

1.1 Subject Site

Rain Consulting pay our respects to the Gamilaroi people who lay claim as the original custodians of this land and respects their customs and traditions and their special relationship with the land. The location of the site is shown in **Figure 1-1**.

The RAC site is located within Tamworth Regional Council, New South Wales; approximately 310km North-west of Sydney CBD and 215km North-west of Newcastle. The project site will be one of many sporting facilities in the immediate area. This includes the Tamworth Gymnastics Club building to the north, hockey courts for the Tamworth Hockey Association immediately east, and athletics centre and track south of the site. The main building and respective carparking is proposed to sit between Longyard Drive as the northern boundary, and Jack Smyth Drive as it's southern boundary.

Running through the centre of the site is an existing 215m long by 1.5m deep bushy vegetated swale which is proposed to be redirected as a major part of the project works. The swale runs south to north towards Longyard Drive and sheet flows across the road through an unconstructed swale before making its way into Greg Norman Basin.

In the proposed development, the swale is re-directed around the east side of the building. The trapezoidal swale upstream of stormwater connection is proposed to be around 6.4 m wide (1 m wide base), with a depth of 0.45 m, 1:6 batters and a longitudinal slope of approximately 1.18%. The swale downstream of the site stormwater connection is proposed to be widened to 7.9 m (2.5 m wide base), at the same depth and slope as upstream.

