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Subject: Burrah Park, Elizabeth Drive , Badgerys Creek - Lots 4.1 & 4.2 – State Significant Development Application SSD-70818708

Date: 13/03/2025

Dear Lloyd,

This letter is provided in support of the State Significant Development Application (SSDA) SSD-70818708 for the development at Burrah Park, Elizabeth Drive, Badgerys Creek – Lots 4.1 and 4.2 (refer to Figure 1). It addresses Item 14 of the Planning Secretary's Environmental Assessment Requirements (SEARs) regarding flood risk and summarises the flood risk assessment and mitigation measures for the proposed development.

The SSDA is a detailed development application (DA) that is linked to and consistent with the approved concept plan (SSD-70316465). It seeks consent for the construction and operation of two single-storey industrial buildings for use as a warehouse and logistics facility with 24/7 operations, as well as car parking and associated landscaping, within a 25-hectare portion of Lot 1 in Deposited Plan 1306448 at 1953-2109 Elizabeth Drive, Badgerys Creek, known as the DHL Masterplan site.

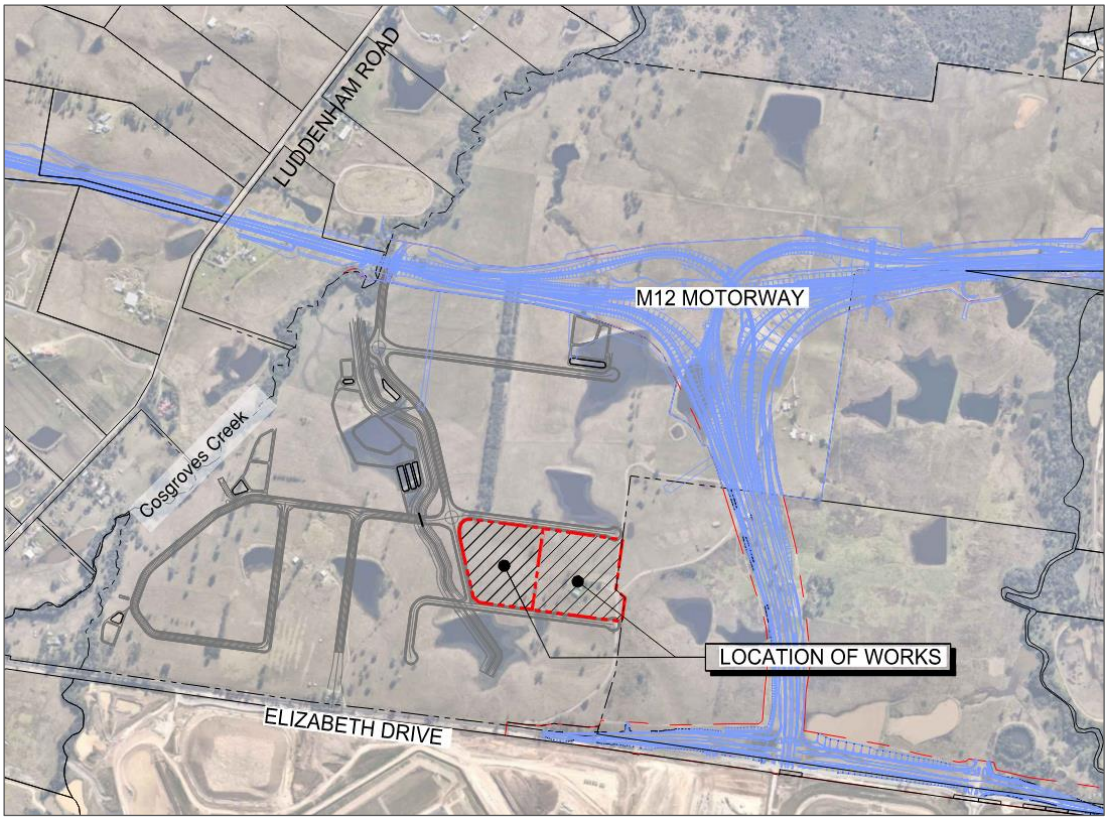

Figure 1 – Lots 4.1 and 4.2 Burrah Park

Lloyd Henderson
DHL Supply Chain
13/03/2025

Flood Risk Assessment Overview

Arcadis has conducted a comprehensive flood risk assessment for the entire Burrah Park business complex at 1953-2109 Elizabeth Drive, Badgerys Creek (SSD-70316465). The assessment evaluates existing flood conditions and the potential impacts of future development on local flood behaviour, considering adopted flood studies, the potential effects of climate change, and the relevant provisions of the NSW Flood Risk Management Manual.

Key findings of the assessment include:

- **Flood Inundation and Impact Analysis:** The proposed business park is primarily outside the 1% AEP flood extent, with only minor encroachments into the PMF zone. For events up to the 1% AEP, impacts are minimal and localised to areas adjacent to the proposed development embankment. Lots 4.1 and 4.2, centrally located within the site, are not related to these minor encroachments.
- **Climate Change Considerations:** The analysis accounts for potential changes in flood behaviour due to climate change.
- **PMF Conditions:** The PMF scenario results in minor flood level increases (less than 150mm) on properties west of Cosgroves Creek and along the M12 Motorway. However, these impacts are not significant in the overall flood risk profile. Additionally, Lots 4.1 and 4.2 are situated at an elevation significantly above the PMF level.
- **On-Site Flood Resilience:** The business park will remain flood-free up to and including the PMF, ensuring that occupants can remain on-site without evacuation. For events up to the 1% AEP, Elizabeth Drive serves as a viable evacuation route toward Northern Road. However, during a PMF event, Elizabeth Drive may experience peak flood depths of up to 400mm (hazard category H5), making it unsafe for vehicles and pedestrians.

Design Solutions and Operational Procedures

A review of civil drawings by at&l confirms that the proposed development design aligns with the overall flood assessment conclusions. Effective internal stormwater management measures have been incorporated to minimise localised flood impacts. In accordance with the Flood Impact and Risk Assessment – Flood Risk Management Guide LU01, the following design solutions and operational procedures will be implemented:

- **Integrated Stormwater Management:** The design should include robust internal drainage systems that effectively manage stormwater and reduce on-site flood risk.
- **Evacuation and Access Planning:** Operational procedures should ensure safe access and egress during flood events. For events up to the 1% AEP, Elizabeth Drive serves as a designated evacuation route, with detailed signage and route management procedures to assist occupants during emergencies. However, during a PMF event, Elizabeth Drive may experience peak flood depths of up to 400 mm (hazard category H5), making it unsafe for vehicles and pedestrians. Therefore, it is recommended that the site be safely evacuated before the onset of flooding.

Lloyd Henderson
DHL Supply Chain
13/03/2025

Conclusion

The flood risk assessment for Burrah Park, Elizabeth Drive, Badgerys Creek – Lots 4.1 and 4.2 confirms that the proposed development meets the flood risk requirements outlined in the Planning Secretary's Environmental Assessment Requirements. The assessment comprehensively evaluates existing flood risks, considers climate change impacts, and outlines the necessary design solutions and operational procedures to mitigate flood risk.

The attached flood risk assessment report by Arcadis provides the full technical analysis supporting this conclusion. Please review the report for detailed methodologies, assumptions, and results. Should you require further information or clarification regarding flood risk evaluation or mitigation measures, please do not hesitate to contact me.

Kind regards,
Arcadis Australia Pacific Pty Ltd

Darlan Castro
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Enc. Flood Assessment, Burrah Park, 1953-2109 Elizabeth Drive, Badgerys Creek, Arcadis, September 2024

Flood Assessment

Burrah Park, 1953-2109 Elizabeth Drive, Badgerys Creek

September 2024

Flood Assessment

Burrah Park, 1953 – 2109 Elizabeth Drive, Badgerys Creek

Our Ref:

30206389-EF001-03-Flood Assessment

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Prepared For:

- Richmond Bridge Burra Park 2 Pty Ltd as trustee for Burra Park Prop Trust 1
- UniSuper Limited as Trustee for UniSuper and UniSuper Management Pty Limited
- ISPT Pty Limited as trustee for The Industry Superannuation Property Trust No. 1
- HB&B Property Pty Ltd

Version Control

Revision No.	Date Issued	Description	Author	Approver
01	16/07/2024	Draft	SJ	DC
02	16/08/2024	Final Report	SJ	DC
03	30/09/2024	Updated GFA	SJ	DC

Executive Summary

This Flood Assessment report has been prepared by Arcadis to accompany a State Significant Development Application (SSDA) for a Concept and Stage 1 SSDA for a Warehouse and Logistics Estate at 1953-2109 Elizabeth Drive, Badgerys Creek. The site is legally described as Lot 1 in Deposited Plan 1306448.

The applicant, the trustee for Burra Park Prop Trust 1 is a joint venture entity, with ISPT Core Fund and UniSuper each holding an equal share. HB&B and ISPT have been appointed as the development team to oversee the project's delivery. By leveraging the expertise of both organizations, the venture is well-positioned to maximize Burrah Park's value to the community.

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued for the project (SSD- 70316465).

This report concludes that the proposed warehouse and distribution centre is suitable and warrants approval subject to the implementation of the following mitigation measures.

- Incorporating detention basins in the design of the development to replicate the existing flow rates discharging into Cosgrove Creek post-construction.

Following the implementation of the above mitigation measures, the remaining impacts are appropriate.

Contents

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1 Introduction

This report has been prepared to accompany a State Significant Development Application (SSDA) for a site located at 1953-2109 Elizabeth Drive, Badgerys Creek (**SSD- 70316465**). The application seeks consent for a concept plan including future development lots and building footprints (as shown in Figure 1). The development also seeks consent for the Stage 1 works which will include bulk earthworks across the site, infrastructure delivery, road access/intersections, internal road construction, civil infrastructure and utilities, stormwater infrastructure works and the construction of three (3) warehouse buildings (as shown in Figure 2).

Specifically, development consent is sought for:

- Concept Plan
  - Concept Masterplan for the Burrah Park comprising warehouse buildings, internal road network layout, building locations, GFA, car parking, concept landscaping, building heights, setbacks, signage strategy, public art strategy, design excellence strategy and Connection with Country framework.
  - Developable area 131.45ha.
  - Total approximate GFA 63.00 ha
- Stage 1 – Site preparation works
  - Demolition and removal of existing structures and vegetation.
  - Heritage salvage works (if applicable).
  - Construction of roads, access infrastructure, including a signalised intersection with Elizabeth Drive.
  - Dam de-watering and de-commissioning.
  - Bulk earthworks, cut and fill, benching, battering and retaining walls.
  - Lead in infrastructure, utilities and servicing.
  - Stormwater infrastructure including construction of Sydney Water basins and Water Sensitive Urban Design (WSUD) elements.
- Stage 1 – Development
  - Construction and fit out of 3 warehouse buildings and ancillary office space.
  - Stormwater management, fencing and landscaping.
  - Internal road network, active transport network, public domain and open space.
  - Subdivision, and
  - Estate and on lot signage.
- Total approximate GFA 85, 864sqm
  - Warehouse 1.1 – 26,860sqm GFA
  - Warehouse 1.2 – 31,443sqm GFA
  - Warehouse 3.1 – 27,561sqm GFA

Figure 1 Burrah Park - Concept Masterplan

Figure 2 Burrah Park - Stage1

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (**SEARs**) dated 22 May 2024 and issued for the SSDA (**SSD-70316465**). Specifically, this report has been prepared to respond to the SEARs requirement as presented in Section 1.2.4.

It is important to note that this flood assessment focuses exclusively on external major flows, specifically Cosgrove Creek, and does not address internal stormwater management. Flows are assumed to be appropriately managed via a series of detention basins as documented by others. Consequently, the key elements considered in this flood study to assess the post-development condition are proposed development footprint and levels, which will be implemented during Stage 1. It is not anticipated that any additional work conducted in subsequent phases will alter the outcome of this flood assessment. Therefore, the results of this assessment should be comprehensive enough to support both the Stage 1 and the overall site concept master plan approvals.

1.1 Project Description

Figure 3 provides regional context and Figure 4 shows an aerial view of the area to be developed as part of this SSD.

Figure 3 Site Locality - Source: Near Maps and Urbis)

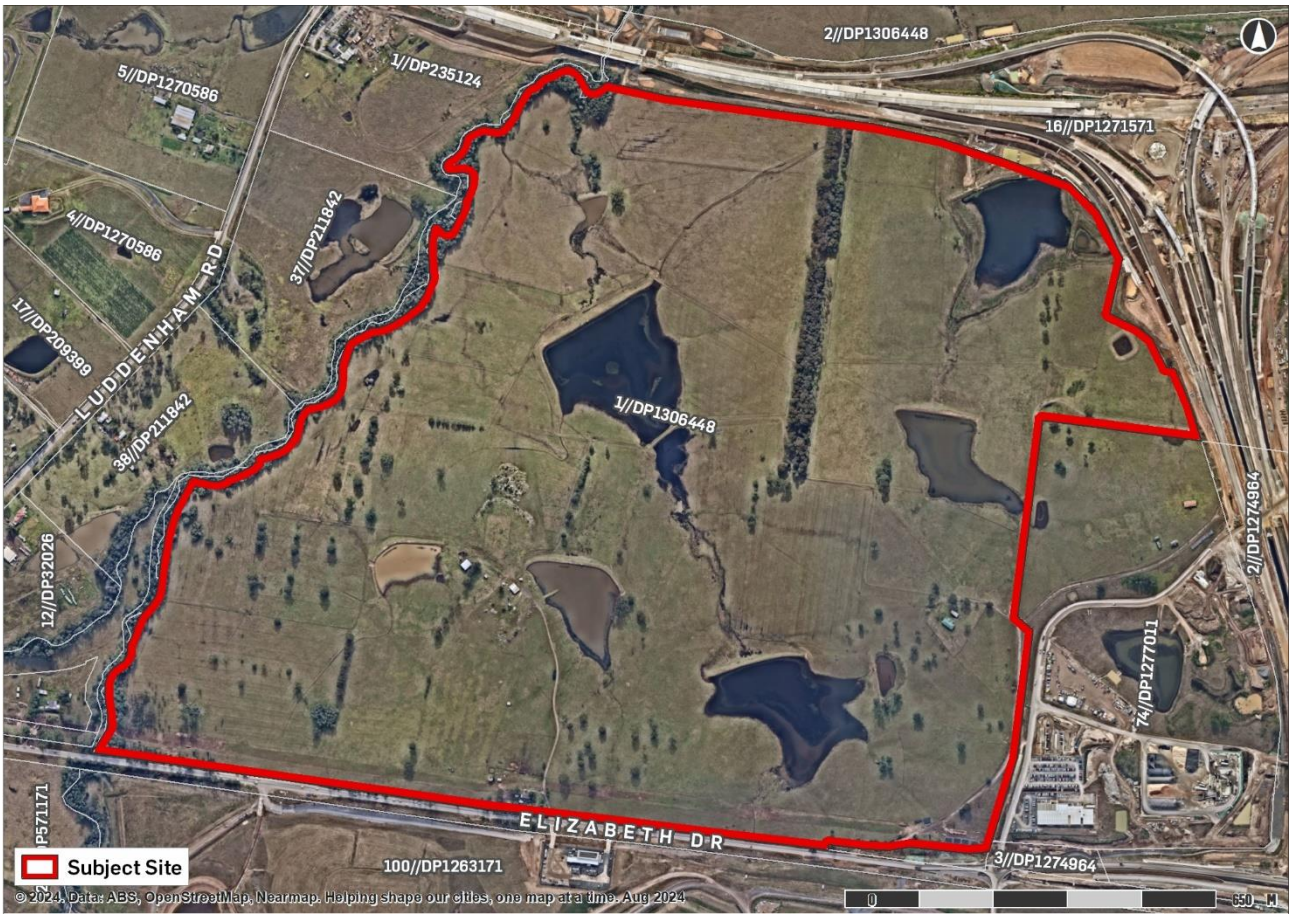


Figure 4 Site Context – Development Area (Source: Near Maps and Urbis)

The key features of the site are summarised in Table 1 below.

Table 1 Key Features of Site and Locality

Descriptor	Site Detail
Land Configuration	The site is legally described as Lot 1 in Deposited Plan 1306448. The site area is 171.84ha. The site generally slopes from high points adjacent to Elizabeth Drive (RL 75m AHD) to low points in the northeast corner (RL 40m AHD). Topography is characterised by a central ridgeline running from the central portion of the southern boundary towards the northeast.
Surrounding Land Use	Surrounding land uses include: ▪ M12 Motorway and Metro (under construction) to the north and east with predominantly rural uses beyond ▪ Western Sydney Airport is under construction opposite the site on the southern side of Elizabeth Drive, ▪ Rural residential uses on the opposite side of Cosgrove Creek to the west.
Site Access and road network	The site is accessible from Elizabeth Drive, a State arterial road aligned in an east-west direction adjacent to the southern boundary.
Easements and Covenants	An easement for electricity purposes is located on the northern side of the site.

Services	The site has power and water available.
Acid Sulfate Soils	Not mapped.
Contamination	The site has the potential to be contaminated, due to the current agricultural land use. A Detailed Site Investigation will be submitted as part of the SSDA lodgement. As per the previous Detailed Site Investigation prepared by Douglas Park, the site is appropriate for proposed development subject to remediation works undertaken.
Stormwater and Flooding	As indicated in the *Wianamatta (South) Creek Flood Study – Existing Conditions (Prepared by Advisian for Infrastructure NSW, November 2020)* the site is subject to 1 % AEP(Annual Exceedance Probability) along the main creek lines of Cosgrove and Badgerys Creek.
Bushfire Prone Land	The site is classified as bushfire-prone land. A bushfire report will be submitted with the SSDA.
Flora and Fauna	The site currently consists of cleared rural land with the occasional scattered Cumberland Plain Woodland, trees, weeds, and shrubs. Most of the site is certified under the Cumberland Plain Conservation Plan (CPCP)
Riparian Corridor	Cosgrove Creek and Oaky Creek run along the western part of the site, while Badgerys Creek runs along the eastern side. The proposed development is designed to generally avoid land-zoned ENZ. The site contains multiple hydrolines and dams.
Aboriginal Heritage	Aboriginal objects have been identified along the Oakey Creek – Cosgrove Creek corridor along the entirety of the western study area boundary.
European Heritage	The site does not contain any State or locally significant heritage listed items. The site does form part of the former CSIRO McMaster Field Station which is identified as a potential heritage item under the Precinct Plan. The site is adjacent to the McGarvie Smith Farm which is identified as a local Heritage Item under the *State Environmental Planning Policy (Precincts—Western Parkland City) 2021*.

The development extent has been illustrated on the SEPP Flood Prone Areas (FPA) map in Figure 5. As shown, the proposed development is located generally outside the 1% Annual Exceedance Probability (AEP) extent of Cosgrove Creek. This strategic positioning ensures that the development is not at significant risk of flooding and will not adversely impact the creek's flood behaviour. This compliance with SEPP requirements further reinforces the safety and feasibility of the project.

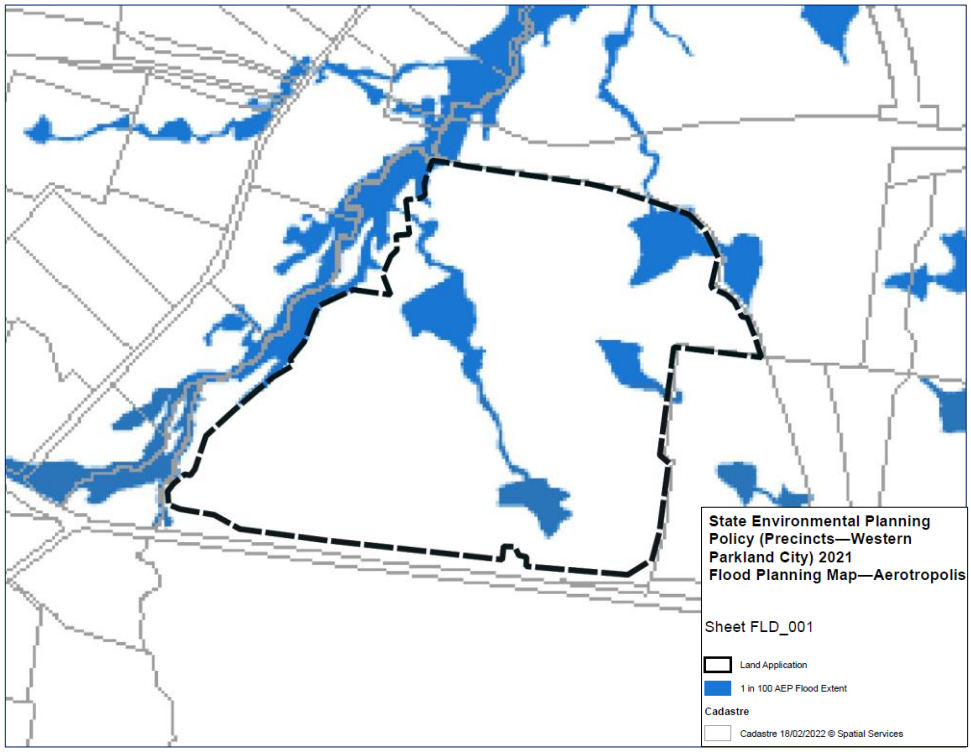


Figure 5 Development Extent on the SEPP 2021 Flood Planning Map – Aerotropolis

1.2 Methodology and Objectives

1.2.1 Study Methodology

The objective of the current flood assessment is to identify potential flood risks, considering established flood studies, the potential impacts of climate change, and relevant provisions of the NSW Floodplain Development Manual.

The study will address the Secretary's Environmental Assessment Requirements (SEARs) related to flooding, issued by the Secretary of the Department of Planning, Industry and Environment (DPIE) on May 22, 2024 (as detailed in Section 1.2.2) Additionally, it will consider the provisions of the Aerotropolis Development Control Plan (DCP) (as detailed in Section 1.2.3) and requirements of the Flood Risk Management Guideline (DPE, 2023) (as detailed in Section1.2.4). The details of the requirements relating to flooding as presented in Sections 1.2.2, 1.2.3 and 1.2.4.

The scope of the study is as follows:

1. Collation and review of available data:

- Gather and review previous flood studies, relevant policies, and development control plans.

2. Hydrologic Assessment:

- Verify the accuracy and reliability of the existing XP-RAFTS model.
- Ensure that the XP-RAFTS model reflects the latest topographic data and changes to the catchment.

- Adjust the existing XP-RAFTS model to better represent the existing site.
- Validate the hydrologic model to ensure its accuracy and suitability for the current catchment conditions.

3. Hydraulic Assessment:

- Develop a TUFLOW hydraulic model using the HPC solver.
- Incorporate both one-dimensional and two-dimensional elements to accurately simulate water flow in the catchment.
- Simulate a range of design events, including the 5%, 2%, 1%, 0.5%, and 0.2% Annual Exceedance Probability (AEP) events and the probable maximum flood (PMF) events.
- Model various scenarios: Pre-development (Base Case), Proposed development, and cumulative development scenarios.

4. Determination of peak flood depts and levels, velocity, and hazard:

- Use the TUFLOW model to determine the peak flood depths and levels, velocity, and hazard for both existing and post-development conditions
- Assess the impact of the proposed development.
- Assess potential impacts of Climate Change.

5. Mapping figures and preparing a report:

- Create figures to visually illustrate the findings of the flood assessment.
- Present the findings in a comprehensive report, including recommendations to mitigate potential flood risks.

1.2.2 State Environmental Planning Policy (Precincts – Western Parkland City) 2021 – Chapter 4 Western Sydney Aerotropolis

Table 2 outlines the requirements extracted from the State Environmental Planning Policy (Precincts – Western Parkland City) 2021 – Chapter 4 Western Sydney Aerotropolis.

Table 2 SEPP (Precincts – Western Parkland City) 2021 – Chapter 4 Western Sydney Aerotropolis

Part 4.4 Development controls – General		
Requirement	**Assessment**	**Consistent**
Clause 4.24 Flood planning (2) This section applies to— a) the land shown as the "flood planning area" on the *Flood Planning Map*, and b) other land that is at or below the flood planning level. (3) Development consent must not be granted to development on land to which this section applies unless the development— a) is compatible with the flood hazard of the land, taking into account projected changes as a result of climate change, and b) is not likely to significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other developments or properties, and c) incorporates appropriate measures to manage risk to life from flood, and d) will enable safe occupation of an evacuation from flood-prone land, and e) is not likely to significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses, and f) is not likely to result in unsustainable social and economic costs to the community as a consequence of flooding, and g) is consistent with any relevant floodplain risk management plan adopted by the council for the land in accordance with the *Flood Risk Management Manual*. (4) Development consent may be granted to development on land below the flood planning level only if the development— a) does not involve earthworks that will affect flood storage capacity or flood behaviour, and	The proposed development complies with the State Environmental Planning Policy (SEPP) requirements, ensuring it is appropriate and safe for the designated area. • The development is located mostly outside the 1% Annual Exceedance Probability (AEP) extent, indicating minimal risk of flood impact. (As shown in Figure 5) • The impacts of climate change have been evaluated and taken into account. (As discussed in Section 5.2.2) • Appropriate mitigation measures have been incorporated in its design such as detention basins to replicate existing flow rates discharging into Cosgroves Creek. These measures will prevent adverse impacts on flood behaviour and avoid erosion, siltation, destruction of riparian vegetation, and maintaining the stability of riverbanks and watercourses. (As discussed in Section 5.2.1) • The development plan includes appropriate strategies to safeguard life from potential flood events, ensuring safe occupation and evacuation from flood-prone areas. (As discussed in Section 6) • The project is designed to avoid unsustainable social and economic costs to the community due to flooding and is consistent with the relevant floodplain risk management plan adopted by the council. (As discussed in Section 1.4) Therefore, the development meets all SEPP criteria and will not negatively impact the existing flood conditions.	Consistent

b) is not located in a floodway or flood storage area. (4A) Subsection (4) does not apply to development carried out by or on behalf of a public authority. (5) Words and expressions used in this section have the same meaning as in the *Flood Risk Management Manual*.		

1.2.3 Aerotropolis Development Control Plan (DCP) 2022

The current study addresses the relevant flooding provisions contained within the Aerotropolis Phase 2 DCP, as outlined in Table 3.

Table 3 Western Sydney Aerotropolis DCP 2022

2.5 Flooding and Environmental Resilience Management			
2.5.1 Flood Management			
Performance Outcome	**1% AEP Floodway and Critical Flood Storage Areas** ***Unsuitable for urban land uses***	**Assessment**	**Consistent**
PO1 Conveyance and storage of floodwaters through the floodplain is managed. The siting and layout of development consider flood constraints, including risks to personal safety during the full range of floods. The site layout and built form of the development are compatible with flood constraints and potential risk.	**1.** Except for concessional development, development is not permissible in this area – refer to clause 4.24 of the Parkland City SEPP. **2.** For concessional development, the applicant is to demonstrate that the structure can be undertaken in accordance with a Flood Impact and Risk Assessment (FIRA). **3.** The FIRA is undertaken by a suitably qualified professional engineer and considers the impacts of: **a.** flooding on the development. **b.** the development on flooding. **c.** flooding and the development on property and the existing and future community; and **d.** climate change consistent with the objectives of this DCP. **4.** The FIRA has considered the impacts on flooding due to encroachment of structures and the associated collection of debris and potential for blockage.	The development is mainly outside the 1%AEP extent, with some minor encroachments of bulk fill into the creek's flood extent. These impacts are minimal and localized, occurring directly adjacent to the proposed development embankment and do not affect any surrounding developments.	Consistent

2.5 Flooding and Environmental Resilience Management			
2.5.1 Flood Management			
	5. The FIRA assesses flood constraints for both pre and post-development cases to ensure there are no significant detrimental impacts on flood behaviour or the community within and outside the development site.		
PO2 Development has minimal impact on flood behaviour.	**1.** In addition to concessional development, the only structures to be considered in this area are for the purposes of creek crossings (pedestrian bridges and road bridges). **2.** The FIRA demonstrates that the structure will not increase flood affectation to existing and proposed developments within and outside the development site. **3.** The FIRA considers the cumulative impact of potential future development from the upstream hydraulic control to the downstream hydraulic control. **4.** The FIRA demonstrates that the peak flow at the downstream hydraulic control is maintained with development and that the shape of the flood hydrograph is generally maintained for events up to and including the 1% AEP flood event.	The development is mainly outside the 1%AEP extent, with some minor encroachments of bulk fill into the creek's flood extent. These impacts are minimal and localized, occurring directly adjacent to the proposed development embankment and do not affect any surrounding developments.	Consistent
PO3 Structures are designed and constructed so that they remain structurally sound for the life of the development considering flood and debris forces.	**1.** In addition to concessional development, the only structures to be considered in this area are for the purposes of creek crossings (pedestrian bridges and road bridges). **2.** In addition to concessional development, the only structures to be considered in this area are for the purposes of creek crossings (pedestrian bridges and road bridges). **3.** All structures are of flood-compatible building components below or at the flood planning level. **4.** An engineer's report is submitted to certify that the structure can withstand the forces of floodwater including debris and buoyancy up to and including the flood planning level (based on the 1% AEP	The development is mainly outside the 1%AEP extent, with some minor encroachments of bulk fill into the creek's flood extent.	Not applicable

2.5 Flooding and Environmental Resilience Management			
2.5.1 Flood Management			
	flood plus 500mm freeboard).		
PO4 All fill ensures the long-term stability of the development site and is not affected by erosion.	**1.** The FIRA demonstrates that any fill as a result of the development will not be impacted by erosion and will have long-term stability.	The development is primarily outside the 1%AEP flood extent, with only minor encroachments of bulk fill into the creek's flood zone. Given that peak flood velocities at the edge of the embankment are less than 1 m/s, the risk of erosion is generally low.	Consistent
PO5 The safety of users of developed areas located on the floodplain for the full range of flooding is ensured.	**1.** Applicant demonstrates that evacuation of the proposed development can be undertaken in accordance with the Local Flood Plan or SES flood emergency management strategy for the area. **2.** The FIRA demonstrates that evacuation can be undertaken consistent with the Local Flood Plan or SES flood emergency strategy for the area.	For events up to 100-year ARI, the M12 Motorway can be used as the safest evacuation route as discussed in Section 6.	Consistent
PO6 Public safety and the environment are not adversely affected by the detrimental impacts of floodwater on hazardous materials manufactured or stored in bulk**.**	**1.** No external storage of materials which may cause pollution or be potentially hazardous during any flood.	All hazardous materials will be managed in secure, flood-proof facilities to prevent any risk of contamination or environmental harm. This approach ensures the protection of public safety and environmental integrity, even during flooding events.	Consistent
PO7 Fencing is designed and constructed so that it does not impede and/or direct the flow of floodwaters, add debris to floodwaters or increase flood affectation on surrounding land**.**	**1.** Use open-type fencing. **2.** Fencing is not permissible unless it can be shown, through a FIRA, not to impact on flood conveyance or behaviour.	Not applicable	Not applicable
PO8 Earthworks including cut and fill do not impact flood storage areas.	**1.** The FIRA demonstrates earthworks will not affect flood storage capacity or flood behaviour for the full range of flood events.	The development is mainly outside the 1%AEP extent, with some minor encroachments of bulk fill into the creek's flood extent. These impacts are minimal and localized, occurring directly adjacent to the proposed development embankment and do	Consistent

2.5 Flooding and Environmental Resilience Management			
2.5.1 Flood Management			
		not affect any surrounding developments.	
Performance Outcome	**Between 1% AEP Floodway / Critical Flood Storage and Flood Planning Area** ***Unsuitable for Critical and Sensitive Land Uses***	**Assessment**	**Consistent**
PO2 Development has minimal impact on flood behaviour.	**1.** The FIRA demonstrates that development will not increase flood affectation to existing and proposed development within and outside the development site. **2.** The FIRA demonstrates the cumulative impact of potential future development from the upstream hydraulic control to the downstream hydraulic control. **3.** The FIRA demonstrates that the peak flow at the downstream hydraulic control is maintained with development and that the shape of the flood hydrograph is generally maintained for events up to and including the 1% AEP flood event.	There are some minor encroachments of bulk fill into the creek's flood extent. These impacts are minimal and localized, occurring directly adjacent to the proposed development embankment and do not affect any surrounding developments.	Consistent
PO3 Structures are designed and constructed so that they remain structurally sound for the life of the development considering flood and debris forces.	**1.** All structures are of flood-compatible building components below or at the flood planning level. **2.** An engineer's report is submitted to certify that the structure can withstand the forces of floodwater including debris, immersion, and buoyancy up to and including the flood planning level. **3.** The FIRA demonstrates that all new electrical equipment, power points, wiring, fuel lines, sewerage systems or any other service pipes and connections can be waterproofed and/or located above the flood planning level.	Not applicable, as all buildings are situated above the Probable Maximum Flood (PMF) levels.	Not applicable
PO4 All fill ensures the long-term stability of the development site and is not affected by erosion.	**1.** The FIRA demonstrates that any fill as a result of the development will not be impacted by erosion and will have long-term stability.	There are only minor encroachments of bulk fill into the creek's flood zone. Given that peak flood velocities at the edge of the embankment are less than 1 m/s, the risk of erosion is generally low.	Consistent
PO6 Public safety and the environment are not	**1.** No external storage of materials which may cause pollution or be potentially hazardous during	All hazardous materials will be managed in secure, flood-proof facilities to prevent any risk of	Consistent

2.5 Flooding and Environmental Resilience Management			
2.5.1 Flood Management			
adversely affected by the detrimental impacts of floodwater on hazardous materials manufactured or stored in bulk**.**	any flood.	contamination or environmental harm. This approach ensures the protection of public safety and environmental integrity, even during flooding events.	
PO7 Fencing is designed and constructed so that it does not impede and/or direct the flow of floodwaters, add debris to floodwaters or increase flood affectation on surrounding land**.**	**1.** Fencing is constructed in a manner that does not obstruct the flow of floodwaters. **2.** Fencing of flow paths is limited to permeable open-type fences.	Not applicable.	Not applicable
PO8 Earthworks including cut and fill do not impact flood storage areas.	**1.** The FIRA demonstrates that earthworks will not affect flood storage capacity or flood behaviour for the full range of flood events.	There are some minor encroachments of bulk fill into the creek's flood extent. These impacts are minimal and localized, occurring directly adjacent to the proposed development embankment and do not affect any surrounding developments.	Consistent
Performance Outcome	**Outside Flood Planning Area to Probable Maximum Flood** ***Unsuitable for Critical Land Uses***	**Assessment**	**Consistent**
PO2 Development has minimal impact on flood behaviour.	**1.** The FIRA demonstrates that development will not increase flood affectation to existing and proposed developments within and outside the development site. **2.** Except for single detached dwellings and alterations and additions to existing dwellings, an engineer's report is required to certify that the development will not increase flood affectation to existing and proposed developments.	This flooding assessment is based on the implementation of appropriate detention basins, which will be designed as part of the stormwater study. These basins are expected to ensure that the discharge flow hydrographs from the development closely resemble the existing flow rates for events up to and including the 1% Annual Exceedance Probability (AEP) events, Consequently, the development does not increase flood impacts on existing or proposed developments within and beyond the site boundaries for events up to and including the 1% AEP. While there are some localized increases in flood levels due to bulk	

2.5 Flooding and Environmental Resilience Management			
2.5.1 Flood Management			
		filling encroaching into Cosgroves Creek's flood extent, these increases are very localized and do not impact any other developments. For larger events, the assessment was conducted without the detention basins. It was concluded that during climate change events, although the peak flood rates and volumes increase, the peak flow in the creek is expected to reduce due to the faster occurrence of the development peak discharge as a result of urbanization. During the Probable Maximum Flood (PMF), the development encroachment may result in impacts of up to 150mm upstream of M12. However, these impacts are mostly confined within the creek. (As discussed in Section 5.2.1).	
PO3 Structures are designed and constructed so that they remain structurally sound for the life of the development considering flood and debris forces.	**1.** Critical and sensitive land uses are of flood-compatible building components below or at the PMF level, where intended to be utilised during flooding. **2.** An engineer's report is submitted to certify that the structure can withstand the forces of floodwater including debris and buoyancy up to and including the PMF level for sensitive development or essential community facilities intended to be utilised during flooding.	Not applicable, as all buildings are situated above the Probable Maximum Flood (PMF) levels.	Not applicable
PO4 All fill ensures the long-term stability of the development site and is not affected by erosion.	**1.** The FIRA demonstrates that any fill as a result of the development will not be impacted by erosion and will have long-term stability.		
PO6 Public safety and the environment are not adversely affected by the detrimental impacts of floodwater on hazardous materials	**1.** No external storage of materials which may cause pollution or be potentially hazardous during any flood.	All hazardous materials will be managed in secure, flood-proof facilities to prevent any risk of contamination or environmental harm. This approach ensures the protection of public safety and environmental integrity, even during flooding events.	Consistent

2.5 Flooding and Environmental Resilience Management			
2.5.1 Flood Management			
manufactured or stored in bulk**.**			
PO7 Fencing is designed and constructed so that it does not impede and/or direct the flow of floodwaters, add debris to floodwaters or increase flood affectation on surrounding land**.**	N/A	Not applicable	Not applicable
PO8 Earthworks including cut and fill do not impact flood storage areas.	**1.** The FIRA demonstrates that earthworks will not affect flood storage capacity or flood behaviour for the full range of flood events. **2.** Any fill platform associated with development does not create a local site-specific flood island isolating the user from safety during flooding	The earthworks for this development have been designed to ensure that they do not impact flood storage capacity or flood behaviour for the full range of flood events. The development bulk fill does not encroach into the Cosgroves Creek flood extent up to the 1%AEP event. Although there is some encroachment into the Probable Maximum Flood (PMF) extent, the impact is confined within the creek and does not affect other developments. (As discussed in Section 5.2.1) Additionally, any fill platform associated with the development is designed to avoid creating a local site-specific flood island, ensuring that users are not isolated from safety during flooding events. (As discussed in Section 6)	Consistent
*Areas identified in *Wianamatta (South) Creek Flood Study – Existing Conditions* prepared by Advisian for Infrastructure NSW in November 2020 or subsequent versions of this report by Advisian for Infrastructure NSW and the Department of Planning and Environment. Note: Refer to Appendix A of this DCP for a definition of terms referred to in this section, including definitions for critical and sensitive land uses, as well as concessional development.			

1.2.4 SEARs

This report has been prepared to support and inform the EIS by addressing the SEARs relevant to flooding as listed in Table 4.

Table 4 Project-Specific SEARs

Requirements	Scope of work undertaken to address	Section
A description of the existing environment, using sufficient baseline data	A detailed description of the existing environment regarding flooding conditions, including catchment characteristics and flooding mechanisms has been provided. Additionally, a comprehensive flooding assessment using hydrological and hydraulic models has been conducted to evaluate the existing conditions.	Section 5.1
An assessment of the potential impacts of all stages and activities that form part of the development, including any cumulative impacts, taking into consideration relevant guidelines, policies, plans and statutes	The potential impacts of the proposed development have been assessed, and the cumulative impacts of other projects in the vicinity have been discussed.	Section 5.2
Justification for the level of assessment carried out for each of the key issues as they relate to the Concept and Stage 1 development applications.	The assessment has been conducted in accordance with the requirements outlined in the issued SEARs, the Aerotropolis DCP, and the SEPP, considering all other relevant guidelines and policies. This approach appears to be thorough and adequate for achieving the objectives of the current study. The assessment methodology has also been thoroughly discussed to describe the level of assessment undertaken.	Section 1.2
A description of the measures that would be implemented to avoid, minimise, mitigate and if necessary, offset the potential impacts of the development, including proposals for adaptive management and/or contingency plans to manage significant risks to the environment.	This flooding assessment is based on the implementation of appropriate detention basins, which will be designed as part of the stormwater study to mitigate the flood impacts of the proposed development.	Section 5.2.1
Identifies any flood risk on site having regard to adopted flood studies, the potential effects of climate change and any relevant provisions of the NSW Flood risk management manual (2023)	The development has thoroughly identified any flood risk on site by referencing adopted flood studies, considering the potential effects of climate change, and adhering to the	Section 5.2

Requirements	Scope of work undertaken to address	Section
	relevant provisions outlined in the NSW Flood Risk Management Manual (2023).	
Addresses the relevant provisions contained within the Aerotropolis Phase 2 DCP	The provisions of the Aerotropolis Phase 2 DCP are addressed in this study.	Section 1.2.3
Where the development could alter flood behaviour, affect flood risk to the existing community or expose its users to flood risk, provide a flood impact and risk assessment (FIRA) prepared in accordance with the Flood Impact and Risk Assessment – Flood Risk Management Guide LU01	A flood impact and risk assessment in accordance with the requirements of the Flood Impact and Risk Assessment has been conducted.	Section 5.2
Details design solutions and operational procedures to mitigate flood risk, where required.	This flooding assessment is based on the implementation of appropriate detention basins, which will be designed as part of the stormwater study to mitigate the flood impacts of the proposed development.	Section 5.2.1

1.3 Legislative and Policy

The guidelines outlined in Table 5 have been used in the preparation of this flood impact assessment.

Table 5 Legislative and Policies

Legislation/Policy	Brief Description
Western Sydney Aerotropolis Plan, 2020	Strategic Plan for the Aerotropolis
State Environmental Planning Policy (Planning Systems) 2021 – Schedule 1 (29)	Sets up the project as SSD – development in the Western Sydney Aerotropolis
State Environmental Planning Policy (Precincts – Western Parkland City) 2021 – Chapter 4 – Western Sydney Aerotropolis	Principle EPI for the Aerotropolis
Western Sydney Aerotropolis Precinct Plan Technical Studies to inform the Precinct Plan	Provides place-based objectives and requirements to guide development in the Aerotropolis. The project is within the Northern Gateway Precinct.
Western Sydney Aerotropolis Development Control Plan Western Sydney Aerotropolis DCP Appendices	Provides specific development controls for the Aerotropolis. Address both general controls and controls for the Enterprise Zone and Neighbourhood Centres. The appendices include specific requirements for landscaping and consultant reports.

Legislation/Policy	Brief Description
Wianamatta (South) Creek Flood Study – Existing Conditions (Prepared by Advisian for Infrastructure NSW, November 2020)	The Wianamatta South Creek Catchment Flood Study - Existing Conditions (2022) report updates and extends a previous study prepared for Penrith City Council in association with Liverpool, Blacktown and Fairfield City Councils (2015). It provides up-to-date flood information for the South Creek Catchment between Bringelly Road and Richmond Road, including tributaries such as Kemps, Bonds, Badgerys, Cosgroves and Oaky creeks.
Australian Rainfall and Runoff	As a national guideline, ARR is employed across Australia for flood estimation and floodplain management. Its significance to the current study lies in its provision of guidelines and methodologies for various components of flood assessment, such as Estimating Design floods, conducting Hydrological and Hydraulic Assessments, considering Climate Change implications, and more.
Practical Consideration of Climate Change - Flood Risk Management Guideline (DECC, 2007)	This guideline provides guidance on incorporating climate change considerations into flood risk management practices. It helps ensure that the development is resilient to future climate scenarios and contributes to sustainable flood risk management.
Flood Impact and Risk Assessment Flood Risk Management Guide (LU01) (DPE, 2022)	This guideline provides advice on the scope and scale of a Flood impact and risk assessment (FIRA) as required by the consent authority.
Aerotropolis Development Control Plan (DCP)	This is a planning instrument developed by the relevant local or state government authority that provides detailed guidelines and requirements for development within the Aerotropolis precinct. The relevant flooding objectives are outlined in Table 3 and addressed in the current study.

1.4 Previous Studies

The previous studies relevant to the current project are presented in Table 6.

Table 6 Previous Studies

Study	Description	Incorporated in the current study
Updated South Creek flood study (Worley Parsons, 2015)	Penrith City Council, in collaboration with Blacktown City Council, Fairfield City Council and Liverpool City Council, engaged WorleyParsons to update the hydrologic and hydraulic models previously established for evaluating flood conditions across the South Creek catchment. The aim of the study was to produce information on flood flows, velocities, levels, flood extents, and hydraulic and hazard category mapping for a range of flood events under existing floodplain and catchment conditions. A two-dimensional hydrodynamic model was developed using the RMA-2 software package. The model was based on the latest topographic data for the catchment, collected between 2002 and 2006. The report documents the findings from the modelling investigations, including details on flows, flood levels, flood depths, flow velocities, and provisional hydraulic and hazard categories for current catchment and floodplain conditions.	The Hydrological XP-RAFT model (WP, 2015) was utilised in the current study with some modifications to reflect recent changes in the South Creek catchment.
Wianamatta South Creek Catchment Flood study - Existing condition - May 2022 by Advisian	The objective of the study was to inform the Agency Working Group (AWG) of the flood constraints that could impact on development within the South Creek catchment. This investigation extended the areas modelled along many of the tributaries of Wianamatta South Creek and utilised the Light Detection and Ranging (LiDAR) topographic data collected in 2019. During the study, the 2015 XP-RAFTS hydrologic was updated. This involved refining the XP-RAFTS sub-catchment delineation and updating catchment parameters. Additionally, the 2015 RMA-2 model network was extended and refined to accommodate the updated 2019 topography and to better represent recent and future developments. Moreover, roughness values were updated. The updated XP-RAFTS and RMA-2 models underwent validation by simulating the 1% Annual Exceedance Probability (AEP) flood and comparing the results with	The 2015 XP-RAFT model was revised using the sub-catchment delineation figures and hydrological parameter table provided at the end of the report. The revised XP-RAFT model was then utilised to provide flow hydrograph inputs to the site-specific TUFLOW model developed for the current assessment. The TUFLOW model was validated against the findings of the 2022 Advisian study, as detailed in Section 4.8.

