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2 September 2022

Joanna Ward
National Planning Manager - Wireless
Service Stream Limited
Level 3, Tower B, Zenith Centre
821 Pacific Highway, Chatswood NSW 2067

Attention: Joanna Ward

Dear Joanna

RE: PENRITH LAKES SMART POLES FLOOD IMPACT ASSESSMENT

This document provides the background, methodology and results of the flood impact assessment (FIA) undertaken for the proposed smart poles at the Penrith Regatta Centre located at 153 Old Castlereagh Road, Castlereagh NSW (referred to as the 'Site'). The purpose of this FIA is to assess the potential impact of the proposed two smart poles on flood behaviour at the Site and across adjoining properties to address the requirements outlined in the Penrith Lakes State Environmental Planning Policy (SEPP). This document provides a summary of the flood modelling undertaken and its findings including relevant mapping.

Yours Sincerely,

BMT

Nathan Cheah
Associate Principal Engineer

1 Background

The Penrith Regatta Centre ("the Site"), which is situated at 153 Old Castlereagh Road, Castlereagh NSW, lies on the eastern bank of the Nepean River. The Site is managed under the Penrith Lakes State Environmental Planning Policy (SEPP) and is subject to mainstream flooding from the Nepean River which is bordered to the west and south of the Site.

Optus Mobile are proposing to install two smart poles at the Site. The location of the smart poles is as shown in Figure 1.1. The smart poles have an approximate diameter of 0.573 m and height in excess of 9 m, and they will be connected to the nearby proposed underground fibre cable and power pits. As the Site is managed under SEPP, a flood impact assessment is required for the proposed smart poles installation to address the requirements of Clause 33.

BMT understands that the proposed smart poles are not designed to provide services during a major flood event, as there are other macro base stations around the Site to provide emergency services. The proposed smart poles are mainly to provide coverage during events in the Penrith Regatta Centre.

The TUFLOW model developed for the Penrith Lakes Development Cooperation (PLDC) as part of the '*Penrith Lakes Scheme Summary Flood Impact Report*' (BMT WBM, 2015) covers the Site and has been found to be suitable for assessing design floods and setting Flood Planning Levels (FPLs) for the Penrith Lakes Development Area (PLDA) where the Site is located. This TUFLOW model was adopted for the flood impact assessment herein[1] to simulate the 1% Annual Exceedance Probability (1 in 100 AEP), 0.2% AEP (1 in 500 AEP) and Probable Maximum Flood (PMF) design flood events under existing (pre-development) and proposed (post-development) conditions.

[1] PLDC has granted permission to use the model for this assessment based on the following conditions:

- No warranty or guarantee is provided by PLDC and no liability is accepted by PLDC for any loss or damage resulting from the use of this model;
- The reporting and model are not to be distributed; and
- The model will be used for this assessment at our own risk.

Figure 1.1 Location of the proposed two smart poles

2 Flood Modelling Approach

2.1 Existing (Pre-Development) Conditions Model

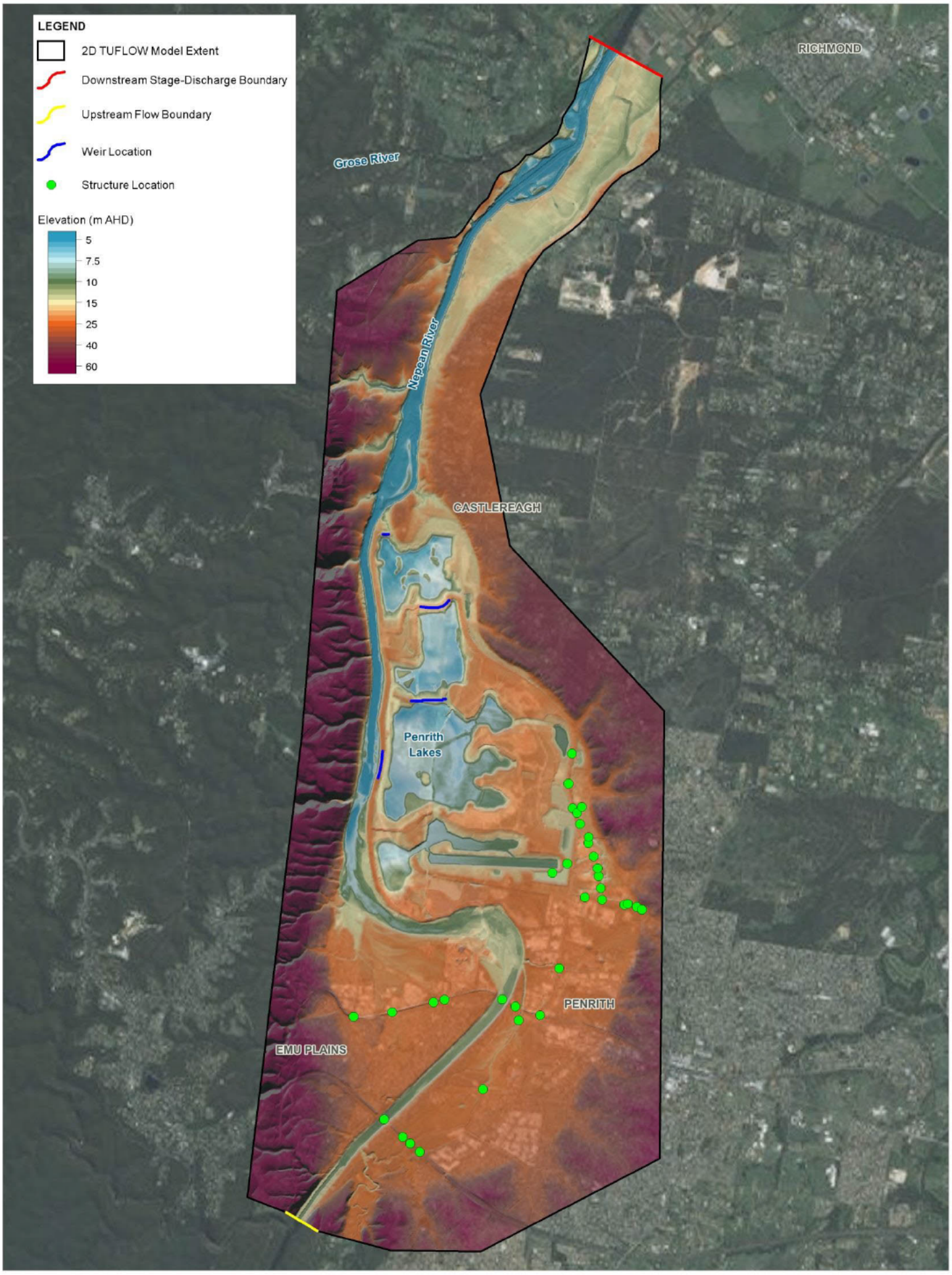
The following is a summary description of the TUFLOW model from the '*Penrith Lakes Scheme Summary Flood Impact Report*' (BMT WBM, 2015) adopted for the assessment herein:

- The TUFLOW model was primarily based on the previous SOBEK Nepean River model developed by Cardno for PLDC with some components of the previous RMA model developed by Worley Parsons for Penrith City Council (PCC) also incorporated;
- The TUFLOW model is a linked 1D/2D (one-dimensional/two-dimensional) model extending along the reach of the Nepean River and floodplain from 2.3 km upstream of the M4 Freeway Bridge in the south to 1.9 km downstream of the Nepean River/Grose River confluence in the north;
- The ground surface elevations for the TUFLOW model grid points were sampled directly from the digital elevation model (DEM) established for the model area, which was derived from a combination of topographical data sets gathered from 2011 to 2015. Additional topographic refinements were also introduced as part of the BMT WBM (2015) study;
- A 2D domain model resolution of 15m was adopted, with DEM elevations being sampled every 7.5 m. This resolution was selected to provide a sufficiently accurate representation of floodplain topography whilst still resulting in acceptable model simulation times;
- The adopted inflow hydrographs were based on the inflow hydrographs used in the previous SOBEK and RMA models. It should be noted that no allowance has been made for direct rainfall onto the TUFLOW model domain or for any significant lateral inflows to the floodplain area within the model domain. Neither of these assumptions are expected to have any significant influence on predicted peak flood levels;
- A stage-discharge relationship was adopted at the downstream model boundary (as used in the RMA model);
- The different hydraulic roughness (Manning's 'n') zones assigned across the model domain were primarily based on the previous SOBEK and RMA models;
- Key structures located within the modelled area including bridges, culverts, weirs and underpass structures were represented in the model; and
- The TUFLOW model was deemed suitable for undertaking design flood assessments and setting FPLs for the PLDA.

The TUFLOW model configuration is as shown in Figure 2.1. This model was adopted to simulate the existing flood conditions for the 1% AEP, 0.2% AEP and PMF events around the Site.

2.2 Proposed (Post-Development) Conditions Model

The proposed conditions were represented and simulated in the TUFLOW model by deactivating (blocking off) the cell where each proposed smart pole is located, so that the obstructive effect of each pole could be accounted for. It is noted that this (cell blocking off) modelling approach would provide a conservative estimate of afflux (an increase in peak flood level) since the entire square cell is assumed to blocked out compared to a flow-constriction approach based on the actual diameter of the blockage. Notwithstanding, the adopted approach is deemed suitable for the flood impact assessment herein.



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TUFLOW Model Configuration

Figure: **2-1**

Rev: **A**

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0 1.25 2.5km

Approx. Scale

BMT

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3 Flood Modelling Results

The flood modelling results are presented as follows:

- Figure 3.1 – 1% AEP peak flood depth and level (existing conditions);
- Figure 3.2 – 1% AEP peak flood velocity (existing conditions);
- Figure 3.3 – 1% AEP peak flood level impact (proposed conditions);
- Figure 3.4 – 1% AEP peak flood velocity impact (proposed conditions);
- Figure 3.5 – 0.2% AEP peak flood depth and level (existing conditions);
- Figure 3.6 – 0.2% AEP peak flood velocity (existing conditions);
- Figure 3.7 – 0.2% AEP peak flood level impact (proposed conditions);
- Figure 3.8 – 0.2% AEP peak flood velocity impact (proposed conditions);
- Figure 3.9 – PMF peak flood depth and level (existing conditions);
- Figure 3.10 – PMF peak flood velocity (existing conditions);
- Figure 3.11 – PMF peak flood level impact (proposed conditions); and
- Figure 3.12 – PMF peak flood velocity impact (proposed conditions).