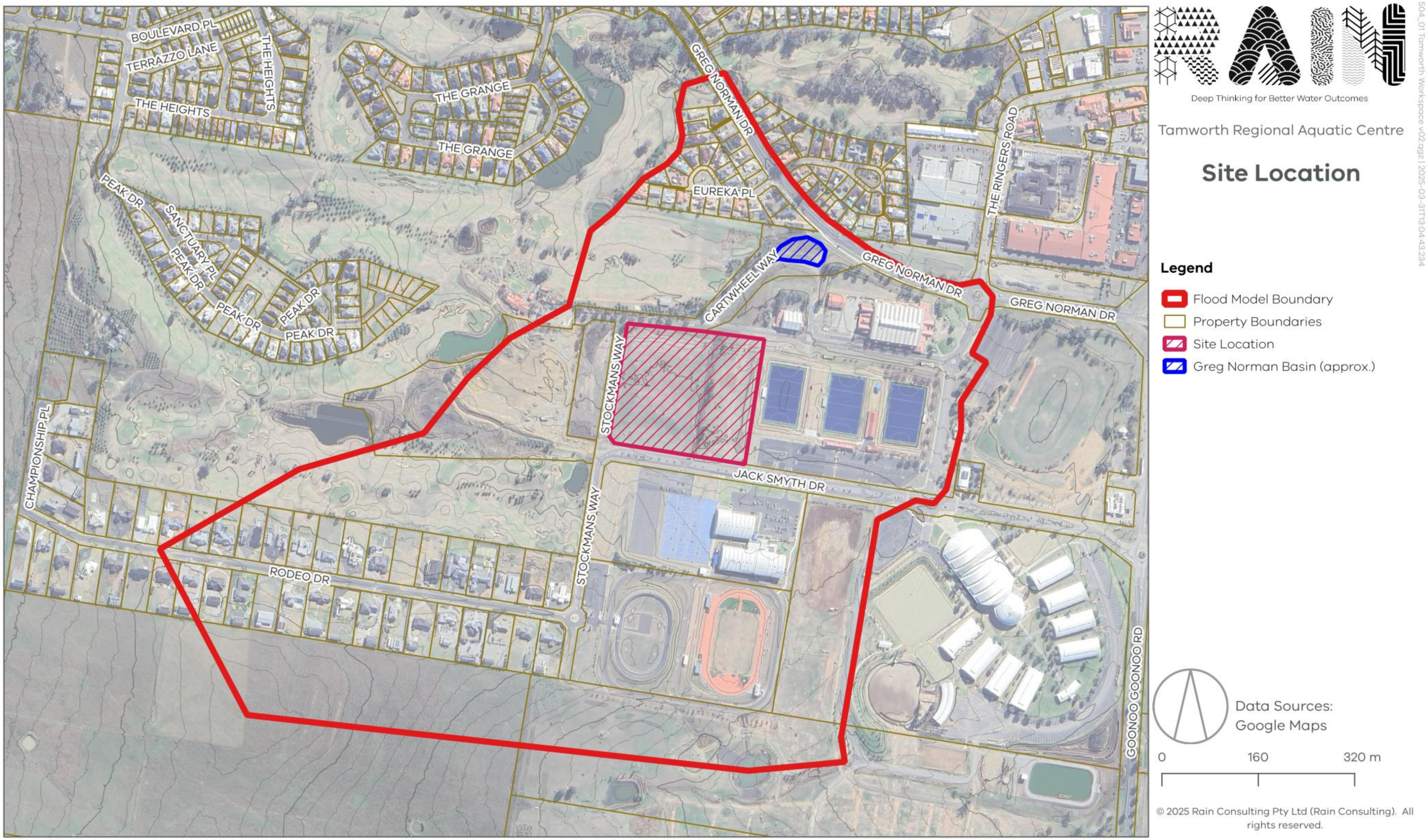

Figure 1-1 Subject Site

2 Flood Modelling

2.1 TUFLOW Model Build

An existing TUFLOW model was not available for use from Tamworth City Council. A TUFLOW model was therefore developed to consider the existing and developed conditions of the subject site's localised catchment. Prior to commencement of the modelling, the modelling approach was discussed with Council and approved. The TUFLOW model build information is shown in **Table 2-1**. These are visually represented in **Figure 2-1** and **Figure 2-2**.

Table 2-1 TUFLOW Model Build Information

Input Parameter	Data
2d Code	The 2d code captures most of the neighbouring sporting facilities and aims to define the full catchment area upstream of the site as well as an appropriate catchment area downstream of the site. The code extends from south of the properties along Rodeo Drive and Tamworth Athletics Centre, towards Greg Norman Drive further north. The code does not include the eastern side of Jack Smyth Drive (where the Australian Equine and Livestock Events Centre and Tamworth Regional Sporting Complex is located).
Topographic data	The DEM was derived from (in order of least to highest resolution): • 1m resolution LiDAR (Elvis) • Existing survey • Design surface (Creo Structures, 2025) – design model only • Terrain modifications based on updated Civil Layout Plan (Creo Structures, 2025) – design model only **Note:** the proposed swale north of Longyard Drive has not been included in the design conditions flood model
Z shapes	**Existing model:** N/A **Design model:** included to represent the proposed RAC building
Inflow Data	Rain-on-grid ('RoG') data was used for all storm durations (10min – 48hr) and temporal patterns (tp01-tp10) for the 1% AEP event. This is sourced from the Bureau of Meteorology ('BoM') based on 2019 Australian Rainfall and Runoff ('ARR2019') data.
TUFLOW Model Build	2025_0_2_iSP_w64
Grid cell size	2 m
Timestep	2D 0.5 s, adaptive (HPC) 1D 0.5 s
Roughness & Fraction Impervious (FI)	Manning's roughness values were approximated and FI's sourced from the Tamworth Regional Council's Engineering minimum standards based on aerial photography. This was adjusted in the design conditions flood model to reflect changes in the topography.
Downstream boundary	HQ outflow matched to the slope of the terrain.
PO Locations	Placed at intervals through the natural swale, proposed swale and across Greg Norman Basin
Initial Water Level (m AHD)	Placed at downstream pipe nodes at the boundaries to ensure pipes are running full in the RoG simulation North-western boundary: 398.416 m AHD North-eastern boundary: 399.454 m AHD
1d Pipe Network	**Existing model:** Based on Council pipe data and additional missing culverts from aerial topography. **Design model:** everything in the existing model, plus the proposed site stormwater network, outletting at the bend of the proposed swale. In particular, this also includes a 2x 600 mm x 450 mm box culvert conveying flows from the main swale, to across Longyard Dr
1d Pit Network	**Existing model:** Based on Council pit data **Design model:** everything in the existing model, plus the proposed site stormwater network