Study	Description	Incorporated in the current study
	those derived and documented in the 'Updated South Creek Flood Study' (2015).	
M12 Motorway EIS	This report has been prepared to support the environmental impact statement (EIS) for the M12 Motorway project. The report presents an assessment of the activities associated with the construction and operation of the project that have the potential to impact flooding. The project traverses four major creeks (Cosgroves, Badgerys, South and Kemps Creeks) and includes five bridges.	Based on the information from the EIS report, the new bridge proposed over Cosgroves Creek has been incorporated into the TUFLOW model.

1.5 Available Data

Table 7 lists the available data that has been used in the current study.

Table 7 Available Data

Data	Description
Aerial Imagery	The 2024 aerial imagery was employed during the validation phase of the TUFLOW model against the 2022 Advisian flood study. This involved identifying areas that have undergone changes since 2022. (as described in Section 4.8)
LiDAR 2019	The 2019 LiDAR data with a resolution of 1m was obtained from the Geosciences Australia ELVIS online portal. This is regarded as the best available data on the current topography within the catchment area. The dataset utilised to generate this Digital Elevation Model (DEM) has an accuracy of 0.3m vertically (95% Confidence Interval) and 0.8m horizontally (95% Confidence Interval).
Elizabeth Drive Culvert Information	The details of the existing culvert structures under the Elizabeth Drive crossing of Cosgroves Creek and Okay Creek were extracted from the Stage 1 Burrah Park SSDA, 1953- 2109 Elizabeth Drive, Badgerys Creek Flood Impact Assessment conducted by BMT in October 2022.
M12 bridge over Cosgrove Creek	General details about the proposed M12 bridge spanning Cosgroves Creek were sourced from the M12 Motorway Environmental Impact Statement Flooding Assessment report, dated October 2019.
South Creek XP-RAFTs Hydrological Model (2015)	
Site Survey (22/05/2024)	A site-specific survey was conducted in the study area, collected in 16/05/18 by HB&B The survey data was overlayed against the LiDAR 2019 to update the topographic information within the study area.

Data	Description
1m gird DEM of the design surface (01/07/2024)	The design surface

1.6 Assumptions and Limitations

The findings and conclusions presented in this report are based on assumptions and are subject to limitations as follows:

- For this study, LiDAR data from 2019 was employed. As LiDAR is unable to penetrate water, areas with standing water reflect elevations near the water surface level at the time of data capture. Bathymetric surveys of the creeks were not available during the study period. Nonetheless, the results of this study have been validated against the Advisian Flood Study (2022) and have shown a good correlation.
- The XP-RAFTS hydrological model from the Updated South Creek Flood Study (WorleyParsons, 2015) has been used as the basis for hydrological modelling in the current study. This model is based on the Australian Rainfall and Runoff (ARR) 1987 guidelines. In recent years, a new version of ARR (Institute of Engineers Australia, 2019) has been released. While it is anticipated that using the ARR 2019 procedures would result in slightly lower peak flow values compared to the 1987 data and methods, the current study maintains the original methodology for consistency.
- The parameters for the Cosgroves bridge were approximated using the general details provided in the M12 EIS report. However, since the bridge's impact is confined to its immediate footprint and does not extend to the broader project area, it does not change the flood levels around the project (refer to Section 4.2 for bridge assumptions).
- This evaluation focuses solely on mainstream flooding in Cosgroves Creek and Badgerys Creek and does not incorporate an assessment of local runoff within the site. The internal stormwater flows originating from the Stage 1 development area will be addressed by the proposed internal drainage system and the stormwater management plan, which result in no increases in outflows from the site relative to the base case conditions.
- It has been assumed that any additional runoff generated by the development of the Western Sydney Airport will be controlled to prevent post-development peak flows from exceeding pre-development levels before discharge into Cosgroves Creek and Badgerys Creek. Consequently, no further modifications were made to the XP-RAFTS model based on this understanding.

2 Catchment Description and Flooding Mechanism

The study area is situated within the South Creek catchment, which is a tributary of the Hawkesbury River, draining a 414 km² catchment in western Sydney (shown in Figure 6). The South Creek catchment extends from its origin near Narellan in the south to its confluence with the Hawkesbury River near Windsor, predominantly flowing south to north.

Cosgroves Creek and Badgerys Creek are tributaries of South Creek, with upstream catchment areas of 17.5 km² and 27 km², respectively. The land use upstream of the project area is mainly agricultural and grazing, although significant urbanization has occurred in recent years, notably with the development of Western Sydney Airport to the south of the project.

Cosgroves Creek runs along the western boundary of the site, while Badgerys Creek flows along the northeast boundary. As a result, if flood levels exceed the banks of these creeks, the site may be subject to flood inundation.

Cosgroves Creek has a 1% AEP peak flow rate of about 150 cubic metres per second along a flow-path approximately 120 metres wide. Flooding is generally confined within the creek for events up to the 1%AEP event. Badgerys Creek has a 1% AEP peak flow rate of 144 cubic meters per second along a flow-path approximately 170 metres wide.

The catchment contains numerous farm dams that intercept and capture runoff. During storms, when these dams become full, they overflow, causing excess runoff to bypass them.

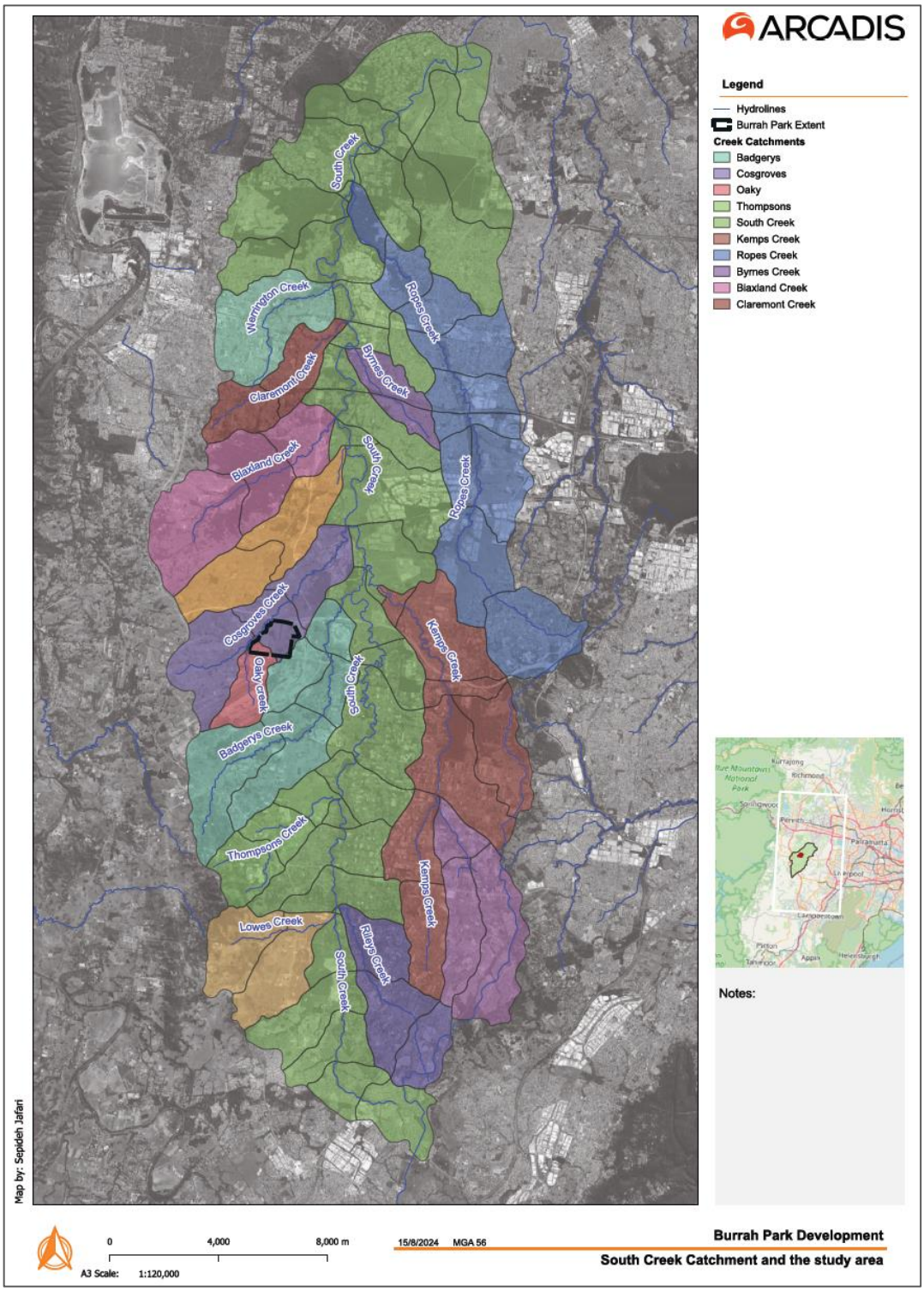


Figure 6 South Creek Catchment Delineation

The development's local catchment slopes from a ridge along Elizabeth Drive down to Cosgroves Creek (as shown in Figure 7). While this assessment does not focus on the conveyance of external flows through the site, it is noted that a small external catchment enters the site across Elizabeth Drive and ultimately discharges into Cosgroves Creek.

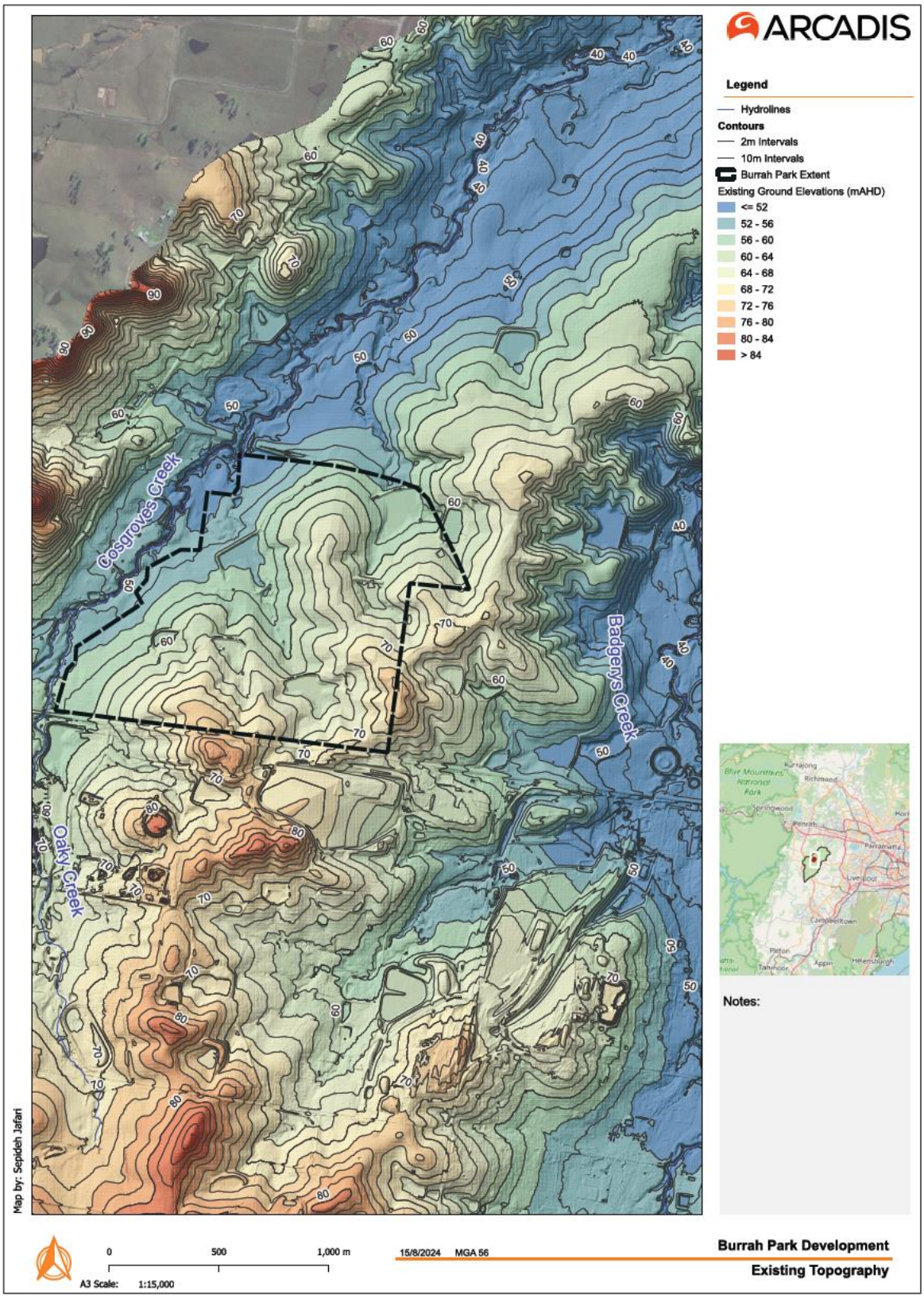


Figure 7 Development Existing Topography

3 Hydrological Modelling

The hydrological modelling was conducted using XPRAFTS, using an existing model from the 2015 Flood Study by WorleyParsons. The hydrological modelling of the South Creek catchment was originally developed by the Department of Water Resources for the 'South Creek Flood Study' (1990). Then updated in the 'Updated South Creek Flood Study' (2015), and later further revised by Advisian in 2022 for the 'Wianamatta South Creek Catchment Flood Study.' However, the latest model was unavailable.

Consequently, the first step involved updating the 2015 model with data from the 2022 report, including subcatchment delineations and parameter tables. This updated model was verified by comparing its hydrographs with those from the 2022 study, as detailed in Section 3.2.

Subsequently, the catchment delineation was further refined to account for recent changes in the catchment from 2022 to the present, including significant developments such as the M12 motorway and Sydney Metro projects. The new delineation also incorporated the local catchment of the study area as shown in Section 3.1.

3.1 ARR Version

The Advisian 2022 Flood Study compared the 1% AEP peak flows derived from simulations based on ARR 2019 and ARR 1987 with peak flows derived by FFA at Elizabeth Drive. This comparison showed that the hydrological modelling based on ARR 1987 generates a peak flow for the 1% AEP event that aligns more closely with the FFA results. The study concluded that, in the absence of improved calibration of the XP-RAFTS model through parameter adjustments, the modelling based on ARR 1987 provides better validation against the available FFA data. Consequently, ARR 1987 was also used in the current study. This is consistent with ARR 2019 guidelines which specify that flood hydrology should be based on observed data and FFA where possible and available.

3.2 Subcatchment Delineation

During the 1990 Flood Study, the South Creek catchment was divided into 76 sub-catchments, with parameters determined for each sub-catchment, including total area, average slope, percentage of impervious area, and roughness. The model accounted for initial and continuing rainfall losses and routed the excess rainfall through the catchment. Surveyed cross-sections of the creeks were used in the channel routing component of RAFTS, and basins were incorporated to represent the South and Kemps Creek dams.

In the 2015 Flood Study, the sub-catchment delineations were reviewed against the latest topographic data (Collected from 2002 to 2006) to determine if adjustments were necessary. The roughness parameters for each sub-catchment were also reviewed using aerial photography to identify any changes in vegetation or floodplain development since 1990. Therefore, the 2015 XP-RAFTS model reflected catchment conditions up to 2007, based on the aerial photography used from that year.

In 2022, Advisian refined the sub-catchment delineations using 2019 LiDAR data and information from flood modelling reports prepared for Liverpool City Council and the Western Sydney Airport. This refinement resulted in a significant increase in the number of sub-catchments between Bringelly Road and Elizabeth Drive for Kemps Creek, Badgerys Creek, Thompson Creek, and Cosgroves Creek. The XP-RAFTS model parameters were updated, including sub-catchment slopes, impervious fractions, and roughness.

For the current study, the refined 2022 XP-RAFT model was not available, so the 2015 XP-RAFTS model was used. Catchment delineations were adjusted using figures from the 2022 study. The focus was on the sub-catchments of Badgerys Creek that flow towards the study area, as illustrated in Figure 8.

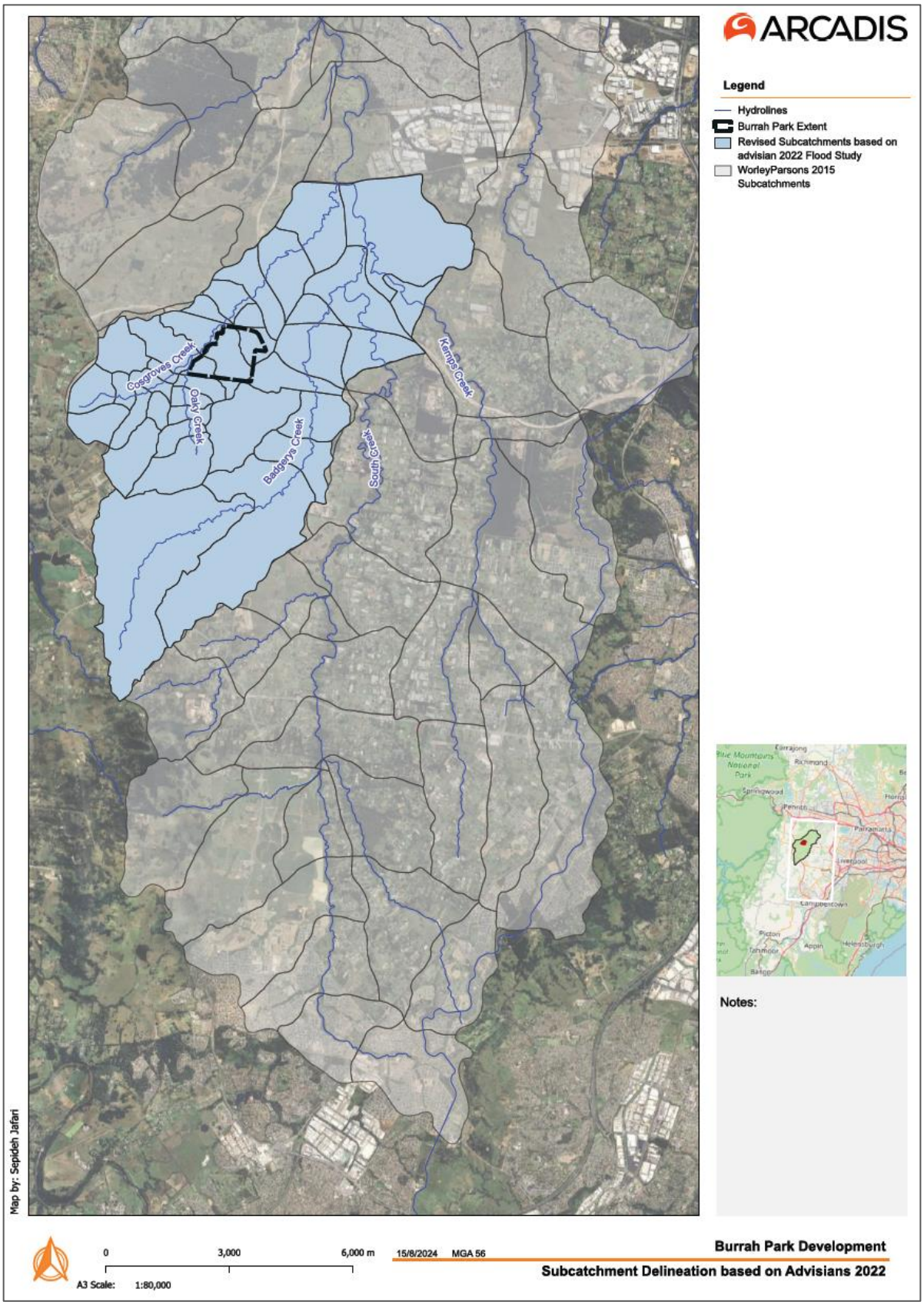


Figure 8 Subcatchment Delineation Based on Advisian 2022

3.3 IFD Parameters

The 2015 Flood Study has used the ARR87 data and methodologies to establish Intensity-Frequency-Duration (IFD) data for the catchment. To account for the significant spatial coverage of the South Creek catchment, nine unique IFD values were used. Among these, Elizabeth, Badgerys and Bringelly cover the study area, as shown in Figure 9 and detailed in Table 8, extracted from the Council XP-RAFTS model.

Table 8 IFD Tables

Location	Geographical Factors		IFD Coefficient (mm/hr)					
	F_2	F_{50}	$^{2}I_{1}$	$^{2}I_{12}$	$^{2}I_{72}$	$^{50}I_{1}$	$^{50}I_{12}$	$^{50}I_{72}$
Narellan	4.29	15.8	31.6	6.0	1.80	60.9	12.0	4.0
Bringelly	4.29	15.8	30.0	6.1	1.88	59.3	12.3	4.0
Elizabeth Drive	4.29	15.8	30.0	6.15	1.90	59.3	12.3	4.1
Badgerys Creek	4.29	15.8	30.0	6.46	1.93	59.1	12.6	4.2
Glenfield	4.29	15.8	35.0	7.0	2.25	65.0	15.0	4.7
Mt Vernon	4.29	15.8	31.3	6.2	1.9	59.4	12.6	4.15
Penrith	4.29	15.8	30.0	6.8	1.97	59.7	12.9	4.7
St Marys	4.29	15.8	30.0	6.42	1.86	59.1	12.8	4.4
Riverstone	4.29	15.8	30.0	6.5	1.92	59.2	13.0	4.5
Narellan	4.29	15.8	31.6	6.0	1.80	60.9	12.0	4.0

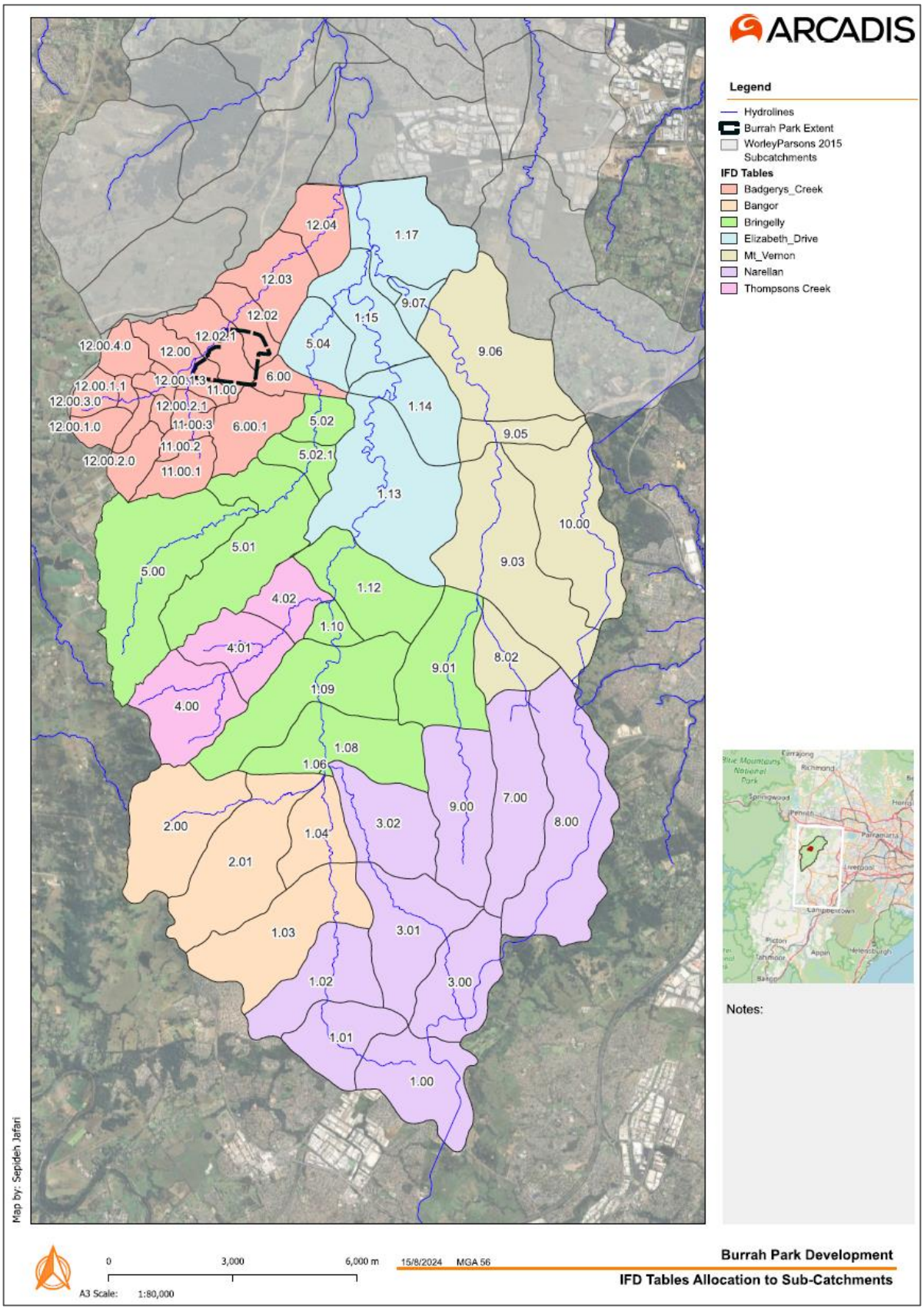


Figure 9 IFD Tables Allocation to Subcatchments

3.4 Rainfall Losses

The Initial-Continuing Loss Model was used to model rainfall losses in the hydrological model. The rainfall loss values are the same as those utilised in the 1990 Flood Study. Since these rates were estimated following calibration to the 1986 and 1988 floods, and no significant floods have occurred since then, it is assumed that the loss values adopted previously for individual sub-catchments are suitable for the current study.

3.5 Hydrological Model Verification

During the 1990 Flood Study, the RAFTS model was calibrated using data collected from the 1986 and 1988 floods. The August 1986 flood was used as the calibration event for the Ropes Creek catchment, while the rest of the catchment was calibrated to the April 1988 flood. Calibration involved adjusting the 'BX' multiplier to achieve a strong correlation between the peak discharge, time of peak, flood volume, and hydrograph shape with the recorded data. Initial and continuing losses were also adjusted to better match the simulated hydrograph with the recorded hydrograph. Ultimately, a 'BX' factor of 1.3 was used for the modelling.

The 2015 XPRAFTS model was subsequently validated against the 1990 Flood Study. For this validation, the updated XP-RAFTS model was used to simulate a 1%AEP storm with a critical storm duration of 36 hours which was the critical duration for South Creek and most of its tributaries.

In the 2022 Flood Study, the results of the updated model were compared to the peak flows recorded in the 2015 Flood Study at multiple locations throughout the catchment. The results for the upper reaches of Wianamatta South Creek indicated that peak flows were approximately 2% lower than those determined in the 2015 Flood Study. Downstream of Elizabeth Drive, peak flows in South Creek were generally higher than those reported in the 2015 Flood Study, ranging from 6% to about 12%. Additionally, flows in Cosgroves Creek were higher by approximately 11%.

The 2022 report acknowledged that changes in the catchment since the original XP-RAFTS model's development could result in inherent differences in model results, so an exact match was not expected, and the model was assumed suitable for assessing flood conditions in the South Creek catchment.

For the current study, the 2015 XPRAFTS model was revised based on information from the 2022 Flood Report aiming to replicate its unavailable hydrological model. To verify the suitability of the revised model, peak flow rates were compared to those from the 2022 study, as shown in Figure 10 and presented in Table 9. The maximum difference for nodes of Badgerys Creek and Cosgroves Creek is approximately 1.25%, which is considered minimal.

The larger differences observed along Kemps Creek and South Creek result from not updating the upstream catchment of these creeks in the XPRAFTS 2015 model. These creeks are distant from the project area and do not impact or get impacted by it.

Consequently, the updated model is verified and suitable for use in the current study.

Table 9 Comparison of Peak 1%AEP Flows (36-Hour Duration)

Tributary	XPRAFTs Model Node Number	1%AEP Peak Discharge (m^3/s)		
		Current XPRAFTs Model	2022 Flood Study XPRAFTs Model	Difference (%)
Badgerys Creek	5.02	118.2	119.7	-1.21
Badgerys Creek	5.04	157.5	155.6	+1.25
Cosgroves Creek	12.04	136.1	137.4	-0.92
Kemps Creek*	9.07	325.4	313.4	+3.83
South Creek*	1.17	959.2	982.0	-2.32

* *Kemps Creek and South Creek are far from the study area and neither impact it nor are impacted by it. Therefore, the upstream catchments of these creeks have not been revised based on the Advisian Flood Study (2022) and remained as defined in the WorleyParsons XPRAFTS model (2015).*

3.6 PMF Event Modelling

PMF storm events have been modelled as part of this flood assessment for both existing and proposed conditions. The PMP (Probable Maximum Precipitation) calculation has been performed following the ARR procedure based on the Generalised Short-Duration method (GSDM). The detailed calculations have been included in Appendix B for further reference. The PMF event was simulated with a 6-hour critical duration which is consistent with the 'Updated South Creek Flood Study' in 2015.

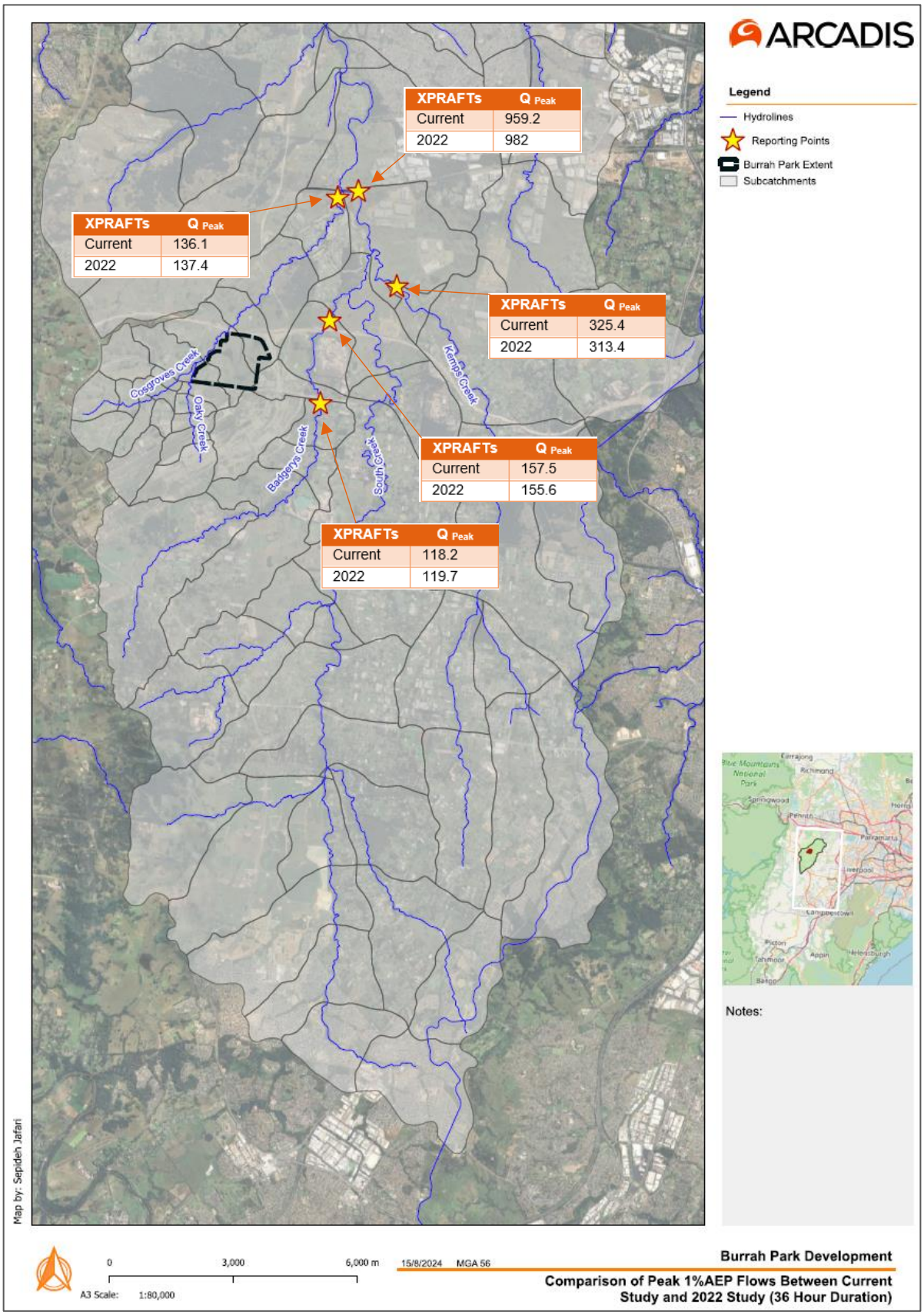


Figure 10 Comparison of Peak 1%AEP Flows Between Current Study and Advisian 2022 Flood study (36-Hour Duration)

4 Hydraulic Modelling

A site-specific TUFLOW model was developed for the study area, covering both the study area and the upstream catchment. The model includes the entire upstream catchments of Cosgroves Creek and Badgerys Creek. For South Creek and Kemps Creek, inflow boundary conditions were applied to minimize run time, considering that the development is not expected to impact or be impacted by these creeks. The model extends downstream to the Warragamba Pipelines, located sufficiently away from the project area. This approach ensures a comprehensive and efficient simulation, concentrating on the areas most relevant to the study. Figure 13 shows the extent of the TUFLOW model and its structures.

4.1 Model Topography

The 2019 LiDAR data with a resolution of 1m was obtained from the Geosciences Australia ELVIS online portal. This is regarded as the best available data on the current topography within the catchment area. The dataset utilised to generate this Digital Elevation Model (DEM) has an accuracy of 0.3m vertically (95% Confidence Interval) and 0.8m horizontally (95% Confidence Interval).

Additionally, a detailed ground survey collected in 2018 by HB&B (as shown in Appendix C) was overlayed against the LiDAR 2019 to update the topographic information within the study area.

4.2 M12 and Sydney Metro Bridges

The SEARs require a cumulative impact assessment regarding flooding. Consequently, the TUFLOW model has been updated to include recently approved developments in the surrounding area, such as the Sydney Metro and M12 Motorway (shown in Figure 11 and Figure 12 respectively). Approved EIS reports for these projects were obtained from the department's portal and reviewed to gather relevant information for modelling the bridges.

As a result, the terrain data at the M12 bridge over Cosgroves Creek was revised to reflect the approach embankments of the proposed bridge. This revision assumed that the bridge soffit would be about 600mm above the peak 1%AEP flood level. Subsequently, loss values at the bridge crossing were estimated using a combination of pier losses, calculated with Bradley's Method (1978), and superstructure loss, following the recent guidelines released by TUFLOW. The same modelling approach and assumptions would apply to both the base case and developed conditions, and result in impacts having a negligible effect due to the approach and assumption.

The Sydney Metro EIS report was reviewed, but no relevant information was found that could be incorporated into the current flood modelling. It is anticipated that the localized alterations in flood behaviour due to the Sydney Metro project will not significantly affect the development.

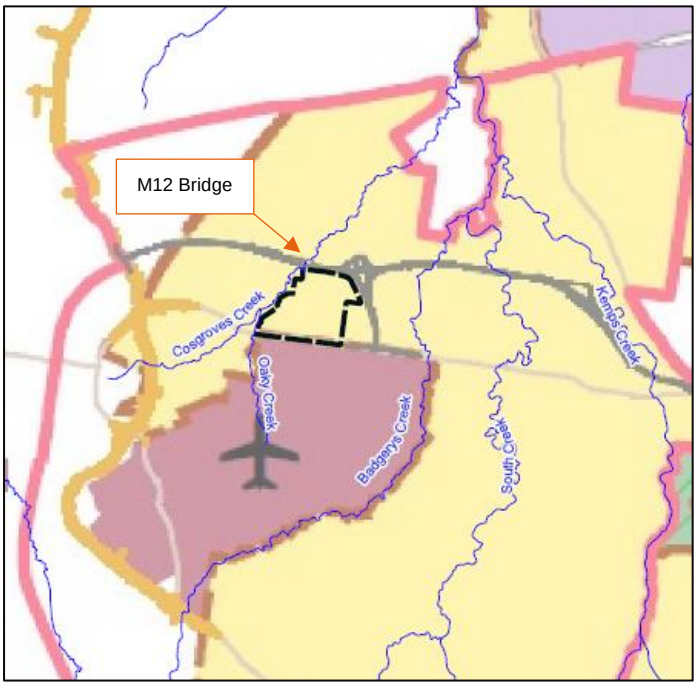


Figure 11 M12

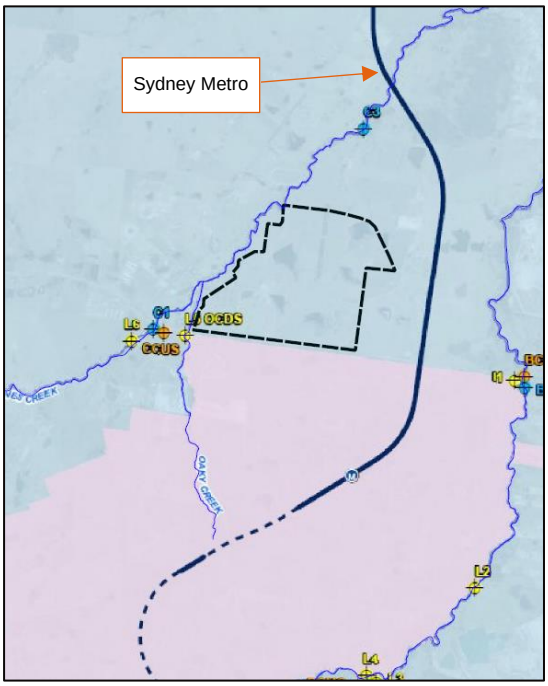


Figure 12 Sydney Metro

4.3 Elizabeth Drive Culverts

The details of the existing culvert structures under the Elizabeth Drive crossing of Cosgroves Creek and Oaky Creek were extracted from the Stage 1 Burrah Park SSDA, 1953- 2109 Elizabeth Drive, Badgerys Creek Flood Impact Assessment conducted by BMT in October 2022 as follows:

- 2x3.0mx2.4m RCBC for the Oaky Creek culvert crossing; and
- 3x3.0mx1.5m RCBC for the Cosgroves Creek culvert crossing.

In the BMT study, the details of the culverts (as shown in Figure 13) were determined based on on-site survey information provided by AT&L for the Oaky Creek crossing and a desktop analysis for the Cosgroves Creek crossing.

4.4 Model Roughness

Land use and roughness (Manning's 'n') zones were delineated based on aerial photography. Figure 13 illustrates the land use map used to assign different hydraulic roughness values across the models. The Manning's 'n' values adopted for each land use category are listed in Table 10 and are consistent with those used in the Advisian 2022 Flood Study.

Table 10 Roughness Values

Roughness ID	Description	Roughness Value
1	Clear creek channel or watercourse	0.035
2	Lightly vegetated creek channel	0.055
3	Moderately vegetated creek channel	0.100
4	Heavily vegetated creek channel	0.120
6	Floodplain with moderate coverage of trees	0.080
7	Floodplain with dense trees	0.120
8	Urban Floodplain	0.040
9	Industrial Development	0.090
10	Roadways	0.015
99	Default, Grassed floodplain	0.050

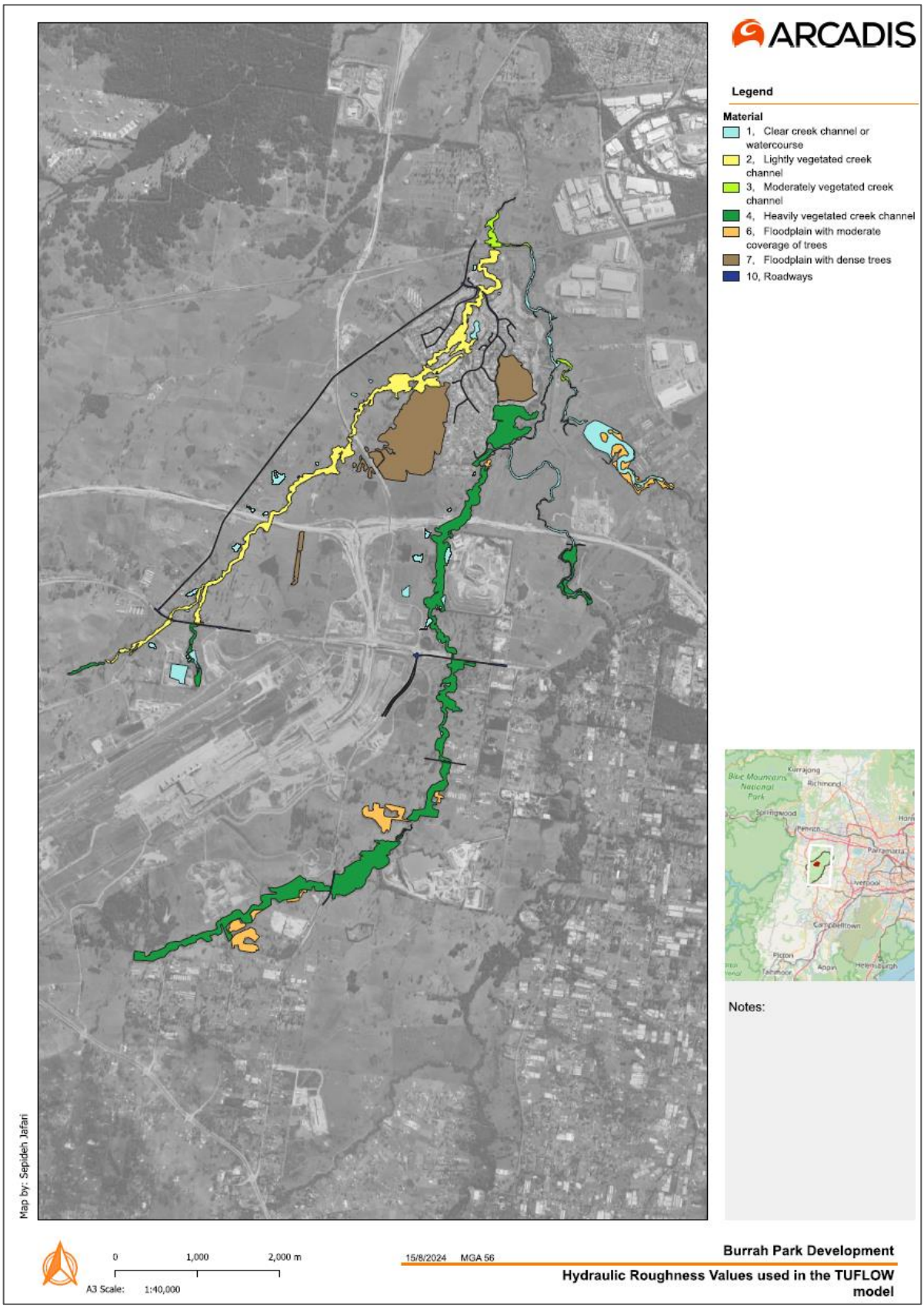


Figure 13 Hydraulic Roughness Values Used in the TUFLOW Model

4.5 Inflow Boundary Conditions

The upstream boundary conditions for each design flood are provided by discharge hydrographs generated from the updated XP-RAFTS hydrologic modelling. Two upstream inflow lines were adopted to input flows into the upstream extents of the flood model along South Creek and Kemps Creek.

Local inflows were also incorporated into the TUFLOW model to account for local runoff. Initially, 20 local inflows were defined, matching the subcatchments of the Advisian 2022 XP-RAFTS model. Later, these local inflows were further refined to account for recent changes since 2022, such as the M12, Sydney Metro, and the local catchment of Burrah Park.

Ultimately, a total of 35 local catchment inflows were defined within the TUFLOW extent. The locations of all upstream and local catchment inflows into the TUFLOW model are shown in Figure 14.

4.6 Tailwater Boundary Condition

A constant tailwater level has been specified for each design flood in South Creek, located downstream of Cosgroves Creek and Badgerys Creek. These tailwater levels were determined based on the results from the Updated South Creek Flood Study (Worley Parsons, 2015). A summary of the tailwater levels is provided in Table 11. The downstream boundary condition is situated approximately 5.5 km downstream of the main study area, far enough from the development site to prevent any impact on flood conditions at the site. The location of the tailwater boundary condition is shown in Figure 14.