The peak flood levels, depths and velocities for the simulated flood events at each smart pole location are presented in Table 3.1.

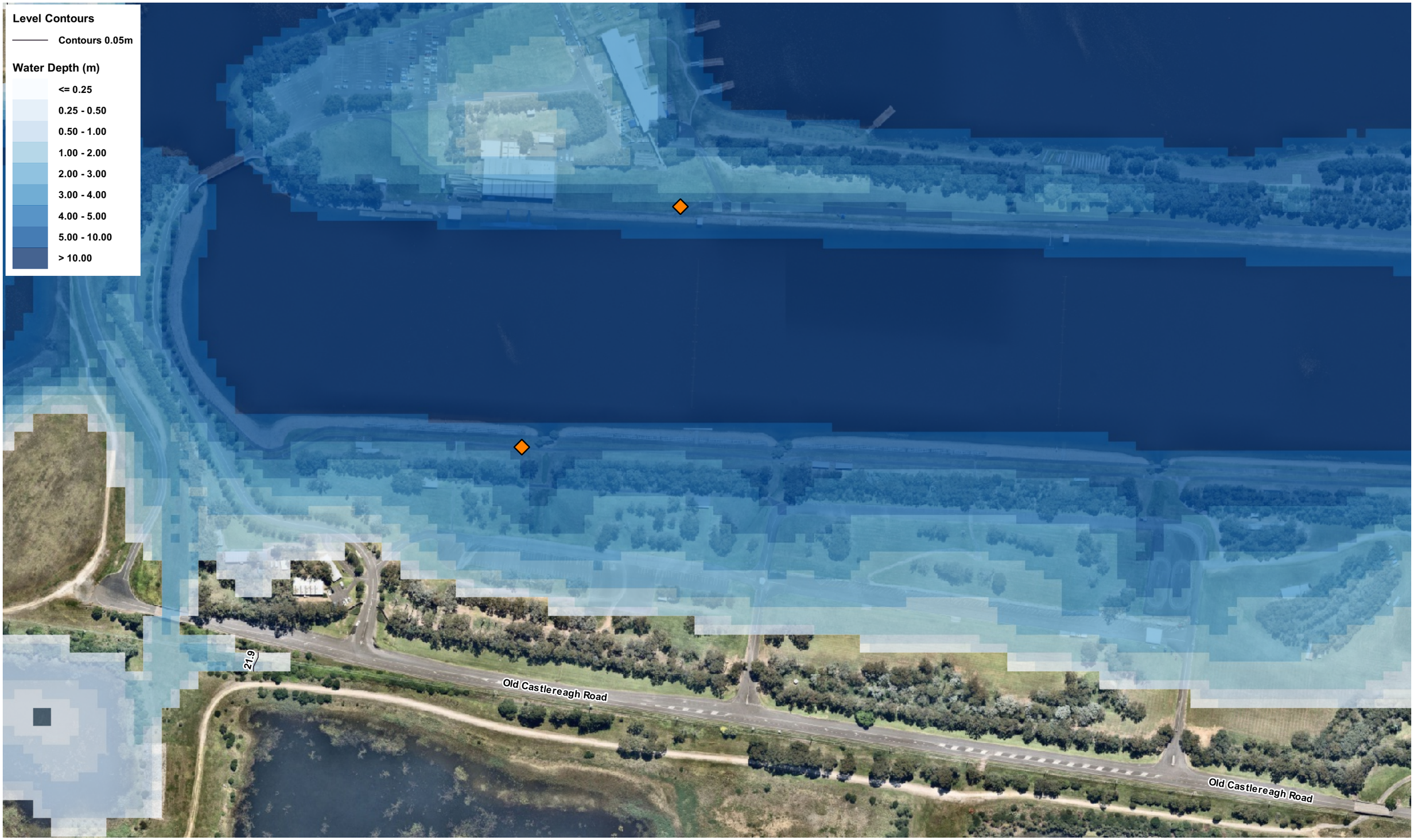
Based on the flood modelling results, it was found that the majority of the Site is subject to significant inundation in excess of 1.0 m for the simulated flood events. At the location of the proposed smart poles, the peak flood depths can reach in excess of 6.0 m in the 1% AEP event. The 1% AEP peak flood velocities are generally less than 0.7 m/s at the location of the proposed smart poles, i.e. not fast-moving floodwaters. Hence, the existing flood behaviour around the Site can be characterised as driven by volume of floodwaters overtopping from the Nepean River.

Table 3.1 Flood Information at Smart Poles Location

	Smart Pole #1			Smart Pole #2		
Events	Peak Flood Level (mAHD)	Peak Flood Depth (m)	Peak Flood Velocity (m/s)	Peak Flood Level (mAHD)	Peak Flood Depth (m)	Peak Flood Velocity (m/s)
1% AEP	21.89	6.35	0.59	21.88	9.42	0.67
0.2% AEP	23.67	8.14	0.62	23.67	11.21	0.70
PMF	29.63	14.10	0.75	29.62	17.15	1.10

The proposed smart poles installation was assessed in terms of potential adverse impacts on the existing flood behaviour up to the PMF event. Flood level and velocity difference mapping was prepared by subtracting peak existing water levels/velocities from peak developed water levels/velocities and indicate the magnitude and location of changes associated with the proposed works.

