The Sikh Grammar School Australia

C/-PMDL

Concept Stormwater Management Plan and Preliminary Flood Study: Sikh Grammar School, 151 & 161 Tallawong Road, Rouse Hill, NSW

martens consulting engineers

ENVIRONMENTAL

WATER

WASTEWATER

GEOTECHNICAL

CIVIL

PROJECT MANAGEMENT

P1806439JR05V04

August 2020

Limitations Statement

The sole purpose of this report and the associated services performed by Martens & Associates Pty Ltd is to provide a Concept Stormwater Management Strategy and Preliminary Overland Flow Study at the subject site in accordance with the scope of services set out in the contract / quotation between Martens & Associates Pty Ltd and The Sikh Grammar School Australia C/-PMDL (hereafter known as the Client). That scope of works and services were defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

Martens & Associates Pty Ltd derived the data in this report primarily from a number of sources which included site inspections, correspondence regarding the proposal, examination of records in the public domain, interviews with individuals with information about the site or the project, and field explorations conducted on the dates indicated. The passage of time, manifestation of latent conditions or impacts of future events may require further examination / exploration of the site and subsequent data analyses, together with a re-evaluation of the findings, observations and conclusions expressed in this report.

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All enquiries regarding this project are to be directed to the Project Manager.

Contents

1 Introduction

1.1 Overview

Martens & Associates Pty Ltd (MA) have prepared this concept stormwater management strategy and preliminary flood to support a State Significant Development Application (SSDA) for a proposed school at 151-161 Tallawong Road, Rouse Hill, NSW (the site).

1.2 Project Scope and Objectives

Project scope and objectives are:

1. Determine temporary OSD and stormwater quality treatment system's requirements for the development site prior to the regional basin is completed.

2. Determine overland flows affecting the site for 1% annual exceedance probability (AEP) floods (with and without climate change) and probable maximum flood (PMF) event.

3. Prepare a hydraulic model (TUFLOW) for the site under existing (1% AEP) and proposed conditions (1% AEP and PMF).

4. Prepare relevant flood maps including flood extents, depths, levels, velocities, and hazards.

5. Comment on flood characteristics and model outcomes in existing and proposed conditions.

1.3 Relevant Guidelines

This report has been prepared in accordance with the following guidelines and policies:

1. Commonwealth of Australia (Geoscience Australia) (2016), *Australian Rainfall and Runoff – A Guide to Flood Estimation.*

2. NSW Department of Infrastructure, Planning and Natural Resources (2005), *Floodplain Development Manual*.

3. Blacktown City Council (2015), *Blacktown Local Environmental Plan (LEP)*.

4. Blacktown City Council (2015), *Blacktown Local Environmental Plan (DCP)*.

5. Blacktown City Council (2005), *Engineering Guide for Development*

2 Site Description and Background Data

2.1 Location and Site Description

Existing site description summary is provided in Table 1.

Table 1: Existing site description summary.

Address	151 and 161 Tallawong Road , Rouse Hill, NSW
Lot / DP	Lot 42 and 43, DP 30186
Site Area	Approximately 4.07 ha (SIX Maps, 2018)
Local Government Area (LGA)	Blacktown City Council (BCC)
Current Land Use	Rural residential
Current Zoning	RU2 – low density residential
Site Description	The site is predominantly grasslands with two individual residences and associated access routes and sheds. A dam exists in the middle of the site.
Surrounding Land Uses	Rural residential
Site Elevation	Site elevation ranges between approximately 54 mAHD (southeastern corner) and 41 mAHD (northwestern corner).
Site Grading & Aspect	The site generally has north westerly aspect across the site, with grades of between approximately 5 % and 15 %.
Site Drainage	Via overland flow into the existing dam and north western corner of the site.

2.2 Proposed Development

The masterplan provided by PMDL Architecture & Design indicates that the Sikh Grammar School will be developed in nine stages. The final stage comprises primary and secondary schools, an early learning centre, a community centre Gurdwara (a place of worship) and Langar (community dinning space), a boarding house, a library and relevant facilities.

We understand that a residential subdivision will be proposed in the western portion of the site prior to the school development and is the subject of a separate development application. As part of the residential subdivision development, three half roads will be constructed along the northern, western and southern boundaries of the site with associated drainage works (1,500 mm diameter trunk drainage pipes) to direct stormwater from Tallowing Road to the south west of the site (Lot F DP407863).

3 Concept Stormwater Management Plan

3.1 Overview

Temporary stormwater quality treatment and on-site detention systems are proposed for the school development prior to the downstream regional basin is fully developed by Blacktown City Council. Two different temporary systems proposed to treat Stage 1 development and Stage 2 - 9 development and are described in the following Sections:

3.2 Stage 1 Development

Proposed temporary basins (Basin 1 -223kL/100m^2 and Basin 2 – 60kL/30m^2) to treat the Stage 1 development areas are shown in MA planset P1806439PS05. Preliminary sizing of the basin is based on the Blacktown City Council's deem to comply requirements of 2% of development area for the bio-retention area and 455m^3/ha for the OSD volume. Refer to the detailed calculation sheet provided in MA planset P1806439PS05 for more details.

3.3 Stage 2 to Stage 9 Development

Stage 2 to Stage 9 will be relying on a temporary below ground OSD tank with a total detention volume of 1,412 m^3. Location and proposed tank details are shown in MA planset P1806439PS05. Tank sizing and outlet configuration have been determined based on the ultimate stage of the development (Stage 9) by using the Council's Deem to Comply tool. Refer to the detailed calculation sheet provided in MA planset P1806439PS05 for more details.

For temporary stormwater quality treatment, Model for Urban Stormwater Improvement Conceptualisation (*MUSIC*, Version 6.2) was used to evaluate treatment train effectiveness (TTE) based on the proposed design at the ultimate stage, including water quality treatment devices required to achieve the minimum pollutant removal targets of Part J of council' DCP 2015:

- 85% reduction in total suspended solids (TSS).
- 65% reduction in total phosphorus (TP).
- 45% reduction in total nitrogen (TN).
- 90% reduction in gross pollutants (GP).

Combination of 'at – source' and 'end – of – line' controls have been adopted to ensure treatment objectives are satisfied. Individual stormwater quality improvement devices (SQIDs) are outlined below:

- STORMSACK is to be installed inside the proposed pits to treat gross pollutants in stormwater prior entering the proposed Ocean Gard system. The modelled treatment efficiency of the StormSack is based on the manufacturer's specifications.

- The eastern portion of the development area shall be conveyed by way of pit and pipe to an 100m^2 raingarden nominated in MA planset P1806439PS05. The raingarden is to provide treatment through filtration, evapotranspiration and detention. Preliminary design with section details of the raingarden are shown in MA planset P1806493PS05 and are subject to detailed design.

- A HUMEGARD GPT is to be installed upstream of the proposed temporary belowground OSD tank to remove gross pollutants and coarse sediments prior entering into the tank. Refer to MA planset P1806439PS05 for design details.

- An OCEAN PROTECT JELLYFISH is to be installed downstream of the proposed temporary belowground OSD tank. The system is to provide a reduction in nutrient pollutant loads through propriety media filtration. Refer to MA planset P1806439PS05 for design details.

MUSIC modelling results are shown in MA planset P1806439PS05 and indicate that council's minimum pollutant removal objective will be met by the proposed SQIDs mentioned above.

We note that the proposed temporary OSD and water quality treatment systems for Stage 2 to Stage 9 have been sized based on the ultimate development footprint. Alternatively, OSD and water quality (WSUD) systems can be sized progressively at each development stage. Requirements for each stage are to be reviewed based on the corresponding development footprint and the construction and operation status of the council's regional basin.

3.4 Summary

The OSD and water quality (WSUD) elements have been designed to comply with the Blacktown City Council's requirements. Deem to comply design approach and MUSIC modelling indicate that the water quality and on-site detention objectives will be met by the proposed temporary treatment systems for both stage 1 and ultimate stage developments, with further details provided at the detailed design stage.

4 Preliminary Flood Study

4.1 Upstream Catchment Flows

The site is located within the First Ponds Creek Catchment and is affected by a local upstream catchment of approximately 6.7 ha (refer Attachment A Figure 2). Based on BCC MapsOnline, part of the site is regarded as flood prone area under *State Environmental Planning Policy (Sydney Region Growth Centres) 2006*. Upstream overland flows running in a southwesterly direction are collect by Tallowong Road and conveyed towards the existing low point fronting the site.