Table 11 Tailwater Levels

AEP	Tailwater Level (mAHD)
5%	32.65
2%	32.80
1%	33.00
0.5%	33.10
0.2%	33.20
PMF	34.70

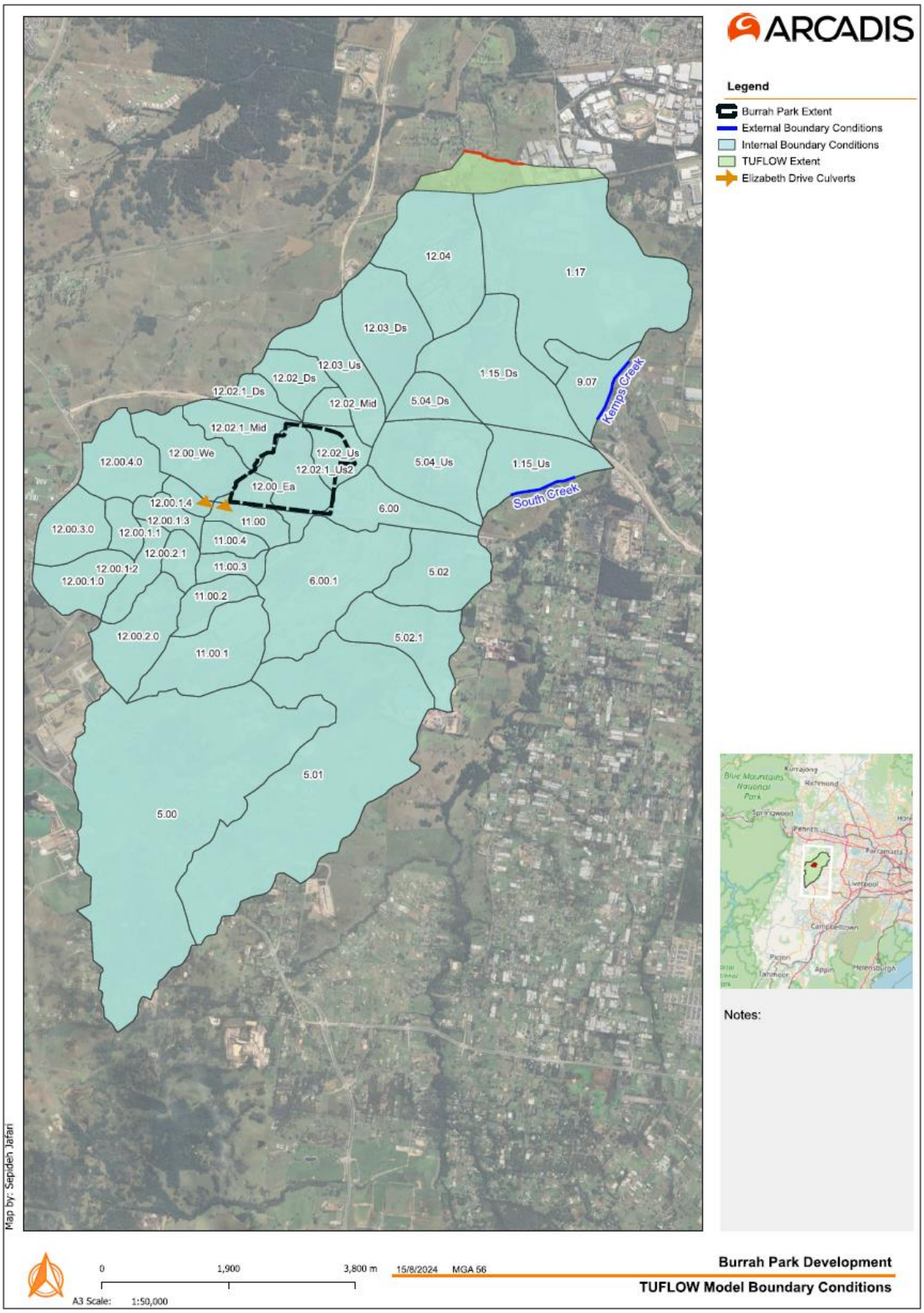


Figure 14 TUFLOW Model Extent and Boundary Conditions

4.7 Design Storm Events

The following design storm events were modelled in accordance with the previous studies:

- 5%AEP
- 2%AEP
- 1%AEP
- 0.5%AEP
- 0.2%AEP
- PMF

The study adopted a 36-hour critical storm duration for South Creek and Badgerys Creek for all events except the Probable Maximum Flood (PMF), which was simulated over a 6-hour duration according to the WorleyParsons 2015 Flood study. Additionally, a 9-hour storm duration was used to simulate the critical duration of Cosgroves Creek. Flood mapping for all the events other than PMF was conducted using 'peak-of-peaks'.

Assessing the potential impacts of climate change has been conducted by comparing model results for the 1%AEP design flood with those for the 0.5%AEP (approximately 15% increase in rainfall intensity) and the 0.2%AEP (approximately 35% increase in rainfall intensity) events. Given the site's distance from coastal areas, the project is not subject to sea level rise resulting from climate change.

PMF storm events have been modelled as part of this flood assessment for both existing and proposed conditions. The PMP (Probable Maximum Precipitation) calculation has been performed following the ARR procedure based on the Generalised Short-Duration method (GSDM). The detailed calculations have been included in Appendix B for further reference. Flow hydrographs were extracted from the XP-RAFT model and input into the TUFLOW model. The PMF event was simulated with a 6-hour critical duration which is consistent with the ‘Updated South Creek Flood Study’ in 2015.

The PMF peak flood levels were compared with the 2022 flood study for verification, as detailed in Section 4.8.

4.8 Hydraulic Model Verification

The TUFLOW flood model developed for this study has not undergone calibration against historic floods but has been validated against the results of the Advisian 2022 study. The WorleyParsons 2015 study was deemed unsuitable for comparison due to significant changes in the catchment since then. Instead, the verified 2022 model was used for validation purposes.

The design 1%AEP peak water levels were derived from the envelope of two simulations: the 36-hour critical duration 1%AEP flood for the entire study area and the 1%AEP with 9-hour critical durations for Cosgroves Creek. These results were compared with peak 1%AEP flood levels from the Advisian 2022 flood levels through georeferencing the flood maps of the Advisian report.

The 1%AEP peak flood level maps from the Advisian 2022 Flood Study report were overlaid with the current study's grid data to facilitate comparison, as illustrated in Figure 15. As depicted in the figure, there is a general agreement between the two results.

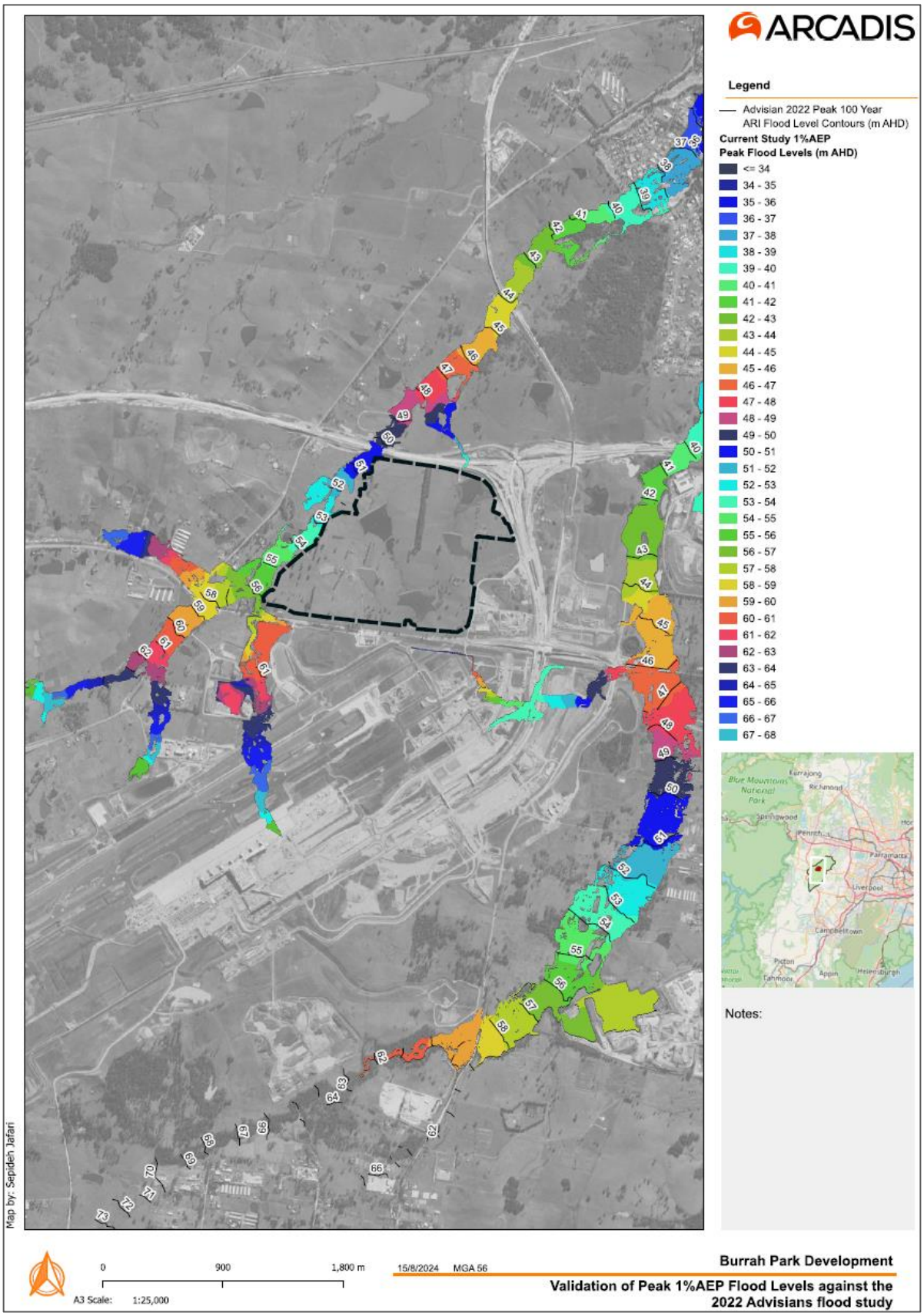


Figure 15 Validation of 1%AEP Peak Flood Levels against the Advisian 2022 Flood Study

Table 12 lists the peak flood levels generated by the current TUFLOW model and those reported in the 2022 Advisian Flood Study along Cosgroves and Badgerys Creeks at key locations. As shown in the table, the differences along these tributaries are minor, measuring less than 50mm.

Table 12 Comparison of 1%AEP Peak Flood Levels: Current Study vs. 2022 Flood Study

Location	1%AEP Peak Flood Level (mAHD)		
	Advisian 2022 Flood Study	Current study	Difference (mm)
U/S of Elizabeth Drive			
- Cosgroves Creek	58.90	58.95	+50
- Badgerys Creek	46.90	46.87	-30
U/S Twin Creek Boulevard – Cosgroves Creek	34.90	34.94	+40

Table 13 compares the current PMF peak flood levels with those reported in the 2022 Advisian Flood Study. The current levels are generally slightly higher than those in the 2022 study. Since the 2022 study does not provide detailed PMP calculations or specify the exact locations from which flood levels were extracted, identifying the exact cause of this discrepancy is challenging. However, one possible explanation could be that the 2022 study addressed the entire South Creek catchment, whereas the current study is focused on the Burrah development. As a result, the upstream catchment area considered in the current flood assessment is smaller, which has led to higher PMP depth estimates for this specific area compared to the broader 2022 study. These higher levels are conservative, making them suitable for the impact assessment.

Table 13 Comparison of PMF Peak Flood Levels: Current Study vs. 2022 Flood Study

Location	PMF Peak Flood Level (mAHD)		
	Advisian 2022 Flood Study	Current study	Difference (mm)
U/S of Elizabeth Drive			
- Cosgroves Creek	59.2	59.7	+500
U/S Twin Creek Boulevard – Cosgroves Creek	36.0	36.6	+600

The differences between Cosgroves and Badgerys Creeks are negligible and reasonable given the variations between the two studies, including:

- **Different hydraulic models were adopted,** with Advisian 2022 using the RMA-2 hydraulic model, whereas the current study employed TUFLOW.
- **Differences in parameters used in the hydraulic models,** as not all parameters adopted in the RMA-2 model are documented in the 2022 flood study report, including land use zones.
- **Differences in model extents,** with the 2022 RMA-2 model simulating the entire South Creek catchment, compared to the truncated model used in the current study.

Given these factors, the differences in peak flood levels are considered acceptable. Consequently, the TUFLOW model was deemed verified and suitable for the current study.

5 Modelling Results

Maps prepared for all events, except for the PMF, are based on the enveloped peak from simulations of the 9-hour and 36-hour storm durations.

5.1 Existing Condition

5.1.1 Flow Hydrographs

The flow hydrographs for Cosgroves Creek near the study area are displayed in Figure 17. The location where flow hydrographs were extracted is shown in Figure 16. Under current conditions, it is predicted that the peak 1%AEP flood flow at Cosgroves Creek will reach the study area approximately 7 hours after the onset of the critical 9-hour storm event. The peak flow rates at Cosgroves Creek are detailed in Table 14.

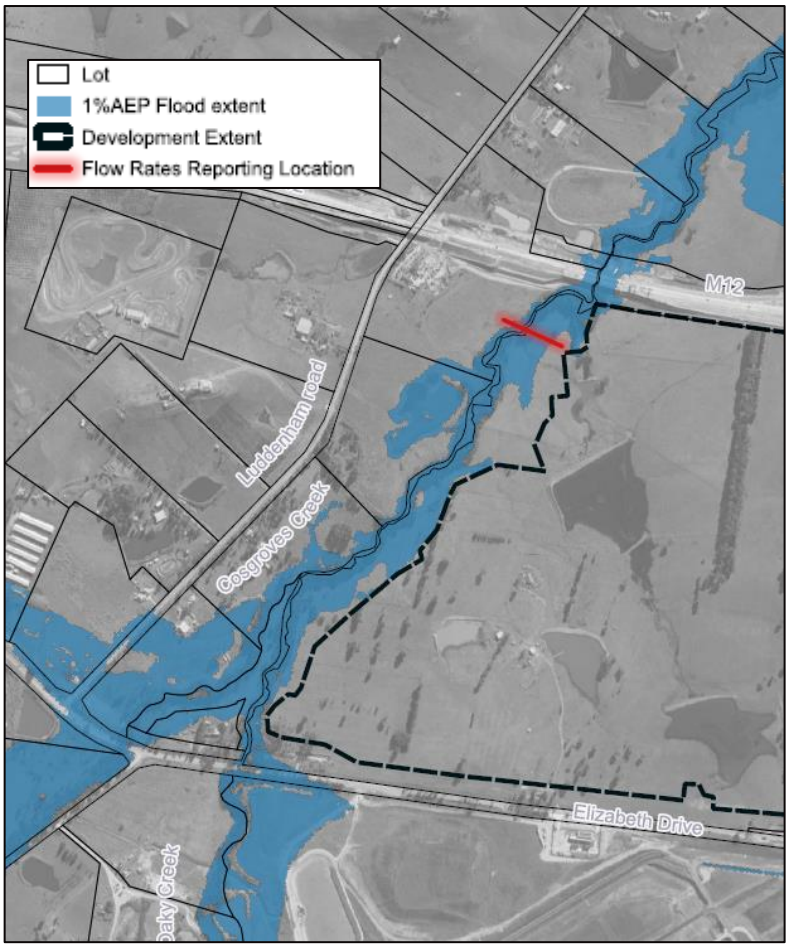


Figure 16 Flow Rate Reporting Location

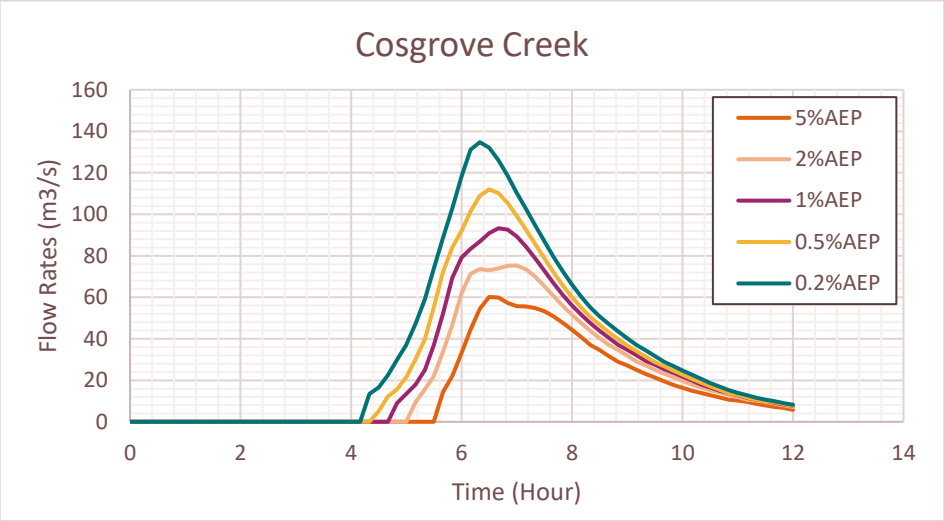


Figure 17 Flow Hydrographs at Cosgroves Creek (9-hour storm duration)

Table 14 Peak Flow Rates at Cosgroves Creek

Event	Peak Flow Rates (m^3/s)
5%AEP	60.2
2%AEP	75.3
1%AEP	93.3
0.5%AEP	112.0
0.2%AEP	134.7

5.1.2 Peak Flood Depths and Levels

Peak flood depths and levels for the 5%AEP, 1%AEP and PMF are shown in Figure 18 to Figure 20. The figures show peak flood depths using grid data and peak flood levels with contour intervals of 0.2 metres and 1 metre. Maps of the 2% AEP, 0.5% AEP, and 0.2% AEP flood events are included in Appendix A.

Table 15 presents the peak flood levels for the design events at locations along the site boundaries along Cosgroves Creek, as shown in Figure 21. The 1% AEP peak flood levels range from 50.37m immediately upstream of the M12 Motorway Bridge to approximately 58m downstream of Elizabeth Drive.

Figure 20 displays the current peak flood depths and levels for the Probable Maximum Flood (PMF). It indicates that the development area slightly extends into the PMF zone, with levels ranging from 58.5 mAHD downstream of Elizabeth Drive to 52 mAHD upstream of the M12 Motorway.

As illustrated in the figures, the flooding extents are mainly confined within the Cosgroves Creek and the development area is predicted to remain flood-free up to 1%AEP flood event.

It should be noted that the Badgerys Creek flood extent will not reach the project area, up to and including the PMF event, and the development will not impact the flood conditions of this creek. Therefore, the flood maps exclusively display the flood conditions of Cosgroves Creek.

Table 15 Peak Flood Levels (mAHD)

Point ID	5% AEP	1% AEP	PMF
1	58.92	59.03	59.68
2	60.47	60.55	60.85
3	57.58	57.89	58.76
4	56.22	56.42	57.34
5	56.17	56.28	56.99
6	54.54	54.89	56.01
7	53.33	53.58	54.85
8	52.26	52.64	54.04
9	-	-	53.17
10	51.65	51.96	53.16
11	50.43	50.73	52.57
12	50.01	50.37	52.38
13	49.16	49.44	50.92
14	48.09	48.30	49.68

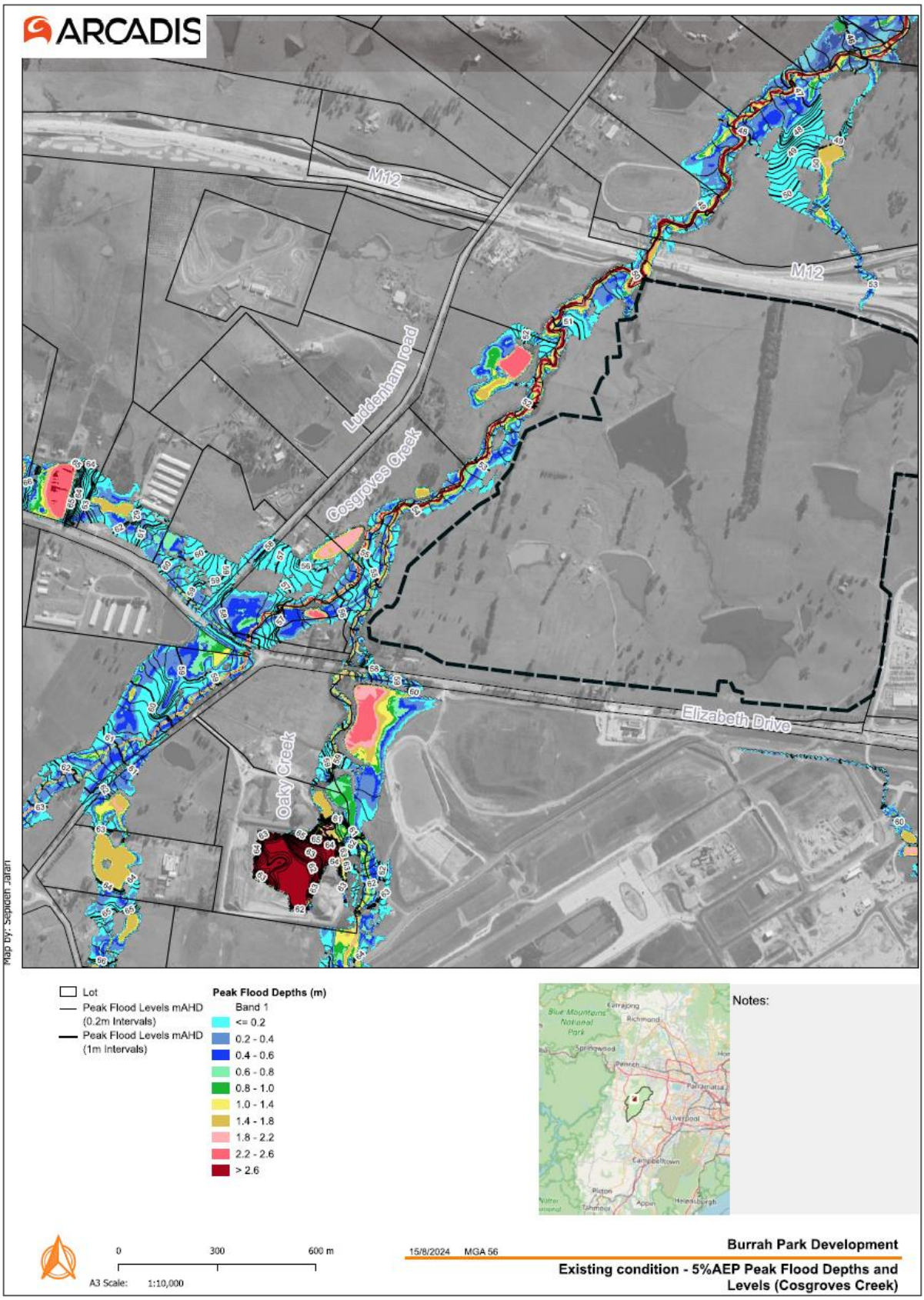


Figure 18 Existing Condition – 5%AEP Peak Flood Depths and Levels (Cosgroves Creek)

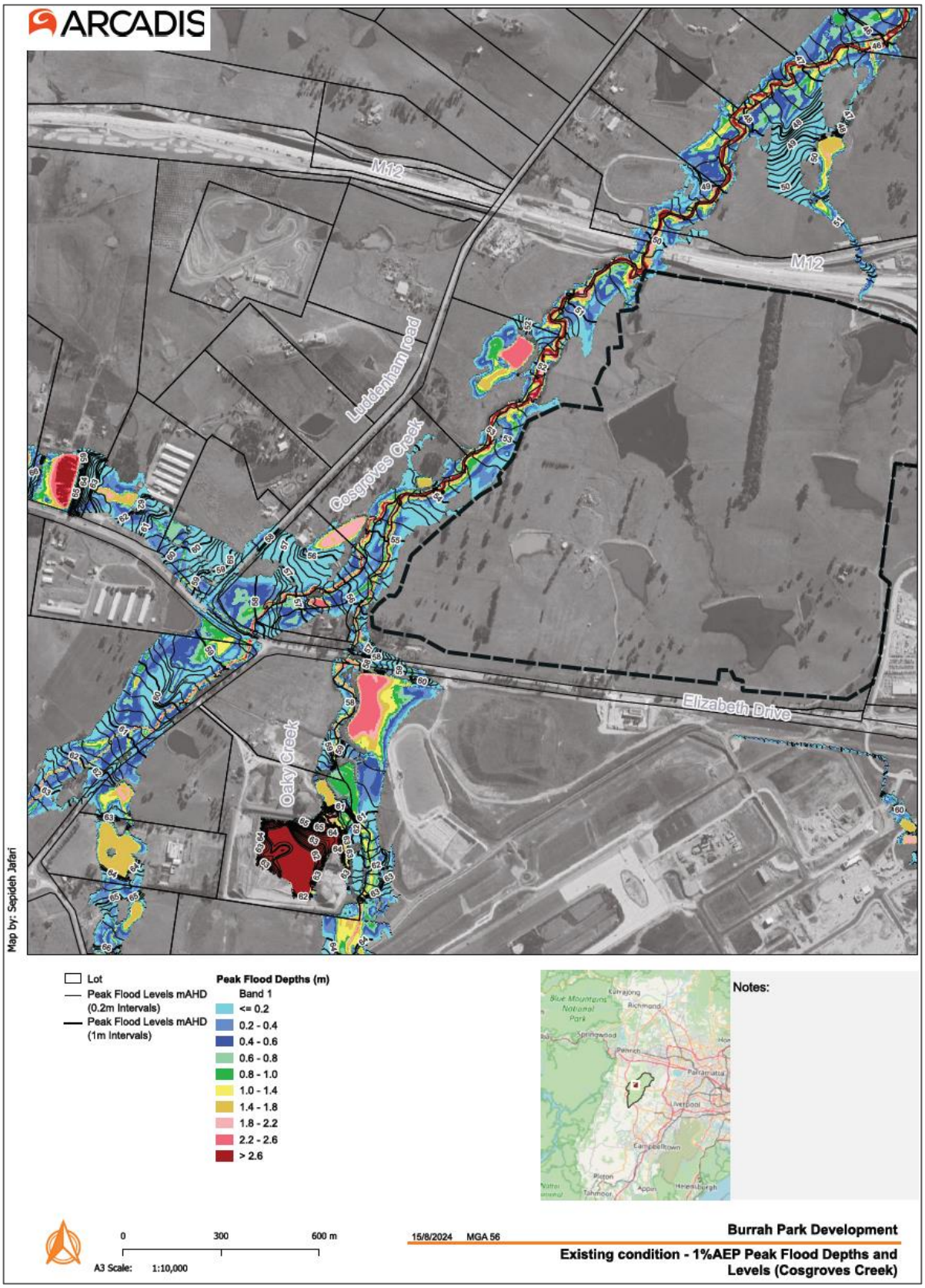


Figure 19 Existing Condition – 1%AEP Peak Flood Depths and Levels (Cosgroves Creek)

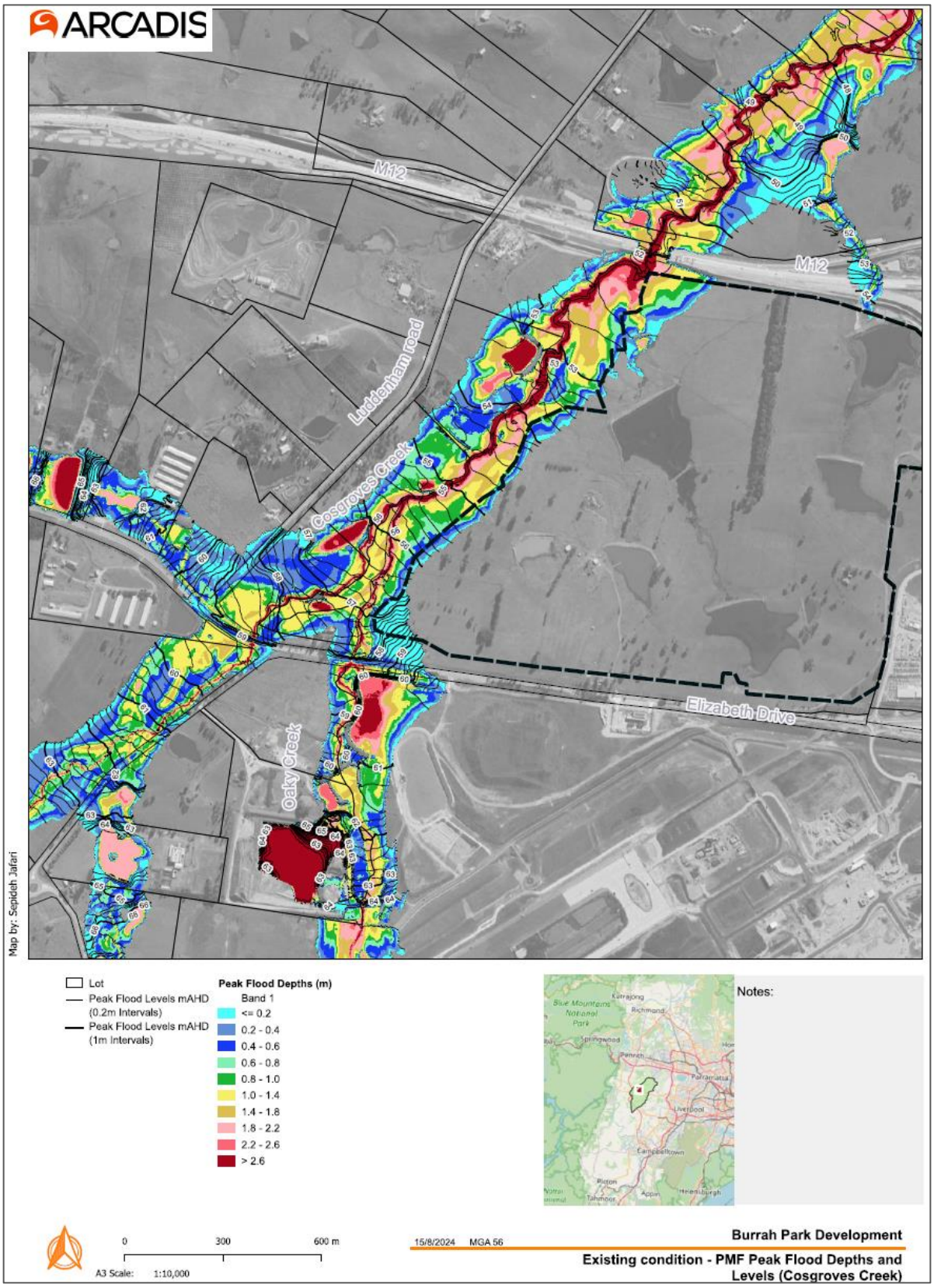


Figure 20 Existing Condition - PMF Peak Flood Depths and Levels (Cosgroves Creek)

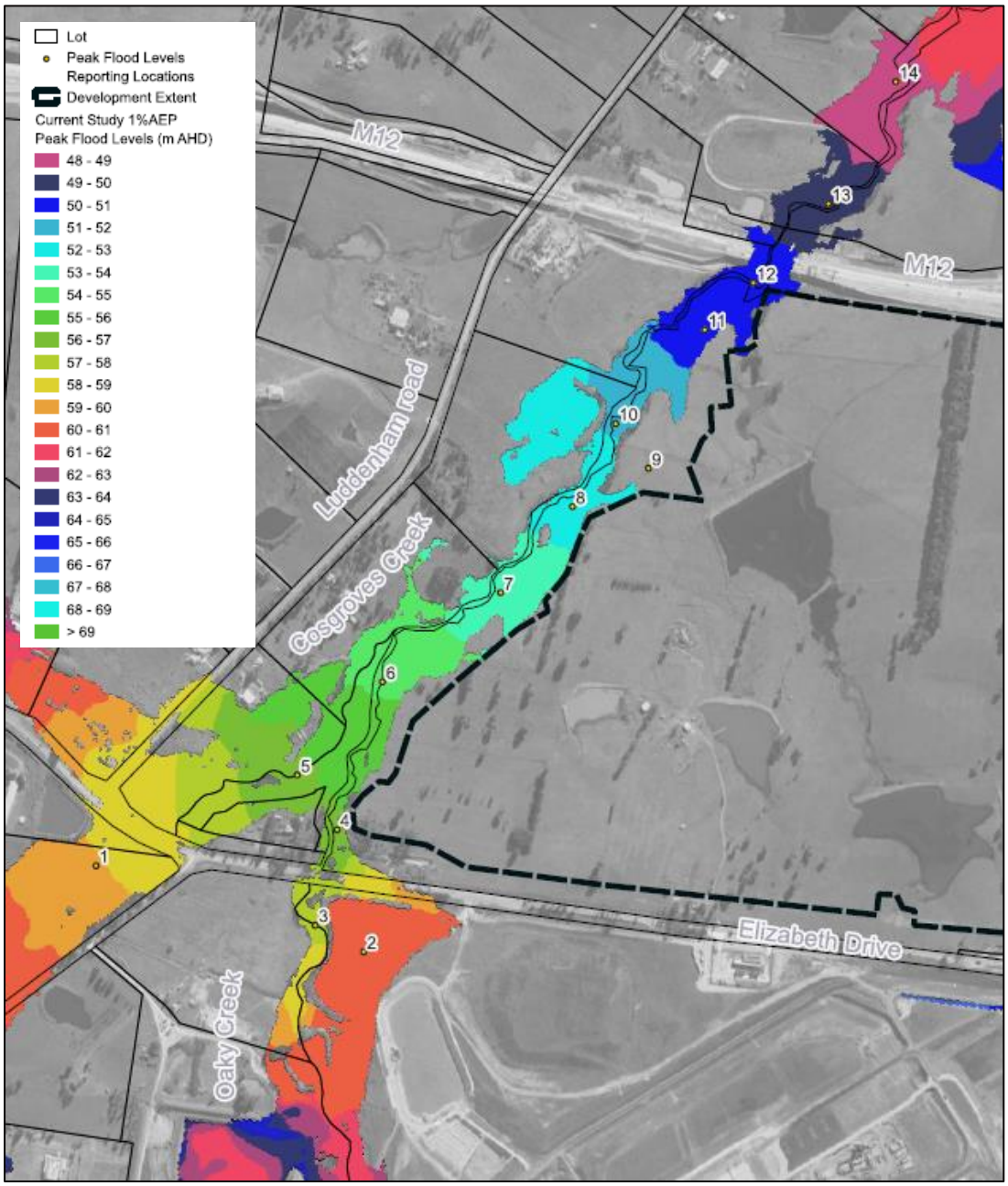


Figure 21 Reporting Points Locations

5.1.3 Peak Flood Velocities

Peak flood velocities for the 5%AEP, 1%AEP flood events and the PMF are shown in Figure 22 to Figure 24. Maps of the 2% 0.5%, and 0.2%AEP flood events are included in Appendix A.

The 1%AEP peak flood velocities outside the banks of Cosgroves Creek are less than 0.5 m/s, while within the creek, peak velocities can reach up to 2 m/s.

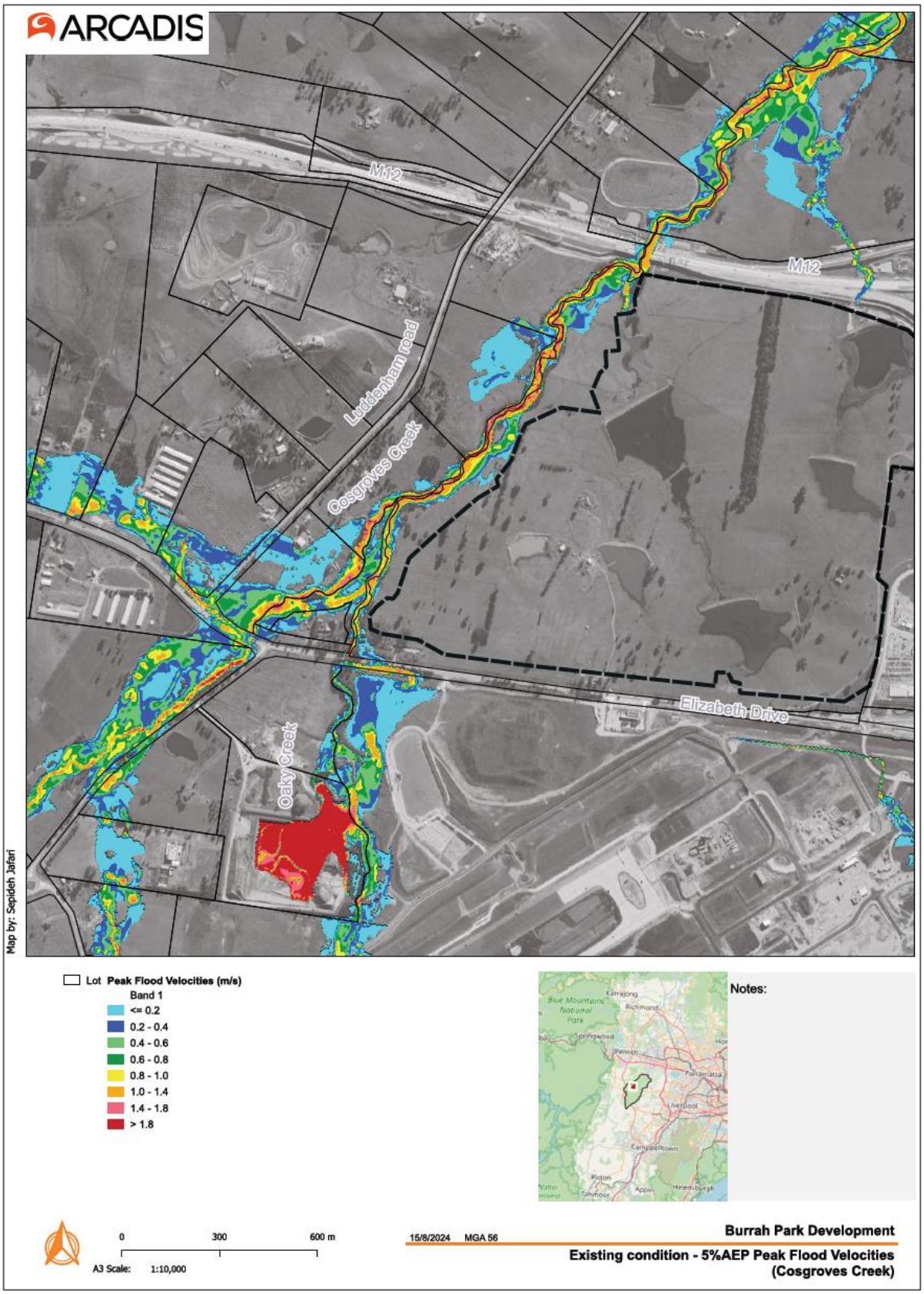


Figure 22 Existing Condition – 5%AEP Peak Flood Velocities (Cosgroves Creek)

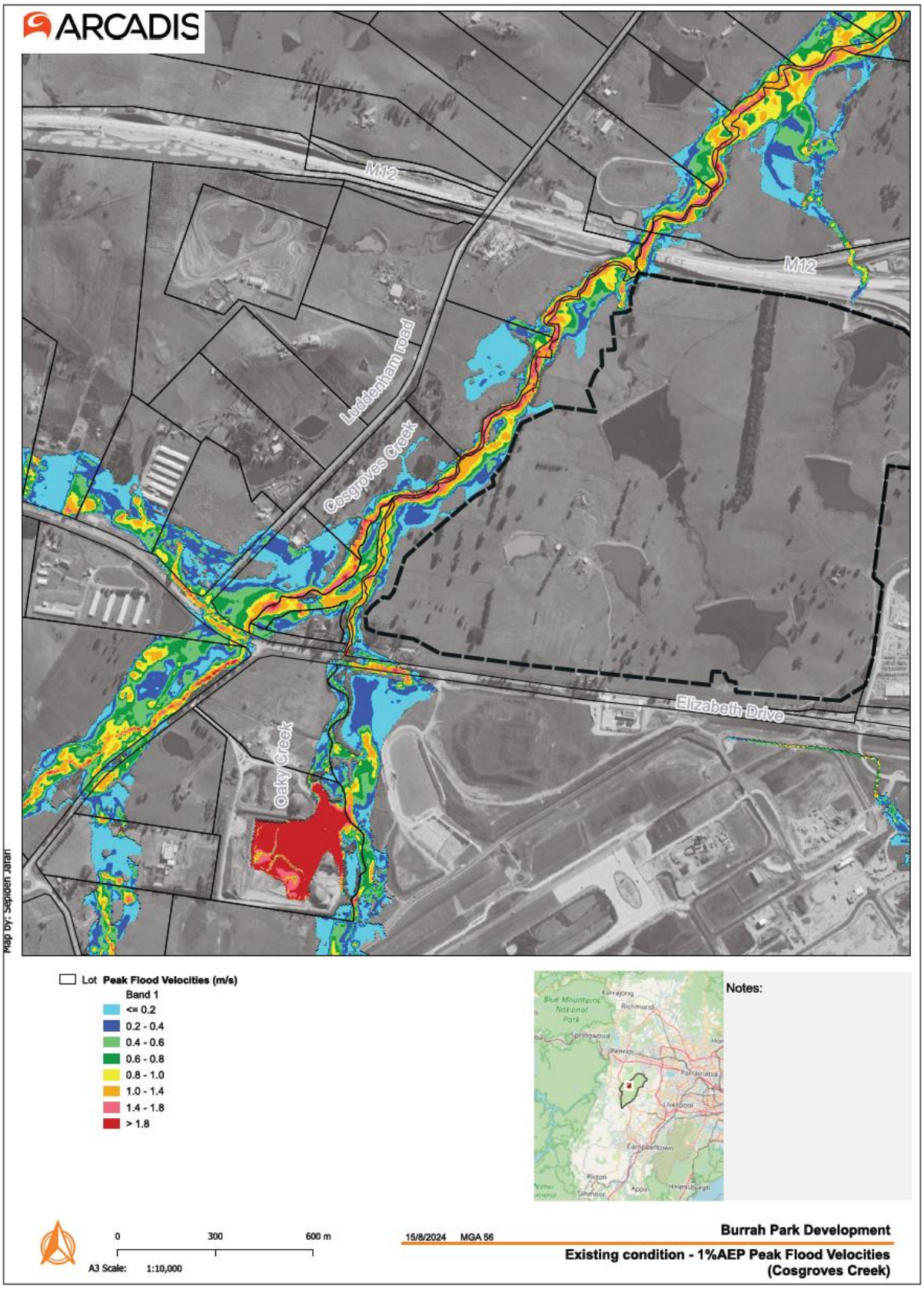


Figure 23 Existing Condition - 1%AEP Peak Flood Velocities (Cosgroves Creek)

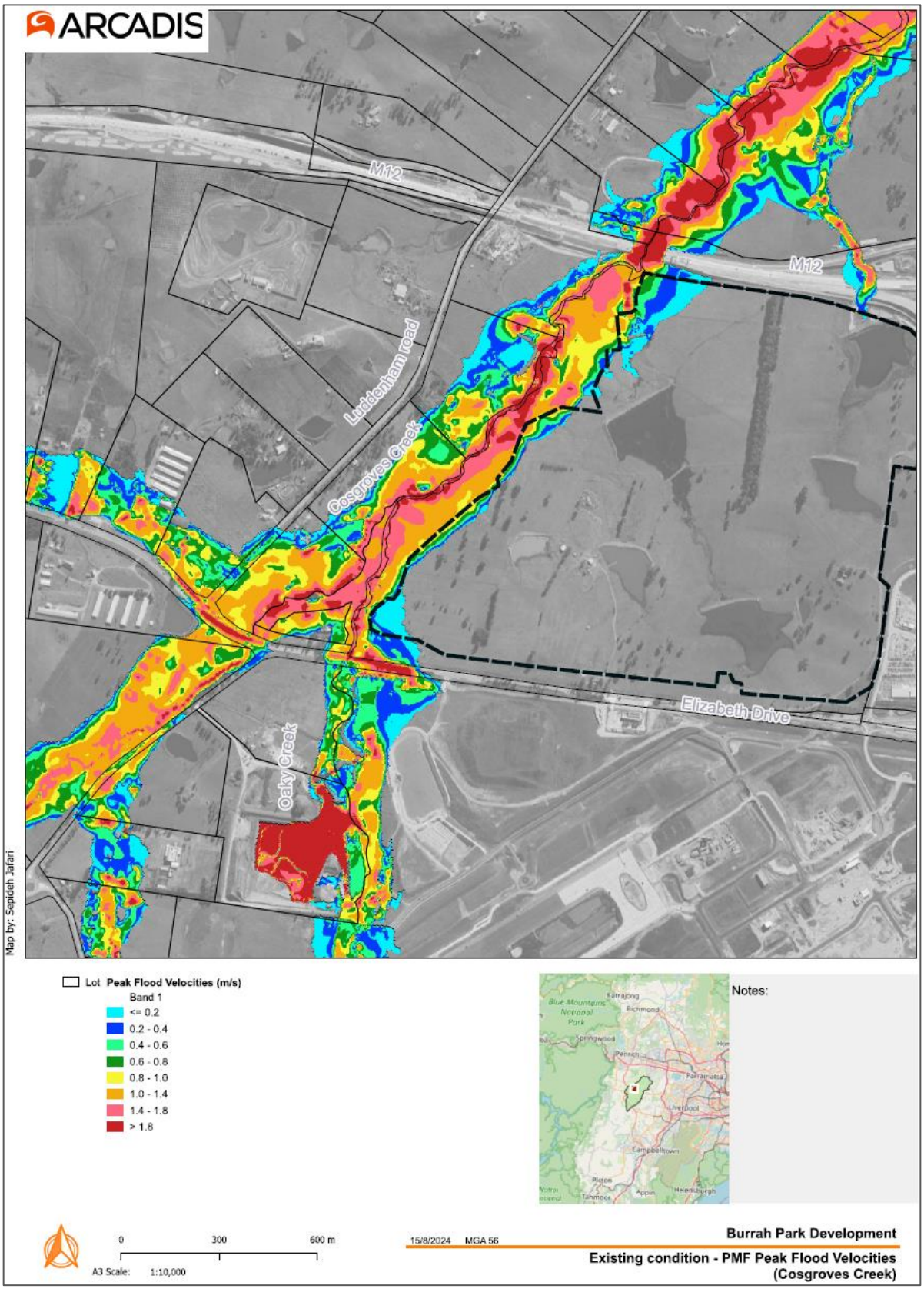


Figure 24 Existing Condition - PMF Peak Flood Velocities (Cosgroves Creek)

5.1.4 Peak Flood Hazard Categories

The Australian Rainfall & Runoff Guidelines (2019) propose a series of curves to define hazard categories, accounting for the risks posed to individuals, vehicles, and structures during flood events. Flood hazard levels are determined by factors such as flood velocity and depth. The proposed curves are shown in Figure 25.