The flood impact maps show that there are negligible flood level and velocity impacts caused by the proposed two smart poles within the Site and across adjoining properties for the simulated 1% AEP, 0.2% AEP and PMF events. Flood levels at the Site are primarily driven by the total volume of floodwater originating from the Nepean River. The minor alteration to the existing conditions at the Site was predicted to have an insignificant effect on the total volume of available flood storage within the Site during flood events, as demonstrated by the results of the modelling.



LEGEND

- Proposed Smart Poles

Title:

1% AEP peak flood depth and level (existing conditions)

Drawing: 3-1

Rev: A

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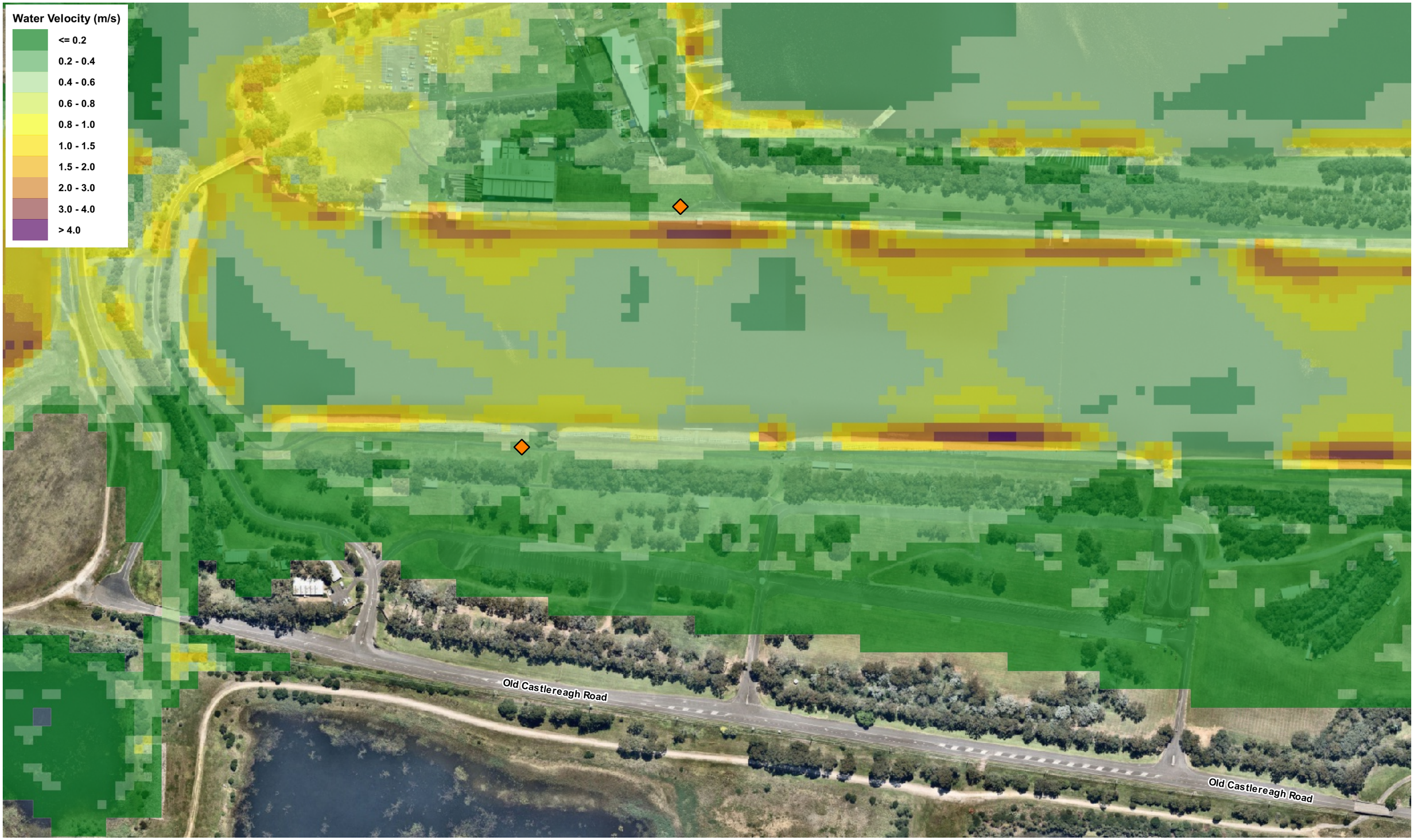

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◆ **Proposed Smart Poles**

Title:

1% AEP peak flood velocity (existing conditions)