We note that upgrade works of Tallawong Road are being undertaken at the time of preparation of this report. A 1.8 x 0.6 m box culvert is being constructed at the sag point of Tallawong Road with a headwall outlet discharging into the site. Refer to the approved construction certification plan of the residential subdivision development at 154 Tallawong Road, Rouse Hill (CC130-02) prepared by Mepstead and Associates (2018) for more details.

A DRAINS model has been developed to simulate the upstream catchment flows discharging into the site. Results of peak flow rates are summarised in Table 2. The 1% AEP flow is consistent with the flow rates documented in the approved construction certification plan of 154 Tallawong Road, Rouse Hill.

Table 2: Peak 1% AEP with and without climate change and PMF flow rates for critical duration storms estimated by DRAINS modelling for upstream catchments arriving at the site.

Flood Event	Critical Storm Duration (mins)	Peak Catchment Flow Rates (m^3/s)
1% AEP	10	41.8
1% AEP climate change [1]	10	51.7
PMF	15	127.0

Notes

1. Based on 18.6% increased rainfall intensity in accordance with ARR 2016.

4.2 Proposed Flood Mitigation Concept

Proposed flood mitigation works to be implemented in the first stage of the school development (Stage 1), which protect the site from flood waters for events up to and including the probable maximum flood (PMF) throughout all stages of the development.

- The drainage system on the low point on Tallawong Road adjacent to the northern site boundary is to be upgraded with five

900 x 900 mm V-grates pits and 1.5m diameter pipes to fully capture 1% AEP flows.

- 1% AEP flood waters collected from Tallawong Road is to be conveyed by a 2m wide and 1.8m deep box culvert under the proposed carpark in the north eastern corner of the site and discharged into the 1.5m diameter trunk drainage pipe under the northern boundary road which would be constructed as parts of the residential development subdivision works.

- An emergency overland flow path is provided through the proposed carpark to direct PMF flows towards the northern boundary road.

- With the flood mitigation works described above, the site is generally flood free for all events up to and including the PMF event from Stage 1 to 9 of the development.

4.3 Flood Modelling

The TUFLOW hydraulic model was used to determine flood characteristics including flood extents, levels, depths, velocities and hydraulic hazard for the critical 1% AEP flood (with and without climate change) and PMF events for existing and proposed conditions.

4.3.1 Scenarios

The hydraulic model was setup to represent the following flood condition scenarios:

1. Existing condition (1% AEP);

2. Proposed Condition (1% AEP, 1% AEP with climate change and PMF).

In summary, a total of 4 scenarios were modelled as part of this assessment.

4.3.2 Terrain Data

Catchment LIDAR data provided by LPI (2013) was merged with site survey data provided by Total Survey Solutions (May 2018) to create a 3D surface for the existing conditions site and the local floodplain environment used in the TUFLOW model.

4.3.3 Model Setup

4.3.3.1 Existing Conditions

TUFLOW model construction for existing conditions consisted of:

1. A 1.0 m topographic grid based on the available survey and LIDAR data.

2. The model domain was defined from the upslope side of Tallawong Road to the drainage depression 150 m downstream of the site.

3. Inflow boundary conditions based on the critical duration 1% AEP overland flow hydrographs from DRAINS.

4. 1% AEP rainfall intensities were increased by 18.6% in accordance with the Interim Climate Change Factors (RCP 8.5) recommended in ARR 2018 Data Hub for the precinct location. This factor was used in the absence of Council policy document.

5. Computed water gradients for downstream model extent boundary conditions based on ground surface gradients from available LIDAR data.

6. Manning's zones based on Nearmaps (2017) aerial photography of the study area with roughness coefficients adopted as per Table 1.

7. Existing dams are conservatively assumed to be full.

Table 3: Manning's roughness values for TUFLOW modelling.

Catchment Material Type	Manning's Roughness Coefficient [1]
Rural Land	0.04
Roads / Concrete	0.015

Notes
1. Based on typical values from similar catchments.

4.3.3.2 Proposed Conditions

The existing conditions model was modified as follows to simulate proposed conditions:

1. A 1.0 m topographic grid based on the available survey, LIDAR data and proposed site grading including the designed PMF overland flow path at the north eastern carpark.

2. Site manning's zones were updated to represent design surfaces.

3. A 1D network to model relevant pit and pipe networks, as shown in MA planset P1806439PS05. Pipe blockages of 33% and 25% have been adopted for the proposed 1.5m diameter trunk stormwater pipe and the 2m wide and 1.5m high box culvert underneath the north eastern carpark based on Blacktown City Council's pipe blockage requirements

All other model construction elements remained consistent with the existing conditions model.

4.4 Results

Flood mapping results (flood levels, depths, velocities and provisional hazard categories) for the critical duration 1% AEP flood event with and without climate change and PMF events in existing and proposed conditions are provided in Attachment A.

Provisional hydraulic hazard categories are based on NSW Floodplain Development Manual (2005) definitions and are shown in Figure 1.

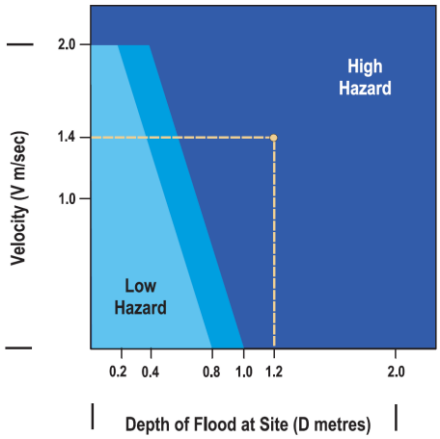


Figure 1: Provisional hydraulic hazard categories (*NSW Floodplain Development Manual*, 2005).

4.5 Discussion

We note the following regarding modelled flood behaviour:

4.5.1 Existing Conditions

1. The primary source of site flooding is the discharge from the headwall recently constructed at the sag point of Tallawong Road fronting the site.

2. Flood waters primarily flow across the site from northeast to southwest along the existing drainage depression and discharge to the south west of the site (Lot F DP407863).

3. Water velocities are generally between 1 m/s and 4 m/s.

4. Areas of high hydraulic hazards are observed in the drainage depressions and dam.

4.5.2 Proposed Conditions

1. The proposed pit and pipe system has been designed to fully capture and convey the 1% AEP flood flows with and without climate change.

2. In the 1% AEP flood event, water on Tallawong Road will reach a maximum depth of 0.185 m, and up to 0.250 m in the climate change scenario.

3. The peak 1% AEP water level is 50.9 mAHD at the north-eastern boundary of the site. As the proposed building floor level is 52.5 mAHD, a freeboard of 1.6 m is achieved. In the 1% AEP with climate change event, the water level reaches up to 51.1 mAHD, which results in a freeboard of 1.4 m.

4. In the PMF event, flood waters on Tallawong Road will pond up to a level of 52.49 mAHD. The overland flow conveyance path is through the northern carpark and along the north-western boundary road.

5. Proposed Entry Foyer and Services Pavilion near the frontage of the site at Tallawong Road is to be raised to 52.5 mAHD to avoid inundation of the buildings by PMF water.

5 Preliminary Flood Emergency Response Plan

Floods up to the 1% AEP flood event are fully contained within the proposed stormwater drainage system on site. In the PMF event, flood waters accumulate at the sag point located on Tallawong Road and then spill through the overland flow path in the northern carpark and onto the proposed north-western road. Therefore, site egress from the northern and western boundaries would be temporarily cut off by the PMF flood, however egress would still be available from the southern and eastern boundaries should evacuation be required. However, as the site is affected by short duration flash flooding and the majority of the site is proposed to be above the PMF level and thus remains flood free, it is not necessary for the site occupants to evacuate from the site in the event of a flood. Instead, short-term shelter-in-place is suggested as the appropriate emergency response strategy for the site.

We note the following with respect to the preliminary flood emergency response plan (FERP):

1. The site is managed, hence a responsible flood officer shall be appointed to manage flood education and instructions for the management and all occupants. The officer should be familiar with the emergency response procedures detailed in the Blacktown City Local Flood Plan (2010).

2. The responsible flood officer shall be subscribed to flood warning systems including the SES emergency alert telephone warning system, BOM alerts and press releases, weather apps and media warnings.