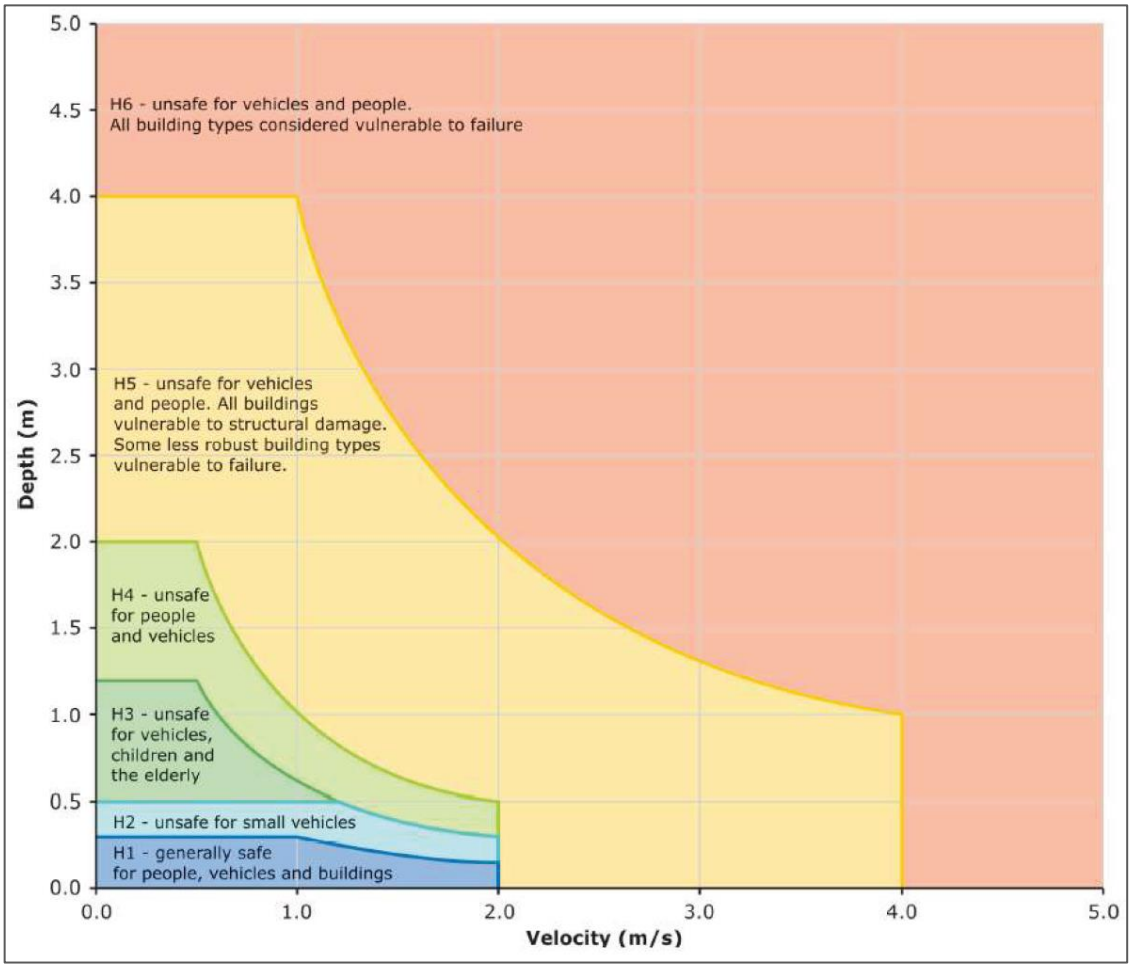


Figure 25 Flood Hazard Curves (ARR 2019)

These curves have been used for defining flood hazards in this study. Flood hazard mapping for the 1%AEP event is shown in Figure 26. It illustrates that the majority of the flood extent along the western edge of the development falls within categories H1 to H4, while along the creek thalweg, it reaches categories H5 and H6 due to higher depths and velocities.

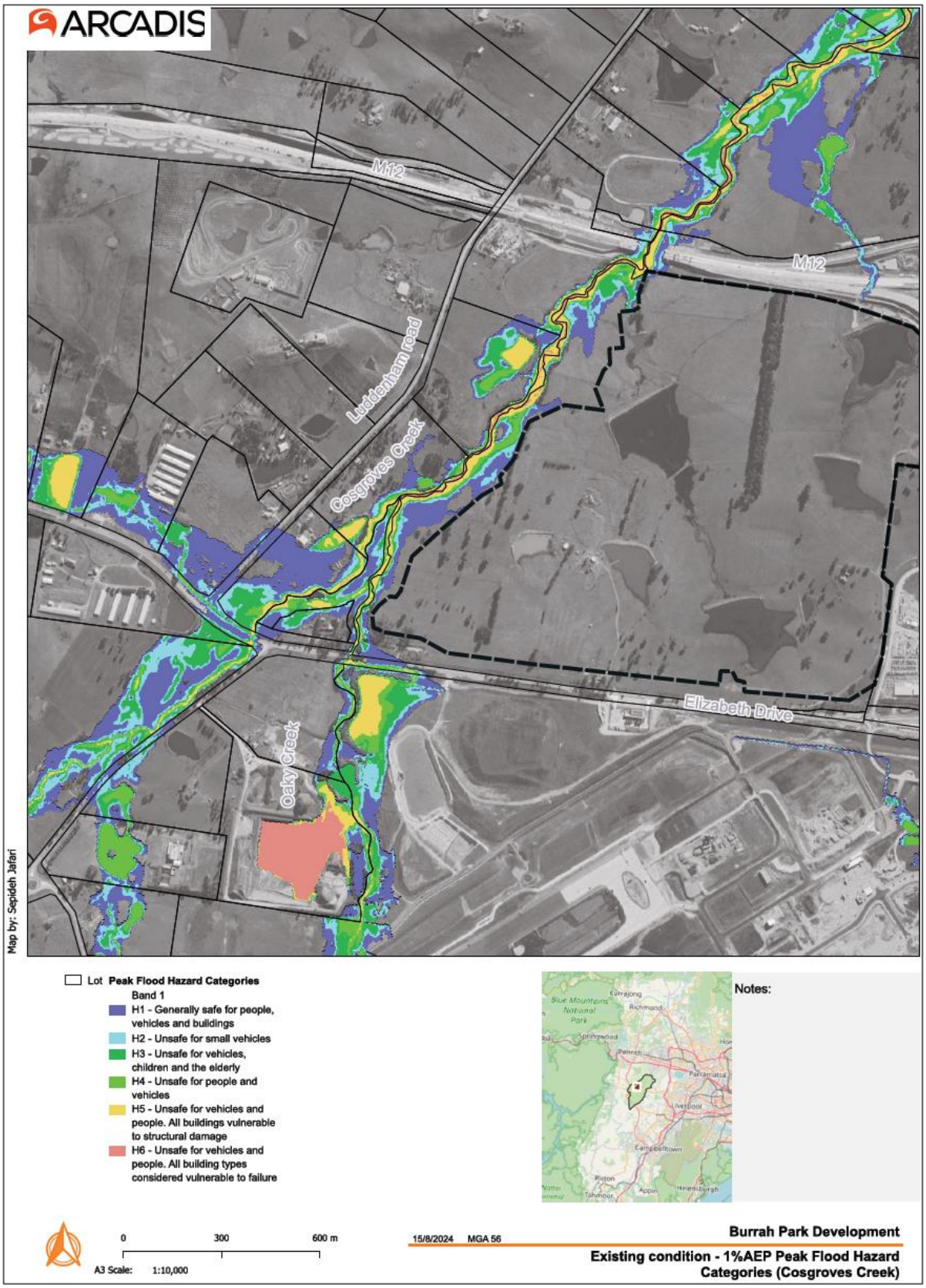


Figure 26 Existing Condition - 1%AEP Peak Flood Hazard Categories (Cosgroves Creek)

5.2 Impact Assessment

5.2.1 Post-Development Impacts

The design surface was obtained on 1st July 2024 as shown in Figure 27 which includes lots, roads, channels, and detention basins. This surface was overlaid onto the existing ground elevation in the developed scenario to assess potential impacts.

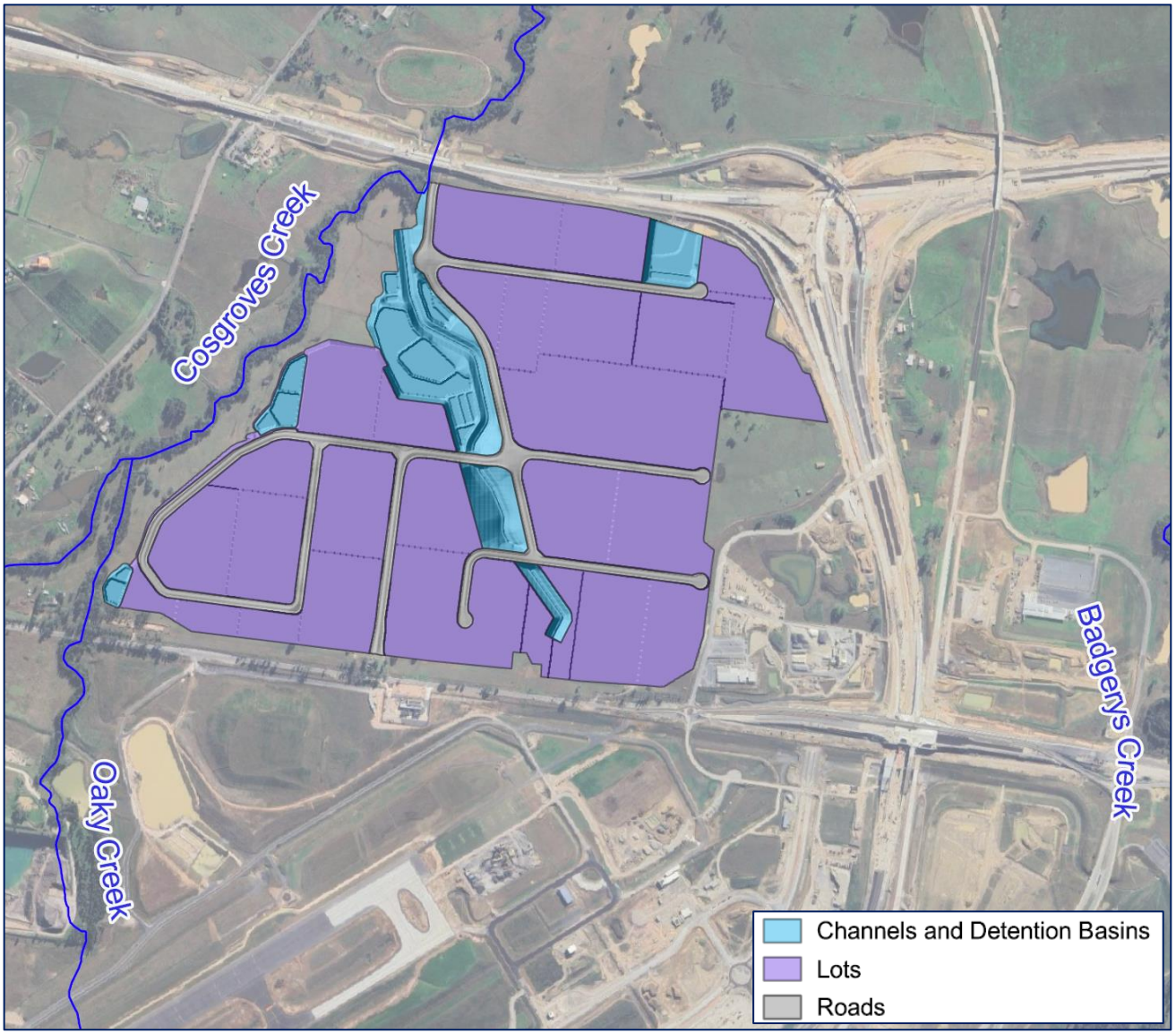


Figure 27 Development Layout

Urbanisation will convert highly pervious rural lands into impervious surfaces. As a result, it is expected that both flow volumes and peak flow rates increase. Additionally, the lots and road surfaces will have lower resistance to flow (lower Manning values) which will accelerate the occurrence of peak flows compared to existing conditions.

To mitigate the potential impacts caused by changes in the discharge hydrograph, the development includes multiple detention basins designed as part of the stormwater study. These basins would have been sized to mimic the existing flow patterns up to and including the 1% AEP event.

The flooding assessment primarily focuses on Cosgroves and Badgerys Creeks without detailed assessments of local internal flows, which are beyond the current scope. Consequently, with the incorporation of detention basins in the development design, the developed scenario maintains the same existing flow hydrographs for events up to and including the 1% AEP event.

The assessment shows that impacts observed beyond the project boundary in Cosgroves Creek up to the 1% AEP event are primarily due to slight encroachments of bulk fill into the creek's flood extent, as depicted in Figure 28. These impacts are minimal and localized, occurring directly adjacent to the proposed development embankment, and they do not affect any surrounding developments.

For larger events, where detention basins are assumed ineffective, the XP-RAFTS model was adjusted to incorporate lower rainfall losses and Manning values. The resulting developed hydrographs were then applied in the TUFLOW model.

During the PMF, higher flow rates and an increased flood extent are expected. Due to the development encroachment, there will be more loss of storage, leading to higher peak flood impacts, as shown in Figure 29. The peak impact ranges from 30 mm downstream of Elizabeth Drive to about 150 mm upstream of the M12. Properties west of Cosgroves Creek may experience some impacts. Some of these properties are already flooded in the Existing case. The flood level impact on the properties is less than 30mm and the hazard level increases by one category in small areas.

The M12 Motorway may also be impacted during a PMF event due to the development of impacts up to 150 mm. However, without reliable design data from the M12, it is challenging to accurately estimate the extent of this impact. Overall, the PMF impacts are not assumed to be significant.

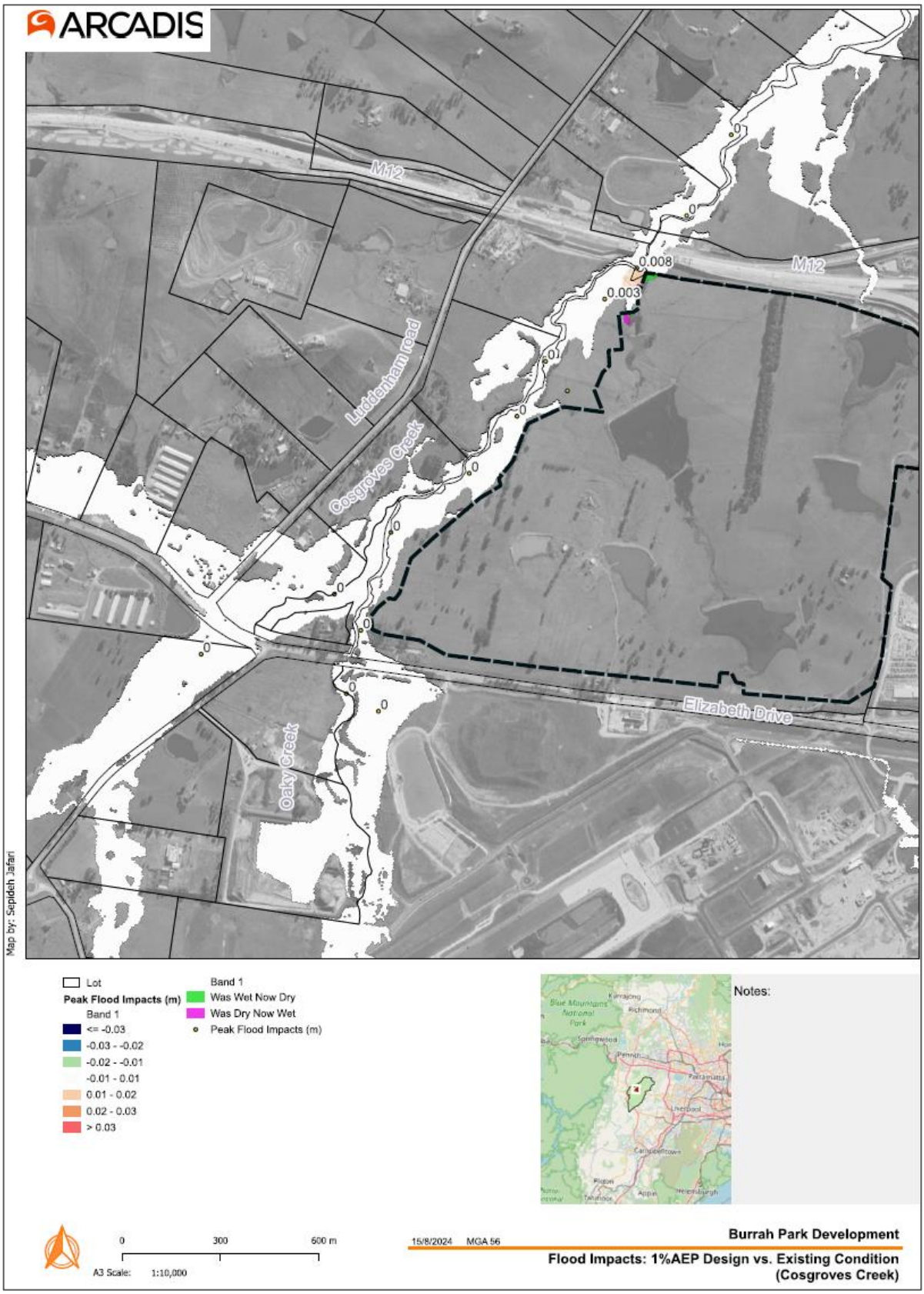


Figure 28 Flood Impacts: 1% AEP Flood Level Design vs. Existing (Cosgroves Creek)

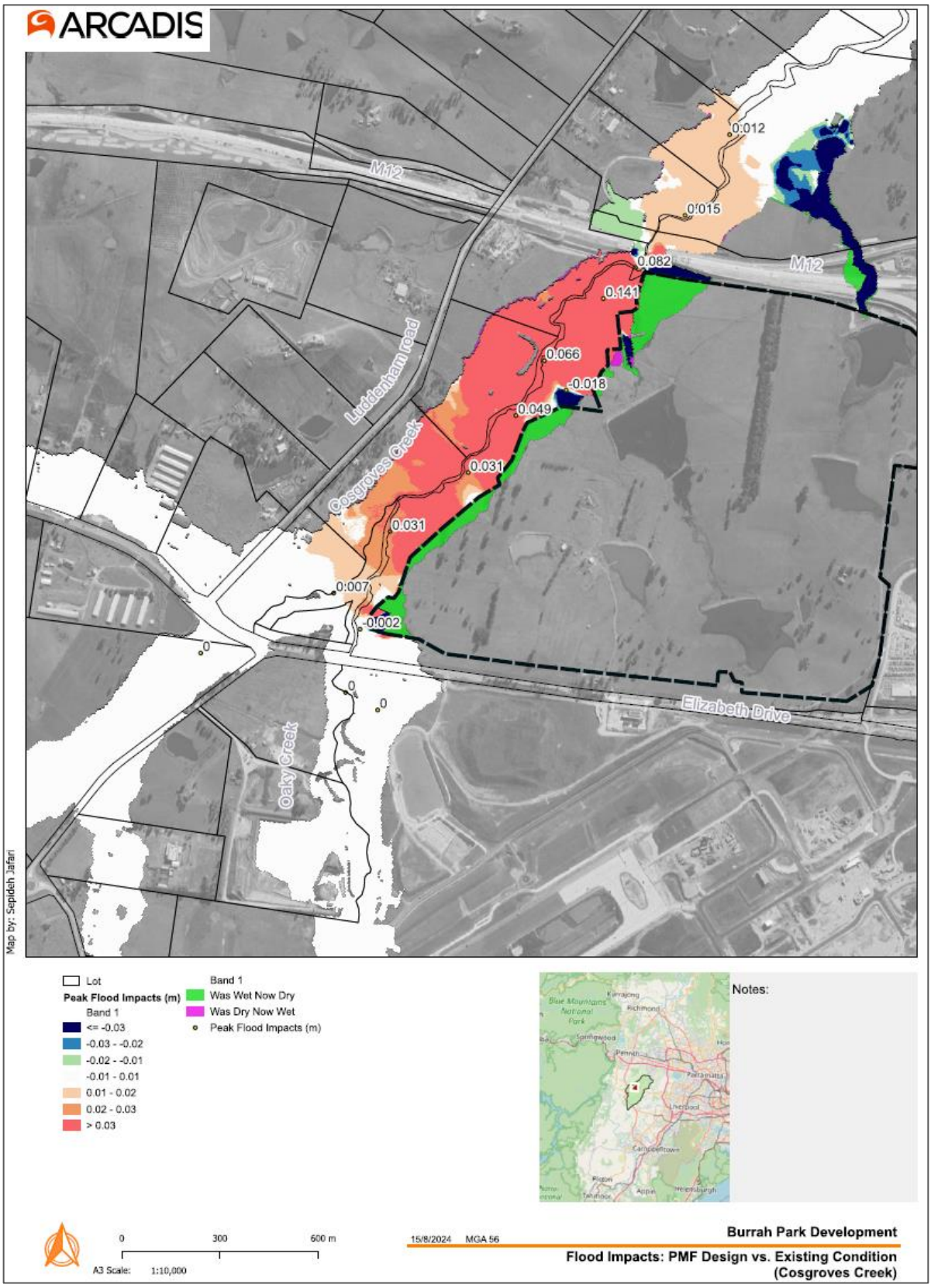


Figure 29 Flood Impacts: PMF Flood Level Design vs. Existing (Cosgroves Creek)

5.2.2 Climate Change Impacts

An assessment of flood impacts under the climate change scenario has been conducted. This scenario considers sea level rise and increased rainfall intensities during major storms.

As the site is located well above the tidal limit of the Hawkesbury River, it is not expected to be affected by sea level rise. Consequently, the assessment focuses on increases in rainfall intensities.

The 0.2% peak flood levels, representing a 35% increase in rainfall intensity, have been used to assess the potential impacts of climate change (As shown in Figure 30) The results of the 0.5% event are included in Appendix A.

During simulations of climate change events, it was revealed that peak flood levels in Cosgroves Creek would decrease. This decrease was investigated and found to be due to the fact that, although the peak flow from the development is higher, it discharges earlier compared to existing conditions

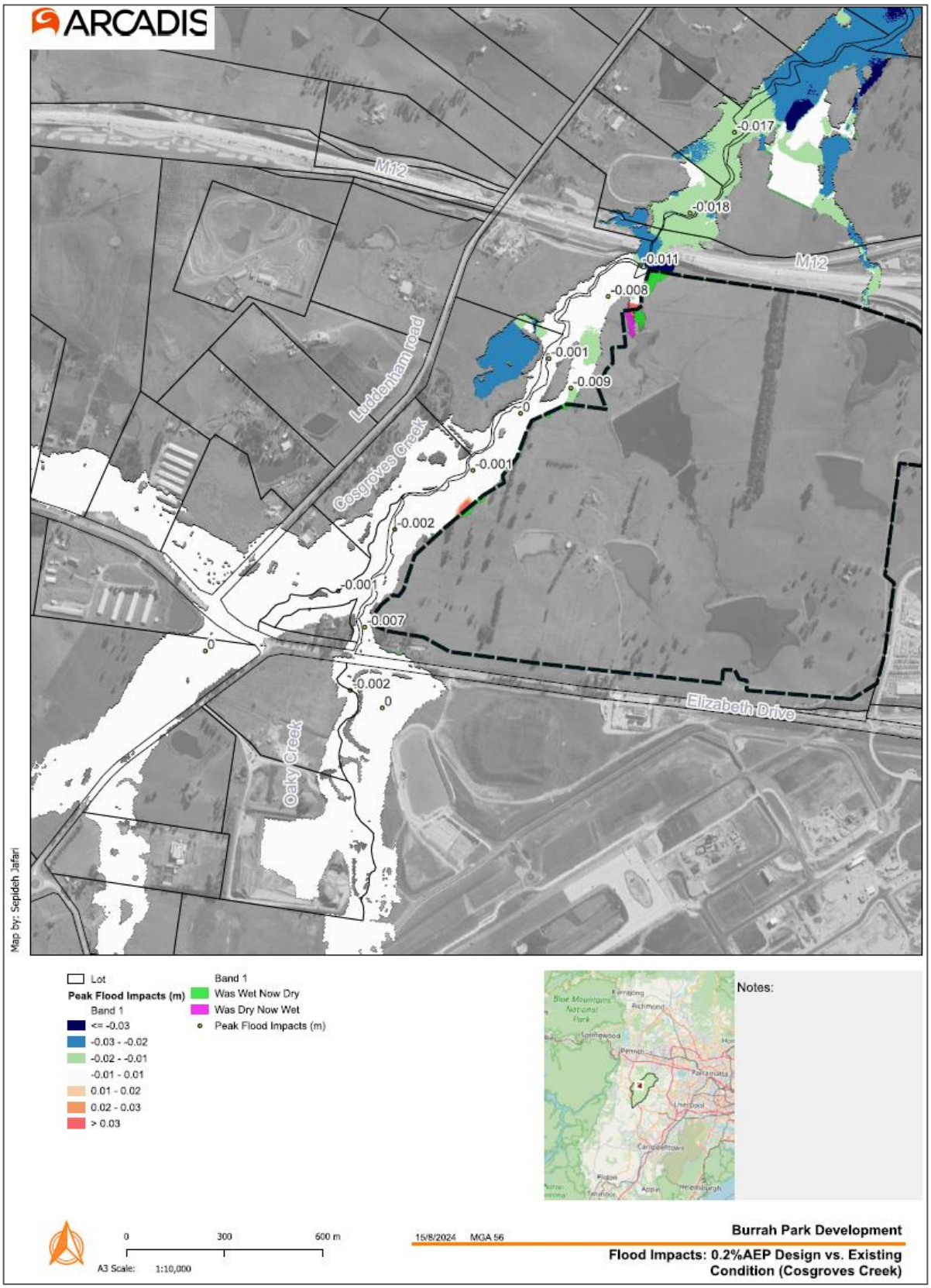


Figure 30 Flood Impacts: 0.2% AEP Flood Level Design vs. Existing (Cosgroves Creek)

5.2.3 Cumulative Impacts

When conducting a flood assessment for a development, it is necessary to consider cumulative impacts to ensure a comprehensive evaluation of potential risks. Cumulative impacts encompass the combined impacts of the proposed development and any existing or future developments in the surrounding area. These impacts can significantly alter flood patterns, hydrological regimes, and flood risk levels.

As mentioned in Section 4.2 to address cumulative impacts, the Environmental Impact Statement (EIS) reports for the M12 Motorway and Sydney Metro projects were reviewed and relevant data was incorporated into the current modelling.

At the time this report was prepared, the following SSDA applications (as outlined in Table 16) in the vicinity of the site were known. It is anticipated that individual development would be required to mitigate the flood impacts associated with the respective development up to the 1%AEP event. No significant changes in the flood conditions would be therefore expected in the 1% AEP and the smaller events.

For the extreme flood event, it was concluded that the M12 Motorway may also be impacted during a Probable Maximum Flood (PMF) event due to the Burrah Park development. However, without reliable design data from the M12, it is challenging to accurately estimate the extent of this impact. The cumulative changes in the flood conditions associated with the Burrah Park development and the other developments in the region are difficult to determine without access to the development layout information of individual developments.

Furthermore, the current assessment indicates that the impacts of the proposed development are minor and localised. Additionally, it is anticipated that other developments in the area will implement measures to mitigate their impacts. Therefore, it is concluded that cumulative impacts on flood behaviour from these developments are expected to be minimal.

Table 16 SSDA's in the vicinity of the site

DA Reference	Development Description	Current Status
DHL Warehouse and Logistics Facility (Southern Site) SSD-38206707	Construction of two single-storey warehouse buildings, landscaping works, associated vehicle crossings and drainage connection to the road drainage system, signage and wayfinding.	Re-application for SEARs and Environmental Impact Statement being prepared
DHL Logistics Facility, Badgerys Creek (North) SSD-38201739	Construction of two single-storey warehouse buildings, landscaping works, associated vehicle crossings and drainage connection to the road drainage system, signage and wayfinding.	Re-application for SEARs and Environmental Impact Statement being prepared
Altis Warehousing Estate, 2289-2309, 2311 Elizabeth Drive, Luddenham (SSD-48438209)	Construction and operation of a warehouse and distribution estate.	Response to Submissions
Elizabeth Enterprise Precinct - Stage 1 1669-1723 Elizabeth Drive, Badgerys Creek	Concept Masterplan and Stage1 Development for general industry and warehouse distribution centres	Prepare Environmental Impact Statement

(SSD-19618251)		
Elizabeth Drive Upgrades	The upgraded road will provide two lanes in each direction together with a median island, landscaping and paths. The proposed upgrades relate to 11.4km of road.	Consultation on the REF closed on 31st October 2023
Mixed-Use Hotel and Commercial Development 1990 Elizabeth Drive, Badgerys Creek (SSD-53643233)	A concept masterplan to support development for the purpose of tourist and visitor accommodation and commercial premises.	Prepare Environmental Impact Statement
WSI Airport (2014-7391)	Staged proposal comprising the construction and operation of a new international airport.	Under construction, proposed to be operational by December 2026.
M12 Motorway (SSI-9364)	A new dual-carriageway motorway to connect the M7 Motorway with the Western Sydney Airport and The Northern Road. The motorway will initially have two lanes in each direction, with capacity for an additional future lane in each direction.	Approved 23 April 2021. Construction commenced in mid-2022 and is to be completed in late 2025.
Western Sydney Freight Line	Proposed dedicated freight rail line connection between Western Parkland City and Port Botany. The new freight rail line will free up the Main West Rail Line to allow more passenger services over time.	Stage 1 Corridor – connecting from OSO to Horsley Park and M7 is now protected and acquiring properties.
Sydney Metro – Western Sydney Airport (SSI-10051)	A new metro line to service Western Sydney International Airport, the Western Sydney Aerotropolis and interchanging with the T1 Western Line at St Mary.	Approved 23 July 2021. Construction is to commence in December 2022 and to be completed in late 2026 to coincide with the WSA

6 Evacuation

When conducting a flood assessment for a proposed development, it is crucial to consider evacuation routes to ensure the safety of residents and users. These routes must remain accessible during flood events, allowing everyone to reach safe locations promptly.

The development design includes an access road to Elizabeth Drive. While the site itself remains flood-free up to and including PMF events, allowing occupants to stay on-site during flood events without the need for evacuation, Elizabeth Drive can still serve as an evacuation route toward Northern Road. However, during a 1% AEP event, a section of Elizabeth Drive at the Cosgroves Creek crossing may be inundated with flood

depths of up to 100mm. Despite this, the hazard category is H1, indicating that the ponding is generally safe for people and vehicles to pass (as shown in Figure 31).

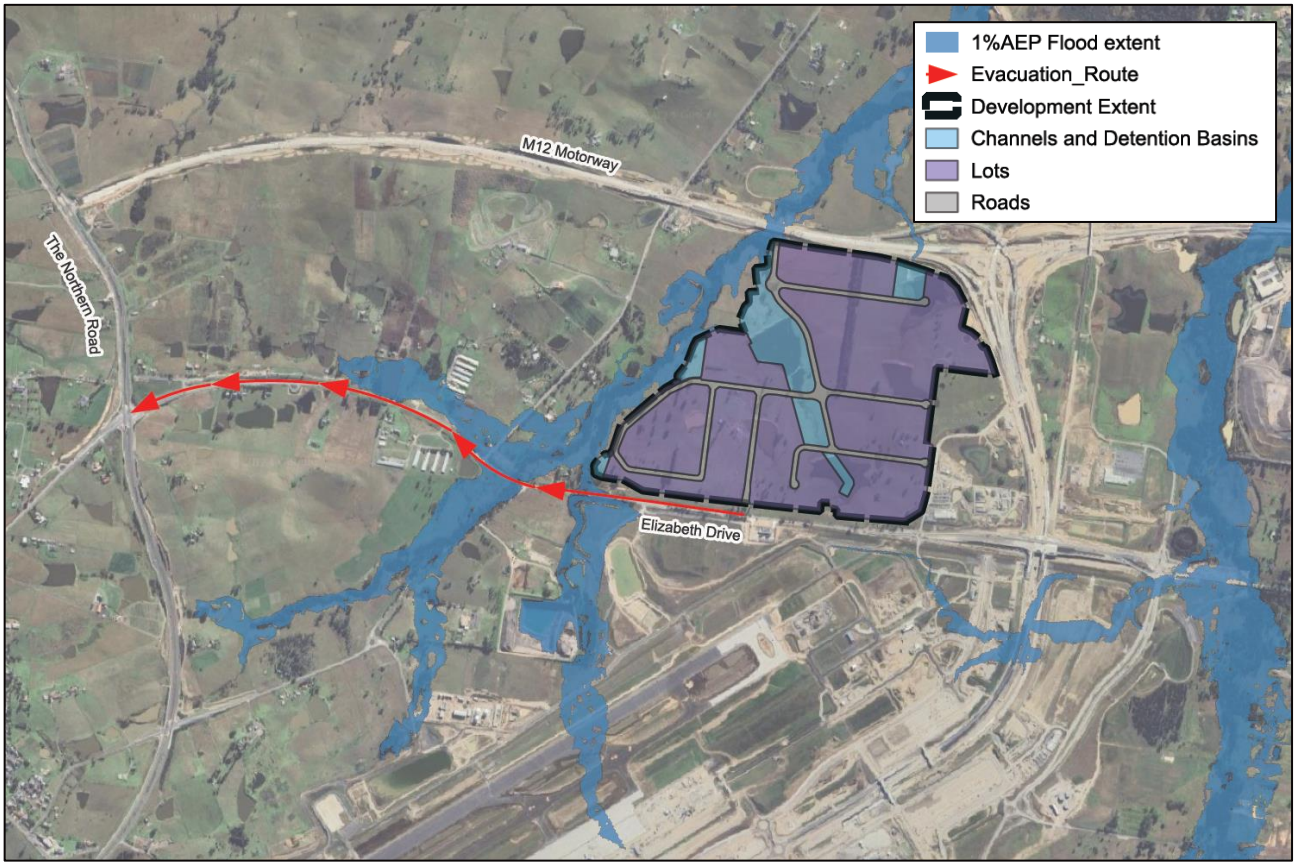


Figure 31 Evacuation Route for flood events up to 1%AEP event.

For flood events exceeding the 1% AEP event, such as the 0.2% AEP flood, Elizabeth Drive will experience increased flood depths, making it unsafe for small vehicles. During a PMF event, Elizabeth Drive will be fully flooded, leaving no viable evacuation routes to the east or west. Consequently, it is essential to either remain on-site until the flood event subsides or evacuate the site before the access route becomes impassable.

7 Conclusions and Recommendations

The flood assessment for the proposed development has comprehensively addressed the SEPP, Aerotropolis DCP, and SEARs requirements, ensuring that both the Stage 1 and overall site concept master plan approvals are well-supported.

- The assessment has evaluated existing conditions, mapping and analysing peak flood depths, levels, velocities, and hazard categories. It has been demonstrated that the development is primarily located outside the 1% AEP flood event, with minor encroachments into the PMF zone.
- The assessment has also evaluated post-development flood impacts for various flood events, including the 5% AEP, 1% AEP, and PMF, as well as climate change and cumulative impacts. It was concluded that impacts up to the 1% AEP event are minimal and localized, occurring directly adjacent to the proposed development embankment without affecting surrounding developments. During climate change events, peak flood levels in Cosgroves Creek are expected to decrease due to earlier peak flows from the development. While the PMF results in higher impacts, with potential increases of less than 150mm affecting properties west of Cosgroves Creek and the M12 Motorway, these impacts are not expected to be significant.
- The site remains flood-free up to and including PMF events, allowing occupants to stay on-site during flood events without the need for evacuation. If evacuation becomes necessary, Elizabeth Drive can serve as an evacuation route toward Northern Road for events up to and including the 1% AEP event. However, during a PMF event, Elizabeth Drive is expected to experience peak flood depths of up to 400mm, with a hazard category of H5, making it unsafe for both vehicles and people.

Overall, the assessment indicates that the proposed development, with the effective internal stormwater management measures incorporated in its design, is appropriate and results in minimal localised impacts. The findings of this assessment are comprehensive enough to support both the Stage 1 and the overall site concept master plan approvals, ensuring that the development meets both immediate and long-term flood management objectives.

Appendix A – Flood Maps

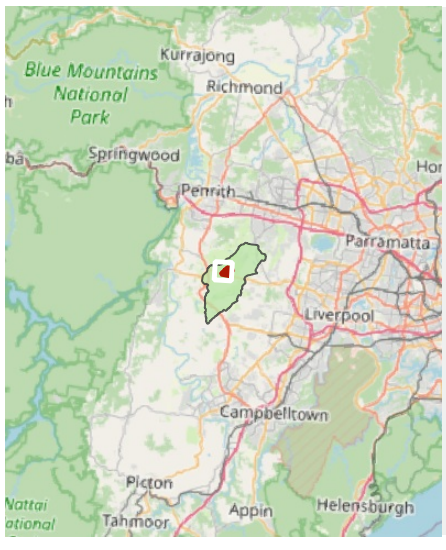
ARCADIS

Map by: Sepideh Jafari

Lot
Peak Flood Levels mAHD (0.2m Intervals)
Peak Flood Levels mAHD (1m Intervals)

Peak Flood Depths (m)

Band 1
- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- 1.8 - 2.2
- 2.2 - 2.6
- > 2.6



Notes:

0 300 600 m

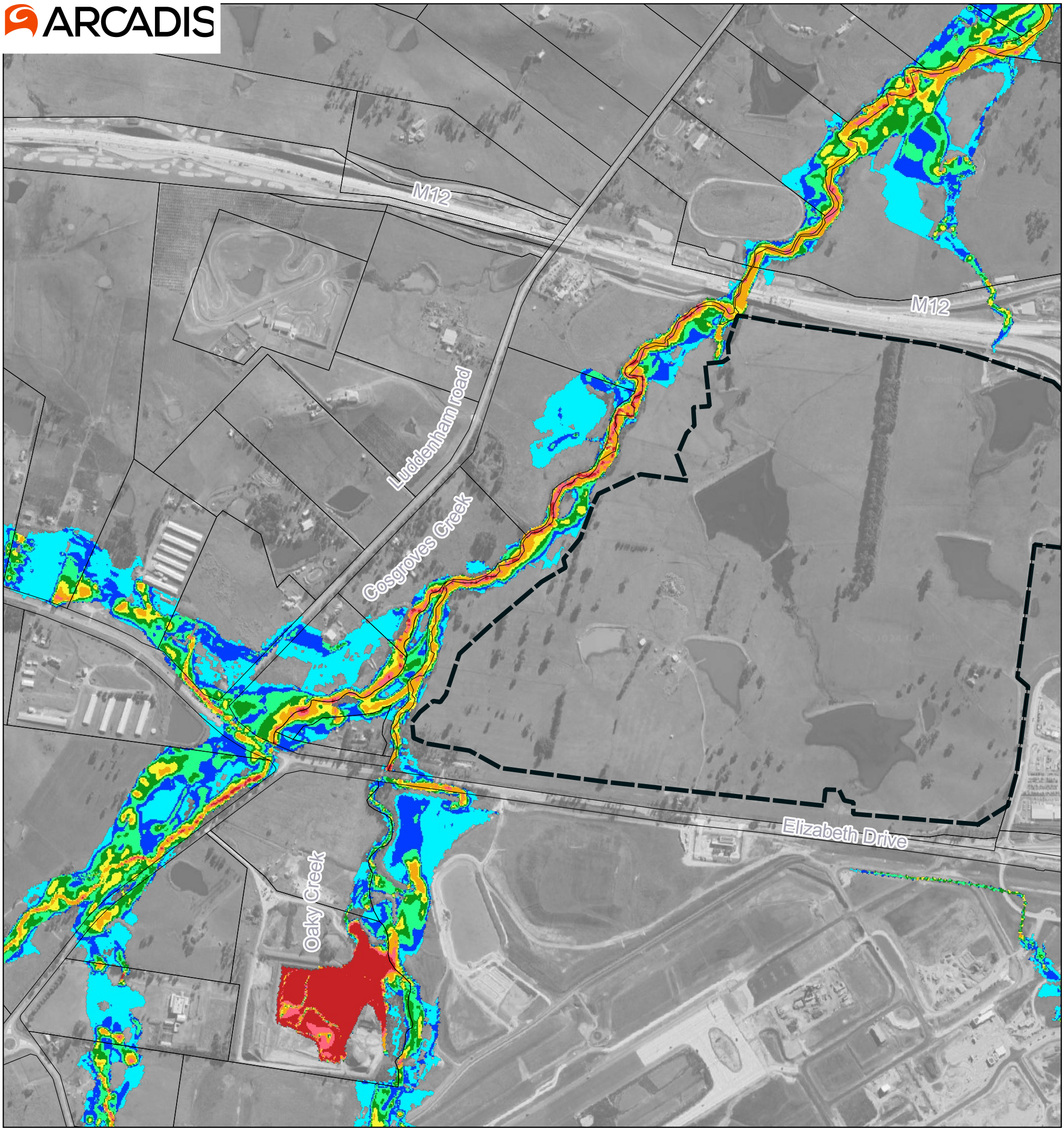
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Existing condition - 5%AEP Peak Flood Depths and Levels (Cosgroves Creek)

ARCADIS



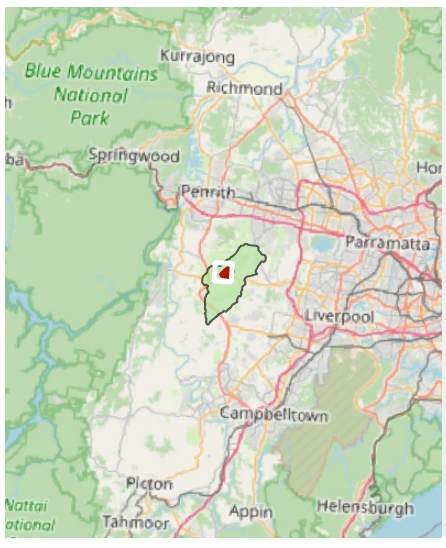
Map by: Sepideh Jafari

Lot

Peak Flood Velocities (m/s)

Band 1

- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- > 1.8



Notes:

0 300 600 m

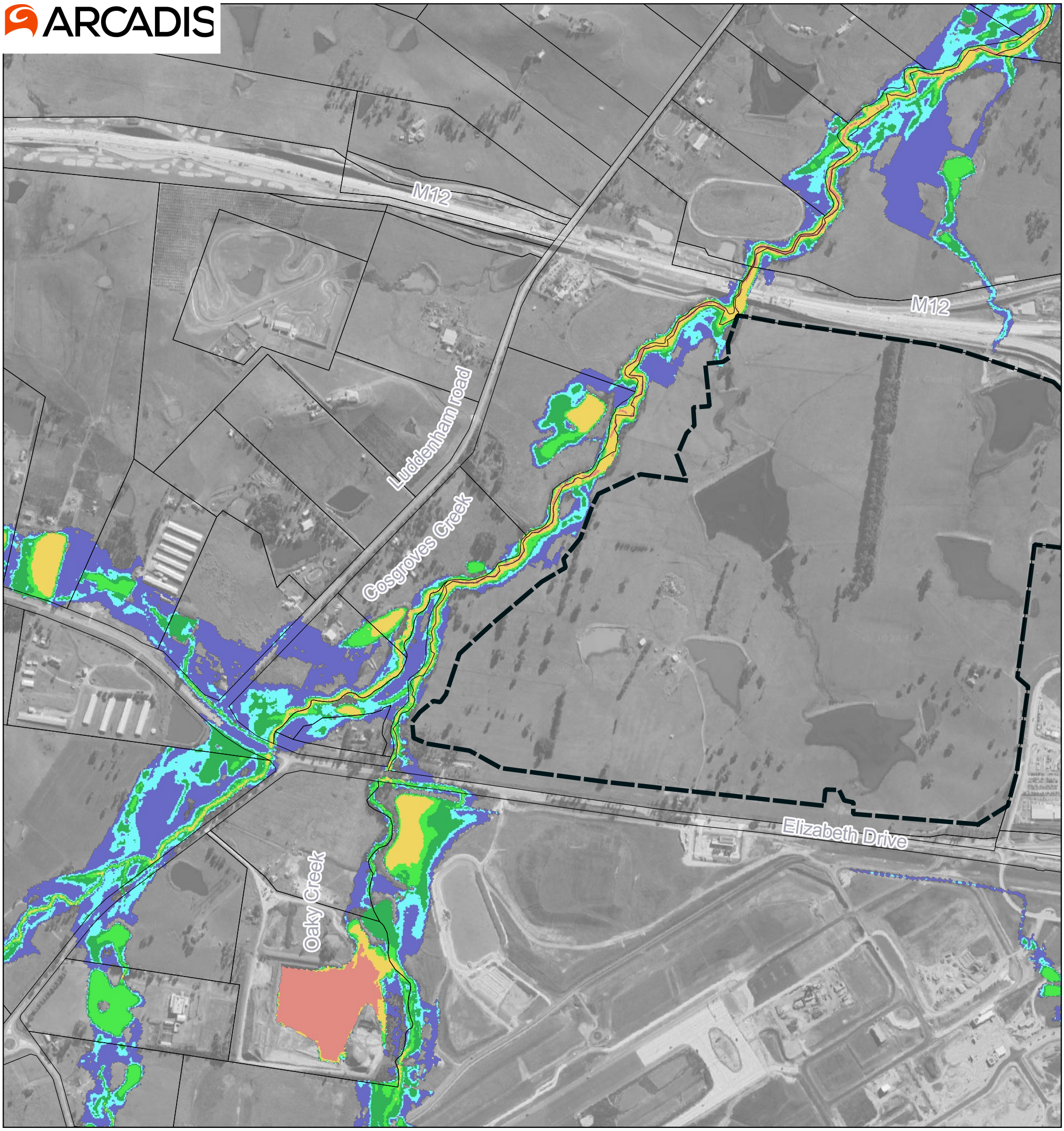
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Existing condition - 5%AEP Peak Flood Velocities (Cosgroves Creek)