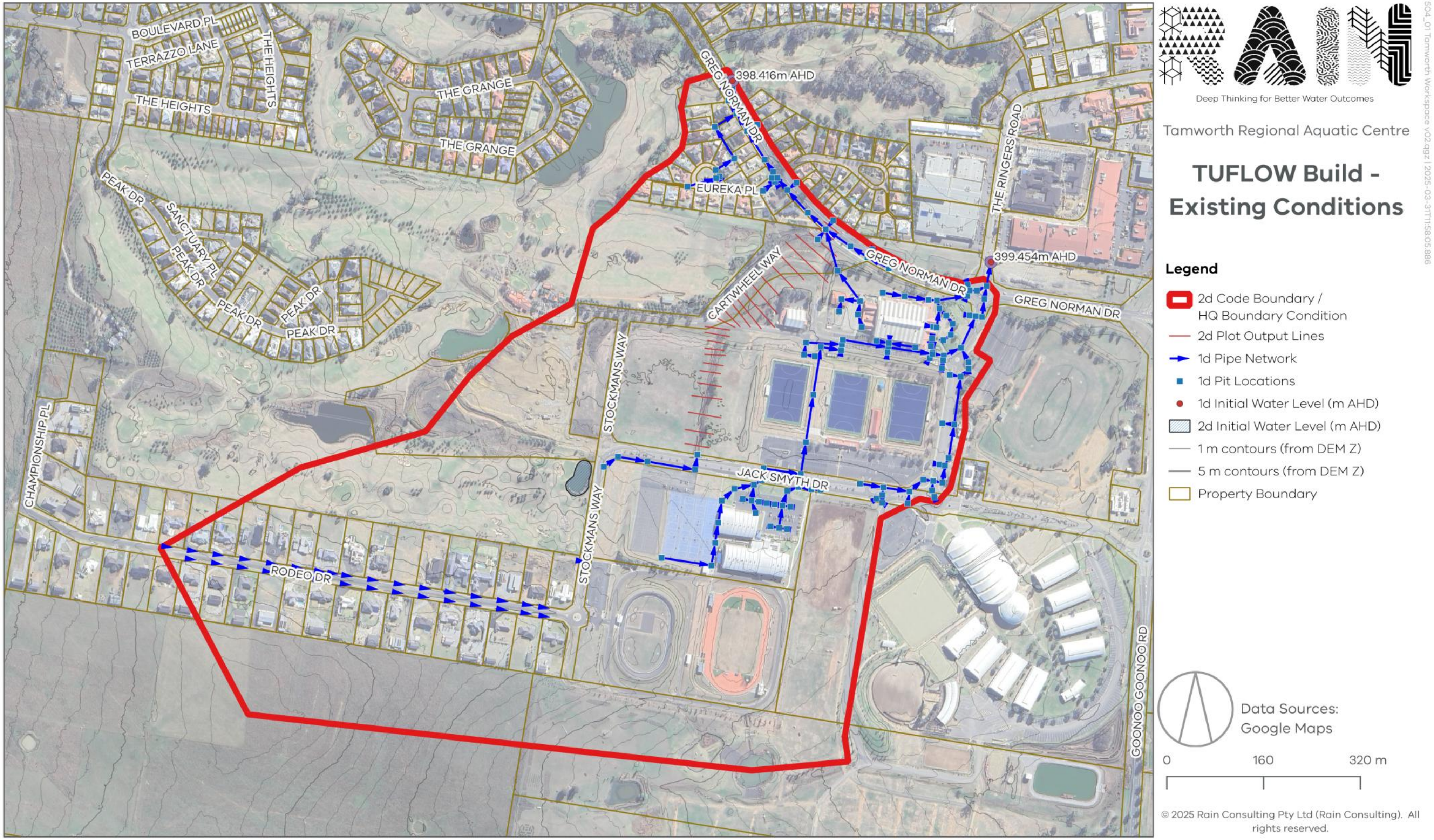

Figure 2-1 TUFLOW Build - Existing Conditions

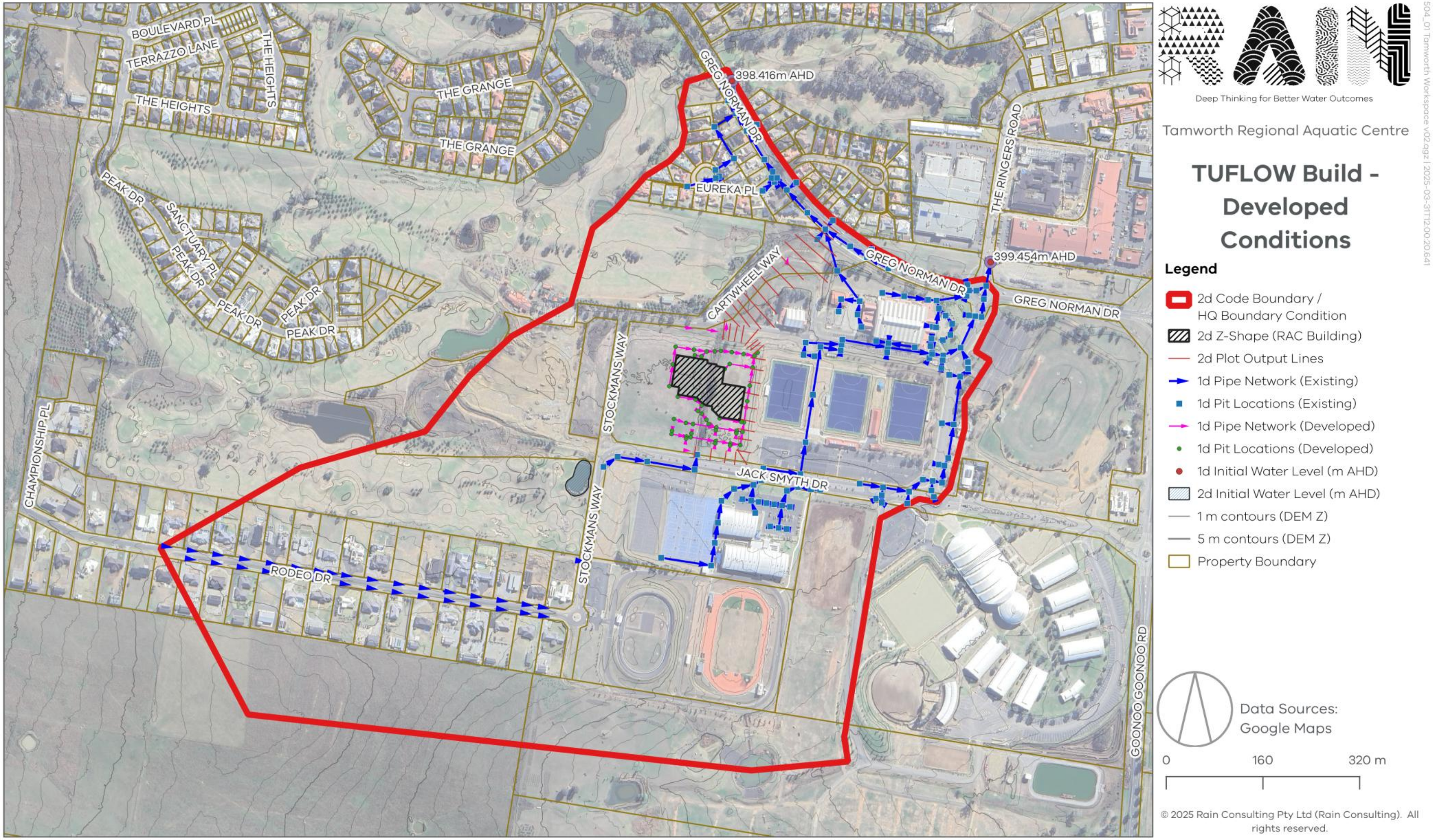

Figure 2-2 TUFLOW Build - Developed Conditions

2.2 Results

2.2.1 Existing Conditions

The key results for the 1% AEP rainfall event are summarised below:

- **Critical rainfall event:** 270 min (or 4.5 hr) duration, temporal pattern 5 (critical event measured at the site)
- **Along main swale:**
    - **peak flow (rate):** 0.627 m^3/s
    - **peak flow (timing):** around 1 hr
    - **peak depth:** 0.474 m
- **Immediately upstream of the basin:**
    - **peak flow (rate):** 0.957 m^3/s
    - **peak flow (timing):** around 1 hr
- **Greg Norman Basin – Water Surface Elevation:** 403.30 m AHD

The existing flows around the subject area run along the existing swale, sheet-flow across Longyard Dr and into Greg Norman Basin.

The existing 1% AEP peak flow rates are shown on the flood depth map in **Figure 2-3**.

2.2.2 Developed Design Conditions

The key results for the 1% AEP rainfall event are summarised below:

- **Critical rainfall event:** 540 min (or 9 hr) duration, temporal pattern 9 (critical event measured at the site)
- **Swale upstream of site connection:**
    - **peak flow (rate):** 0.314 m^3/s
    - **peak flow (timing):** around 8.5 hr
    - **peak depth:** 0.136 m
- **Swale downstream of site connection**
    - **peak flow (rate):** 0.502 m^3/s
    - **peak flow (timing):** around 8.5 hr
    - **peak depth:** 0.133 m
- **Immediately upstream of the basin**
    - **peak flow (rate):** 0.678 m^3/s
    - **peak flow (timing):** around 8.5 hr
    - **peak depth:** 0.278 m
- **Greg Norman Basin – Water Surface Elevation:** 403.29 m AHD
    - As a comparison, water surface elevations were checked across all durations and found to vary between 403.28 – 403.31, showing very minimal change in water levels compared to existing conditions and a reduction in the critical event.

The proposed development's 1% AEP peak flow rates are shown on the flood depth map in **Figure 2-4**. It should be noted here that the design conditions show an improvement of flood depth and flood hazard risk along Longyard Drive. The proposed 2x 600mm x 450mm box culverts taking flows from the swale south of Longyard Drive to the north of Longyard Drive is shown running full in the flood model (at its maximum capacity).

A comparison of the water surface elevation ('WSE') between existing and developed conditions at Greg Norman Basin was undertaken. ***As a result of the developed conditions, there is expected to be minimal impact to Greg Norman Basin***. This has occurred due to the increasing of hard surface on the subject site – rainfall that falls on the site in existing conditions has a longer (slower) response time when compared to the developed site. When the runoff moves from the site in a shorter time period, it flows through the Greg Norman Basin before the upstream peak arrives. This subtle change in timing has allowed the development to occur with no impact on the downstream basin.

Afflux around the site and downstream of the site into the Greg Norman Basin was compared for both the 270-minute event (critical in existing conditions) and the 540-minute event (critical in developed conditions). In both, very minor reductions in water levels were seen in all areas outside of the site.

When comparing critical the critical event in each development scenario, the design conditions show that WSE of the basin is 17 mm lower than the existing conditions, with likely no further capacity risks caused due to flooding events.

- Basin WSE – existing condition = 403.30 m AHD
- Basin WSE – developed condition = 403.29 m AHD