3. Building ground floor levels will not be inundated by flood waters, thus PMF refuge is available in each building.

4. Proposed structures at or under the PMF level will be designed to resist flood forces (water and debris) and any buoyancy forces.

5. Each building should contain an emergency kit including torch and spare batteries, portable radio with spare batteries, first aid kit, high visibility vest, non-slip footwear, and megaphone.

6 Secretary's Environmental Assessment Requirements

We made the following comments in relation to the drainage, flooding and sediment and erosion issues as documented in the Planning Secretary's Environmental Assessment Requirements dated 6 August 2018:

15. Drainage

Temporary stormwater quality treatment and on-site detention systems have been proposed for the development, prior to the downstream regional basin is fully developed by Blacktown City Council, to ensure minimal impacts on the downstream property (Lot F DP407863) with a temporary stormwater tail out easement to be obtained from Department of Planning. Proposed water quality improvement measures will ensure compliance with "Blacktown Control Development Plan 2015 Part J". The on-site detention system will cater for all storm events up to and including 1% AEP storm events in accordance with Council's "Engineering Guide for Development 2005".

16. Flooding

Proposed flood mitigation works have been proposed in the first stage of the school development (Stage 1), which protect the site from flood waters for events up to and including PMF throughout all stages of the development. Proposed underground pit and pipe system has been designed to fully capture and convey the 1% AEP flood flows with and without climate change. Proposed site regrading has ensured the site is flood free for all events up to and including the PMF event.

19. Sediment, Erosion and Dust Controls

Sediment and erosion control measures have been provided in accordance with the "Blue Book" (Managing Urban Stormwater – Soils and Construction).

7 References

Blacktown City Council (2005), *Engineering Guide for Development*

Blacktown City Council (2010), *Blacktown Local Flood Plan*.

Blacktown City Council (2015a), *Blacktown Local Environmental Plan (LEP)*.

Blacktown City Council (2015b), *Blacktown Development Control Plan (DCP)*.

Bureau of Meteorology (2017), *Rainfall IFD Data System*, www.bom.gov.au/water/designRainfalls/revised-ifd/?year=2016.

Commonwealth of Australia (Geoscience Australia) (2016), *Australian Rainfall and Runoff – A Guide to Flood Estimation.*

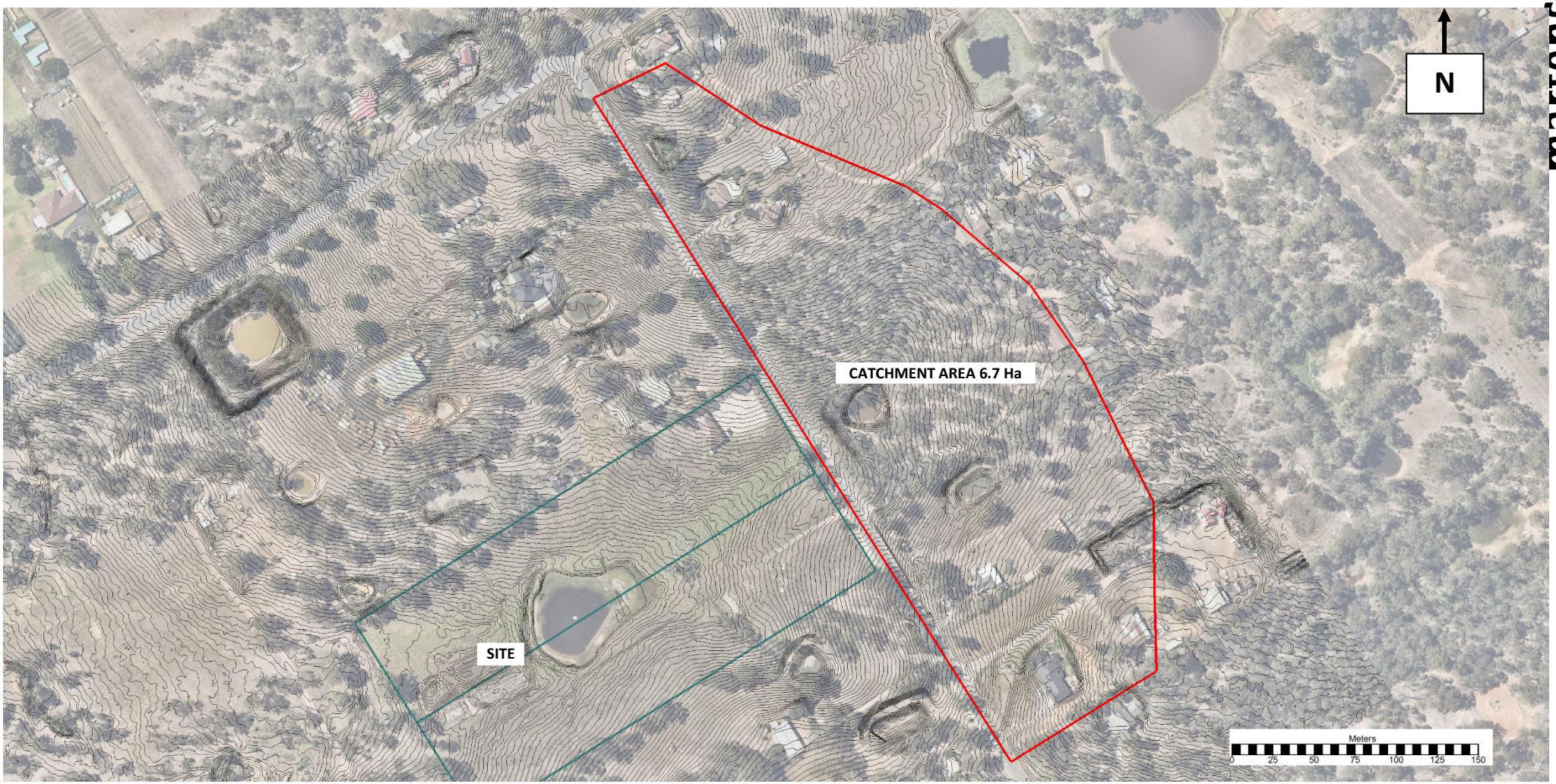
DRAINS (2016), *DRAINS Content Menu*.

Mepstead and Associates (2018), *Proposed Residential Subdivision: 154 Tallawong Road, Rouse Hill.*

NSW Department of Infrastructure, Planning and Natural Resources (2005), *Floodplain Development Manual*.

NSW Government (2006), *State Environmental Planning Policy (Sydney Region Growth Centres) 2006.*