ARCADIS



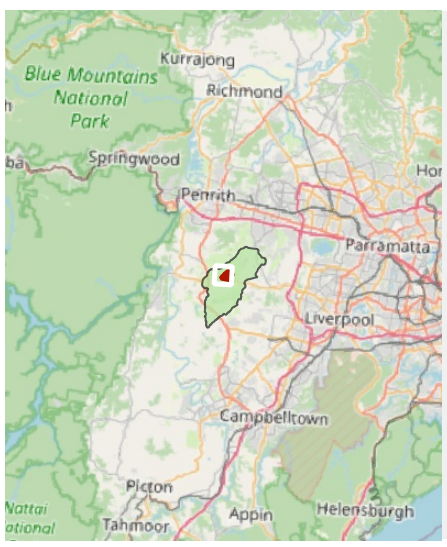
Map by: Sepideh Jafari

Lot

Peak Flood Hazard Categories

Band 1

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure



Notes:

0 300 600 m

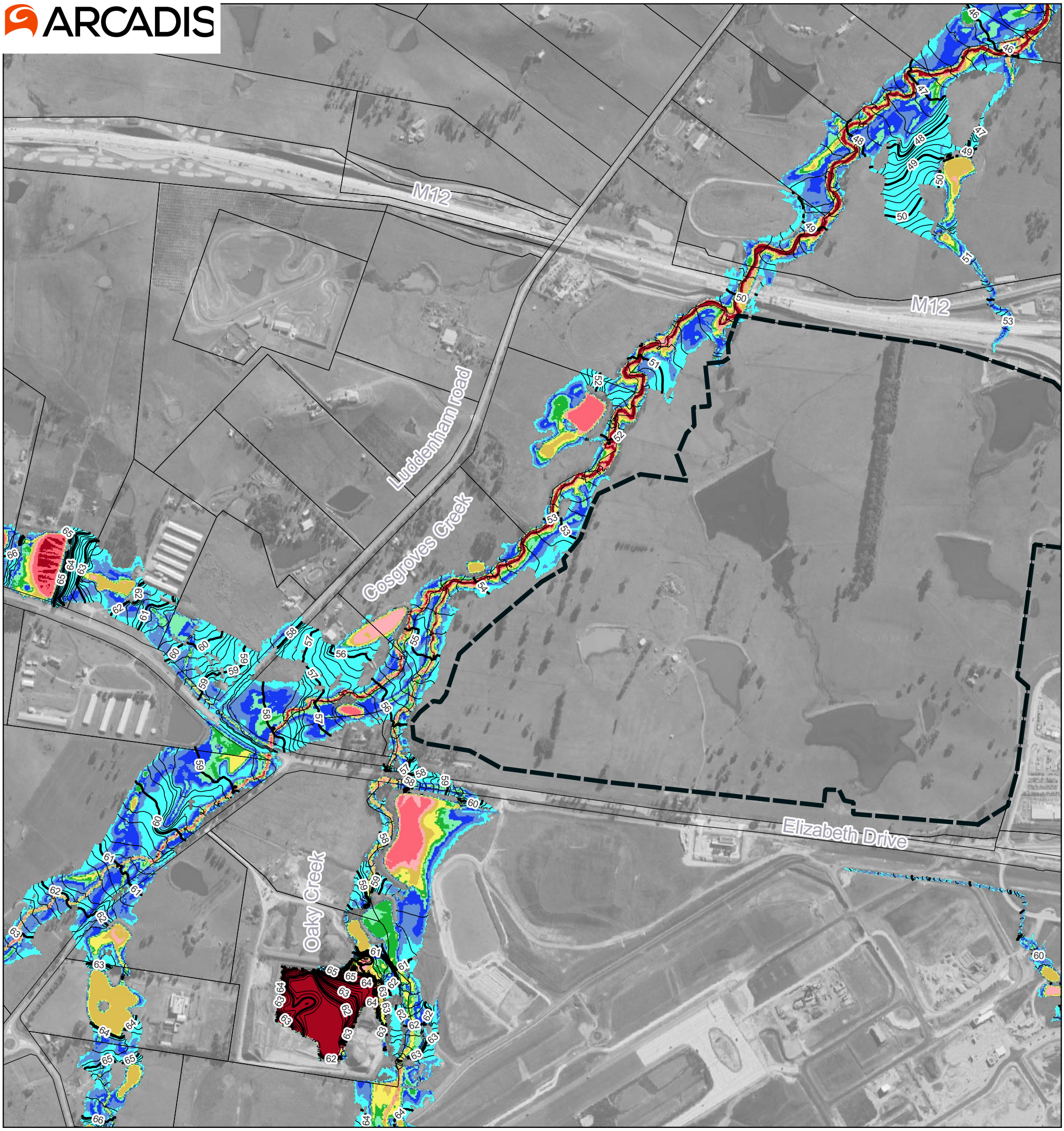
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Existing condition - 5%AEP Peak Flood Hazard Categories (Cosgroves Creek)

ARCADIS



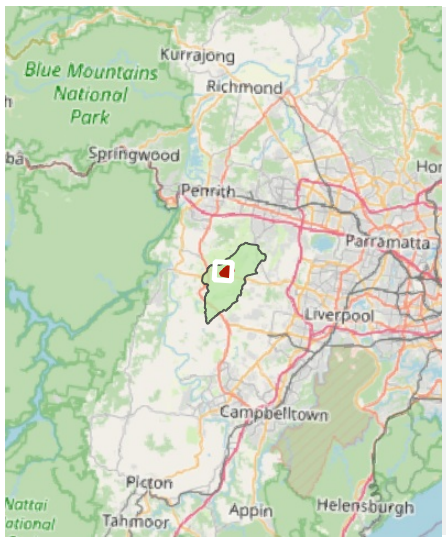
Map by: Sepideh Jafari

- Lot
- Peak Flood Levels mAHD (0.2m Intervals)
- Peak Flood Levels mAHD (1m Intervals)

Peak Flood Depths (m)

Band 1

- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- 1.8 - 2.2
- 2.2 - 2.6
- > 2.6



Notes:

0 300 600 m

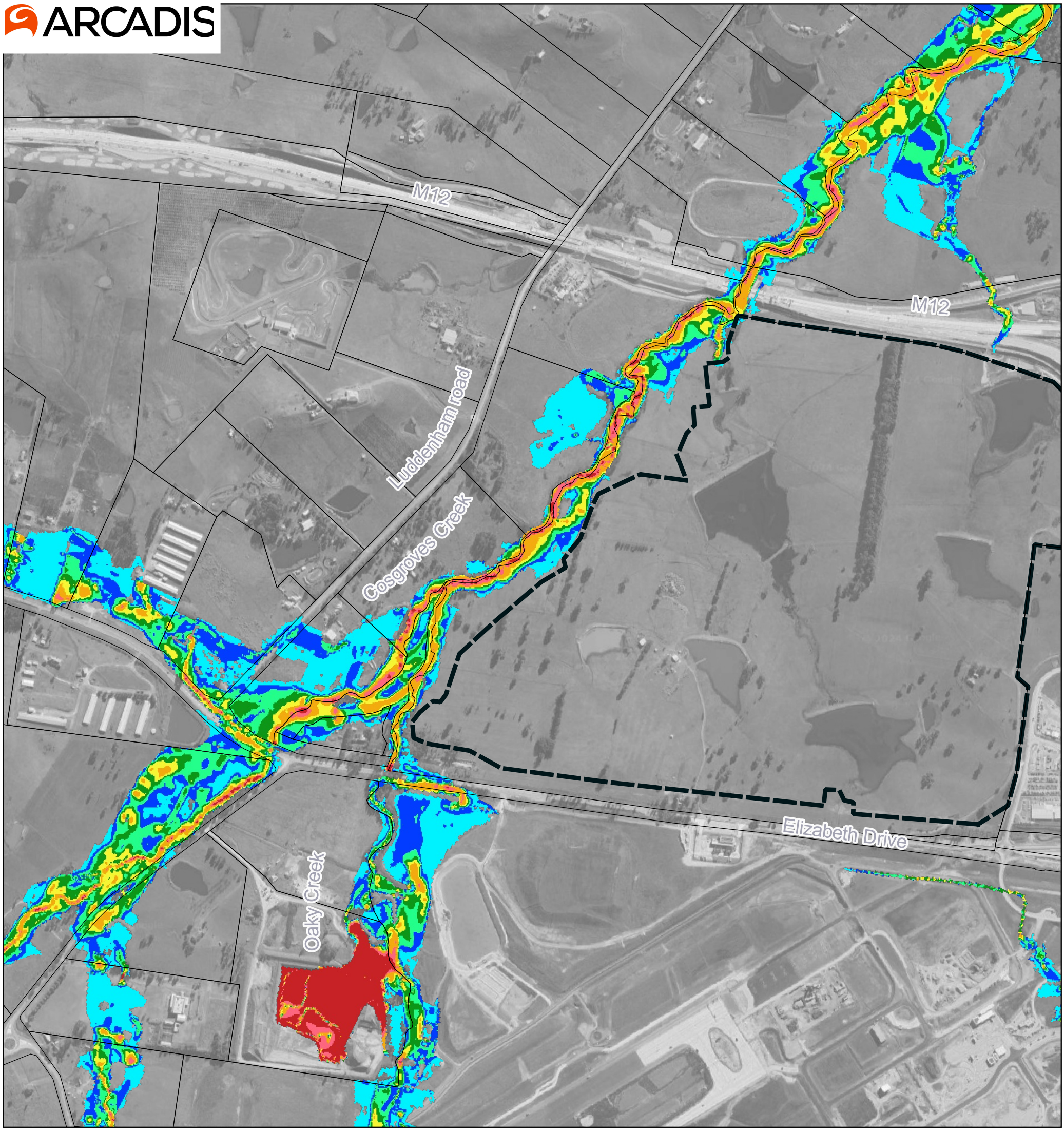
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Existing condition - 2%AEP Peak Flood Depths and Levels (Cosgroves Creek)

ARCADIS



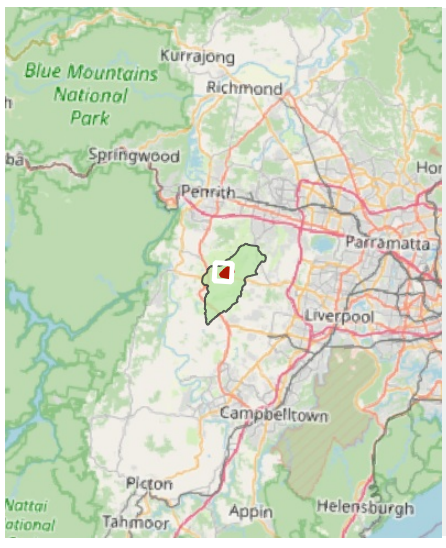
Map by: Sepideh Jafari

Lot

Peak Flood Velocities (m/s)

Band 1

- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- > 1.8



Notes:

0 300 600 m

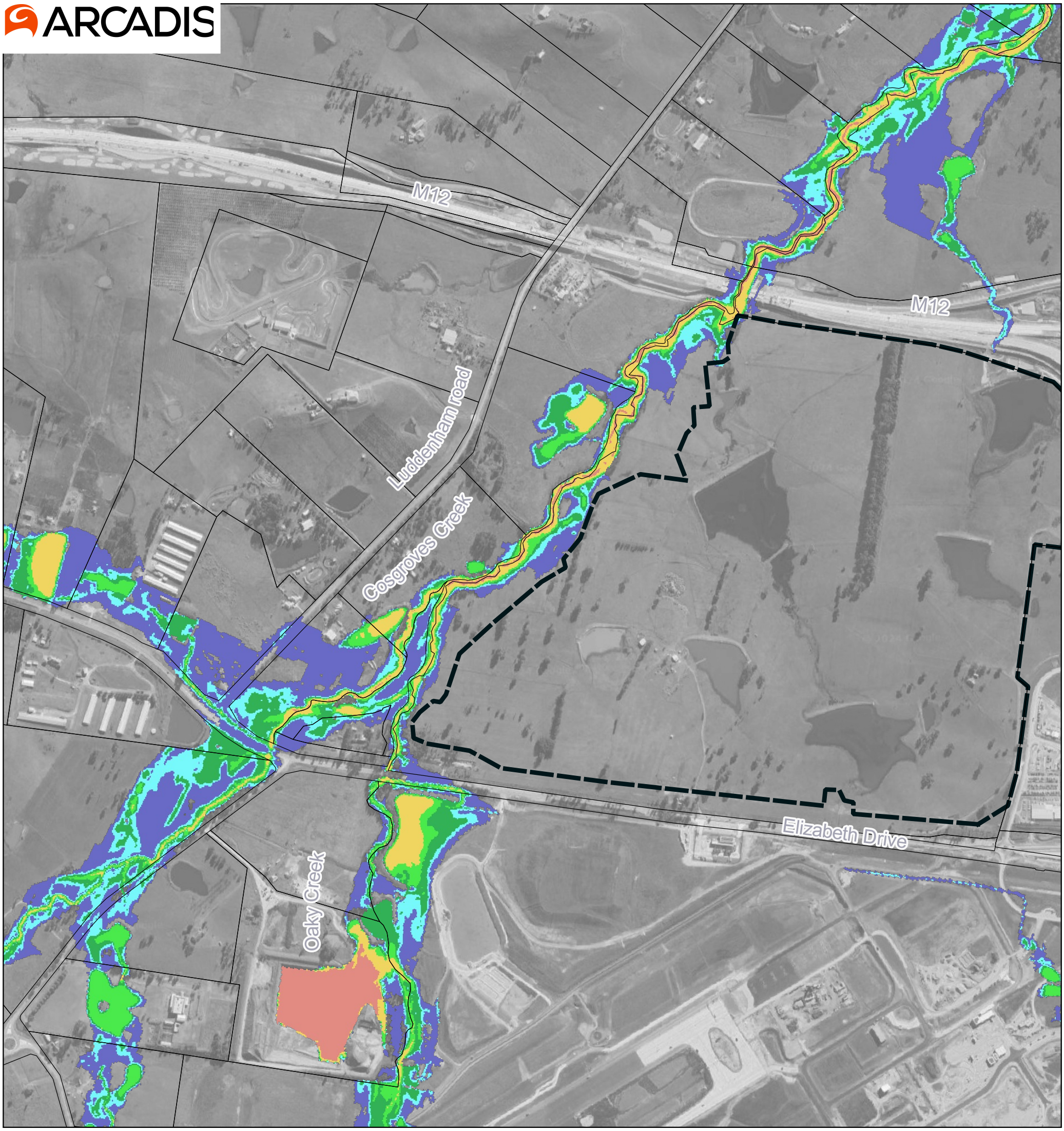
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Existing condition - 2%AEP Peak Flood Velocities (Cosgroves Creek)

ARCADIS



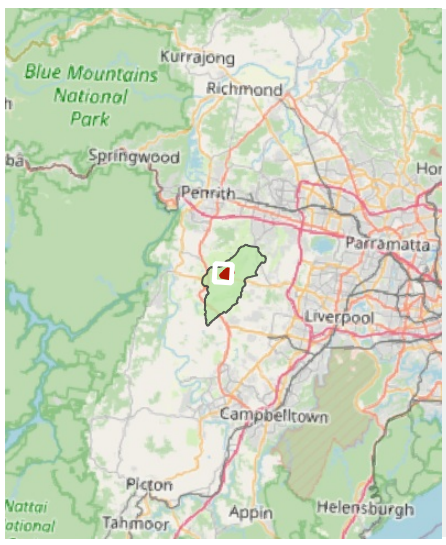
Map by: Sepideh Jafari

Lot

Peak Flood Hazard Categories

Band 1

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure



Notes:

0 300 600 m

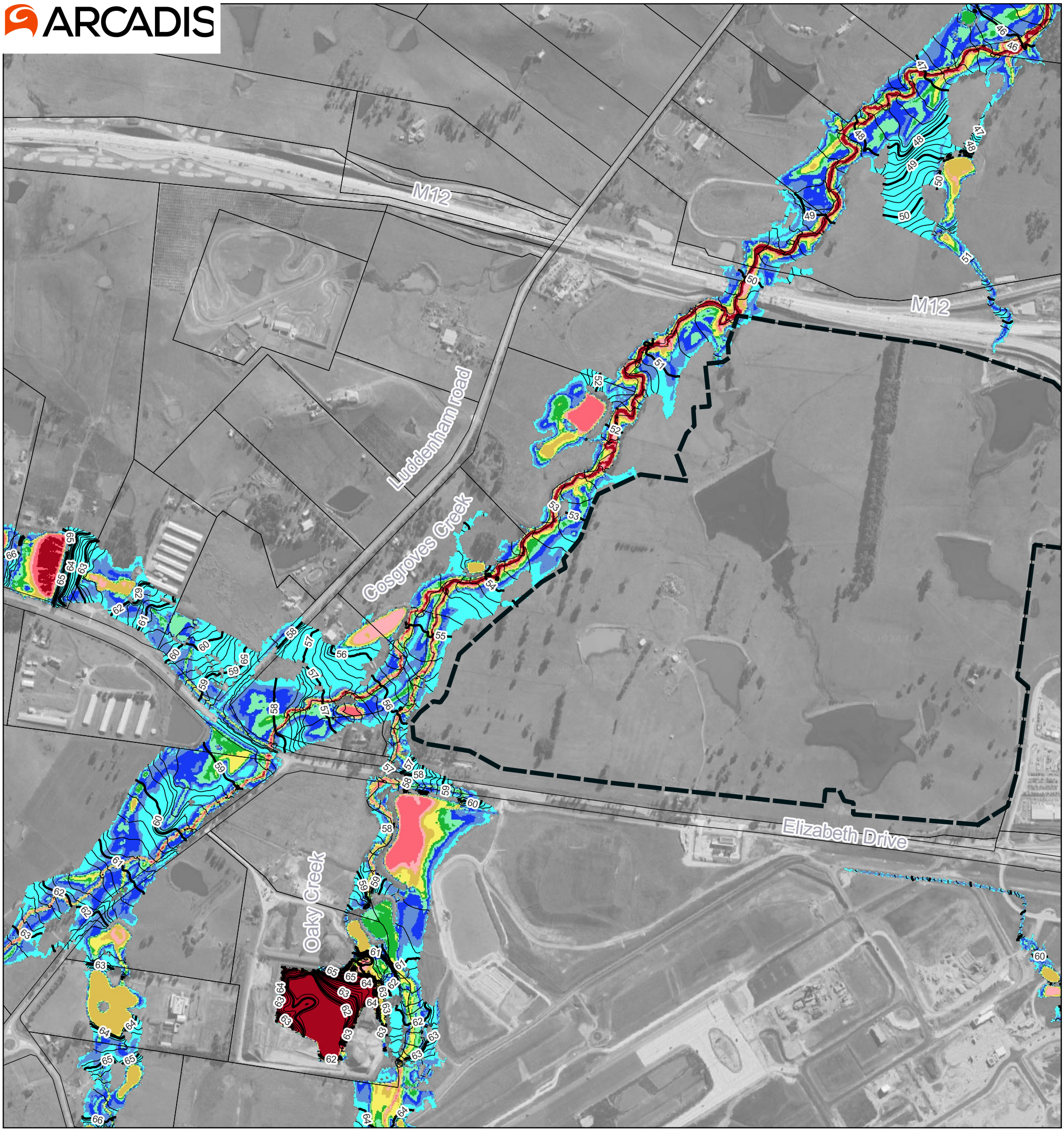
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Existing condition - 2%AEP Peak Flood Hazard Categories (Cosgroves Creek)

ARCADIS

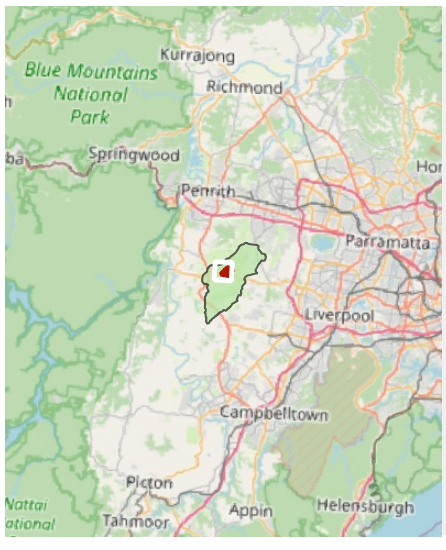


Map by: Sepideh Jafari

Lot
Peak Flood Levels mAHD (0.2m Intervals)
Peak Flood Levels mAHD (1m Intervals)

Peak Flood Depths (m)

Band 1
- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- 1.8 - 2.2
- 2.2 - 2.6
- > 2.6



Notes:

0 300 600 m

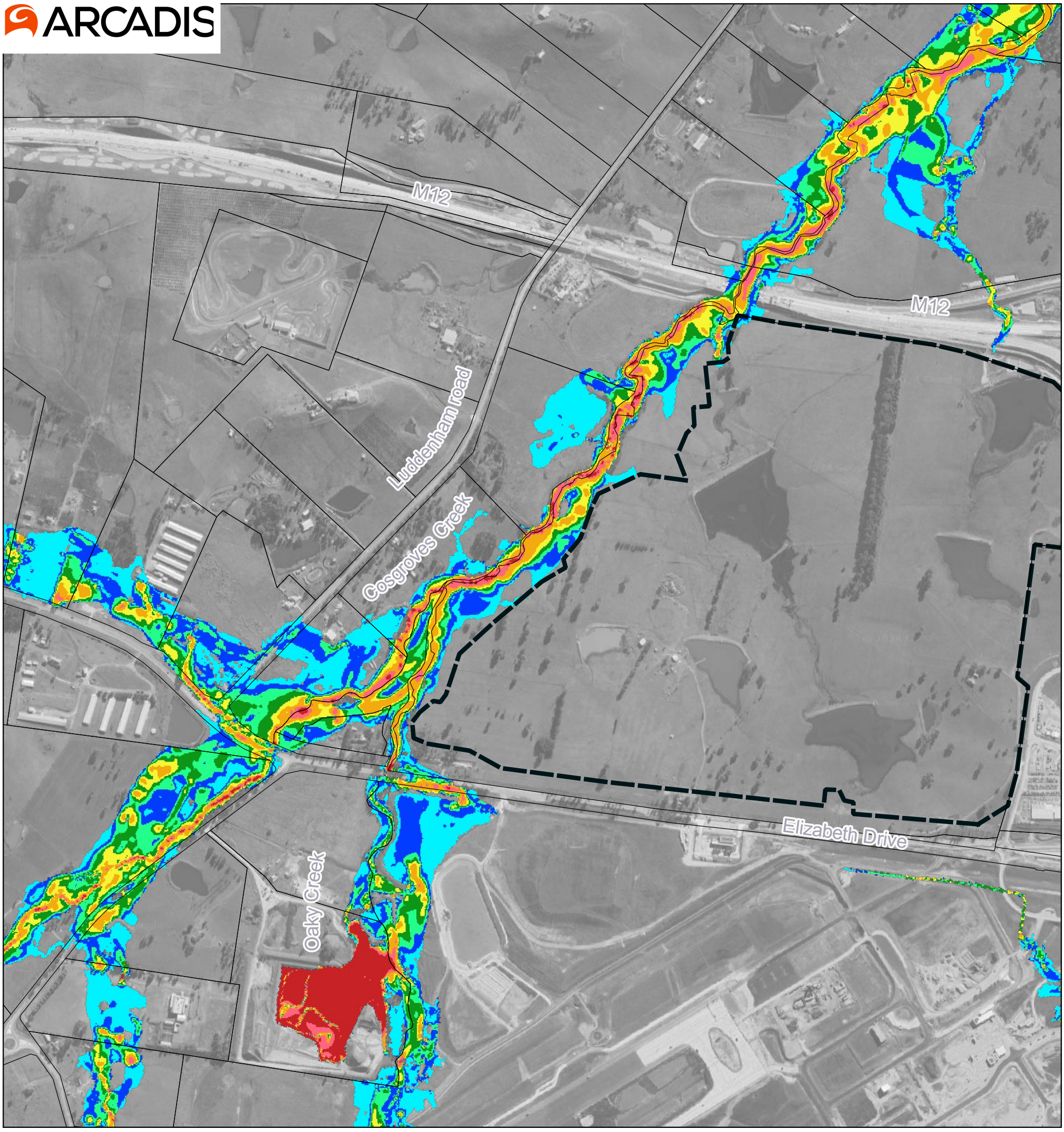
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Existing condition - 1%AEP Peak Flood Depths and Levels (Cosgroves Creek)

ARCADIS



Map by: Sepideh Jafari

Lot

Peak Flood Velocities (m/s)

Band 1

- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- > 1.8

Notes:

0 300 600 m

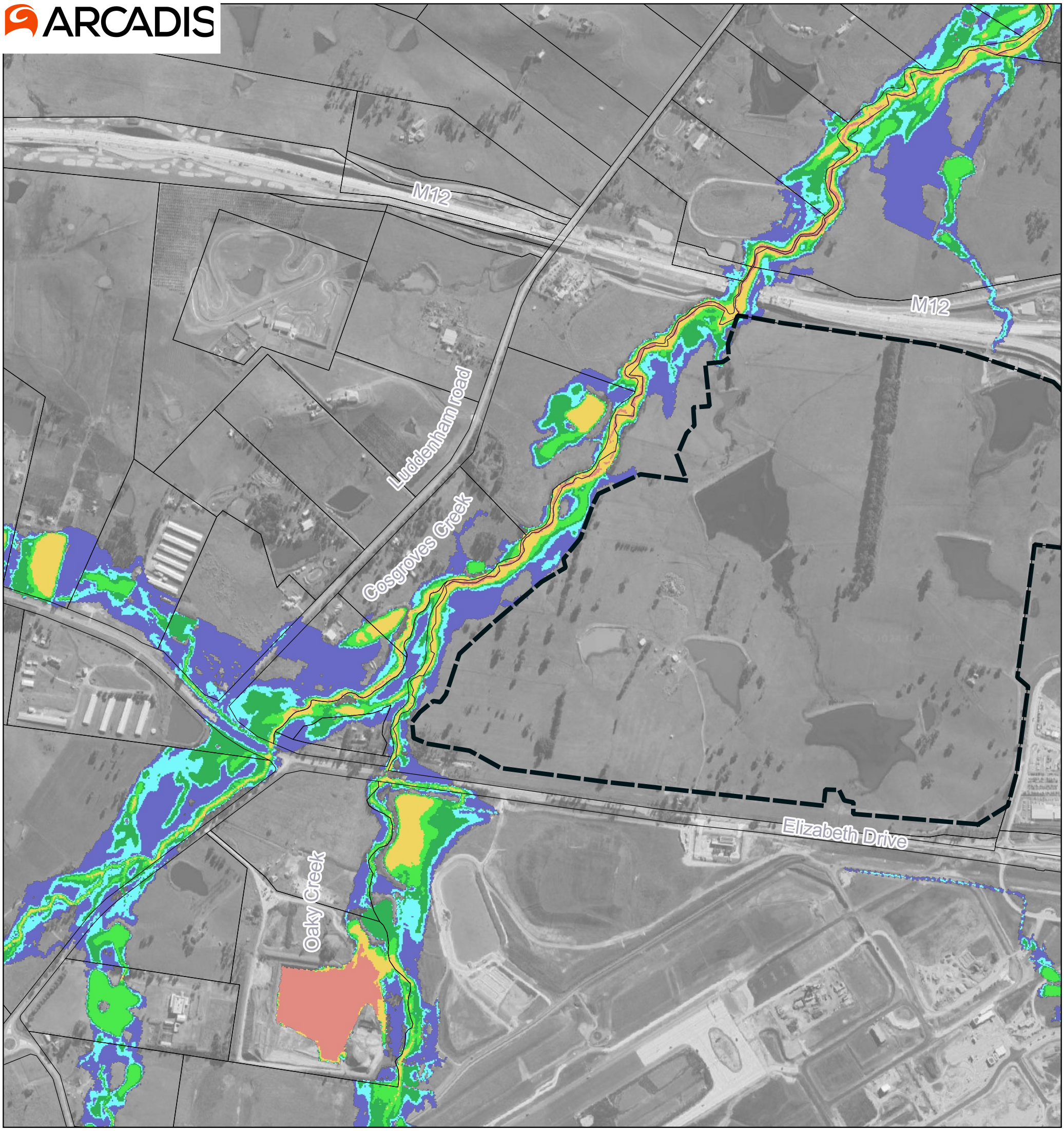
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Existing condition - 1%AEP Peak Flood Velocities (Cosgroves Creek)

ARCADIS



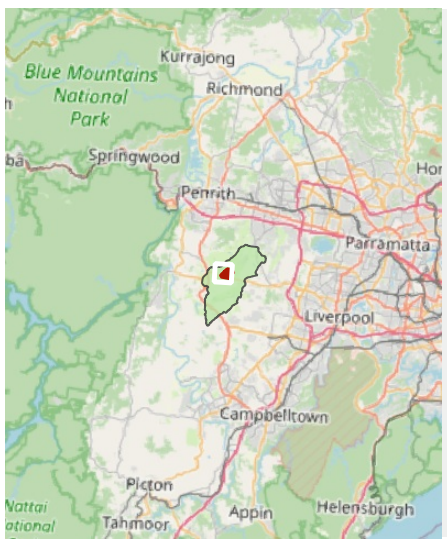
Map by: Sepideh Jafari

Lot

Peak Flood Hazard Categories

Band 1

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure



Notes:

0 300 600 m

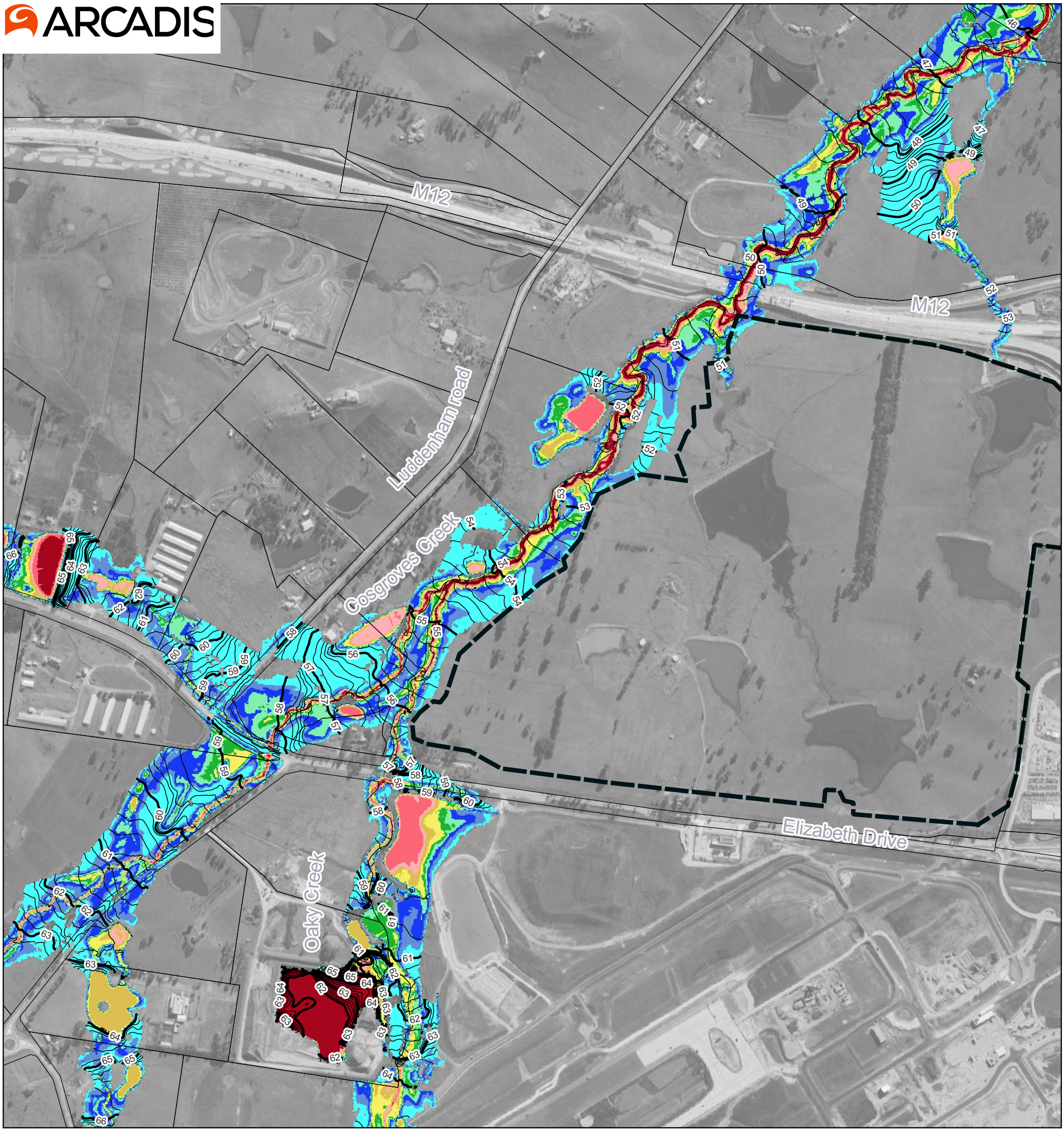
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Existing condition - 1%AEP Peak Flood Hazard Categories (Cosgroves Creek)

ARCADIS

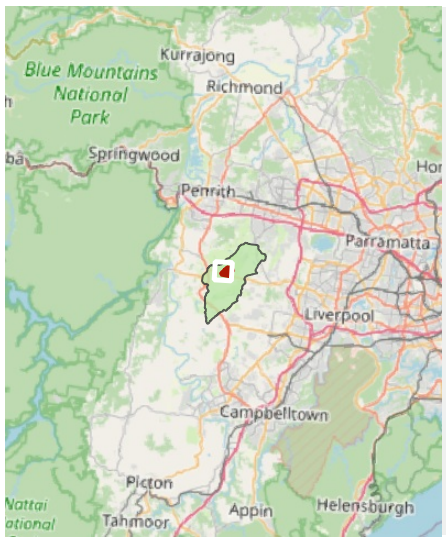


Map by: Sepideh Jafari

Lot
Peak Flood Levels mAHD (0.2m Intervals)
Peak Flood Levels mAHD (1m Intervals)

Peak Flood Depths (m)

Band 1
- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- 1.8 - 2.2
- 2.2 - 2.6
- > 2.6



Notes:

0 300 600 m

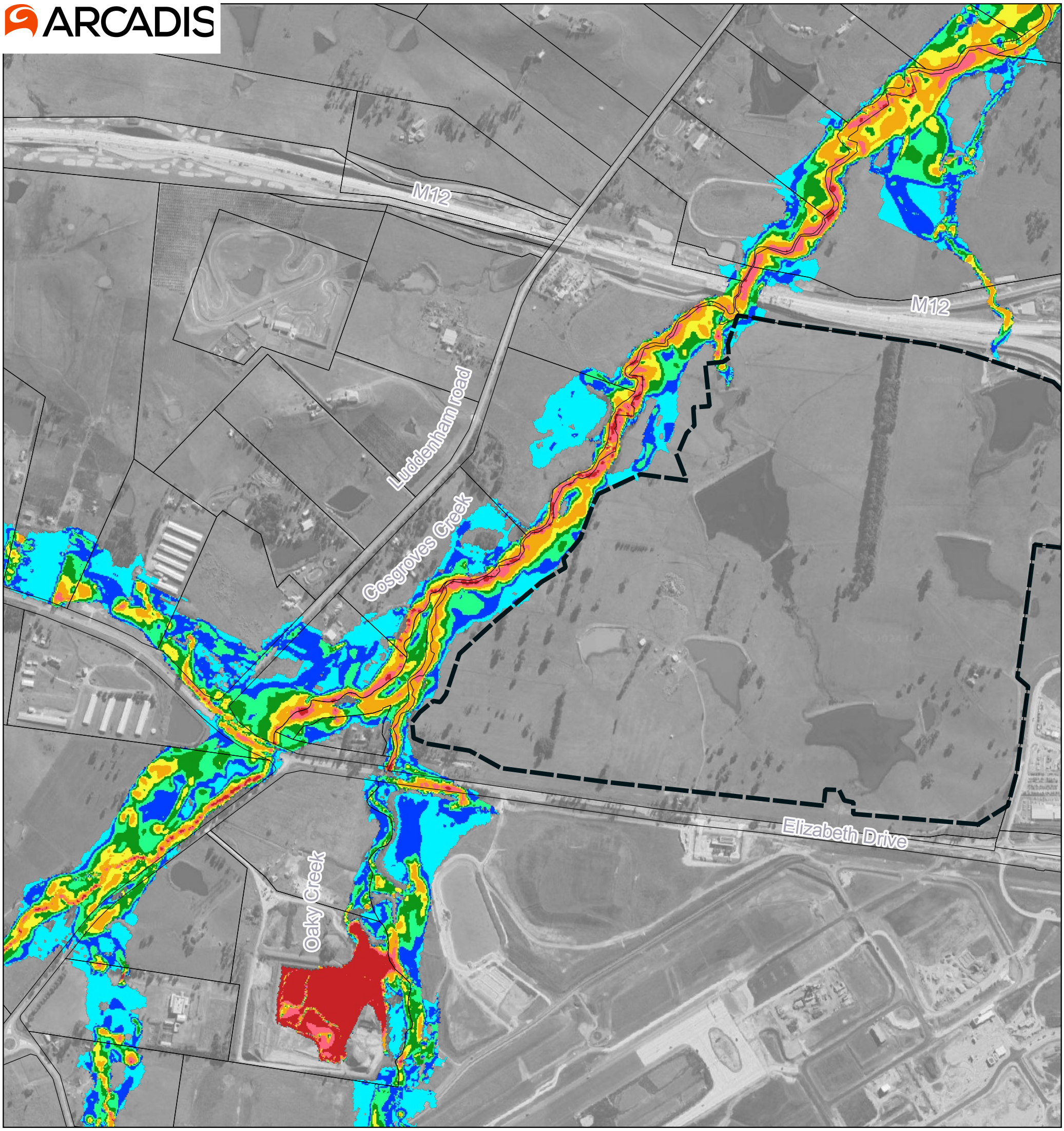
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Existing condition - 0.5%AEP Peak Flood Depths and Levels (Cosgroves Creek)

ARCADIS



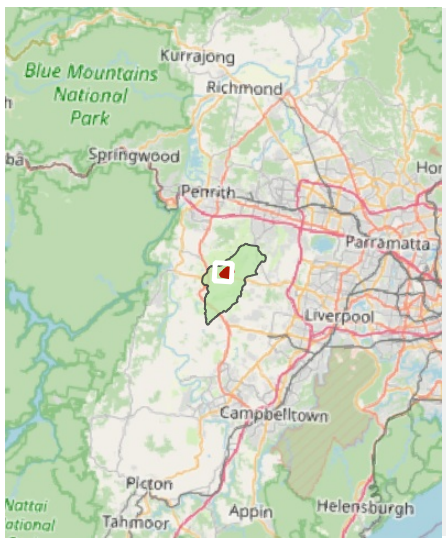
Map by: Sepideh Jafari

Lot

Peak Flood Velocities (m/s)

Band 1

- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- > 1.8



Notes:

0 300 600 m

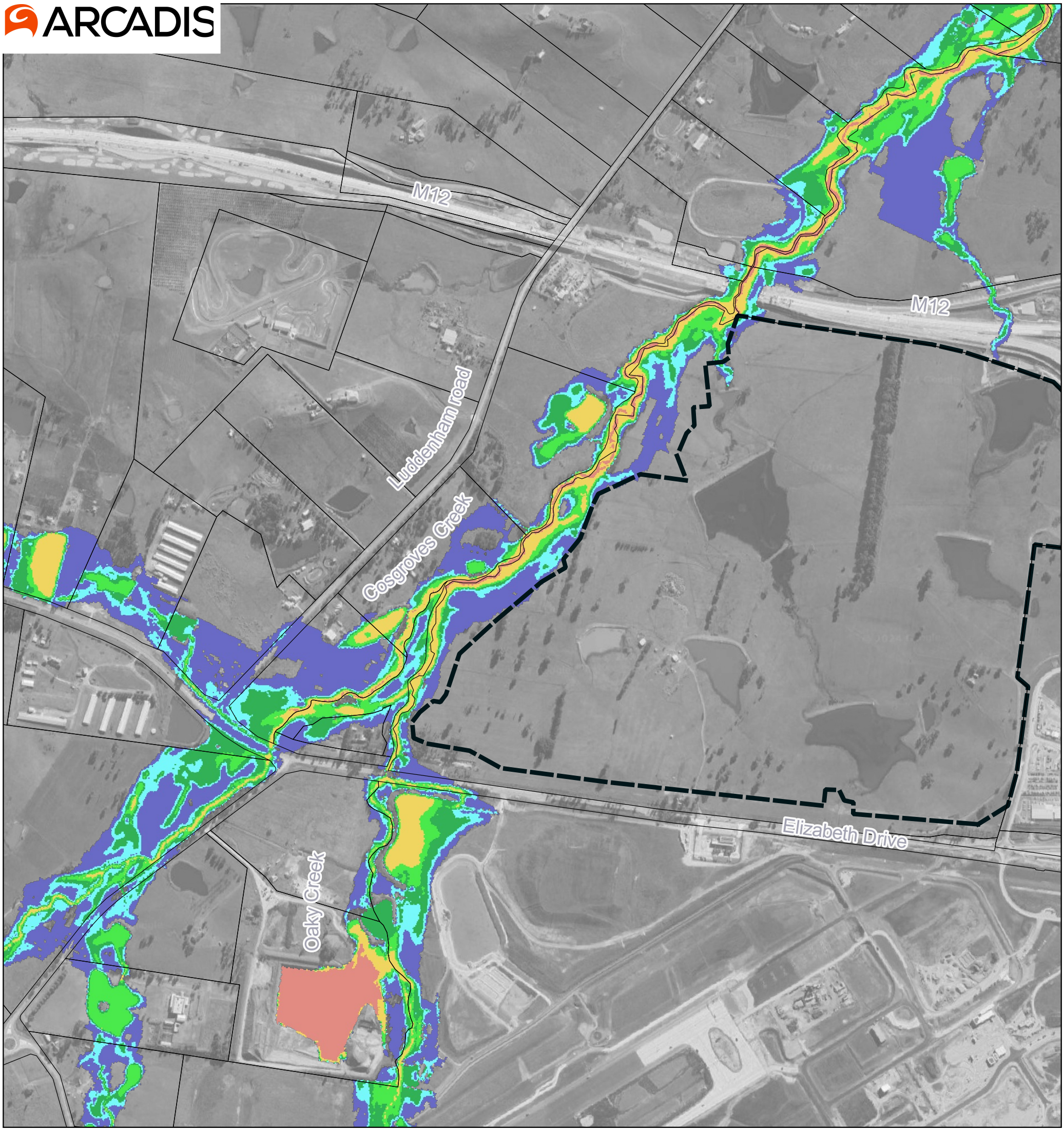
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Existing condition - 0.5%AEP Peak Flood Velocities (Cosgroves Creek)