Drawing: 3-2

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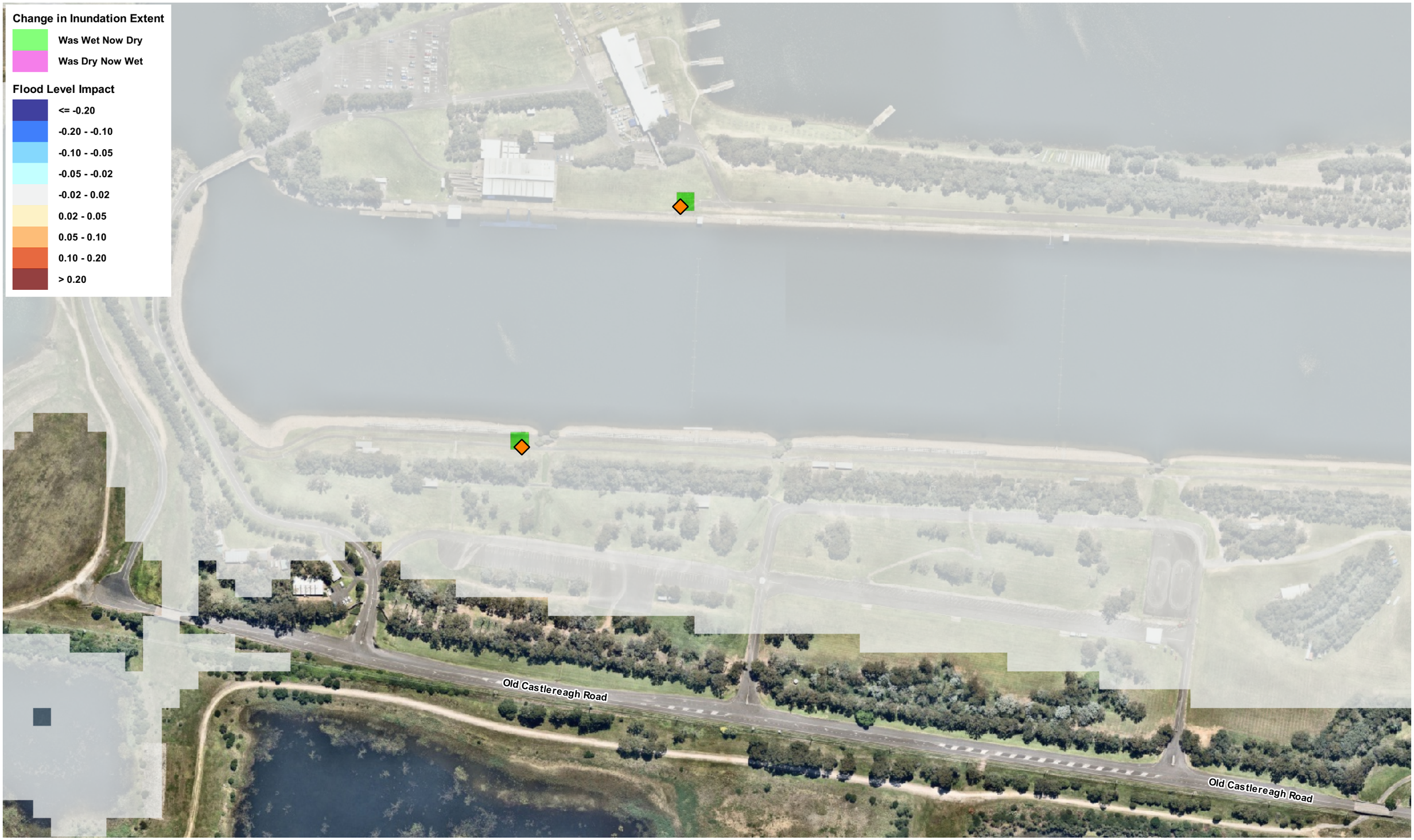

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- Proposed Smart Poles

Title:

1% AEP peak flood level impact (proposed conditions)

Drawing: 3-3

Rev: A

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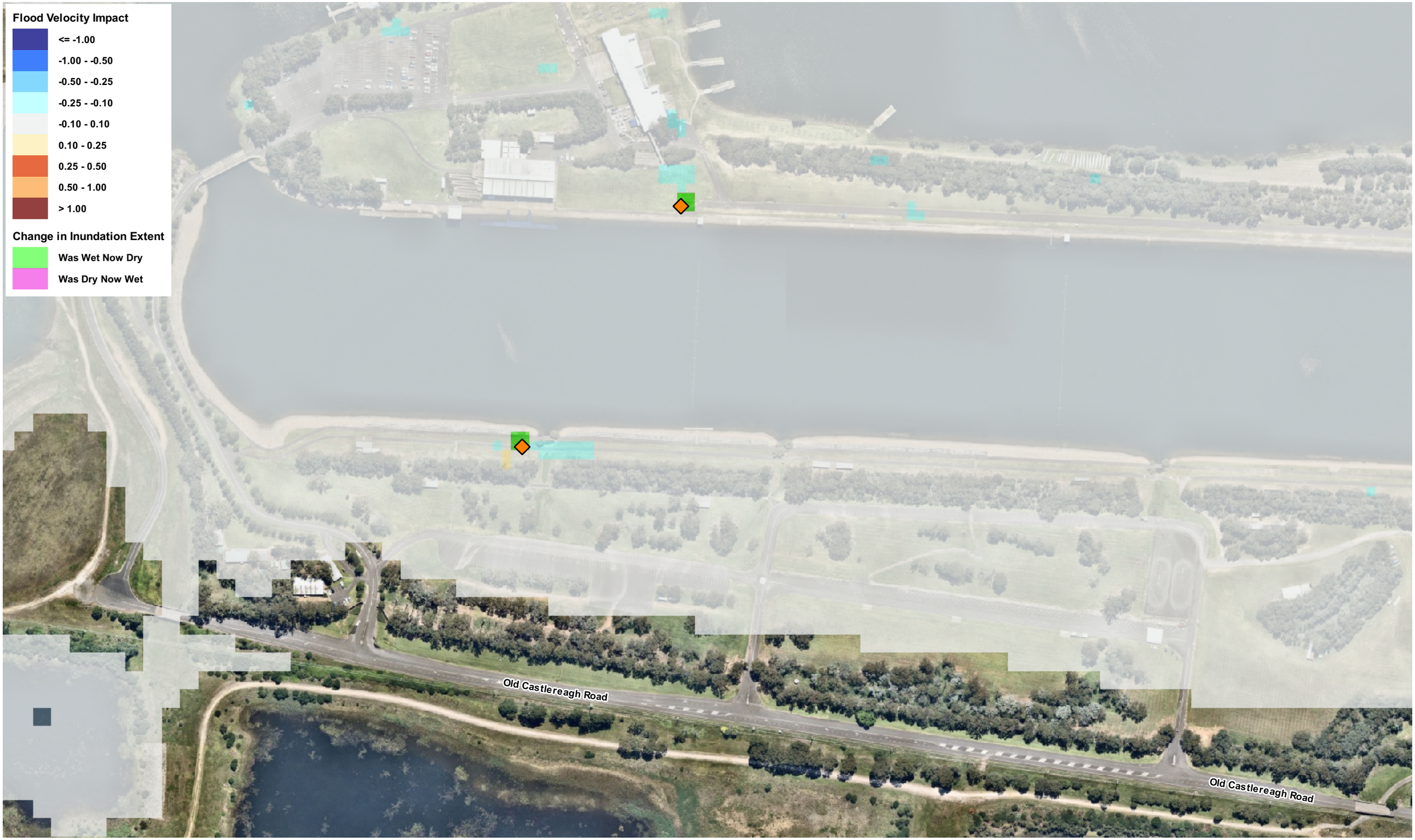