8 Attachment A: Figures



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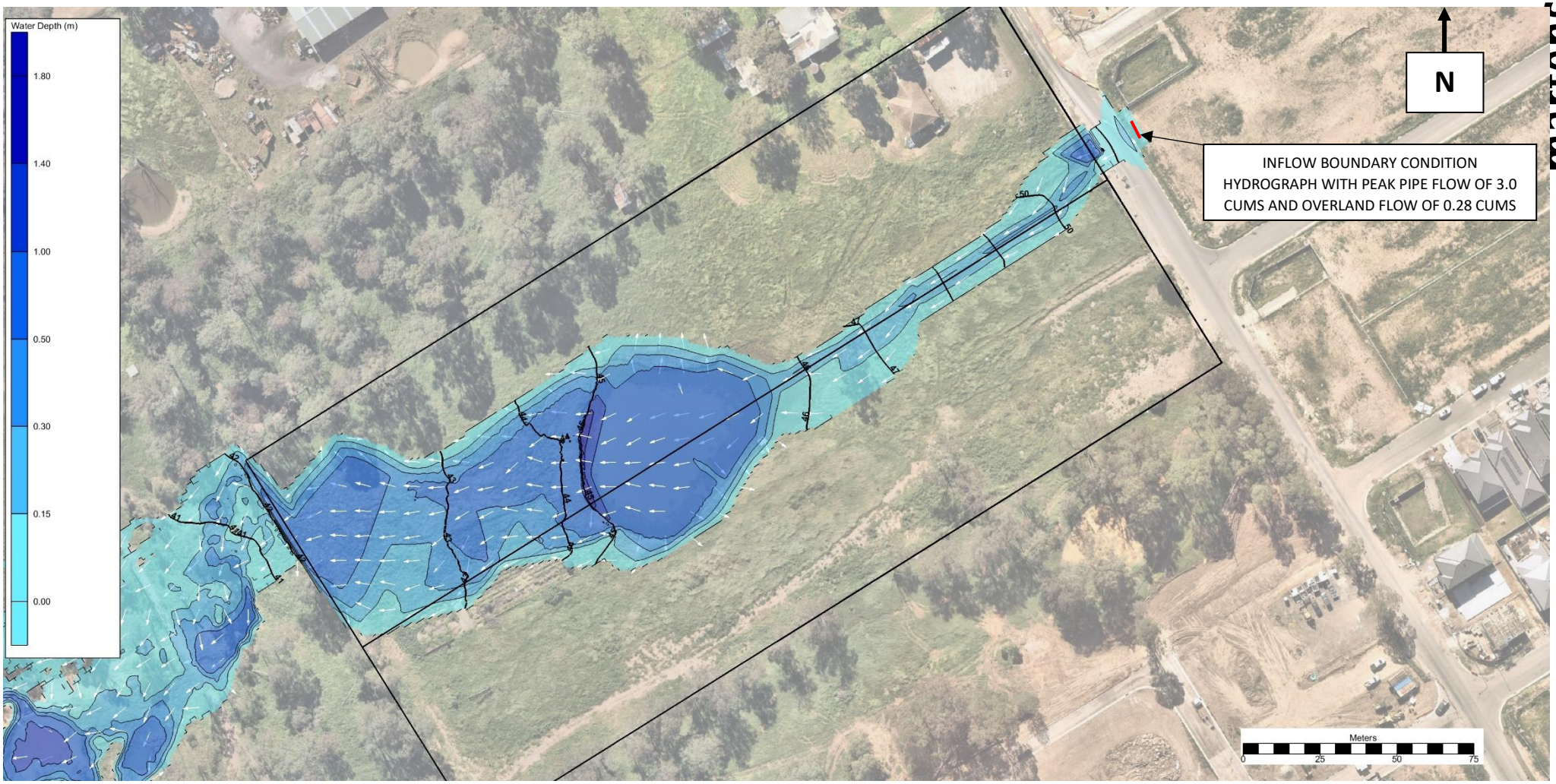

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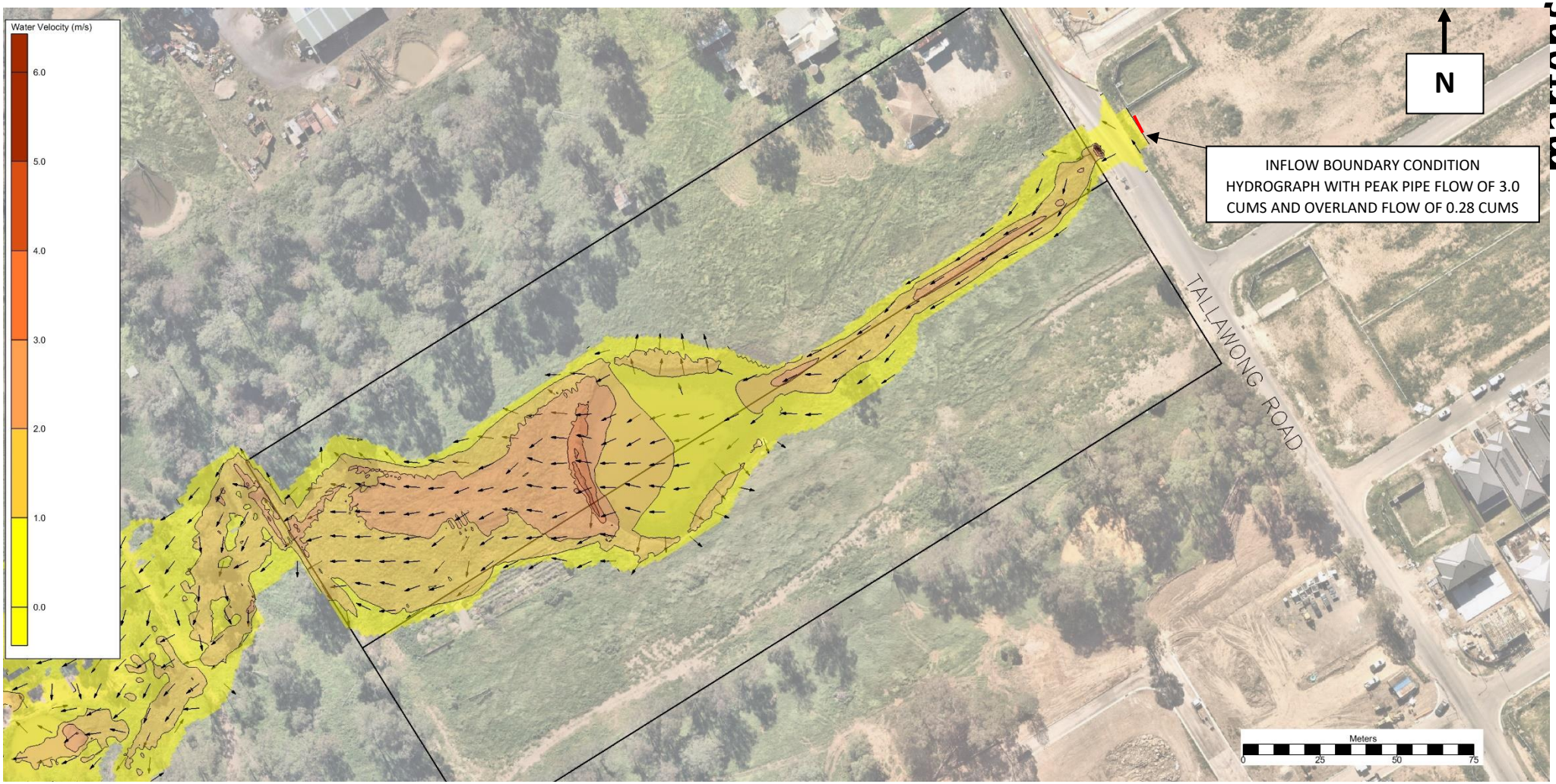

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Approved:	SL		
Date:	21/08/2020		
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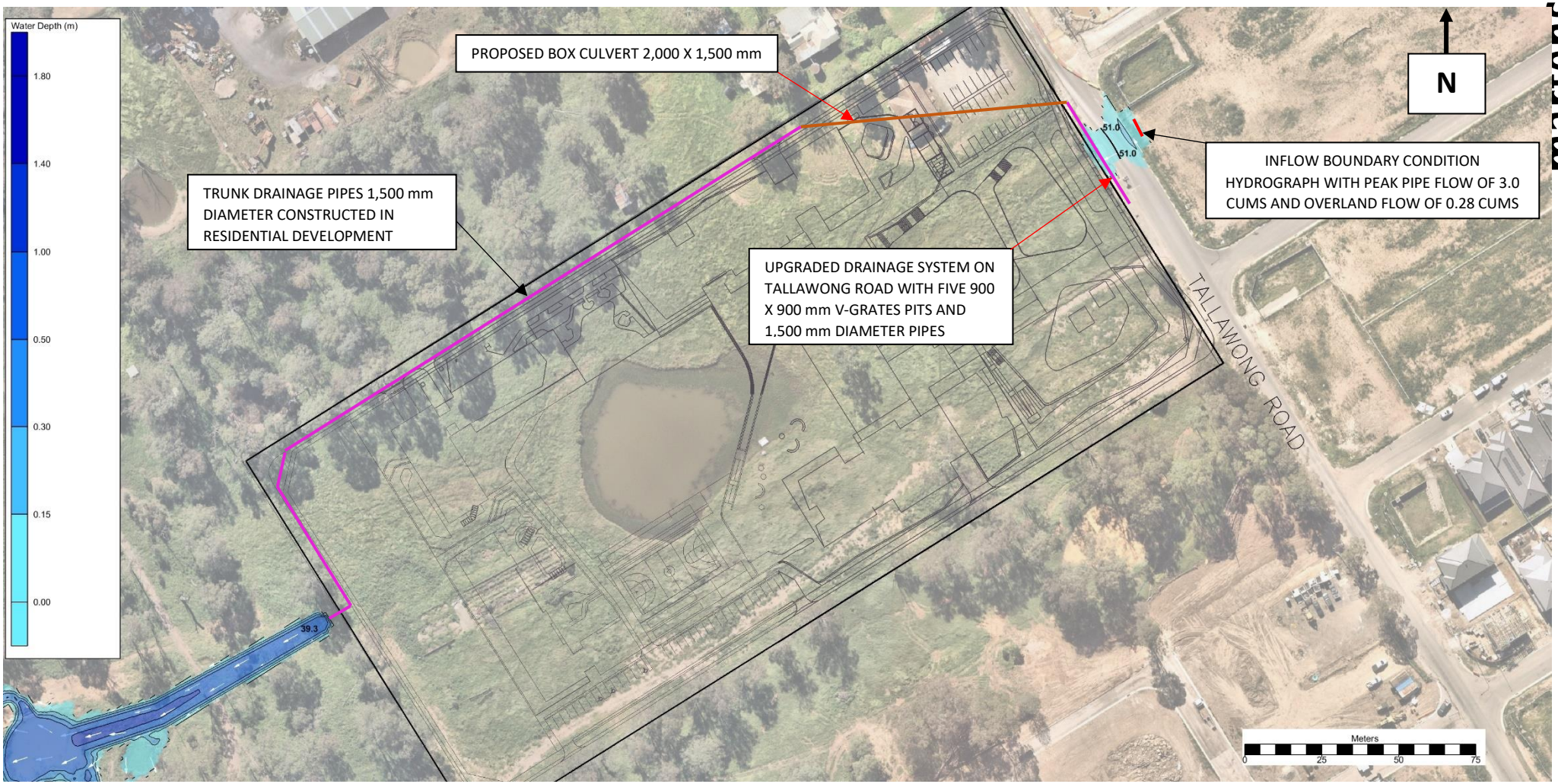