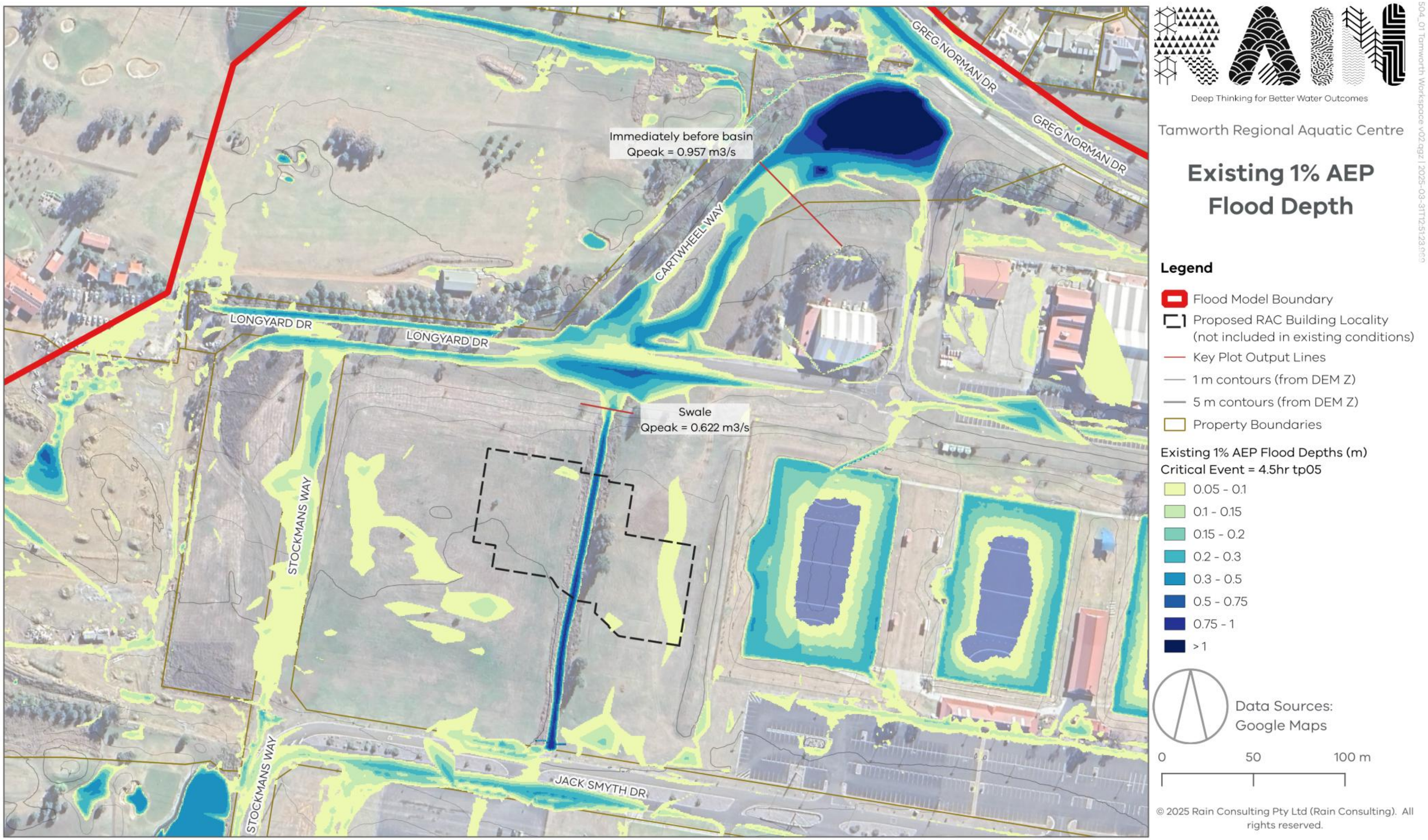

Figure 2-3 Existing 1% AEP Flood Depth

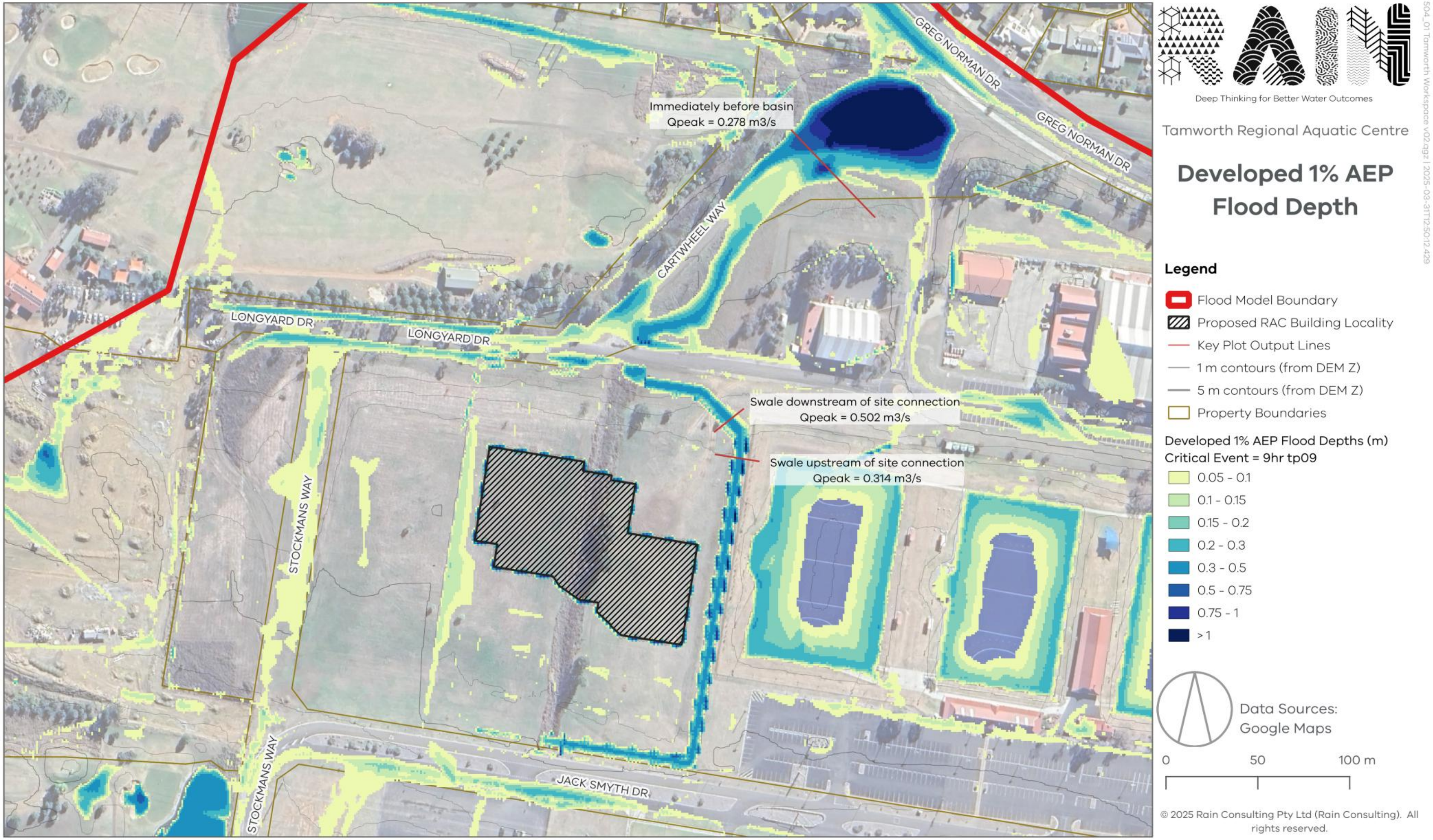

Figure 2-4 Design 1% AEP Flood Depth

3 Conclusion

Based on the flood modelling of the site in the 1% AEP rainfall event, Greg Norman Basin will likely not be impacted by the developed conditions of the Tamworth RAC works. The Greg Norman Basin is unlikely to require a capacity upgrade based on these results. This is largely due to a change in the timing of flows leaving the proposed developed site, in developed conditions discharging before the upstream peak arrives.

The modelling shows that proposed swale design re-directed around the RAC building has the capacity to contain flows in the critical 1% AEP rainfall event as does the proposed culverts at Longyard Drive

These conclusions are generally assumed to be applicable across other rainfall events and durations given the nature and significance of the 1% AEP event. However, it should be noted that the behaviour of the swale and the Basin may differ in other rainfall events, durations and patterns that were not tested within the scope of these works. In particular, climate change factors have not been considered in this analysis, and may likely impact the flood characteristics and results of the site. It is noted however, that pre and post development flood modelling shows a relative difference between the same durations, AEPs and climate scenarios. It is likely that across other climate scenarios, the afflux surrounding the site and impact on the Greg Norman Basin would be similar.

RAIN

Deep Thinking for Better Water Outcomes