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- Proposed Smart Poles

Title:

1% AEP peak flood velocity impact (proposed conditions)

Drawing: 3-4

Rev: A

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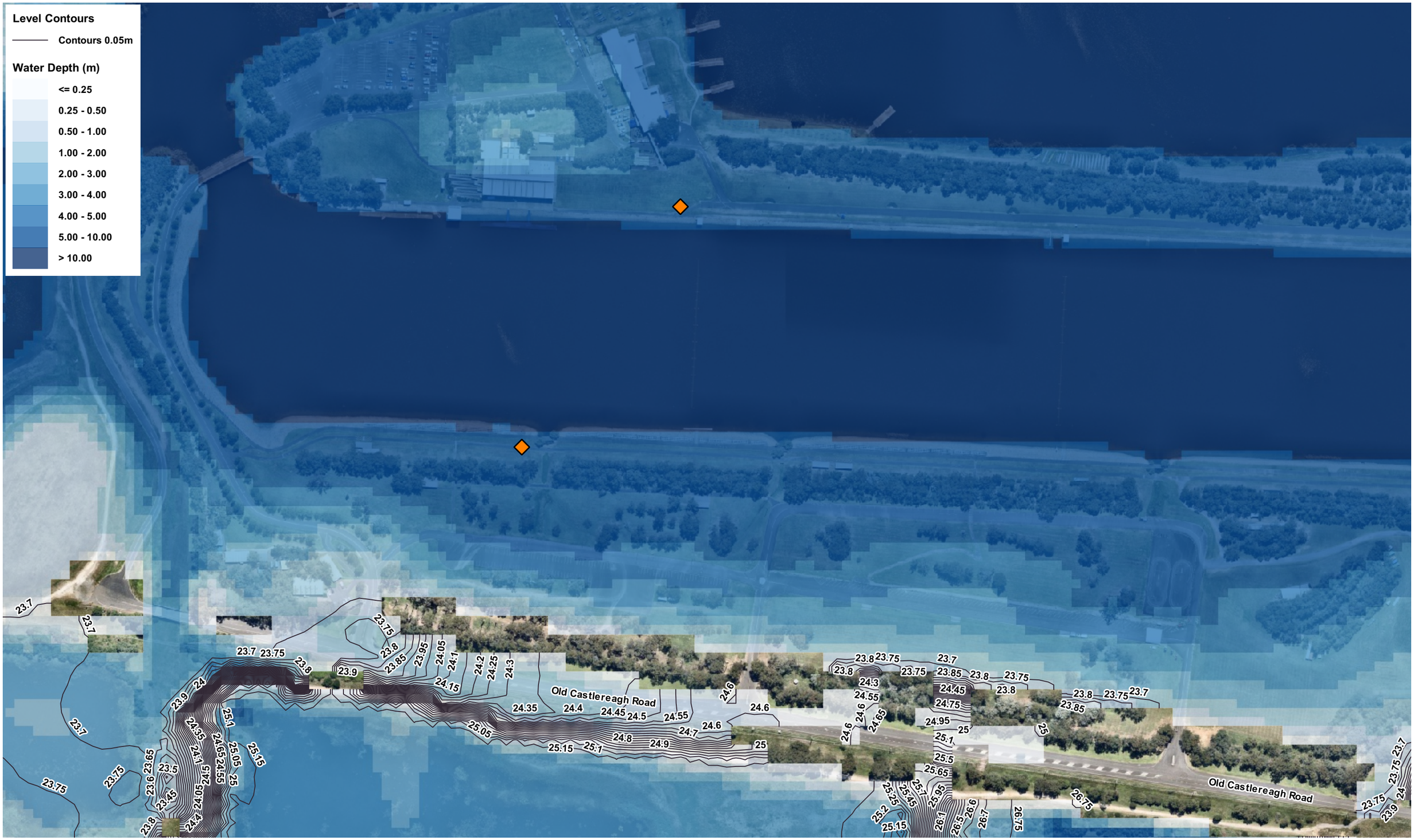