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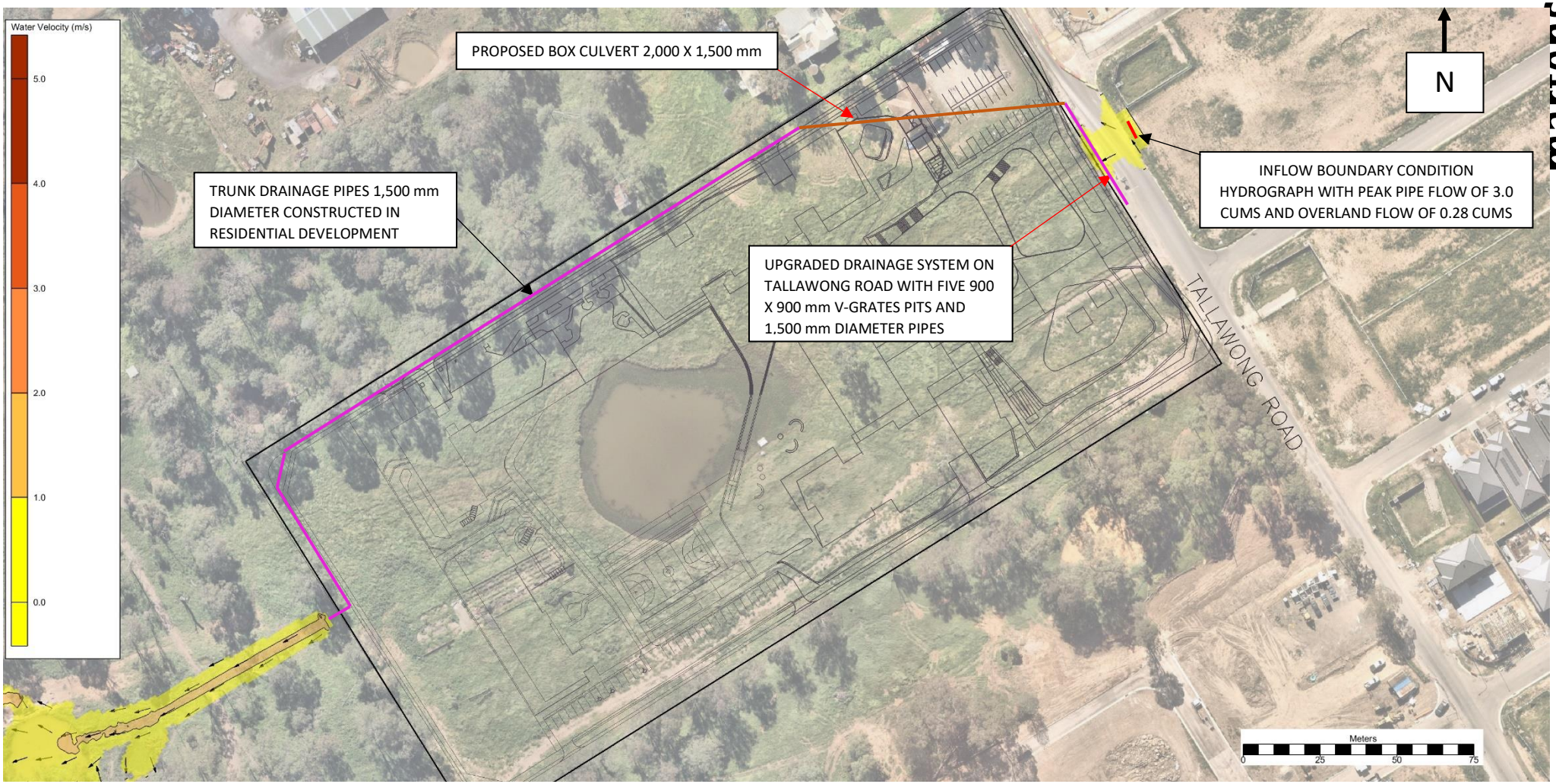

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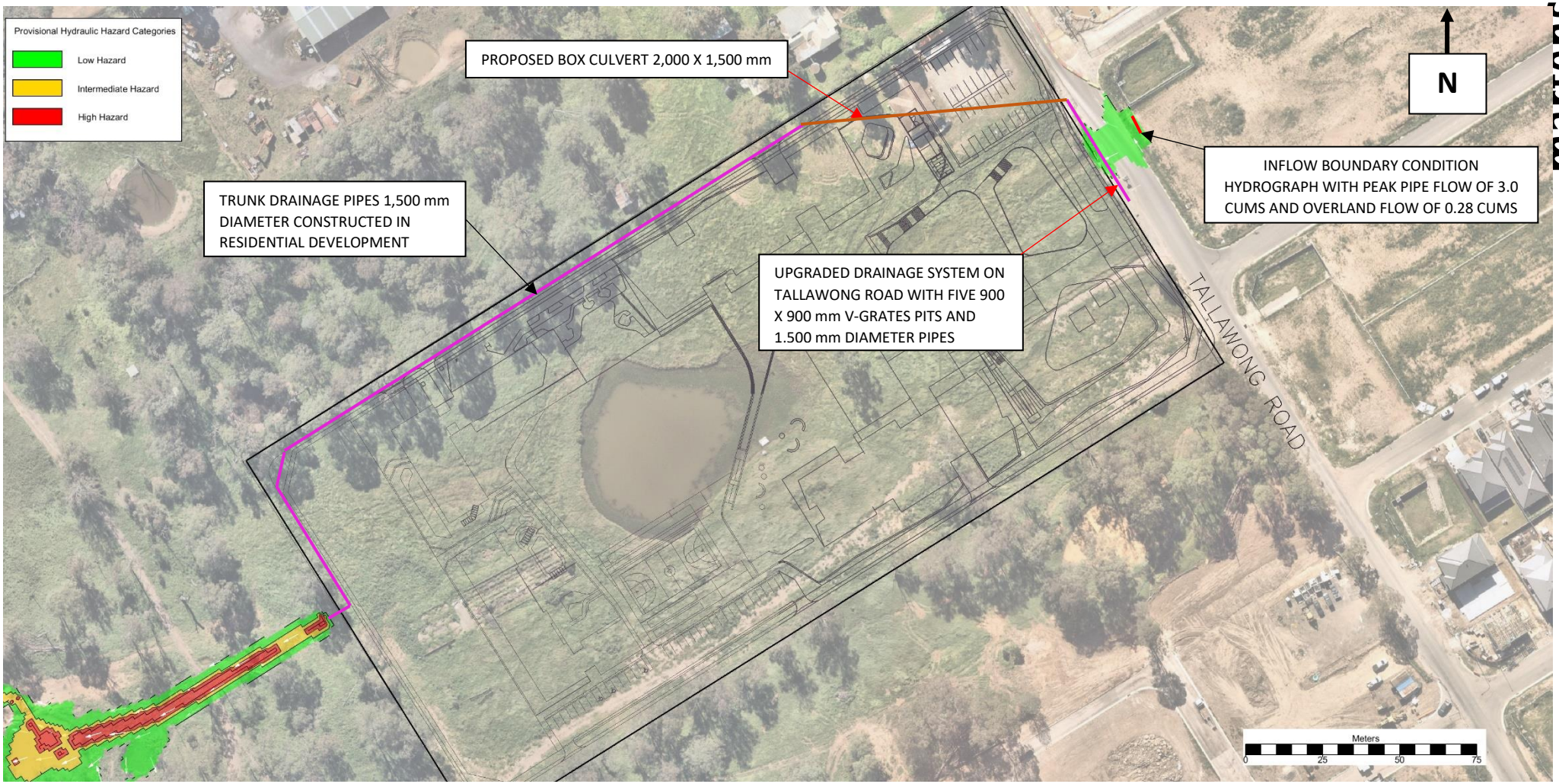