ARCADIS



Map by: Sepideh Jafari

Lot

Peak Flood Hazard Categories

Band 1

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

0 300 600 m

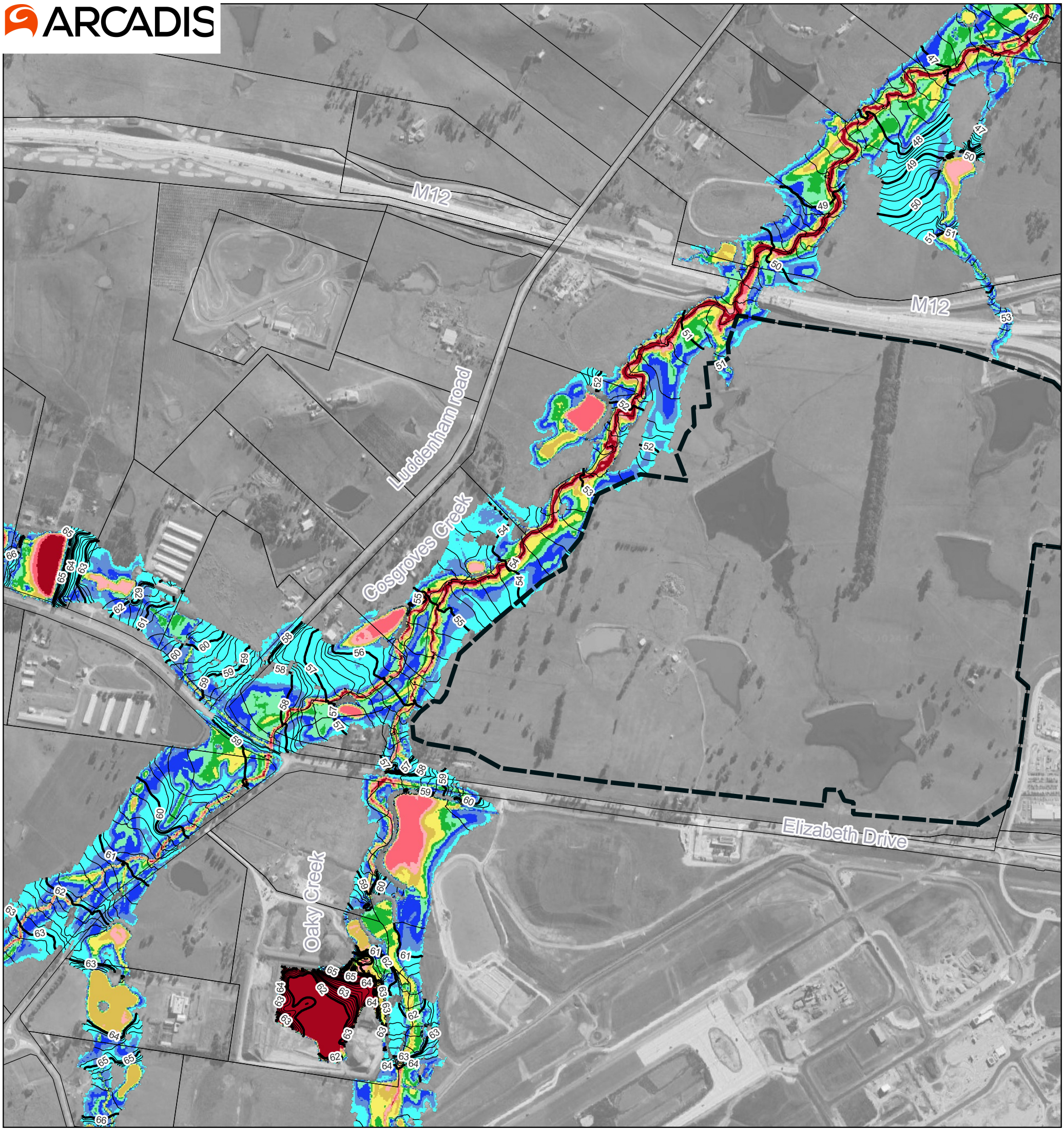
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Existing condition - 0.5%AEP Peak Flood Hazard Categories (Cosgroves Creek)

ARCADIS



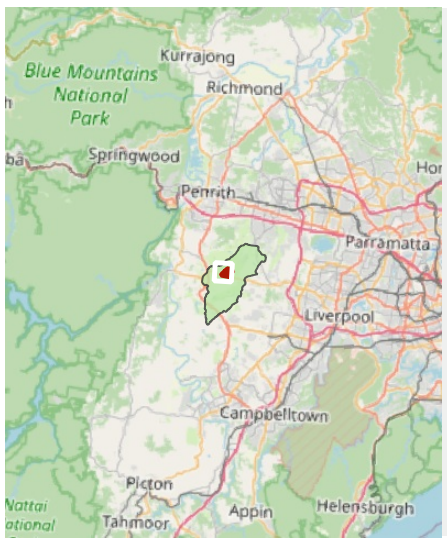
Map by: Sepideh Jafari

- Lot
- Peak Flood Levels mAHD (0.2m Intervals)
- Peak Flood Levels mAHD (1m Intervals)

Peak Flood Depths (m)

Band 1

- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- 1.8 - 2.2
- 2.2 - 2.6
- > 2.6



Notes:

0 300 600 m

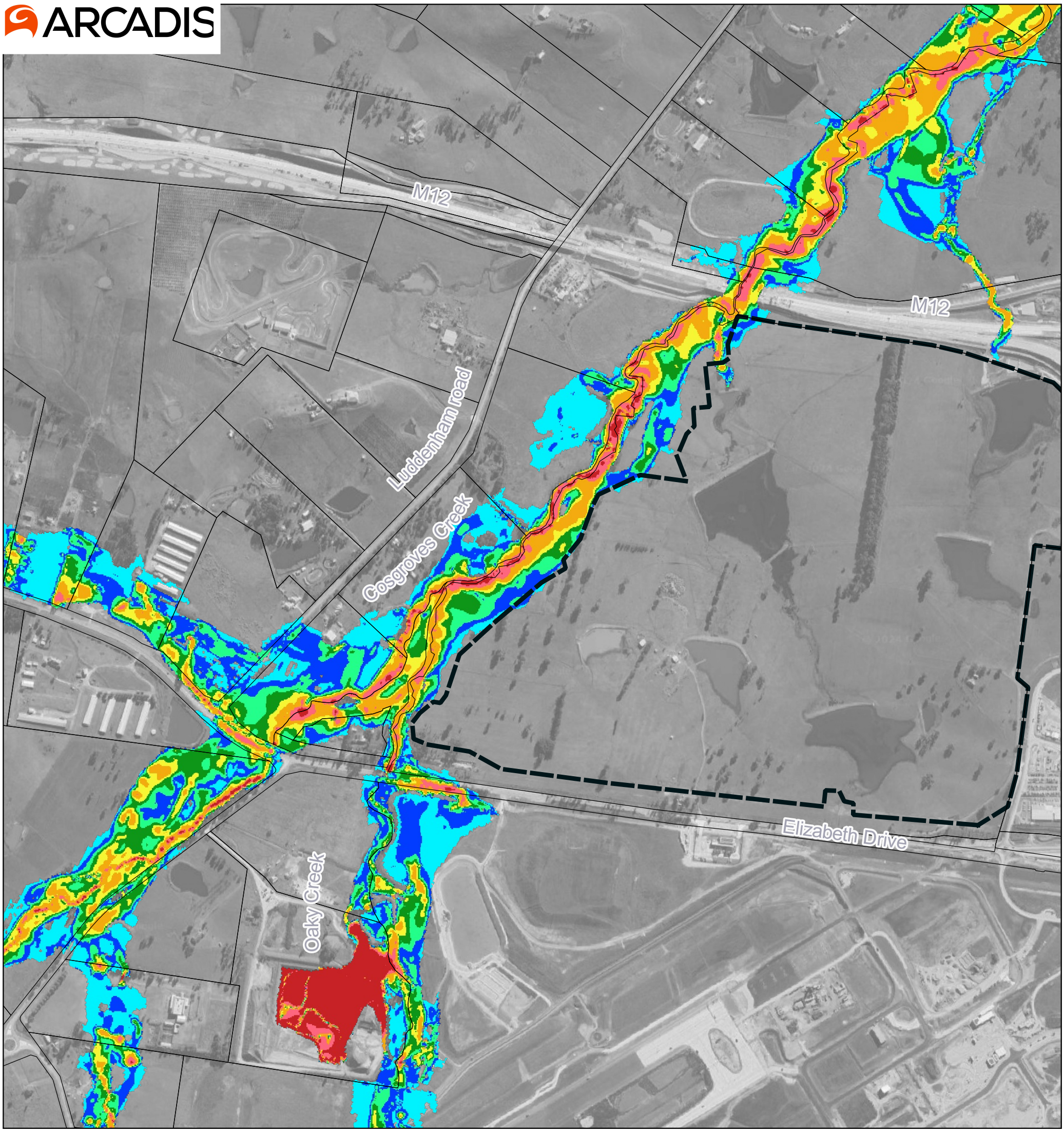
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Existing condition - 0.2%AEP Peak Flood Depths and Levels (Cosgroves Creek)

ARCADIS



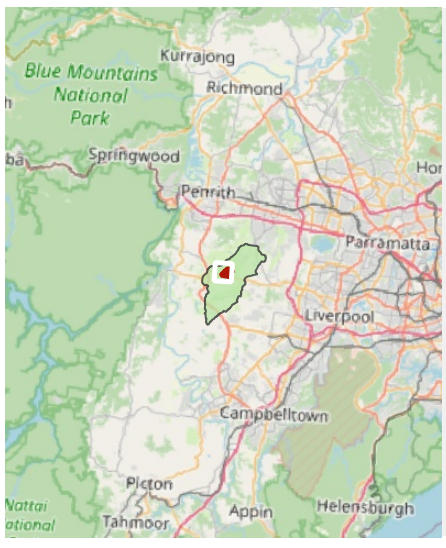
Map by: Sepideh Jafari

Lot

Peak Flood Velocities (m/s)

Band 1

- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- > 1.8



Notes:

0 300 600 m

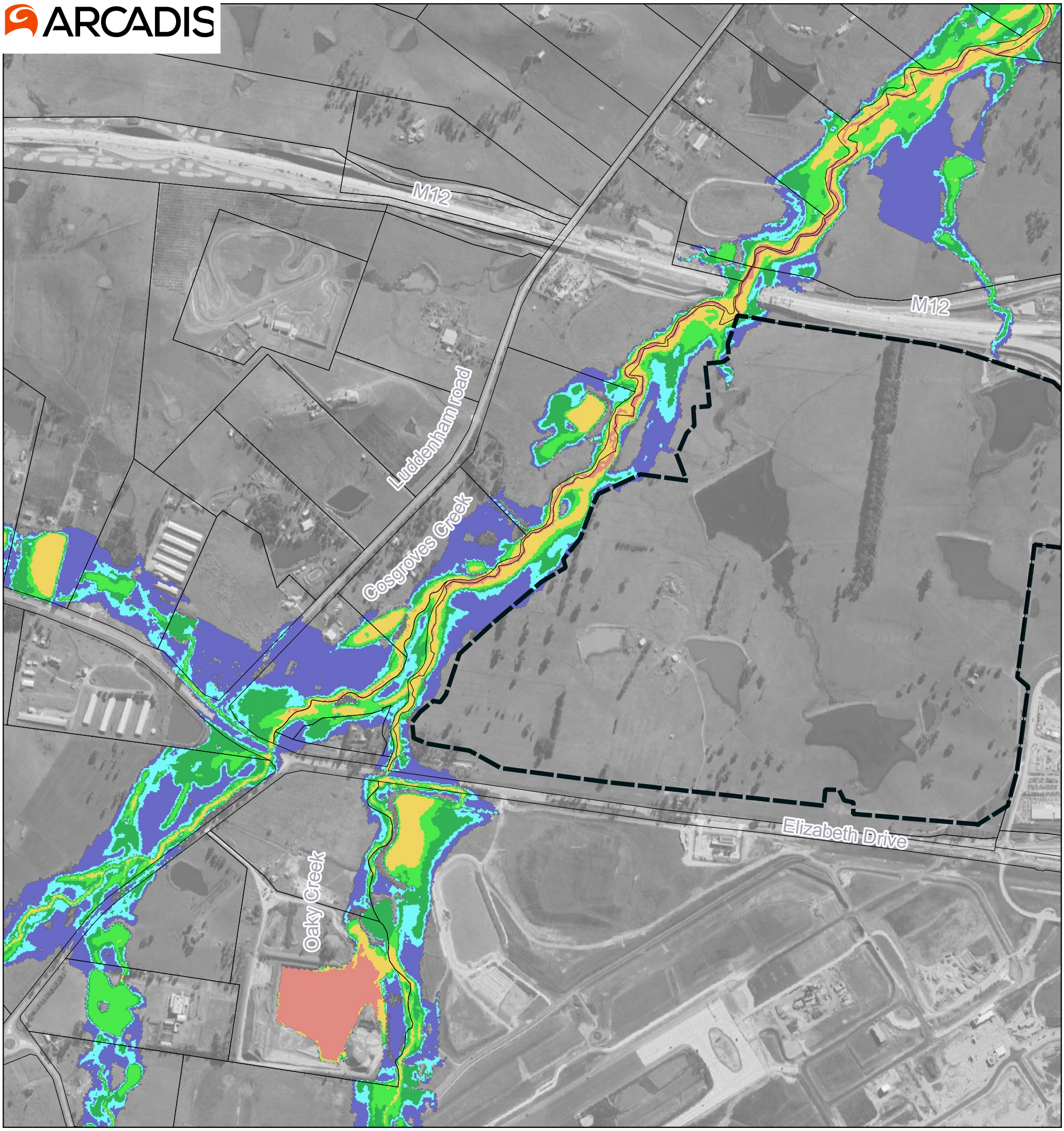
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Existing condition - 0.2%AEP Peak Flood Velocities (Cosgroves Creek)

ARCADIS



Map by: Sepideh Jafari

Lot

Peak Flood Hazard Categories

Band 1

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

0 300 600 m

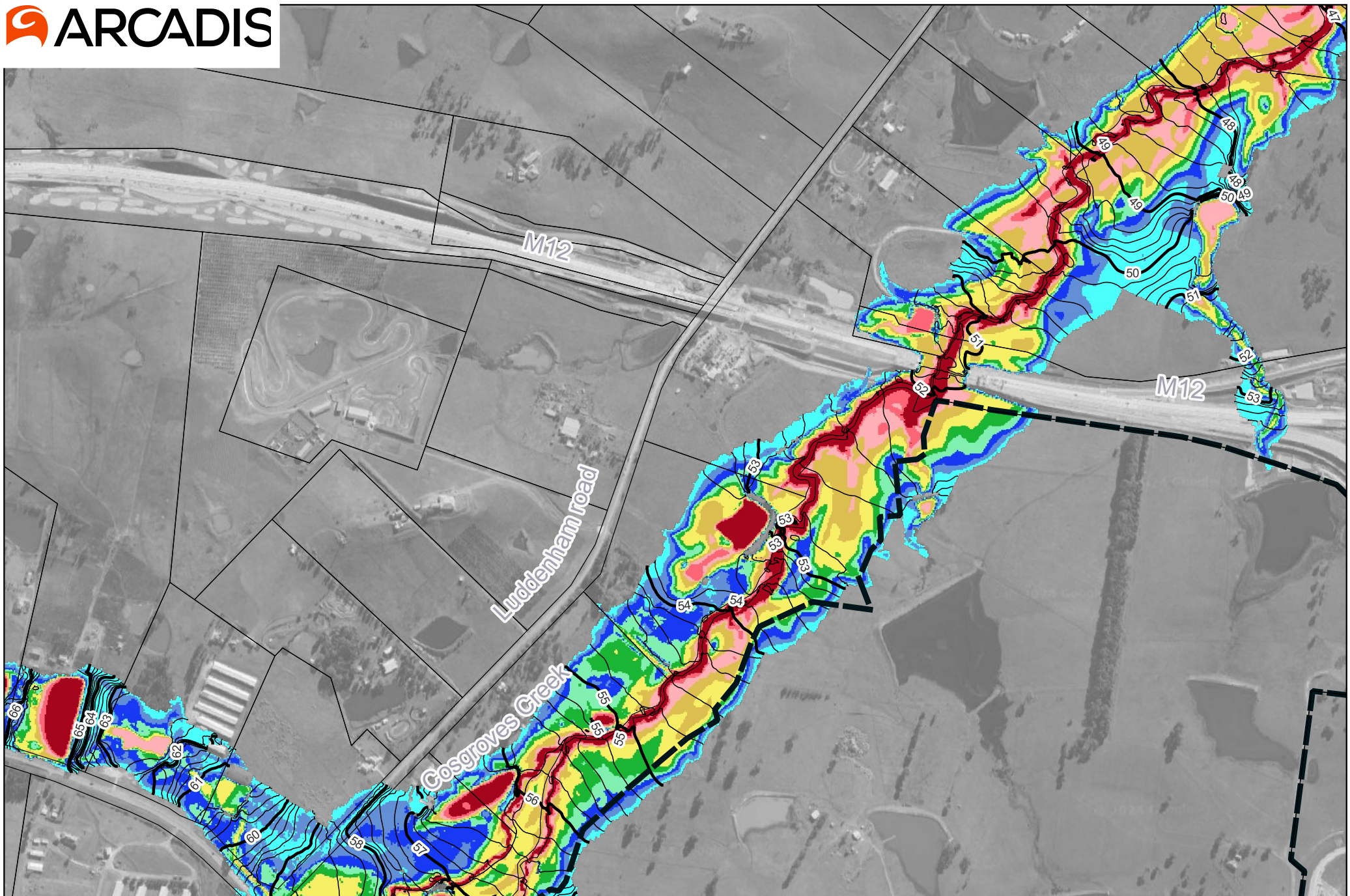
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Existing condition - 0.2%AEP Peak Flood Hazard Categories (Cosgroves Creek)

ARCADIS

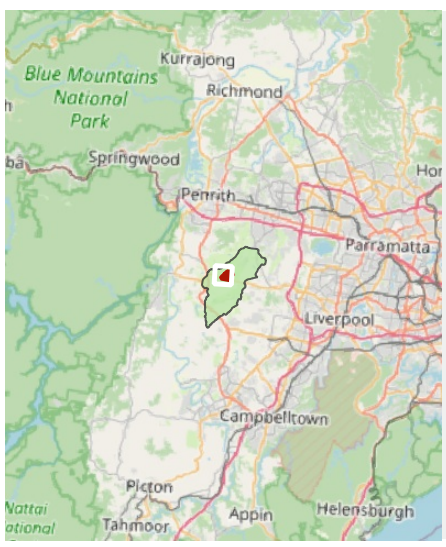


Map by: Sepideh Jafari

Lot
Peak Flood Levels mAHD (0.2m Intervals)
Peak Flood Levels mAHD (1m Intervals)

Peak Flood Depths (m)

Band 1
<= 0.2
0.2 - 0.4
0.4 - 0.6
0.6 - 0.8
0.8 - 1.0
1.0 - 1.4
1.4 - 1.8
1.8 - 2.2
2.2 - 2.6
> 2.6



Notes:

0 300 600 m

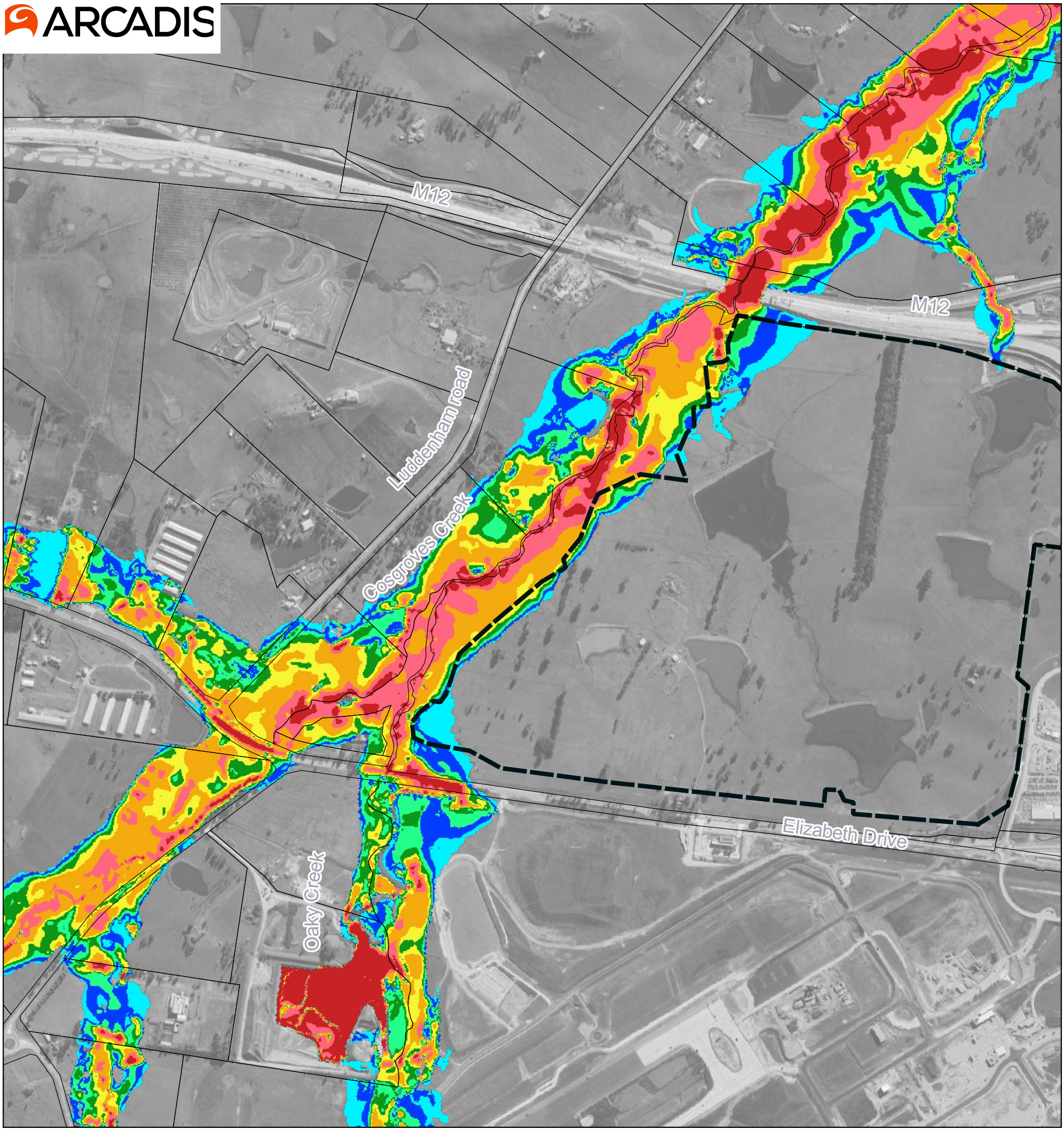
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Existing condition - PMF Peak Flood Depths and Levels (Cosgroves Creek)

ARCADIS



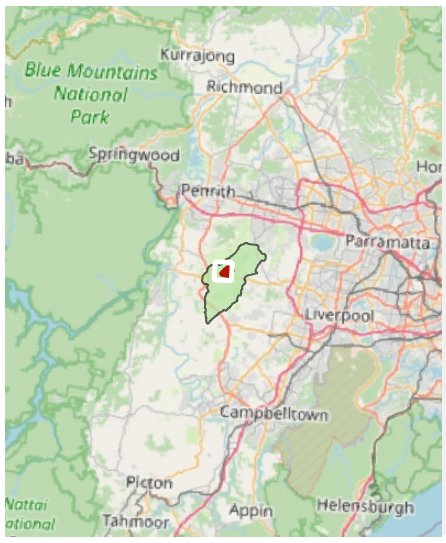
Map by: Sepideh Jafari

Lot

Peak Flood Velocities (m/s)

Band 1

- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- > 1.8



Notes:

0 300 600 m

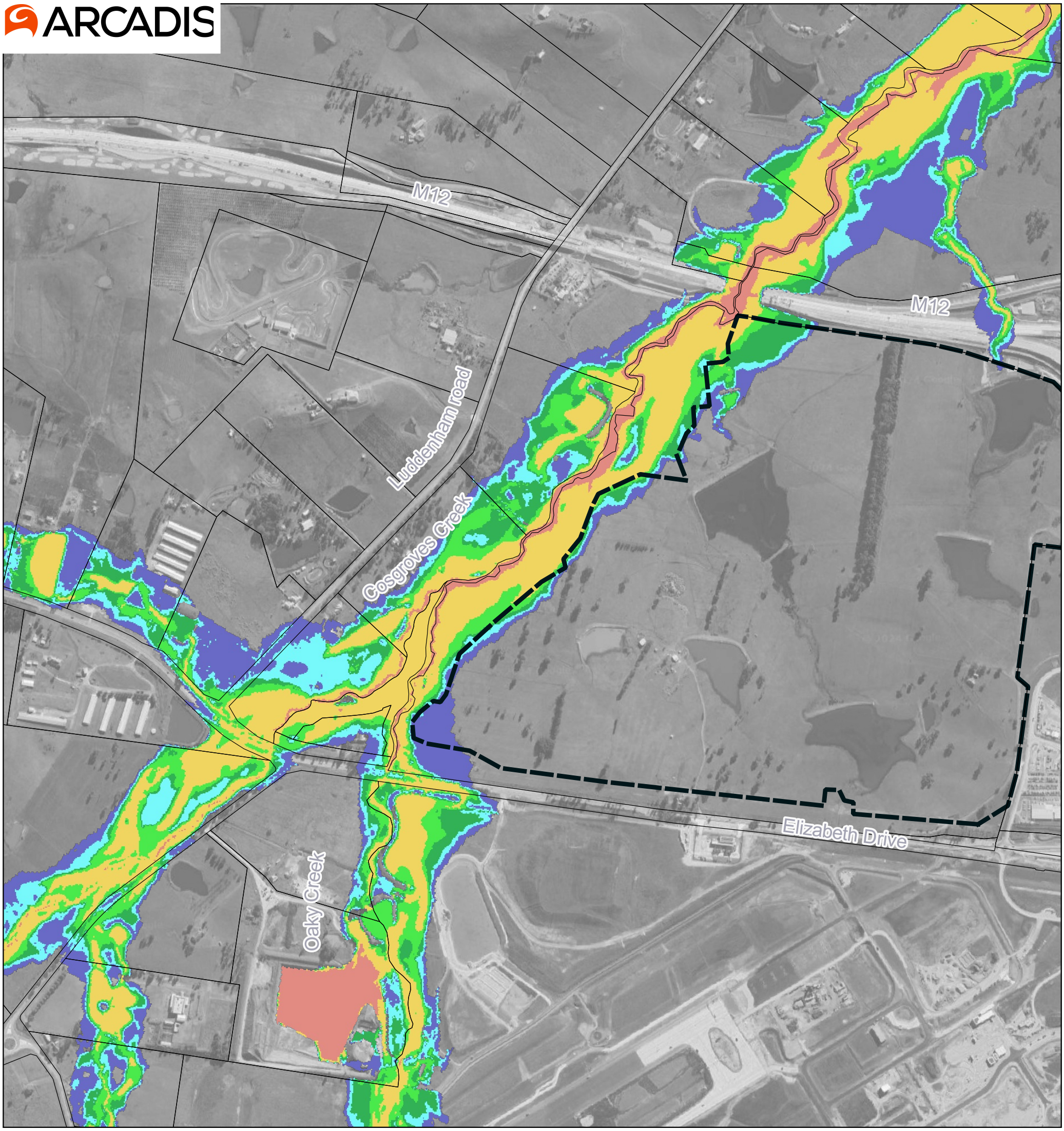
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Existing condition - PMF Peak Flood Velocities (Cosgroves Creek)

ARCADIS



Map by: Sepideh Jafari

Lot

Peak Flood Hazard Categories

Band 1

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

0 300 600 m

A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Existing condition - PMF Peak Flood Hazard Categories (Cosgroves Creek)

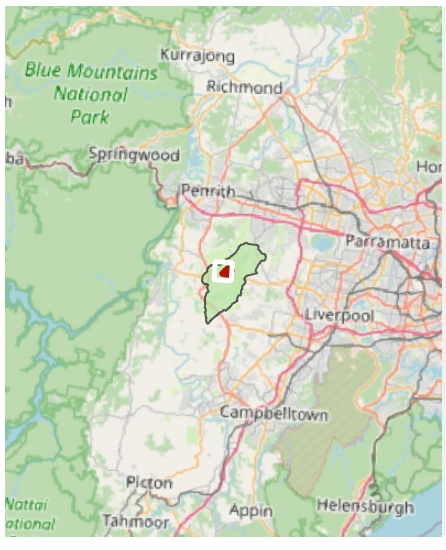
ARCADIS

Map by: Sepideh Jafari

Development Extent
Lot
Peak Flood Levels mAHD (0.2m Intervals)
Peak Flood Levels mAHD (1m Intervals)

Peak Flood Depth (m)

Band 1
- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- 1.8 - 2.2
- 2.2 - 2.6
- > 2.6



Notes:

0 300 600 m

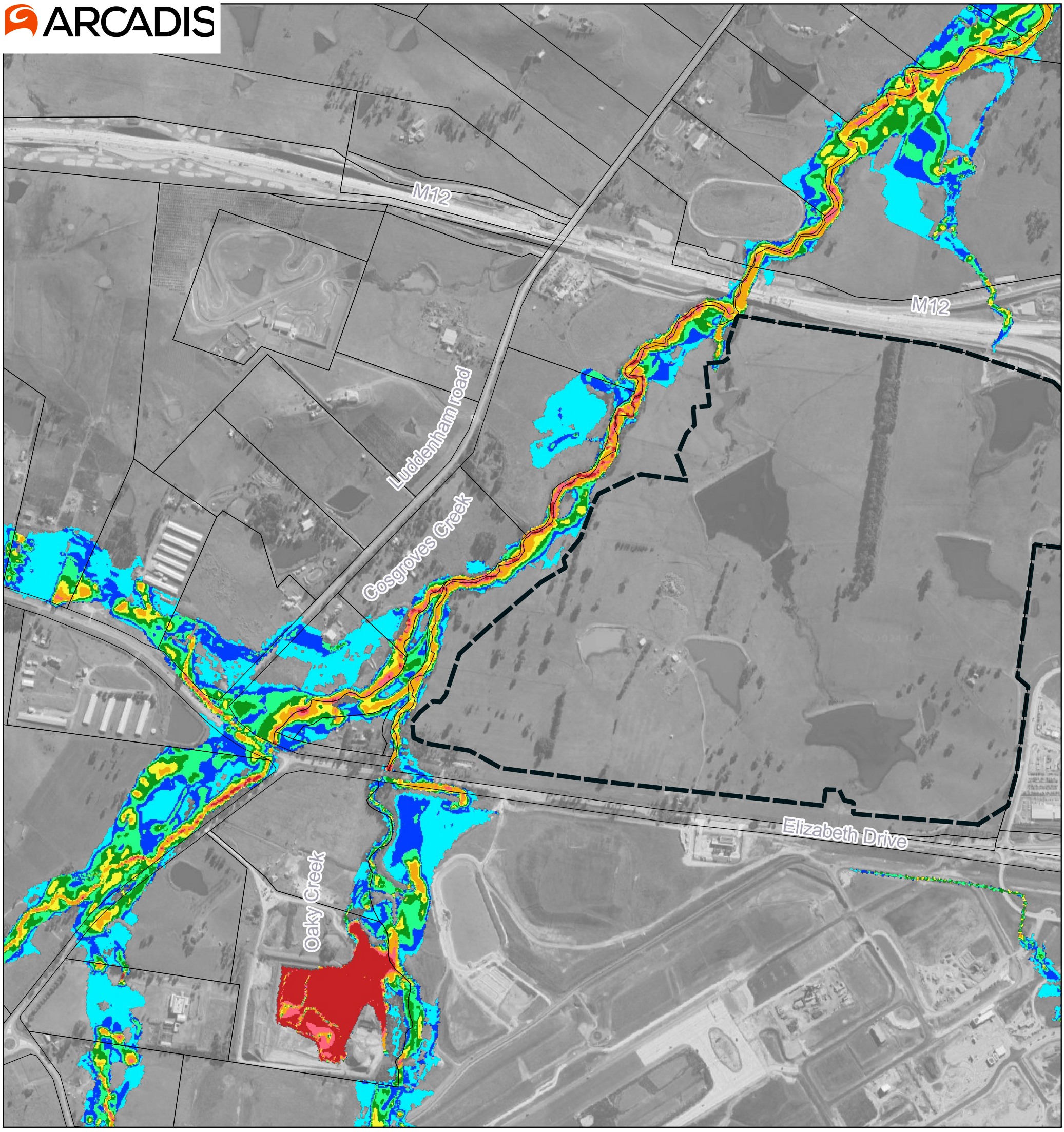
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Design condition - 5%AEP Peak Flood Depths and Levels (Cosgroves Creek)

ARCADIS



Map by: Sepideh Jafari

Development Extent
Lot

Peak Flood Velocities (m/s)

Band 1
- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- > 1.8

Notes:

0 300 600 m

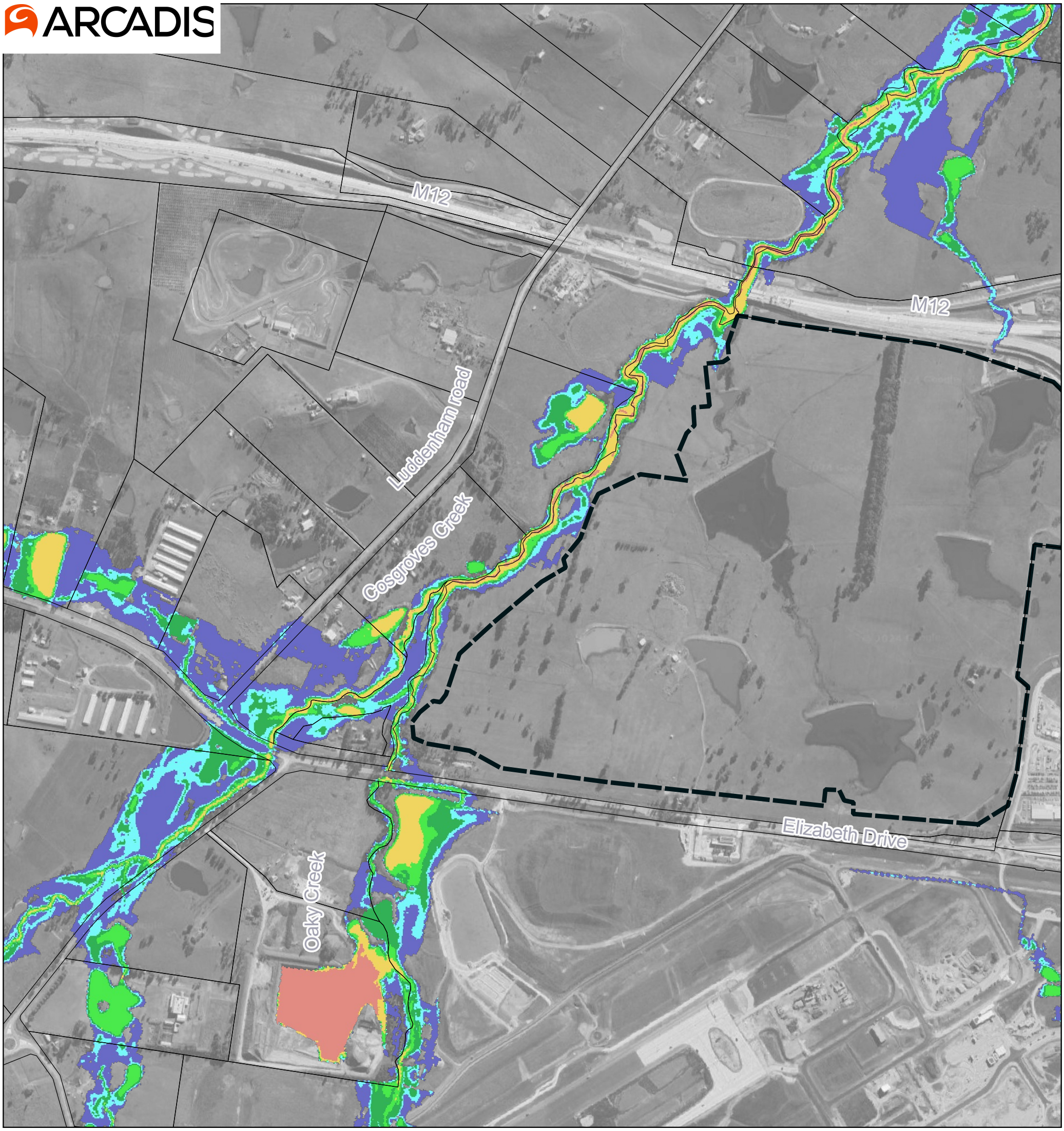
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Design condition - 5%AEP Peak Flood Velocities (Cosgroves Creek)

ARCADIS

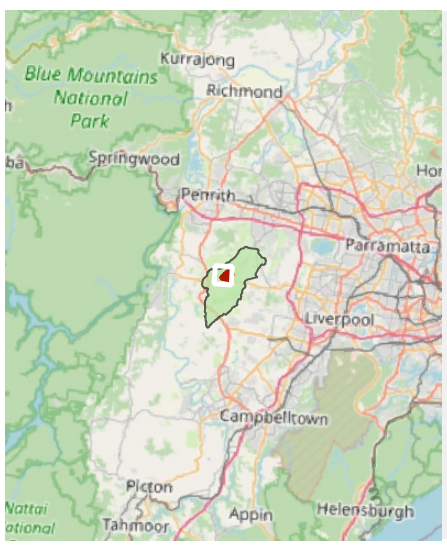


Map by: Sepideh Jafari

Development Extent
Lot

Peak Flood Hazard Categories

Band 1
H1 - Generally safe for people, vehicles and buildings
H2 - Unsafe for small vehicles
H3 - Unsafe for vehicles, children and the elderly
H4 - Unsafe for people and vehicles
H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage
H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure



Notes:

0 300 600 m

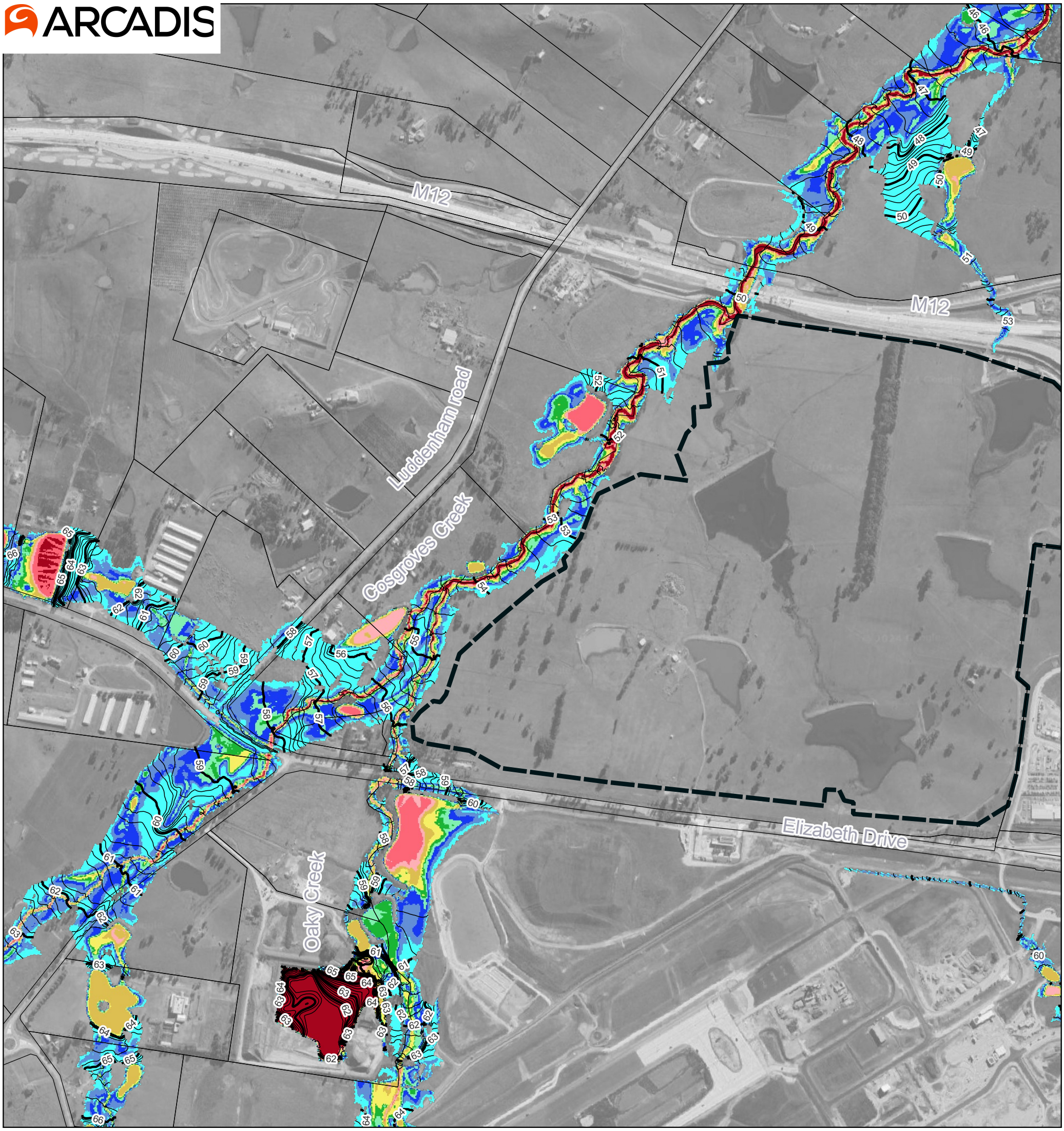
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Design condition - 5%AEP Peak Flood Hazard Categories (Cosgroves Creek)

ARCADIS

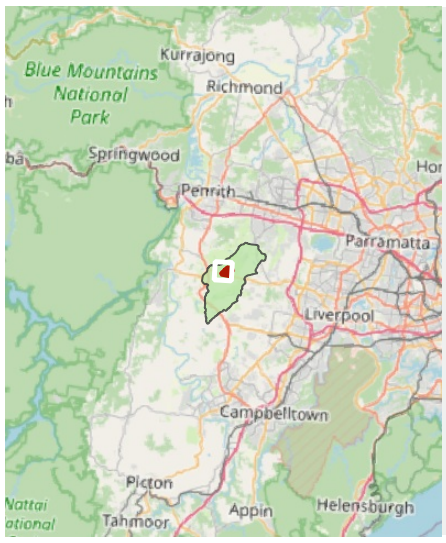


Map by: Sepideh Jafari

Development Extent
Lot
Peak Flood Levels mAHD (0.2m Intervals)
Peak Flood Levels mAHD (1m Intervals)

Peak Flood Depth (m)

Band 1
- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- 1.8 - 2.2
- 2.2 - 2.6
- > 2.6



Notes:

0 300 600 m

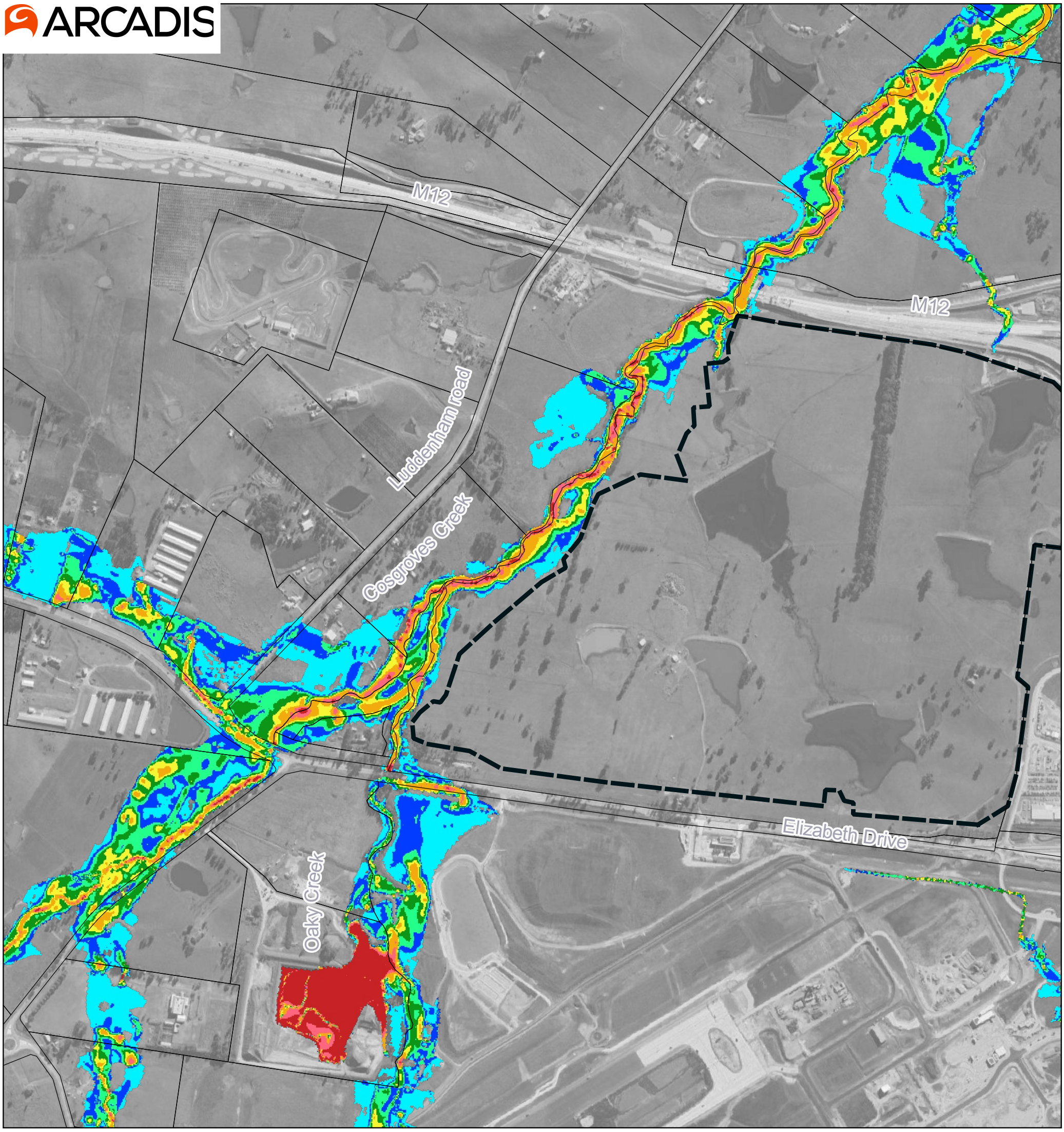
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Design condition - 2%AEP Peak Flood Depths and Levels (Cosgroves Creek)