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- Proposed Smart Poles

Title:

0.2% AEP peak flood depth and level (existing conditions)

Drawing: 3-5

Rev: A

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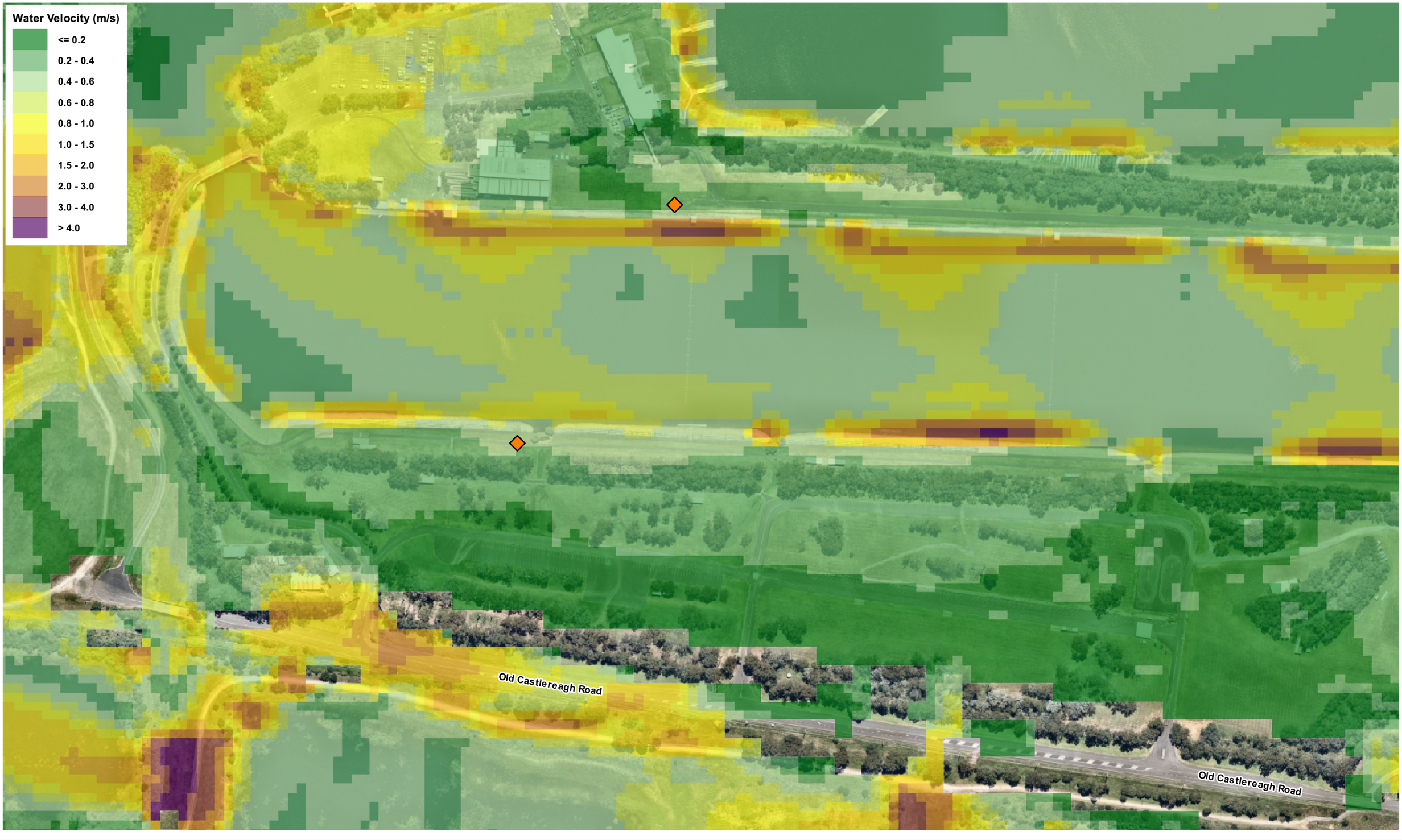

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◆ **Proposed Smart Poles**

Title:

0.2% AEP peak flood velocity (existing conditions)

Drawing: **3-6**

Rev: **A**

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- Proposed Smart Poles

Title:

0.2% AEP peak flood level impact (proposed conditions)

Drawing: 3-7

Rev: A

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- Proposed Smart Poles

Title:

0.2% AEP peak flood velocity impact (proposed conditions)

Drawing: 3-8

Rev: A

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- Proposed Smart Poles

Title:

PMF peak flood depth and level (existing conditions)