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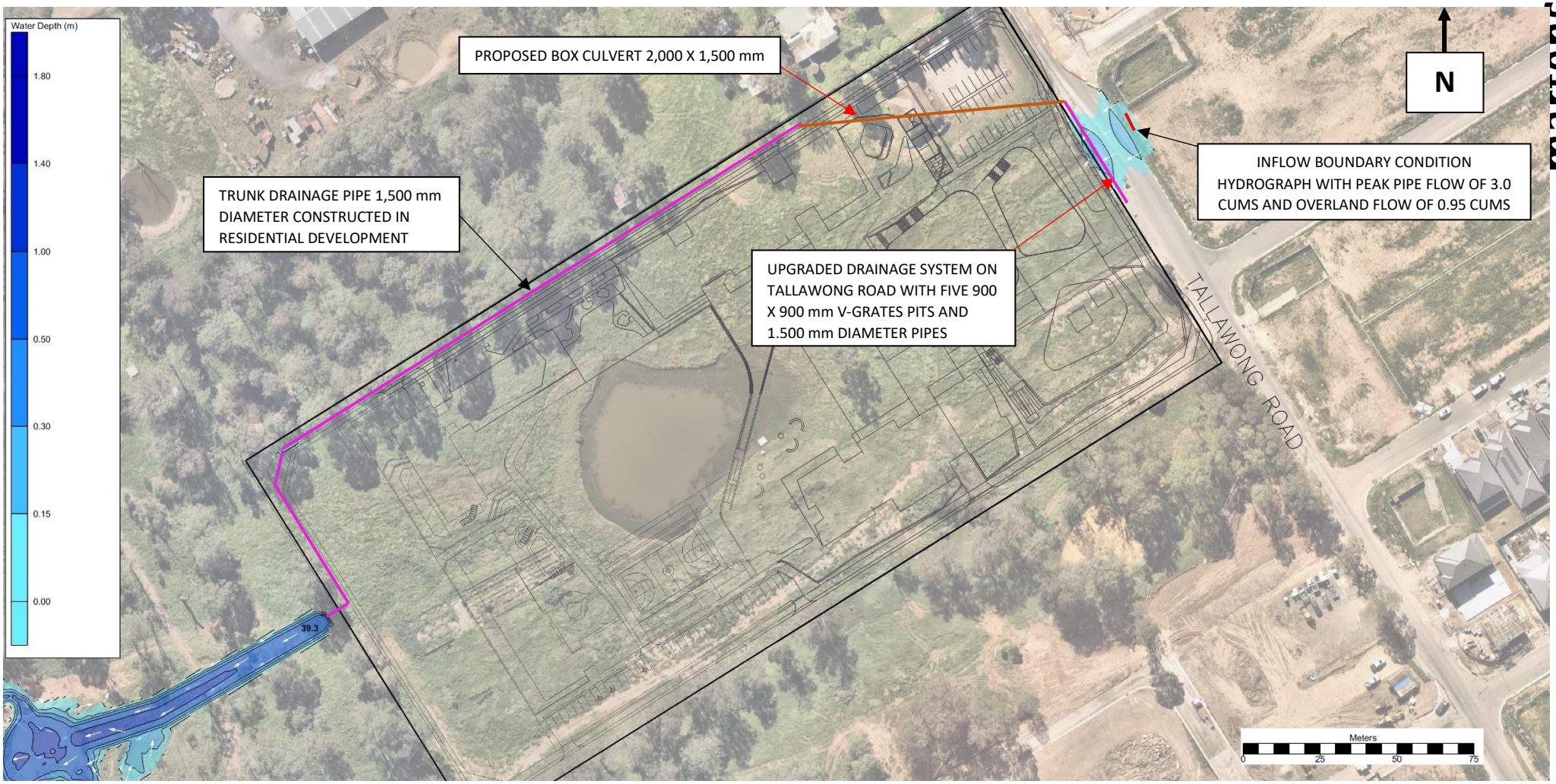

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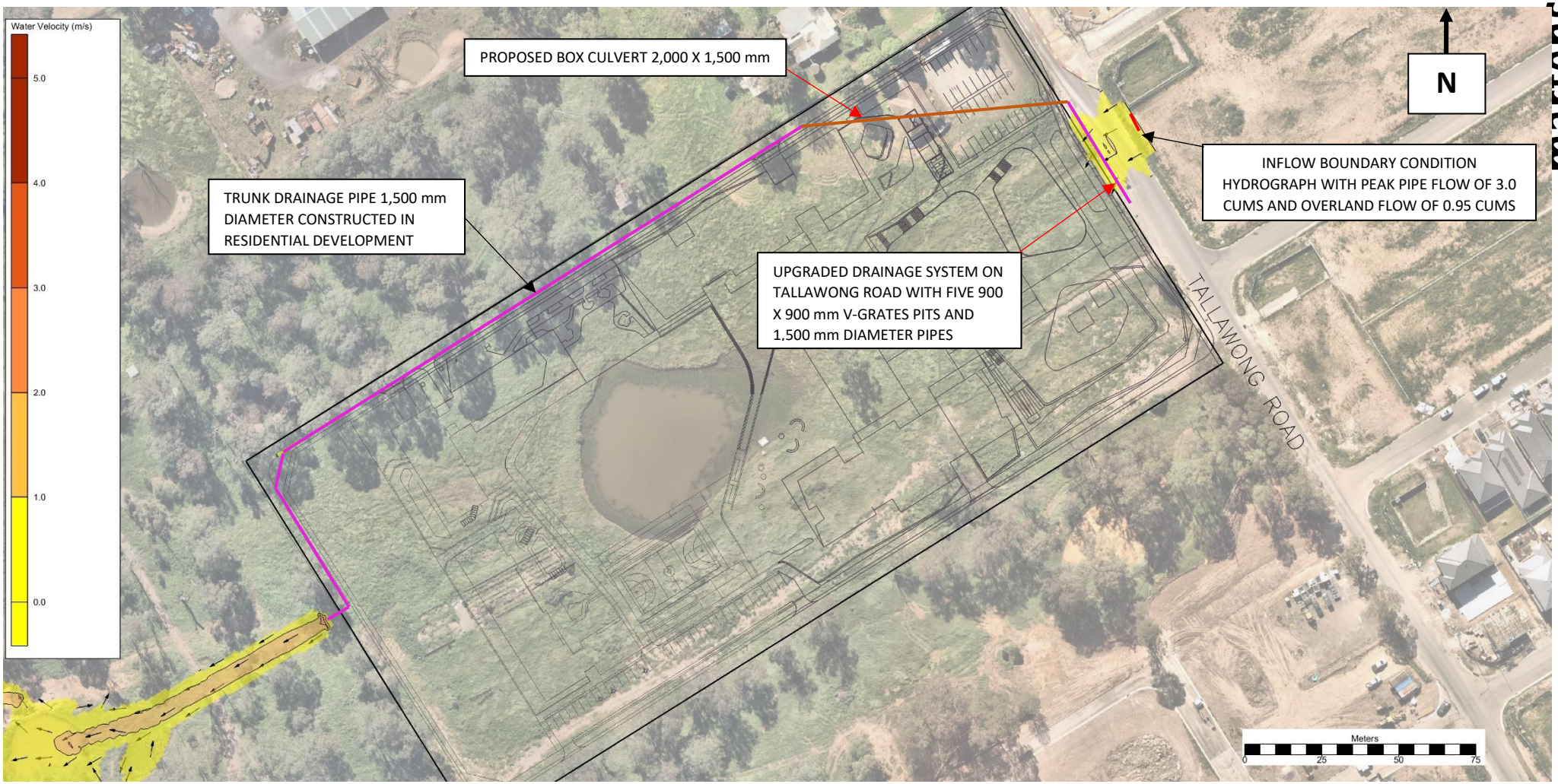