ARCADIS



Map by: Sepideh Jafari

Development Extent
Lot

Peak Flood Velocities (m/s)

Band 1
- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- > 1.8

Notes:

0 300 600 m

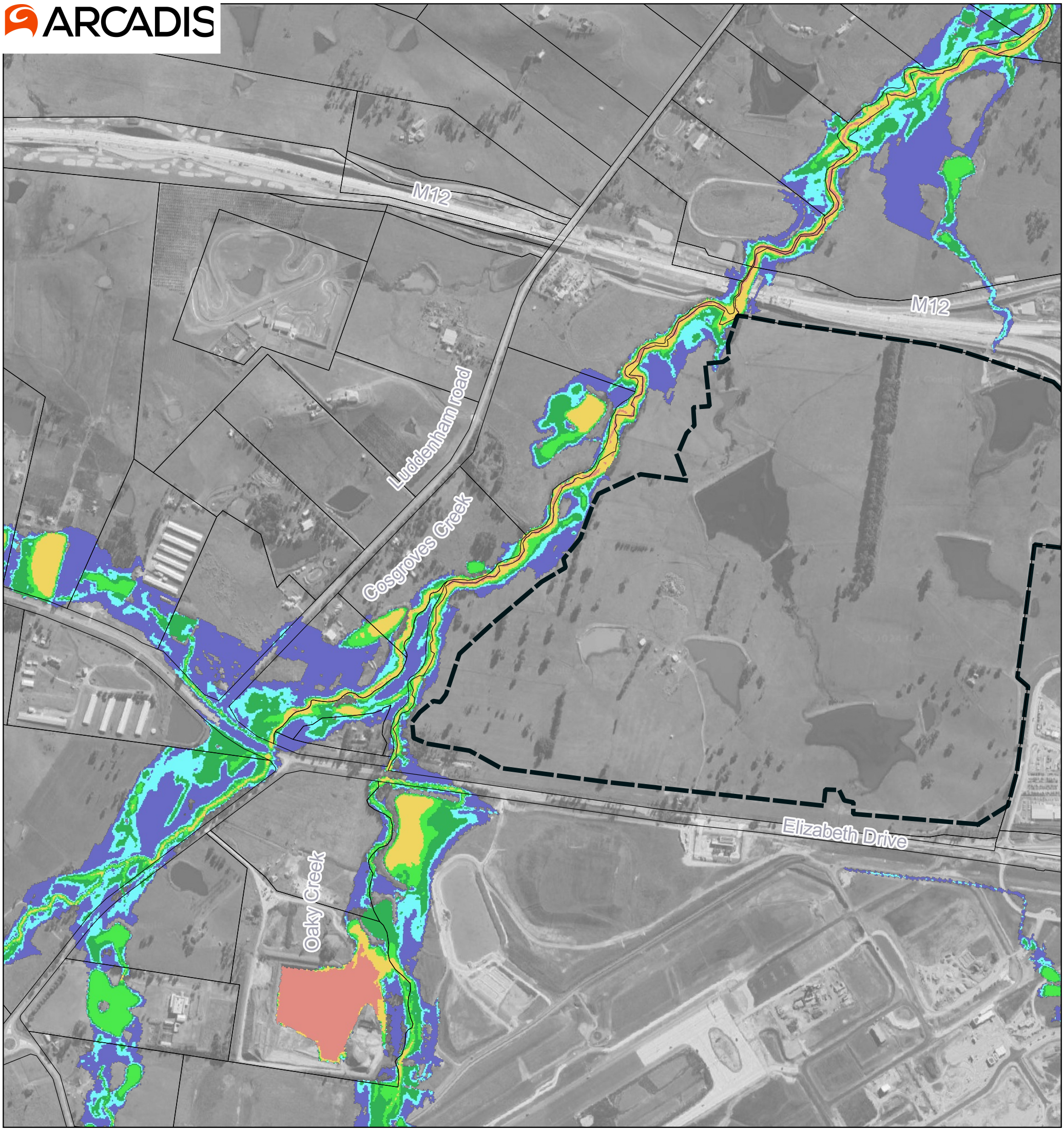
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Design condition - 2%AEP Peak Flood Velocities (Cosgroves Creek)

ARCADIS

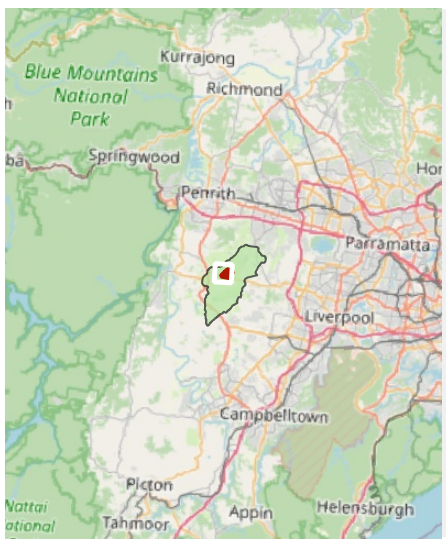


Map by: Sepideh Jafari

Development Extent
Lot

Peak Flood Hazard Categories

Band 1
- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure



Notes:

0 300 600 m

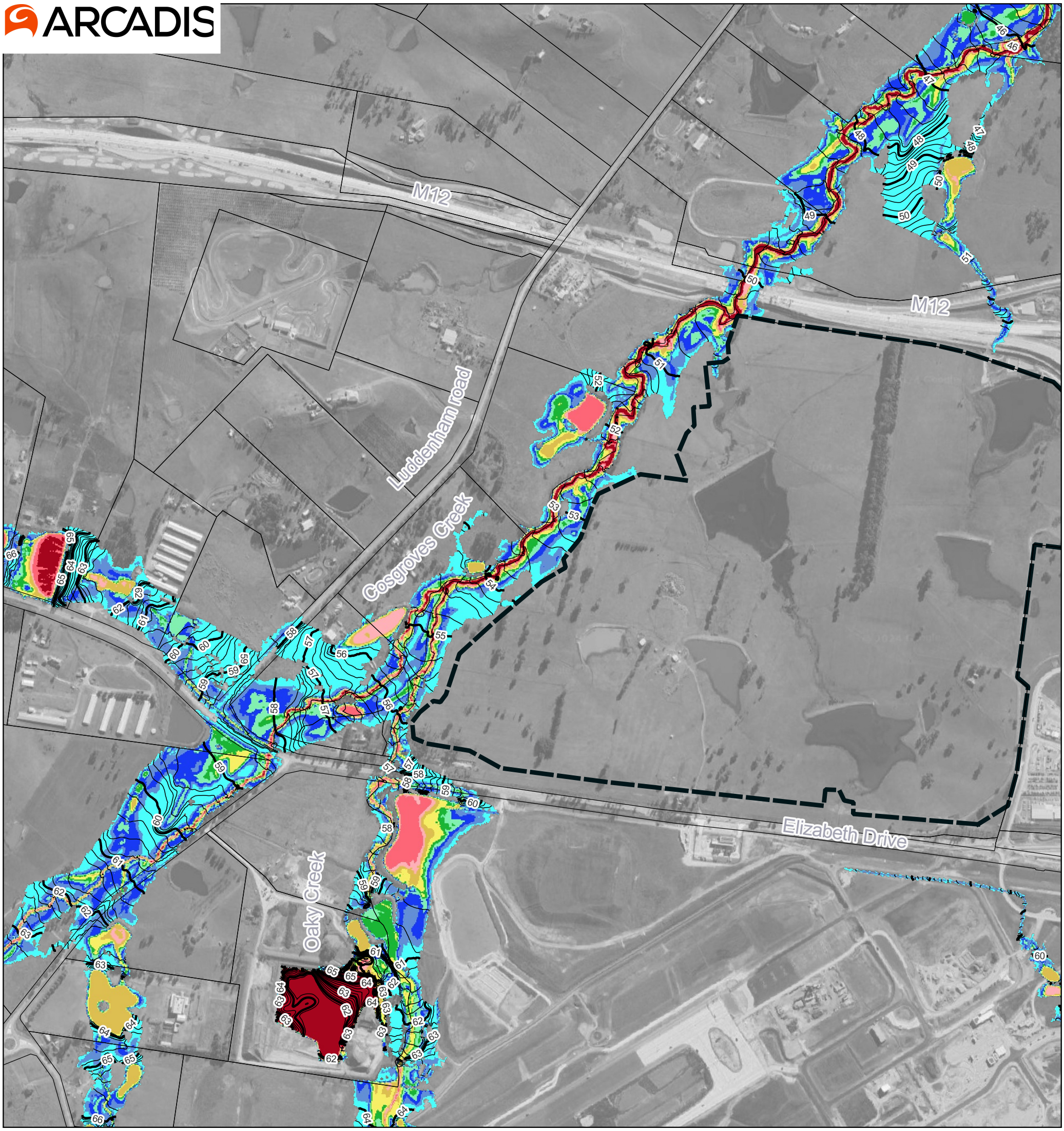
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Design condition - 2%AEP Peak Flood Hazard Categories (Cosgroves Creek)

ARCADIS

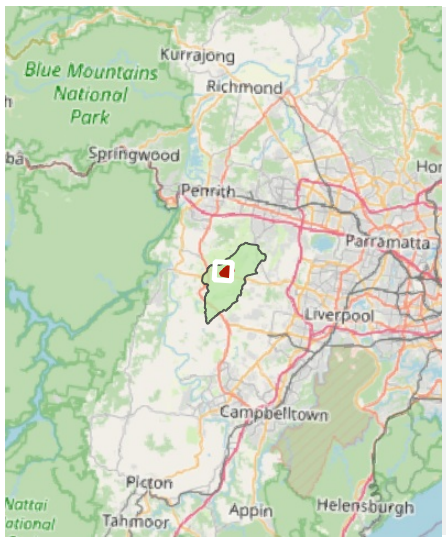


Map by: Sepideh Jafari

Development Extent
Lot
Peak Flood Levels mAHD (0.2m Intervals)
Peak Flood Levels mAHD (1m Intervals)

Peak Flood Depth (m)

Band 1
- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- 1.8 - 2.2
- 2.2 - 2.6
- > 2.6



Notes:

0 300 600 m

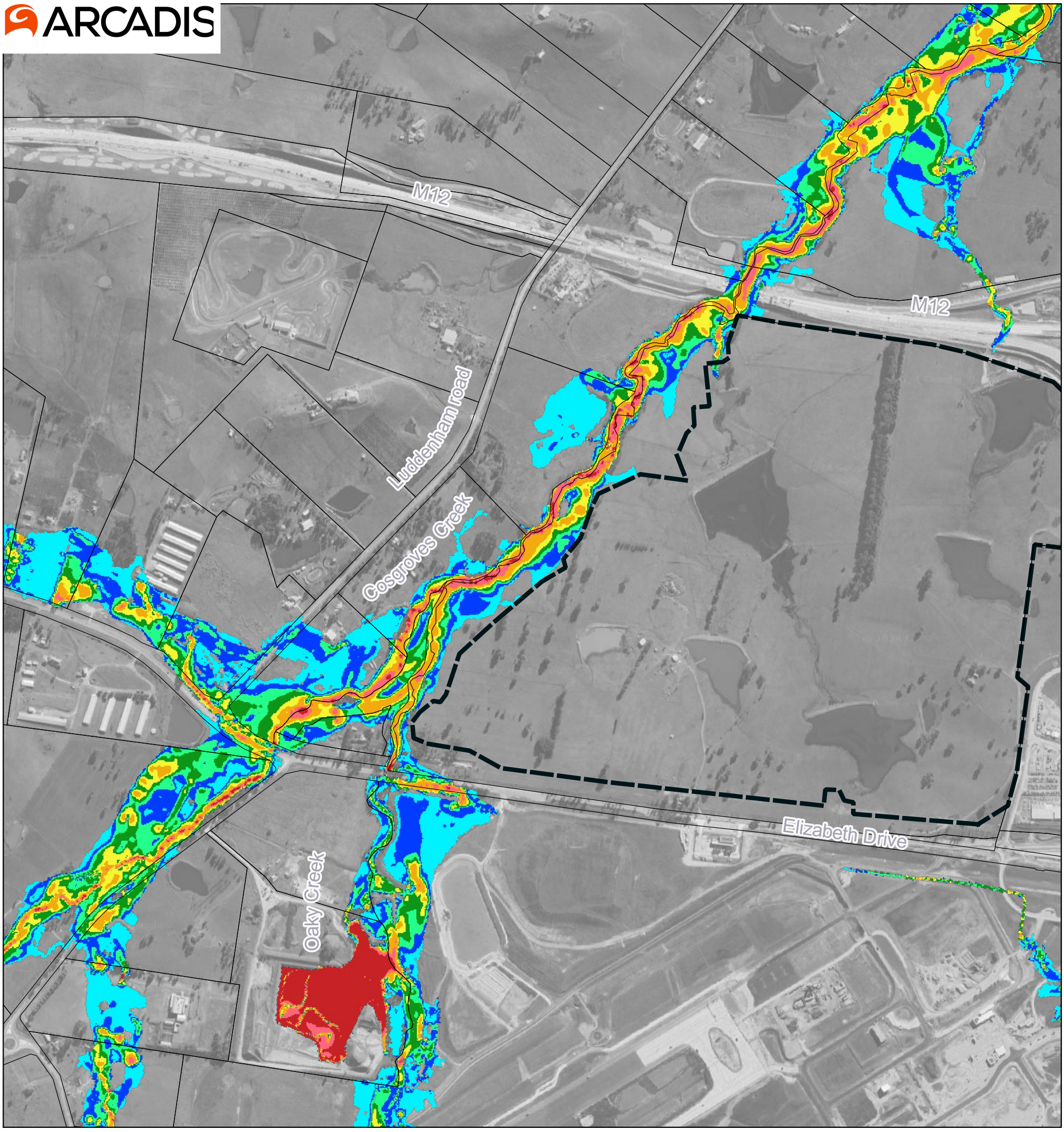
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Design condition - 1%AEP Peak Flood Depths and Levels (Cosgroves Creek)

ARCADIS



Map by: Sepideh Jafari

Development Extent
Lot

Peak Flood Velocities (m/s)

Band 1
- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- > 1.8

Notes:

0 300 600 m

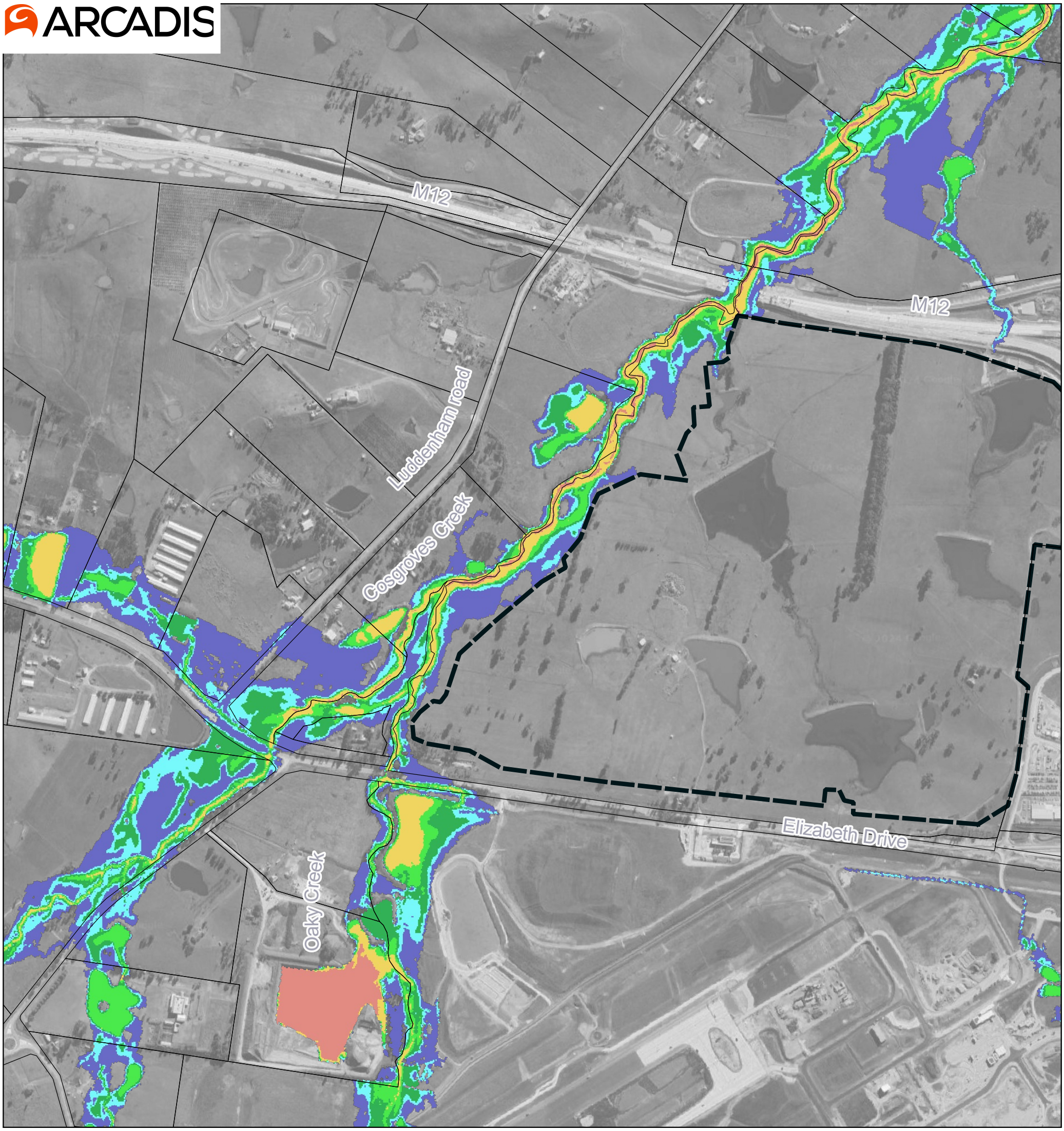
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Design condition - 1%AEP Peak Flood Velocities (Cosgroves Creek)

ARCADIS

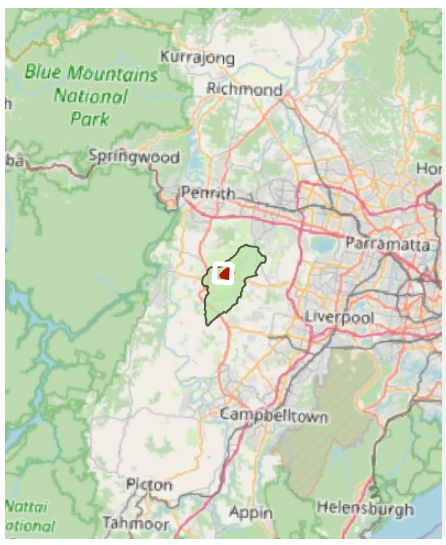


Map by: Sepideh Jafari

Development Extent
Lot

Peak Flood Hazard Categories

Band 1
- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure



Notes:

0 300 600 m

A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Design condition - 1%AEP Peak Flood Hazard Categories (Cosgroves Creek)

ARCADIS

Map by: Sepideh Jafari

M12

Luddenham road

Cosgroves Creek

Oaky Creek

Elizabeth Drive

Development Extent

Lot

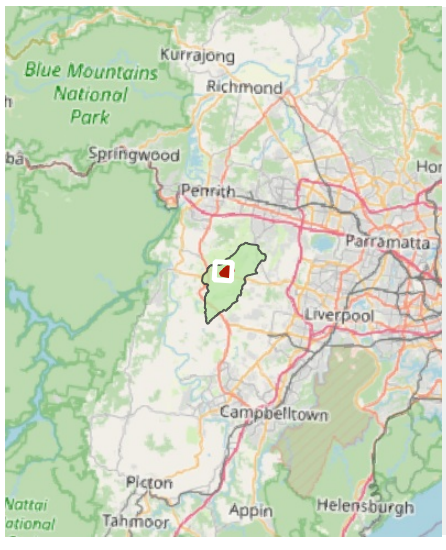
Peak Flood Levels mAHD (0.2m Intervals)

Peak Flood Levels mAHD (1m Intervals)

Peak Flood Depth (m)

Band 1

- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- 1.8 - 2.2
- 2.2 - 2.6
- > 2.6



Notes:

0 300 600 m

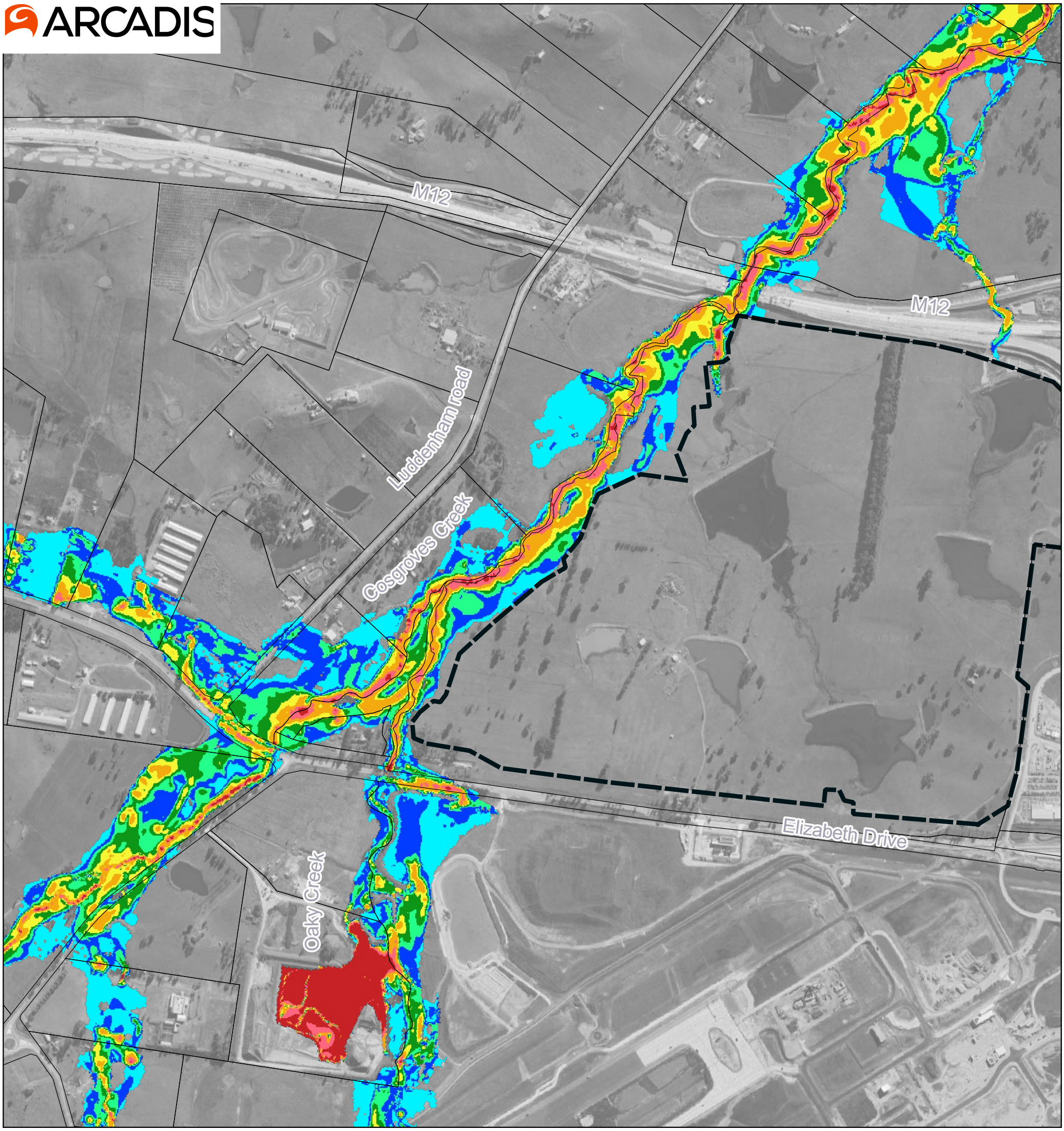
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Design condition - 0.5%AEP Peak Flood Depths and Levels (Cosgroves Creek)

ARCADIS



Map by: Sepideh Jafari

Development Extent
Lot

Peak Flood Velocities (m/s)

Band 1
- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- > 1.8

Notes:

0 300 600 m

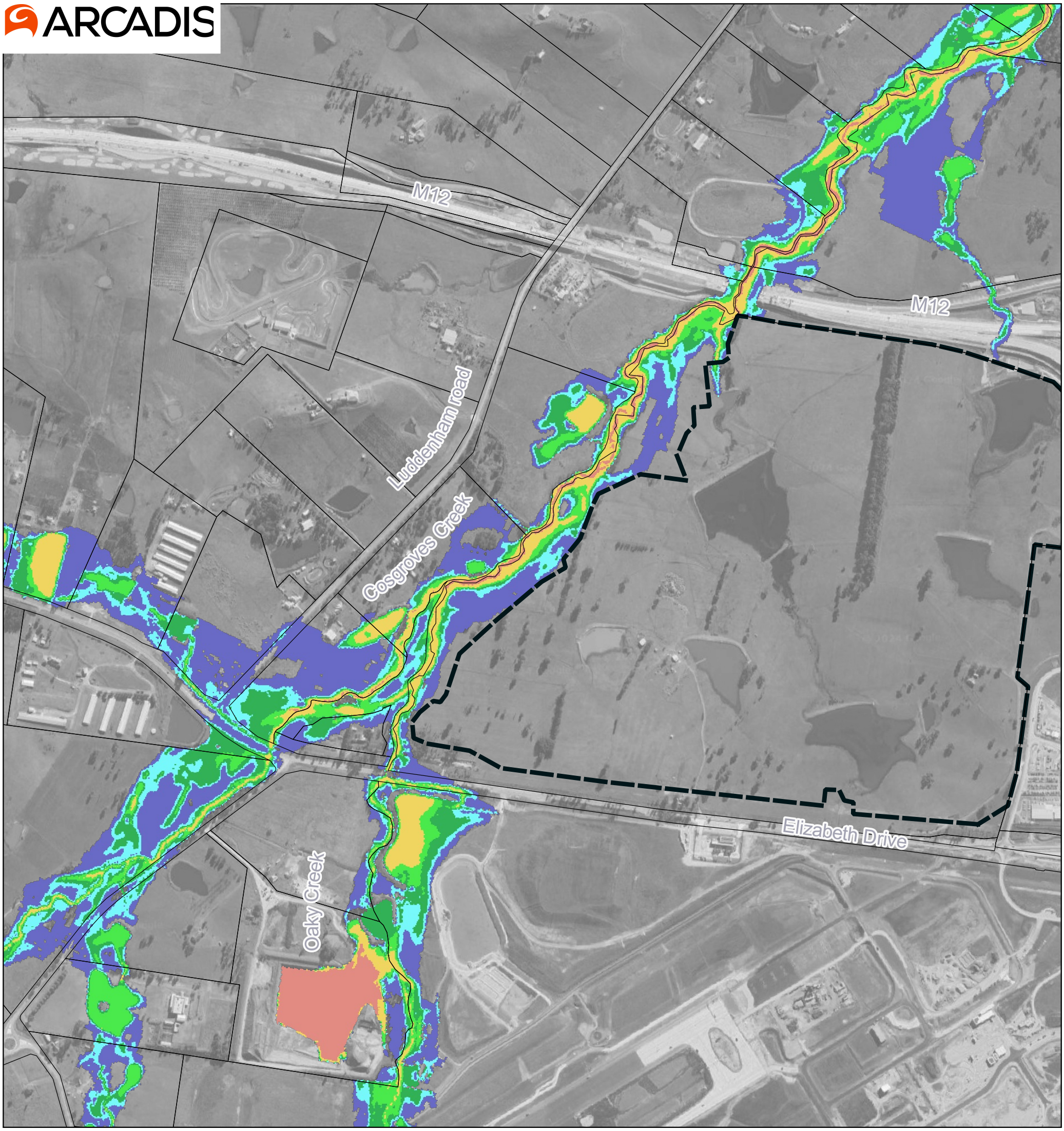
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Design condition - 0.5%AEP Peak Flood Velocities (Cosgroves Creek)

ARCADIS



Map by: Sepideh Jafari

Development Extent
Lot

Peak Flood Hazard Categories

Band 1
- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

0 300 600 m

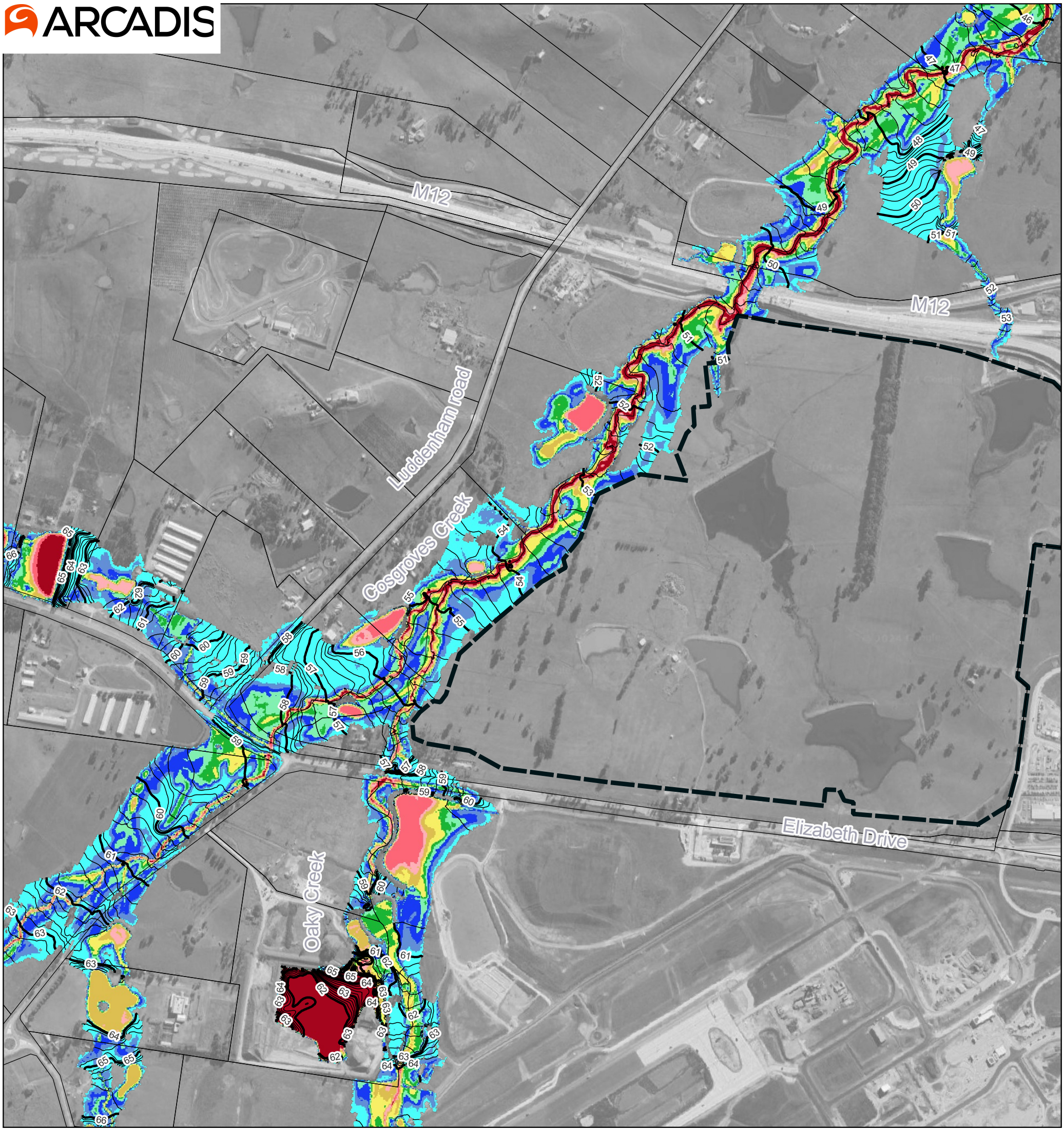
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Design condition - 0.5%AEP Peak Flood Hazard Categories (Cosgroves Creek)

ARCADIS



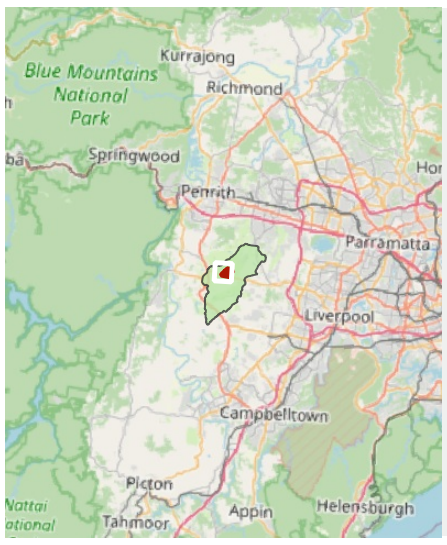
Map by: Sepideh Jafari

- Development Extent
- Lot
- Peak Flood Levels mAHD (0.2m Intervals)
- Peak Flood Levels mAHD (1m Intervals)

Peak Flood Depth (m)

Band 1

- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- 1.8 - 2.2
- 2.2 - 2.6
- > 2.6



Notes:

0 300 600 m

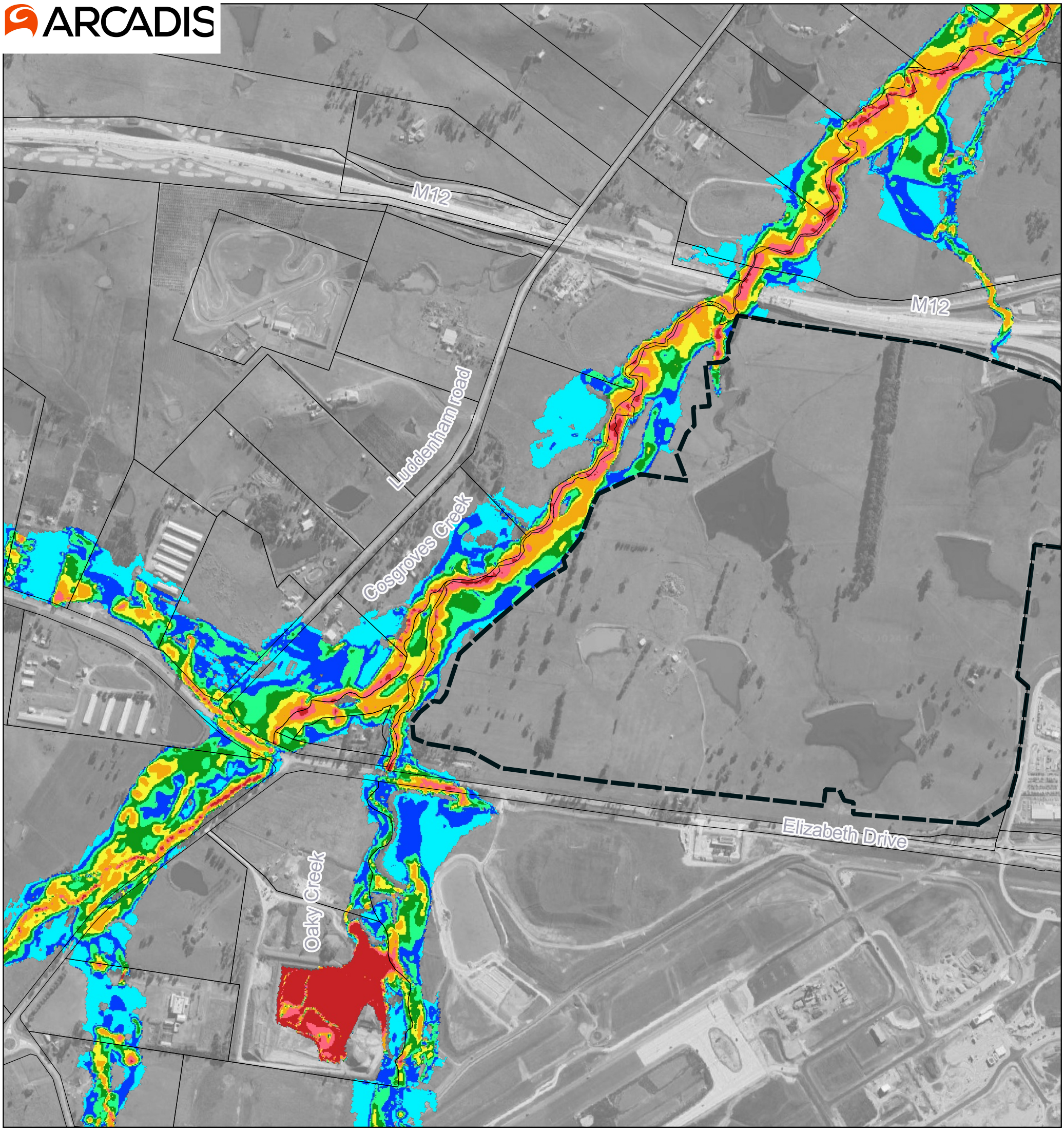
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Design condition - 0.2%AEP Peak Flood Depths and Levels (Cosgroves Creek)

ARCADIS



Map by: Sepideh Jafari

Development Extent
Lot

Peak Flood Velocities (m/s)

Band 1
- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- > 1.8

Notes:

0 300 600 m

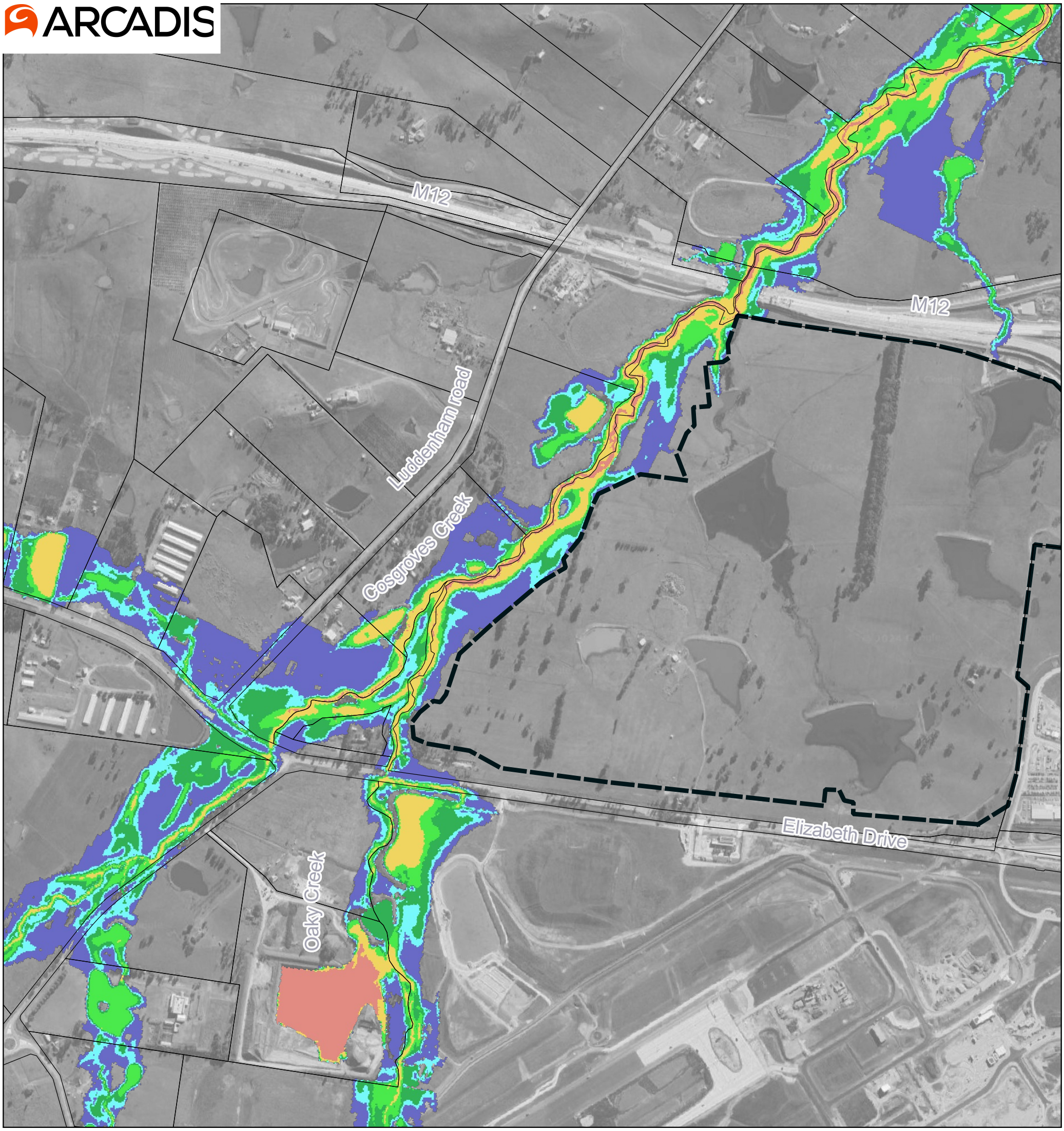
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Design condition - 0.2%AEP Peak Flood Velocities (Cosgroves Creek)

ARCADIS

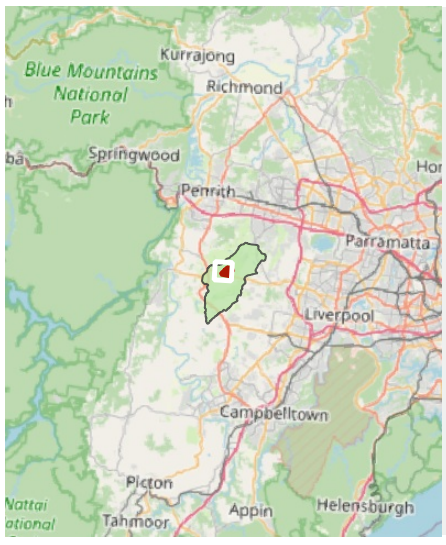


Map by: Sepideh Jafari

Development Extent
Lot

Peak Flood Hazard Categories

Band 1
H1 - Generally safe for people, vehicles and buildings
H2 - Unsafe for small vehicles
H3 - Unsafe for vehicles, children and the elderly
H4 - Unsafe for people and vehicles
H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage
H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure



Notes:

0 300 600 m

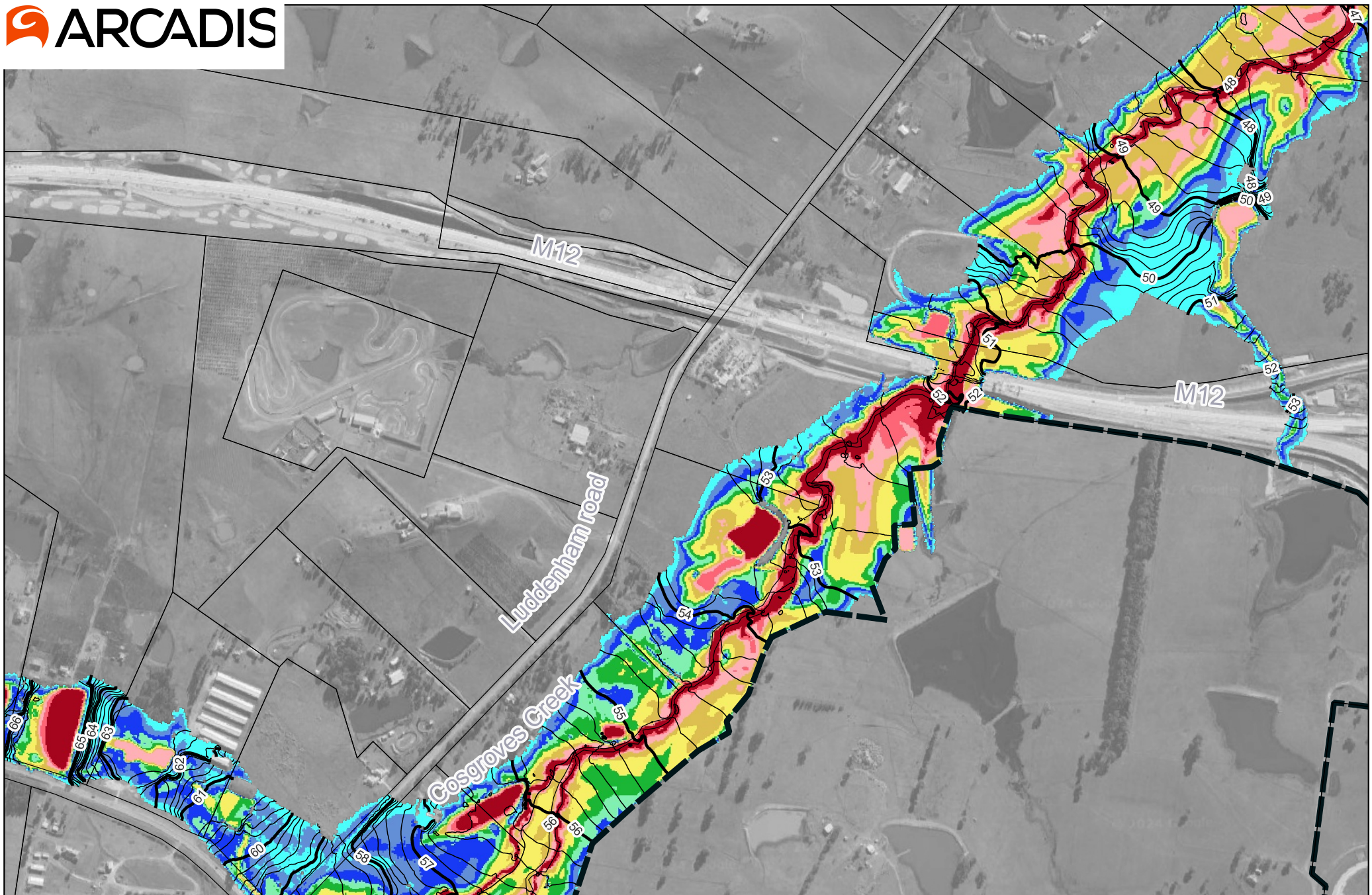
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Design condition - 0.2%AEP Peak Flood Hazard Categories (Cosgroves Creek)