Drawing: 3-9

Rev: A

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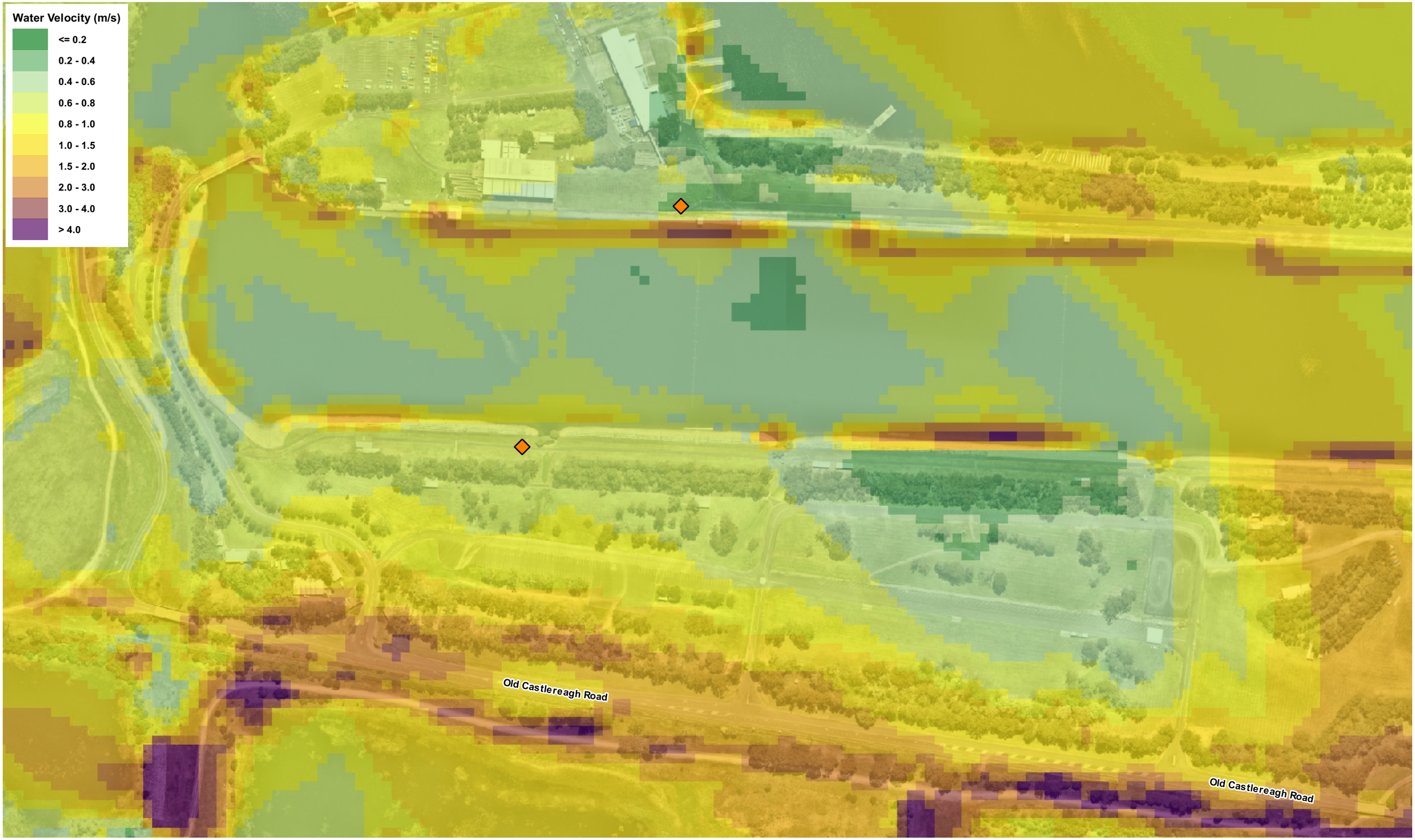

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- Proposed Smart Poles

Title:

PMF peak flood velocity (existing conditions)

Drawing: 3-10

Rev: A

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- Proposed Smart Poles

Title:

PMF peak flood level impact (proposed conditions)

Drawing: 3-11

Rev: A

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- Proposed Smart Poles

Title:

PMF peak flood velocity impact (proposed conditions)

Drawing: 3-12

Rev: A

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4 Conclusion

The flood impact assessment undertaken herein demonstrates that the proposed two smart poles at the Penrith Regatta Centre will result in negligible at-Site and off-Site flood level and velocity impacts for the 1% AEP, 0.2% AEP and PMF events. The existing flood behaviour and flood risks to life around the Site remain unchanged. The proposed installation of the two smart poles will result in negligible impact to the nearby riparian vegetation, as well as stability of the riverbanks or watercourses (as inferred from the negligible impacts on peak velocities). Further, it will not result in unsustainable social and economic costs to the community as a consequence of flooding impacts. As such, the requirements of Clause 33 of the Penrith Lakes SEPP are met for the installation of the proposed works.

In view of the significant flood depths predicted for the 1% AEP event and above, it is very likely that the proposed smart poles would not be operational during major flood events. Nevertheless, it should be noted that the proposed smart poles are not designed to provide services during a major flood event as there are other macro base stations around the Site to provide emergency services. Hence, the existing telecommunication services around the PLDA should not be affected when these smart poles are offline.

BMT understands that the flood loading (accounting for forces of floodwater including debris and buoyancy) on the proposed smart poles installation and their foundation design, as well as the flood compatibility of the materials used in their construction will be assessed as part of the structural assessment, as such this was not part of the flooding scope herein.