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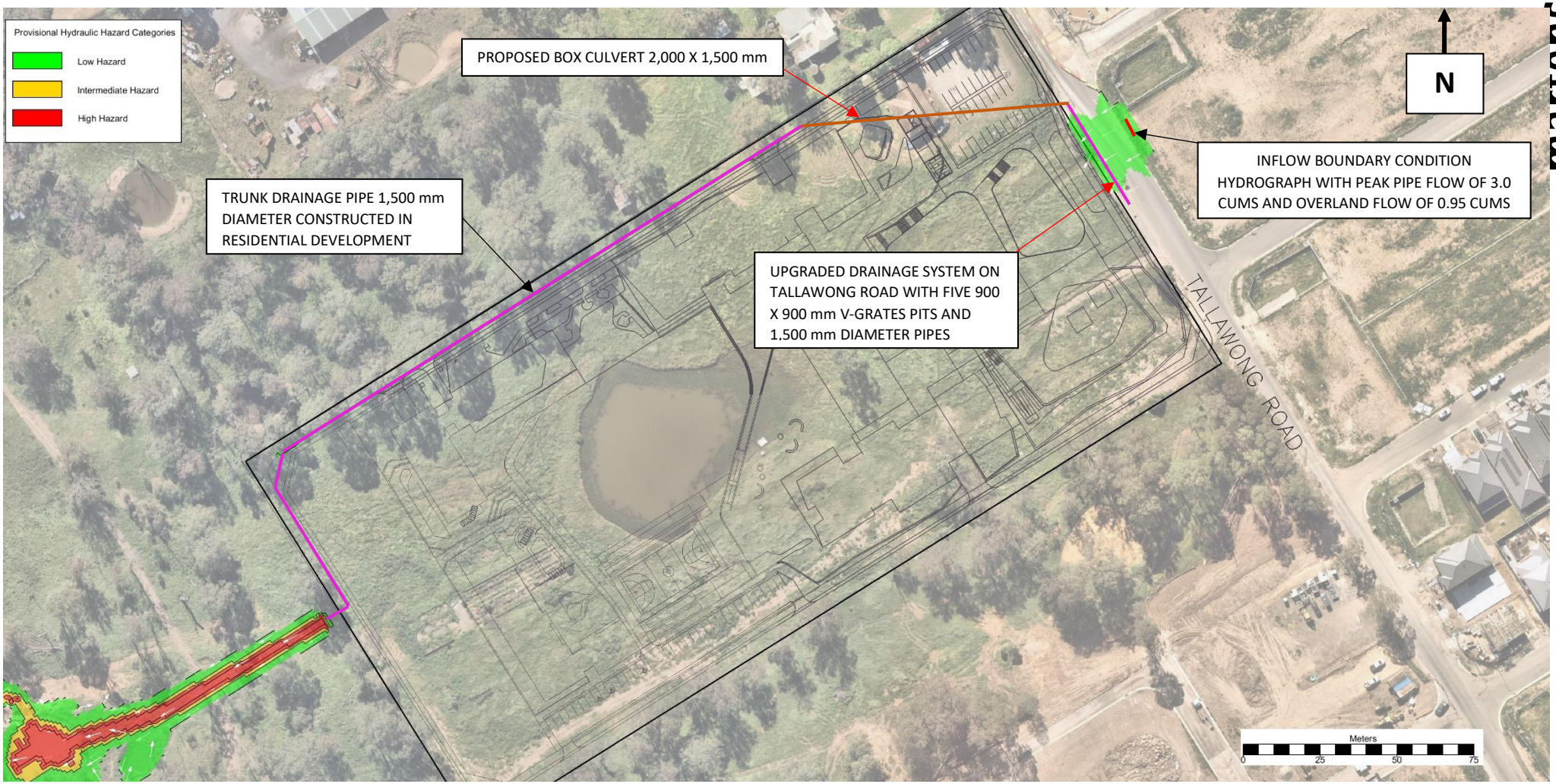

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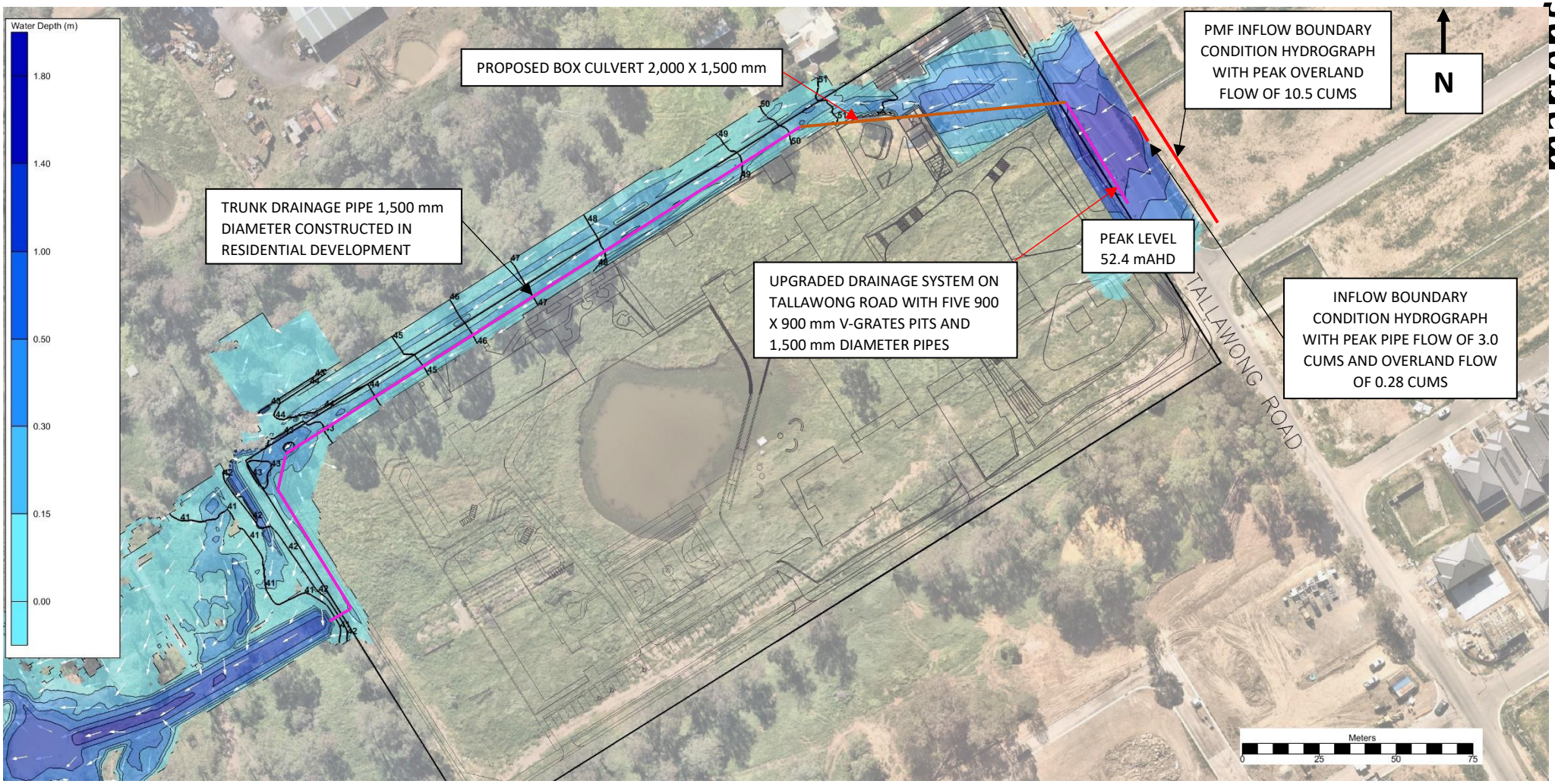

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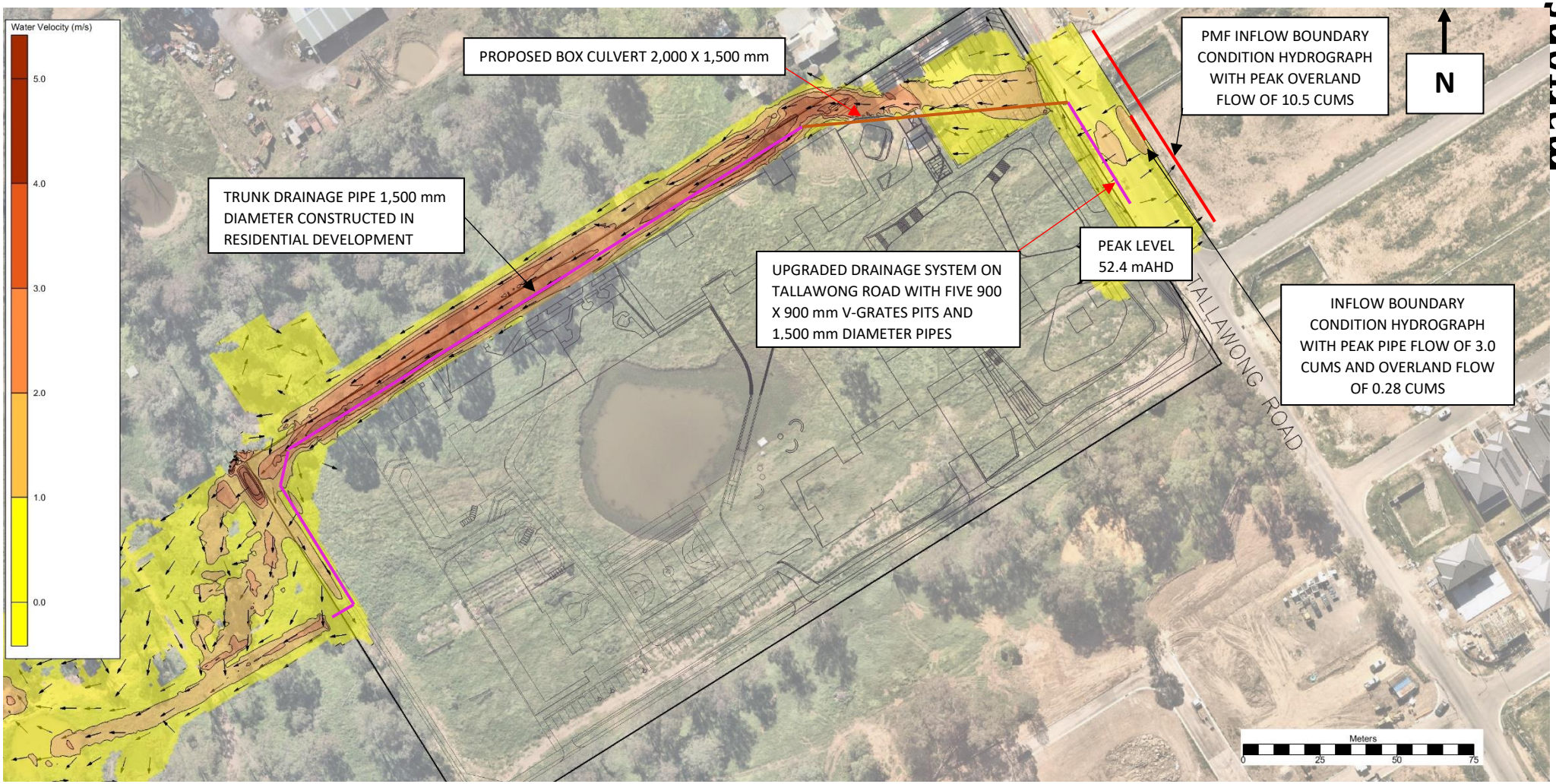
Drawn:	LZ	**PROPOSED PMF FLOOD DEPTHS (m) AND LEVELS (mAHD)**	Drawing No: **FIGURE 12**
Approved:	SL		
Date:	21/08/2020		Job No: P1806439
Scale:	AS SHOWN		



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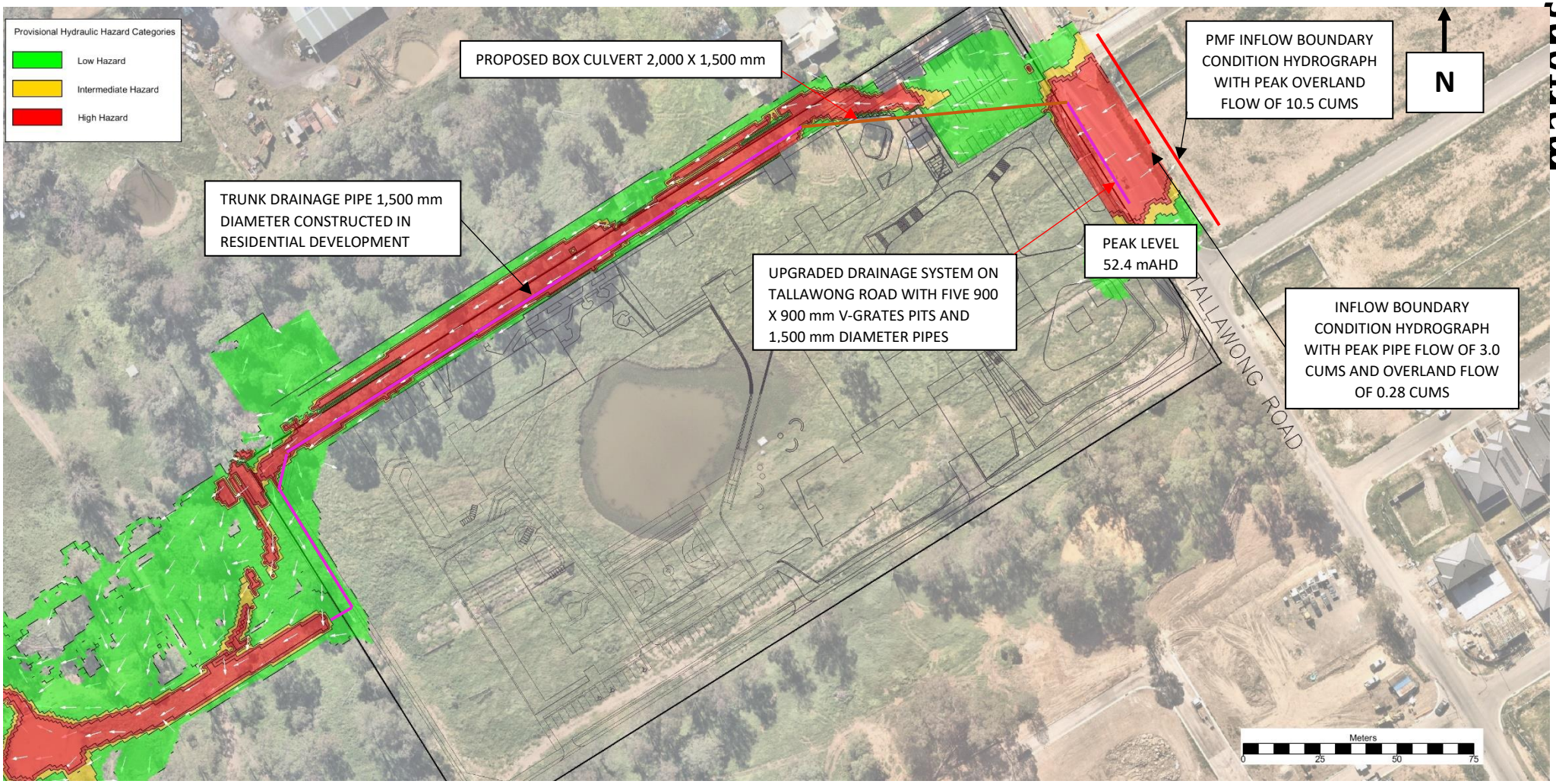
Drawn:	LZ	**PROPOSED PMF FLOOD VELOCITY (m/s)**	Drawing No: **FIGURE 13**
Approved:	SL		
Date:	21/08/2020		
Scale:	AS SHOWN		Job No: P18064398



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Drawn:	LZ	**PROPOSED PMF FLOOD PROVISIONAL HYDRAULIC HAZARD CATEGORIES**	Drawing No: **FIGURE 14**
Approved:	SL		
Date:	21/08/2020		
Scale:	AS SHOWN		Job No: P1806439