ARCADIS

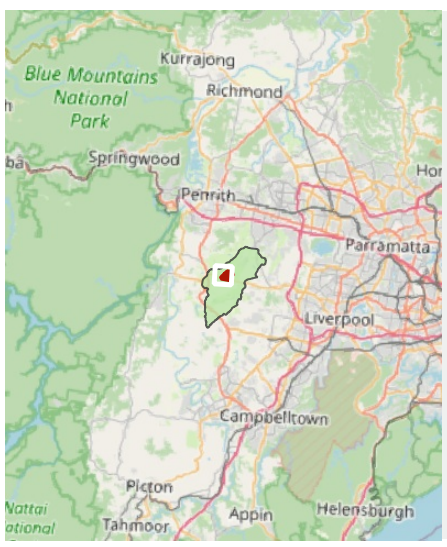


Map by: Sepideh Jafari

Development Extent
Lot
Peak Flood Levels mAHD (0.2m Intervals)
Peak Flood Levels mAHD (1m Intervals)

Peak Flood Depth (m)

Band 1
<= 0.2
0.2 - 0.4
0.4 - 0.6
0.6 - 0.8
0.8 - 1.0
1.0 - 1.4
1.4 - 1.8
1.8 - 2.2
2.2 - 2.6
> 2.6



Notes:

0 300 600 m

A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Design condition - PMF Peak Flood Depths and Levels (Cosgroves Creek)

ARCADIS

M12

M12

Luddenham road

Cosgroves Creek

Oaky Creek

Elizabeth Drive

Map by: Sepideh Jafari

Development Extent

Lot

Peak Flood Velocities (m/s)

Band 1

- <= 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.4
- 1.4 - 1.8
- > 1.8

Notes:

0 300 600 m

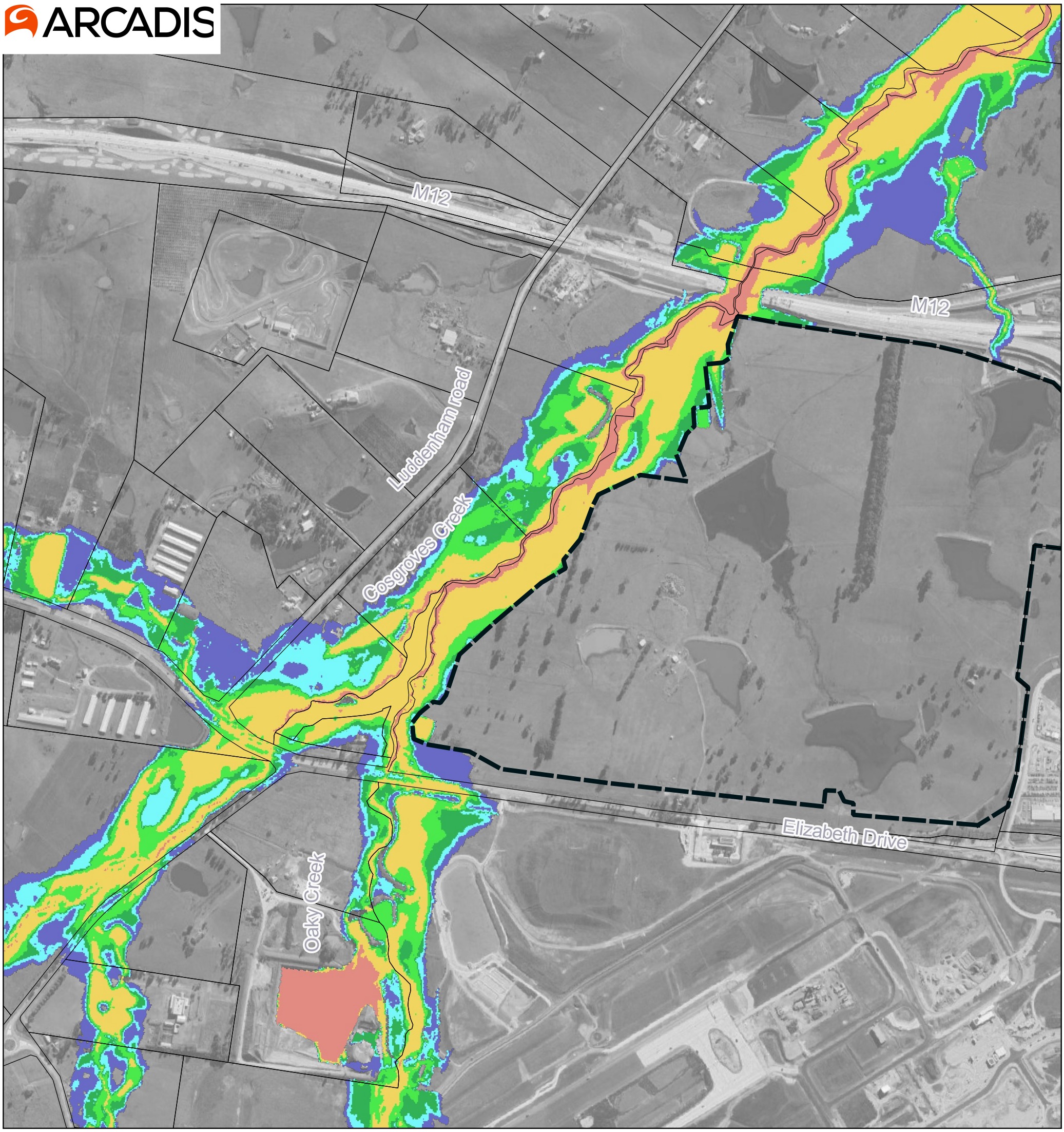
A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Design condition - PMF Peak Flood Velocities (Cosgroves Creek)

ARCADIS



Map by: Sepideh Jafari

Development Extent
Lot

Peak Flood Hazard Categories

Band 1
H1 - Generally safe for people, vehicles and buildings
H2 - Unsafe for small vehicles
H3 - Unsafe for vehicles, children and the elderly
H4 - Unsafe for people and vehicles
H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage
H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure

Notes:

0 300 600 m

A3 Scale: 1:10,000

16/8/2024 MGA 56

Burrah Park Development

Design condition - PMF Peak Flood Hazard Categories (Cosgroves Creek)

ARCADIS

Map by: Sepideh Jafari

Lot

Peak Flood Impacts (m)

Band 1

- <= -0.03
- -0.03 - -0.02
- -0.02 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.03
- > 0.03

Band 1

- Was Wet Now Dry
- Was Dry Now Wet
- Peak Flood Impacts (m)

Notes:

0 300 600 m

A3 Scale: 1:10,000

15/8/2024 MGA 56

Burrah Park Development

Flood Impacts: 5%AEP Design Condition vs. Existing Condition (Cosgroves Creek)

ARCADIS

Map by: Sepideh Jafari

Lot

Peak Flood Impacts (m)

Band 1

- <= -0.03
- -0.03 - -0.02
- -0.02 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.03
- > 0.03

Band 1

- Was Wet Now Dry
- Was Dry Now Wet
- Peak Flood Impacts (m)

Notes:

0 300 600 m

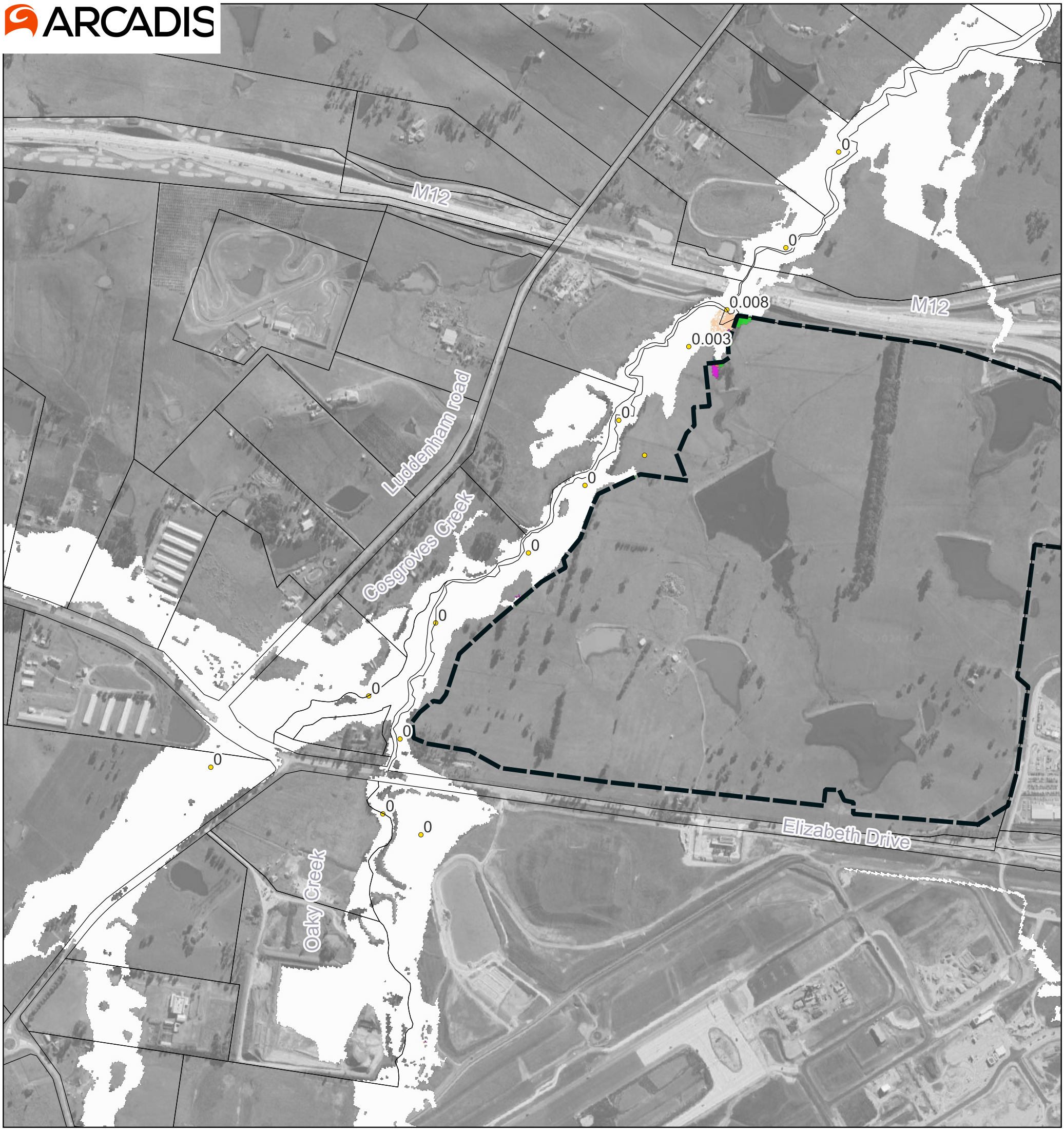
A3 Scale: 1:10,000

15/8/2024 MGA 56

Burrah Park Development

Flood Impacts: 2%AEP Design vs. Existing Condition (Cosgroves Creek)

ARCADIS



Map by: Sepideh Jafari

Lot

Peak Flood Impacts (m)

Band 1

- <= -0.03
- -0.03 - -0.02
- -0.02 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.03
- > 0.03

Band 1

- Was Wet Now Dry
- Was Dry Now Wet
- Peak Flood Impacts (m)

Notes:

0 300 600 m

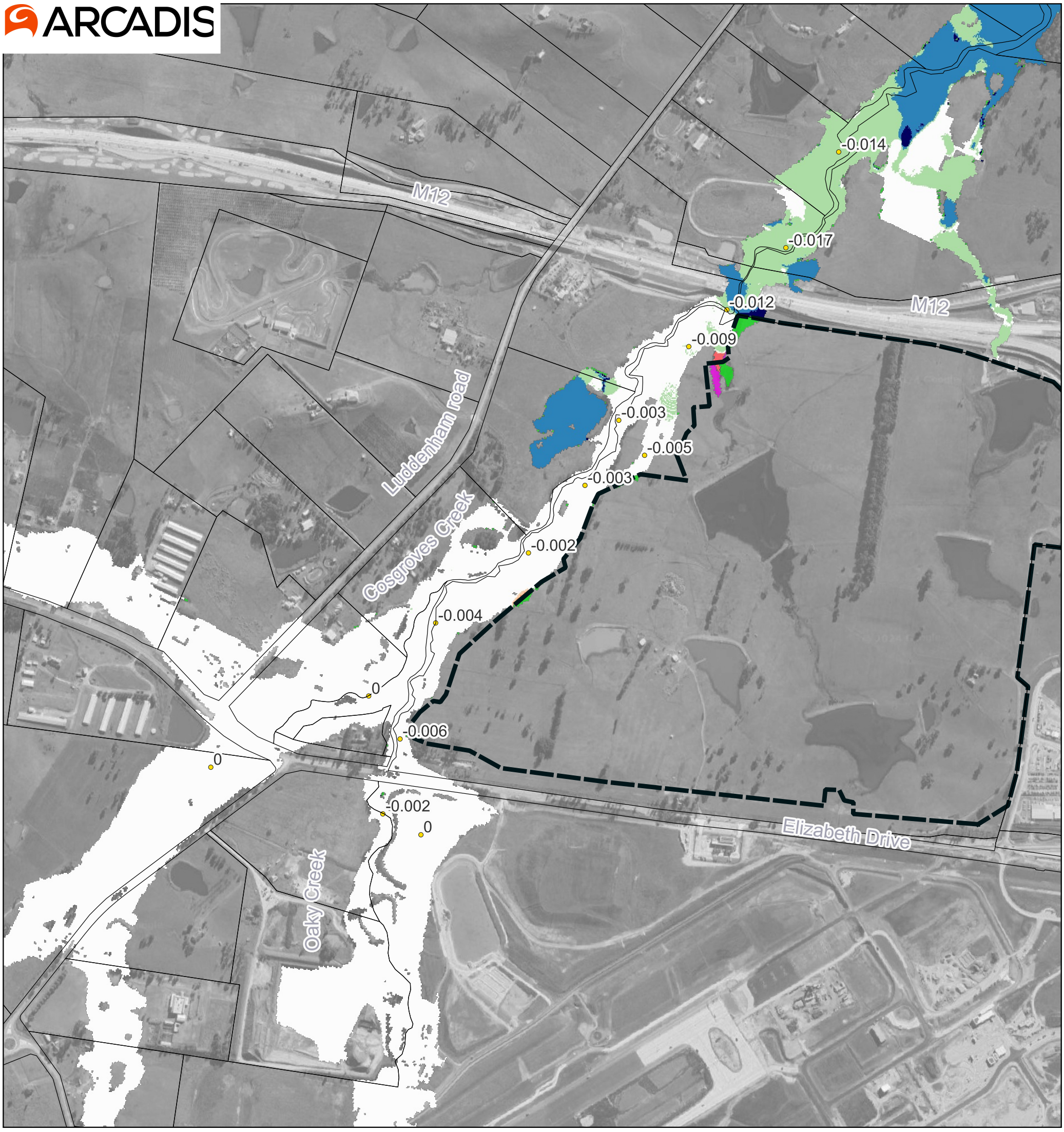
A3 Scale: 1:10,000

15/8/2024 MGA 56

Burrah Park Development

Flood Impacts: 1%AEP Design vs. Existing Condition (Cosgroves Creek)

ARCADIS



Map by: Sepideh Jafari

Lot

Peak Flood Impacts (m)

Band 1

- <= -0.03
- -0.03 - -0.02
- -0.02 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.03
- > 0.03

Band 1

- Was Wet Now Dry
- Was Dry Now Wet
- Peak Flood Impacts (m)

Notes:

0 300 600 m

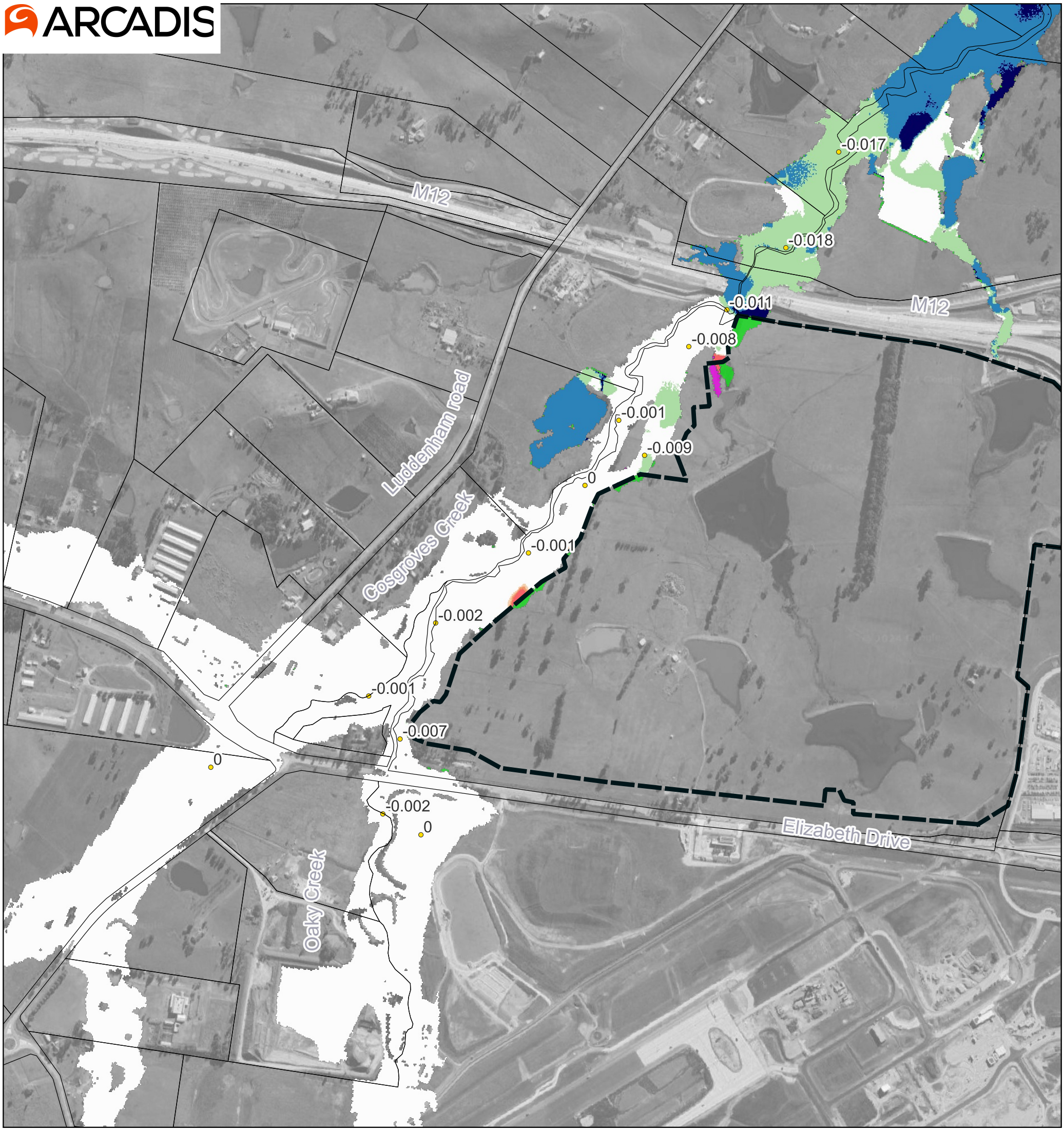
A3 Scale: 1:10,000

15/8/2024 MGA 56

Burrah Park Development

Flood Impacts: 0.5%AEP Design vs. Existing Condition (Cosgroves Creek)

ARCADIS



Map by: Sepideh Jafari

Lot

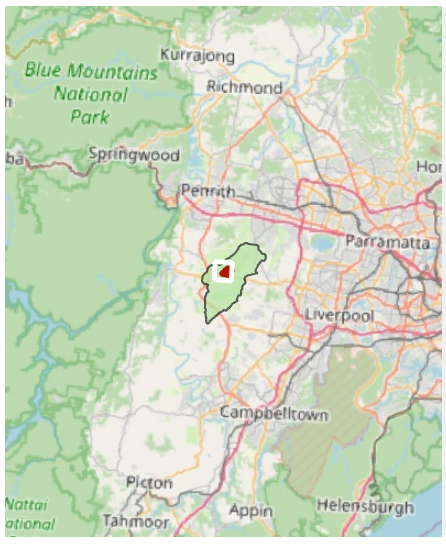
Peak Flood Impacts (m)

Band 1

- <= -0.03
- -0.03 - -0.02
- -0.02 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.03
- > 0.03

Band 1

- Was Wet Now Dry
- Was Dry Now Wet
- Peak Flood Impacts (m)



Notes:

0 300 600 m

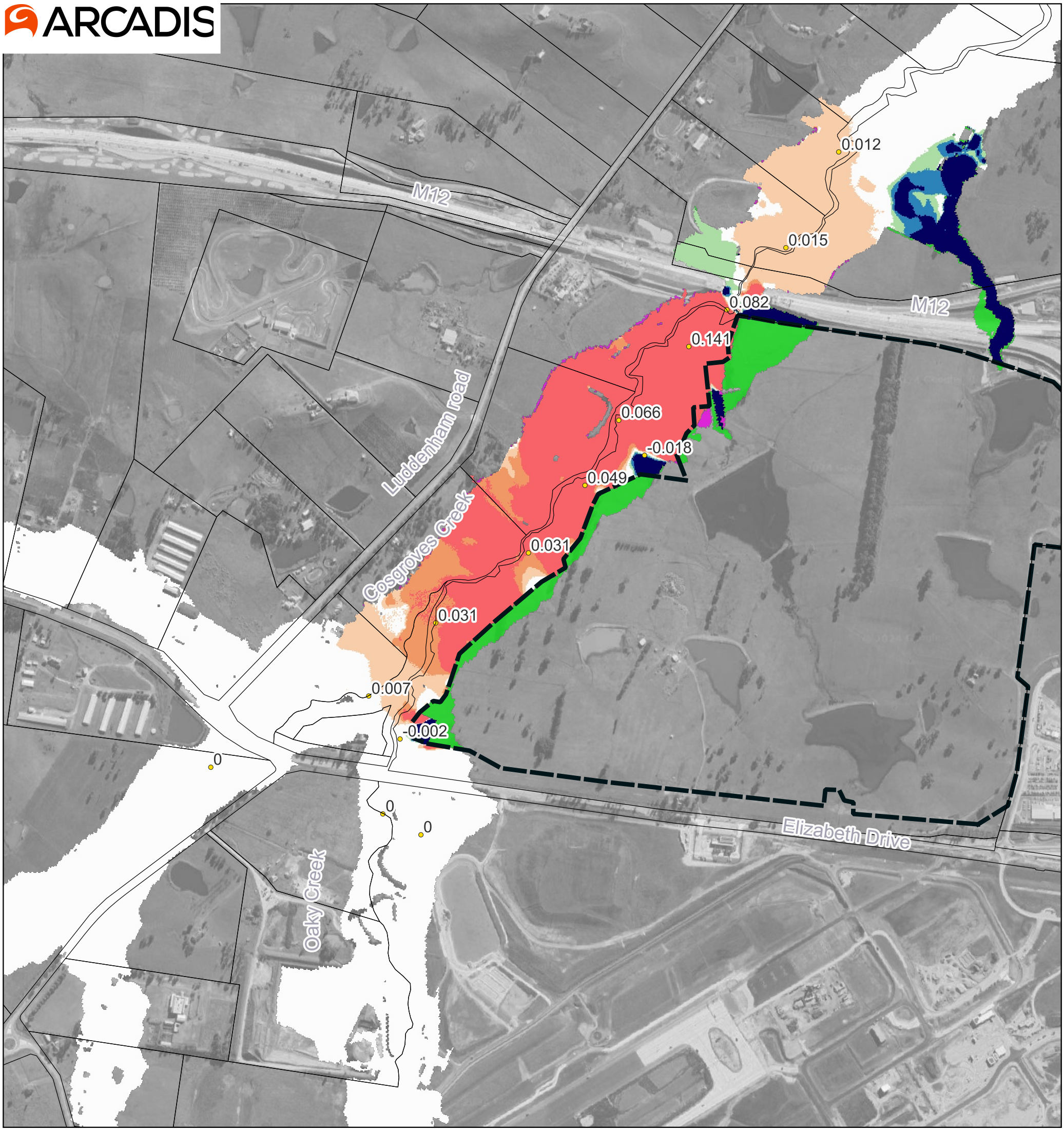
A3 Scale: 1:10,000

15/8/2024 MGA 56

Burrah Park Development

Flood Impacts: 0.2%AEP Design vs. Existing Condition (Cosgroves Creek)

ARCADIS



Map by: Sepideh Jafari

Lot

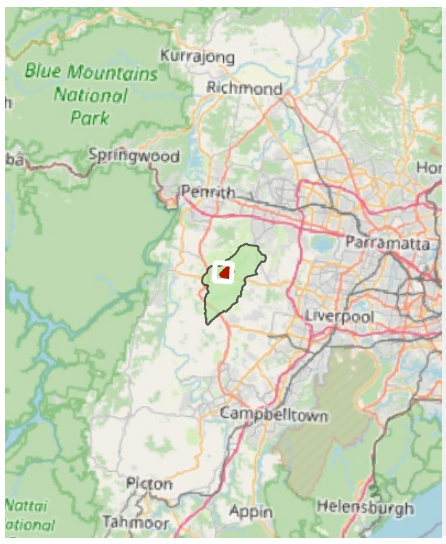
Peak Flood Impacts (m)

Band 1

- <= -0.03
- -0.03 - -0.02
- -0.02 - -0.01
- -0.01 - 0.01
- 0.01 - 0.02
- 0.02 - 0.03
- > 0.03

Band 1

- Was Wet Now Dry
- Was Dry Now Wet
- Peak Flood Impacts (m)



Notes:

0 300 600 m

A3 Scale: 1:10,000

15/8/2024 MGA 56

Burrah Park Development

Flood Impacts: PMF Design vs. Existing Condition (Cosgroves Creek)

Appendix B – PMP Calculations

LOCATION INFORMATION

Catchment: Burra State: NSW

Duration Limit: 6 (3-6) hours Area: 21.3 km2

Approx. Centroid: Latitude: -33.872 Longitude: 150.716

Portion of Area Considered:

Smooth, S= 1 (0.0 - 1.0) Rough, R= 0 (0.0 - 1.0)

ELEVATION ADJUSTMENT FACTOR (EAF)

Mean Elevation: 73.85 m required if greater than 1500 m

Adjustment for Elevation: n/a -0.05 per 300m above 1500 m

EAF = 1 (0.85-1.00)

GSDM MOISTURE ADJUSTMENT FACTOR (MAF)

EPW catchment = GSDM MAF = EPW catchment / 104.5

OR

read directly off GSDM Moisture Adjustment Factor chart at centroid

GSDM MAF = 0.693 (0.46-1.19)

PMP VALUES (mm)

Duration (hours)	Initial Depth - Smooth (DS)	Initial Depth - Rough (DR)	PMP Estimate = (DSxS + DRxR) x MAF x EAF	Rounded PMP Estimate (nearest 10 mm)
0.25	200		138.6	140
0.5	295		204.4	210
0.75	375		259.9	270
1	440		304.9	310
1.5	503		348.6	360
2	563		390.2	400
2.5	600		415.8	430
3	630		436.6	450
4	700		485.1	490
5	752		521.1	530
6	793		549.5	560

Appendix C – Ground Survey

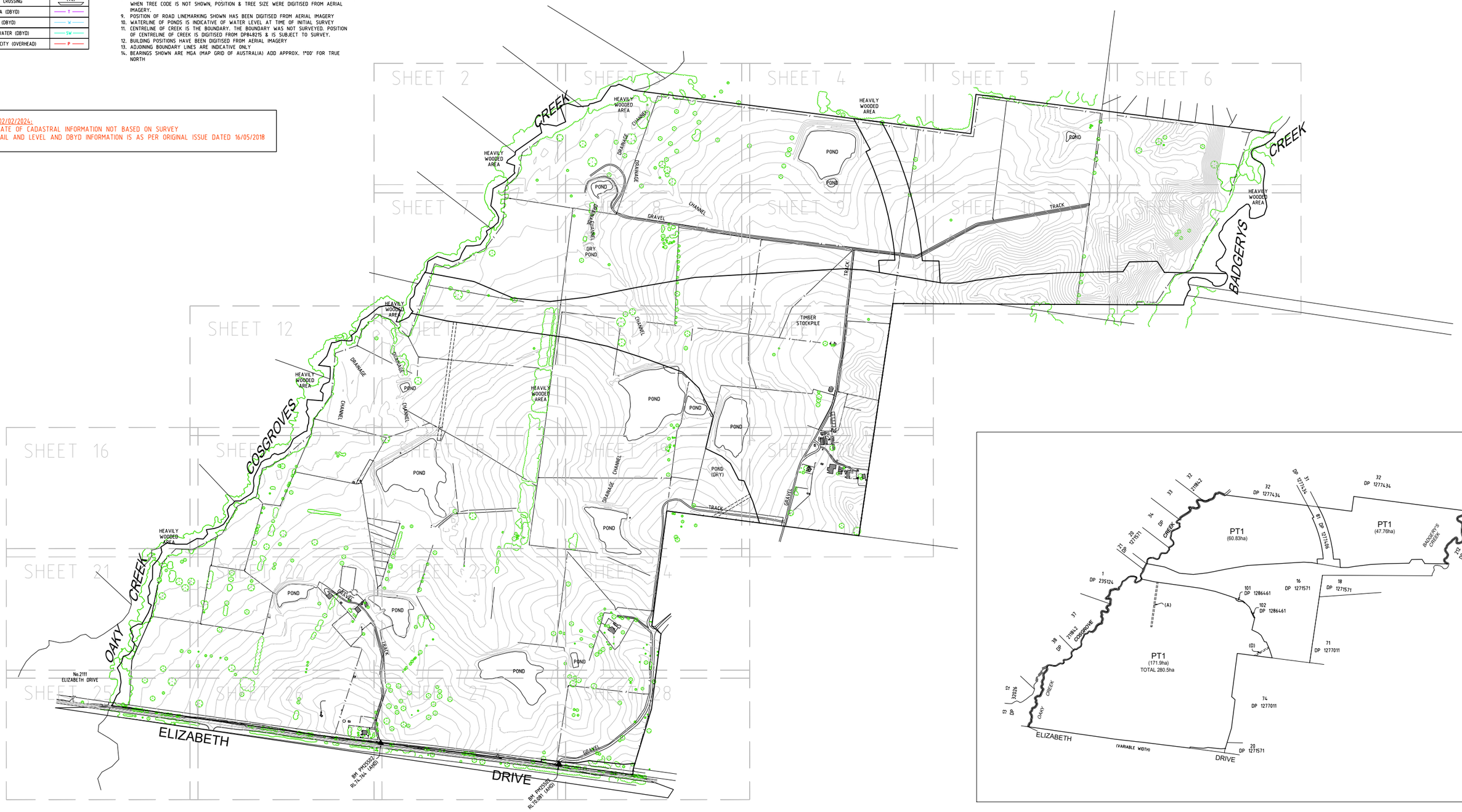
LEGEND

BENCH MARK	▲
COMMS PIT	COM
TELSTRA PIT	TEL
POWER POLE	PP
PIT WITH CONCRETE LID	CLID
STREET SIGN	SS
WATER METER	WM
VEHICLE CROSSING	(VC)
TELSTRA (DBYD)	T
WATER (DBYD)	W
STORMWATER (DBYD)	SW
ELECTRICITY (OVERHEAD)	P

NOTES

1. THE BOUNDARIES HAVE NOT BEEN MARKED
2. ALL AREAS AND DIMENSIONS HAVE BEEN COMPILED FROM PLANS MADE AVAILABLE BY NSW LAND REGISTRY SERVICES AND ARE SUBJECT TO FINAL SURVEY
3. ORIGIN OF LEVELS ON A.H.D. IS TAKEN FROM PM25501 R.L. 59.659 (A.H.D.) IN ELIZABETH DRIVE
4. CONTOUR INTERVAL 1.0 m
5. CONTOURS ARE INDICATIVE ONLY. ONLY SPOT LEVELS SHOULD BE USED FOR CALCULATIONS OF QUANTITIES WITH CAUTION
6. KERB LEVELS ARE TO THE TOP OF KERB UNLESS SHOWN OTHERWISE
7. NO INVESTIGATION OF UNDERGROUND SERVICES HAS BEEN MADE. SERVICES HAVE BEEN PLOTTED FROM RELEVANT AUTHORITIES INFORMATION AND HAVE NOT BEEN SURVEYED. ALL RELEVANT AUTHORITIES SHOULD BE NOTIFIED PRIOR TO ANY EXCAVATION ON OR NEAR THE SITE
8. 8/.4/7 DENOTES TREE SPREAD OF 8m, TRUNK DIAMETER OF 0.4m & APPROX HEIGHT OF 7m. WHEN TREE CODE IS NOT SHOWN, POSITION & TREE SIZE WERE DIGITISED FROM AERIAL IMAGERY.
9. POSITION OF ROAD LINEMARKING SHOWN HAS BEEN DIGITISED FROM AERIAL IMAGERY
10. WATERLINE OF PONDS IS INDICATIVE OF WATER LEVEL AT TIME OF INITIAL SURVEY
11. CENTRELINE OF CREEK IS THE BOUNDARY. THE BOUNDARY WAS NOT SURVEYED. POSITION OF CENTRELINE OF CREEK IS DIGITISED FROM DP848215 & IS SUBJECT TO SURVEY.
12. BUILDING POSITIONS HAVE BEEN DIGITISED FROM AERIAL IMAGERY
13. ADJOINING BOUNDARY LINES ARE INDICATIVE ONLY
14. BEARINGS SHOWN ARE MGA (MAP GRID OF AUSTRALIA) ADD APPROX. 1°00' FOR TRUE NORTH

NOTE 02/02/2024:
- UPDATE OF CADASTRAL INFORMATION NOT BASED ON SURVEY
- DETAIL AND LEVEL AND DBYD INFORMATION IS AS PER ORIGINAL ISSUE DATED 16/05/2018



NOTE 02/02/2024:
- SEE DP1287712 AND DP1286461 FOR BOUNDARY DIMENSIONS
- LOTS 101 AND 102 IN DP1286461 ARE PROPOSED TO BE ACQUIRED

(A) EASEMENT FOR ELECTRICITY PURPOSES (AS820127, DP1286461)
(D) EASEMENT FOR ELECTRICITY PURPOSES (AS820127, DP1286461)

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GDA2020

REFER TO NOTES AND LEGEND

0 80 120 160 240 320 400
SCALE 1:4000 @ A1

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Client HB&B PROPERTY
Drawing title
PLAN OF DETAIL AND LEVELS OVER LOT 1 IN DP1287712 KNOWN AS 1953-2109 ELIZABETH DRIVE, BADGERYS CREEK

datum AHD
site Area 344.7ha
LGA PENRITH

reference number 50294 002DT_v4
scale 1:4000 @A1
date of survey 16/05/18
SHEET 1 OF 28

NOTE 11
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MGA

TN

TRUE NORTH

HEAVILY WOODED AREA

CREEK

HEAVILY WOODED AREA

FENCE

COSGROVES

CYCLONE

HEAVILY WOODED AREA

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SCALE 1:500 @ A1

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MGA

TN

COSGROVES CREEK

HEAVILY WOODED AREA

CYCLONE FENCE

FENCE

TREE CLUSTER

TREE CLUSTER

CHANNEL

DRAINAGE

DRAINAGE

CHANNEL

GRAVEL

GRAVEL

TOAST

METAL

FENCE

POND

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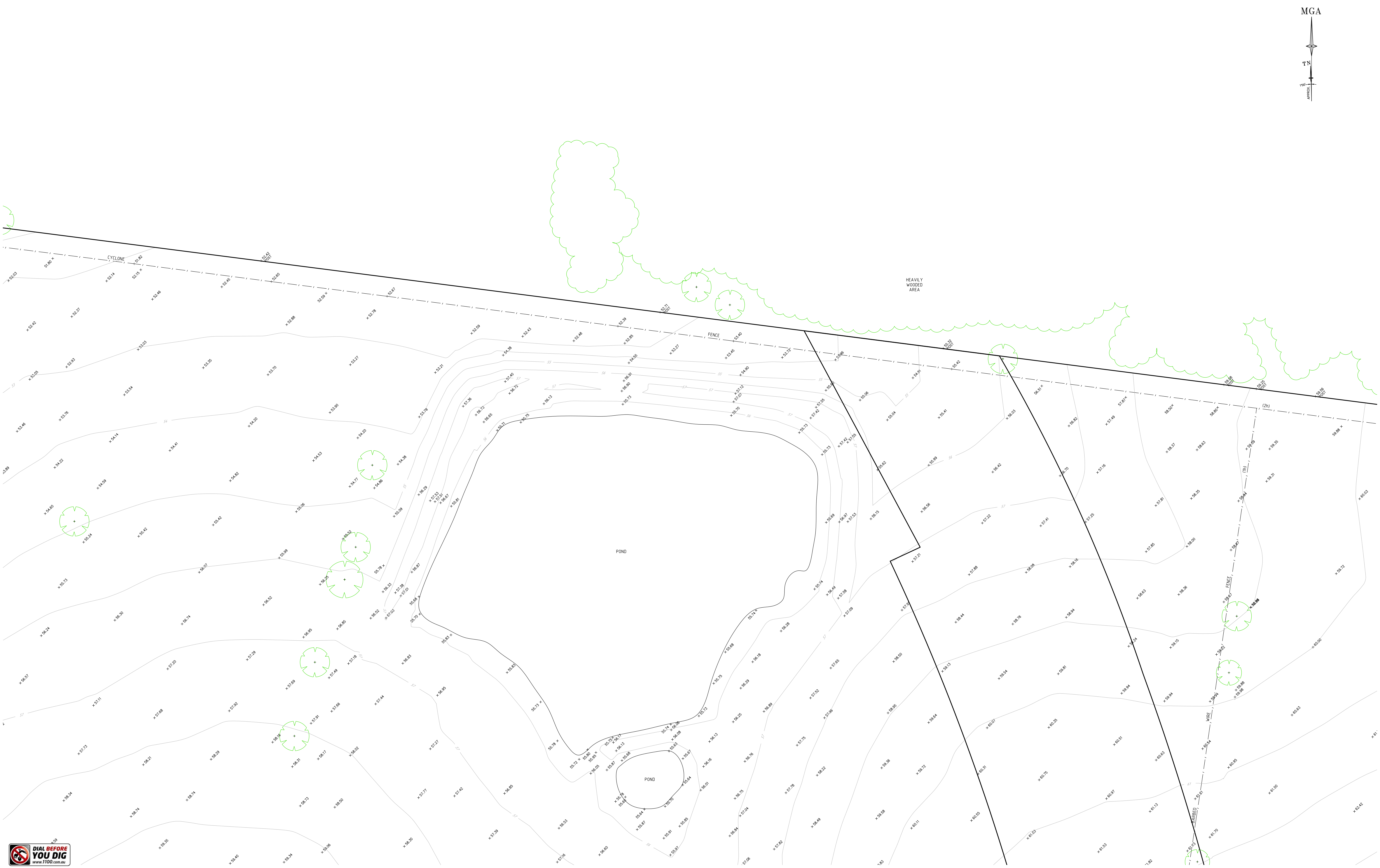

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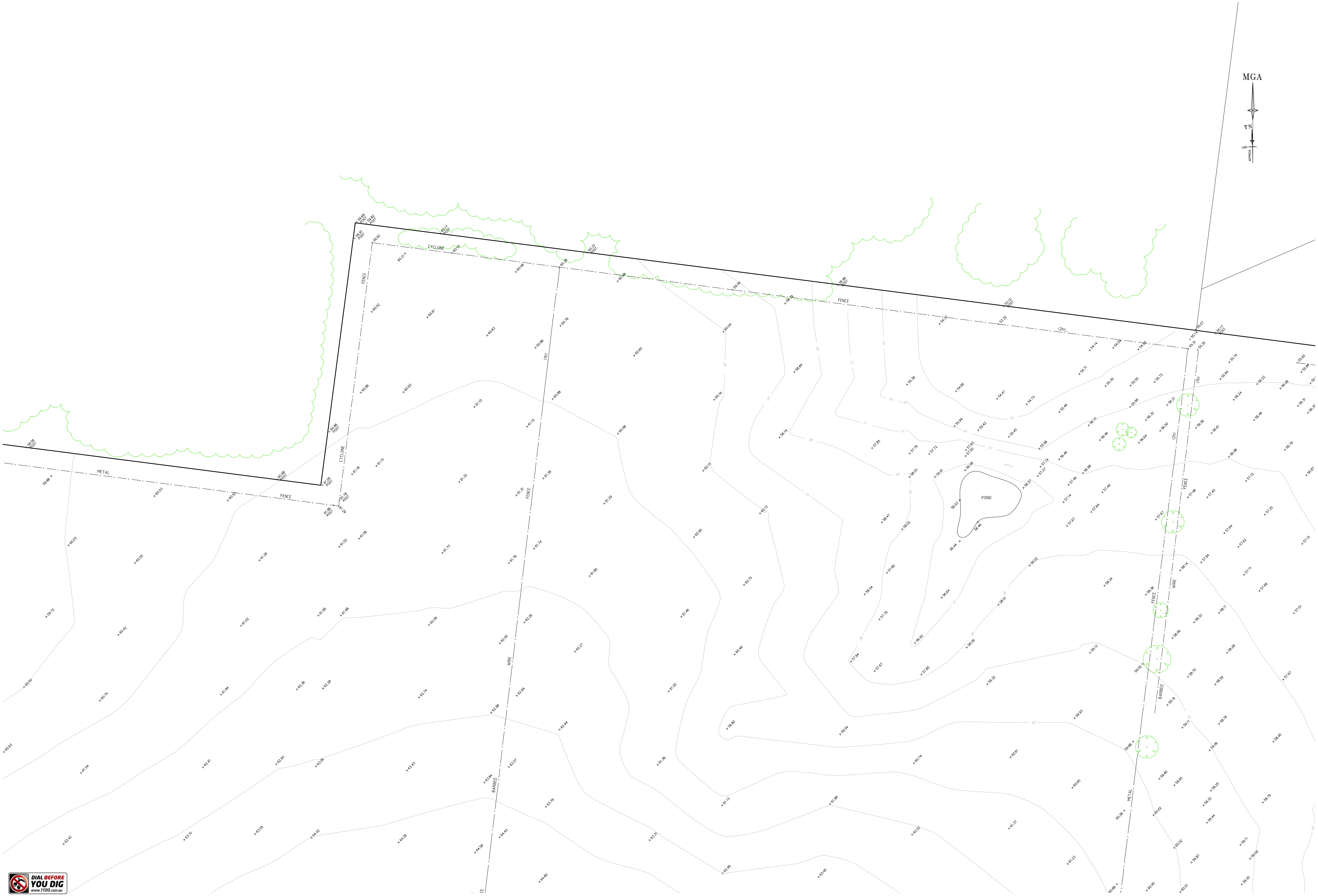

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SHEET 5 OF 28

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MGA

TN

CYCLONE

FENCE

CHANNEL

DRAINAGE

METAL FENCE

FENCE

CREEK

BADGERYS

HEAVILY WOODED AREA

HEAVILY WOODED AREA

TREE CLUSTER

HEAVILY WOODED AREA

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SHEET OF	28 | 6

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MGA

TN

TOP OF BANK

CREEK

COSGROVES

WOODED AREA

HEAVILY WOODED AREA

HEAVILY WOODED AREA

HEAVILY WOODED AREA

FENCE

BARBED

CYCLONE

WIRE

FENCE

METAL

GATE

METAL

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LGA PENRITH

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SHEET 8 OF 28

MGA

TN

BARBED

GRAVEL

BARBED

WIRE

WIRE

FENCE

FENCE

METAL

GATE

GATE

TRACK

FENCE

GATE

TRACK

FENCE

FENCE

METAL

GRAVEL

METAL

CYCLONE

FENCE

TIMBER

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LGA PENRITH

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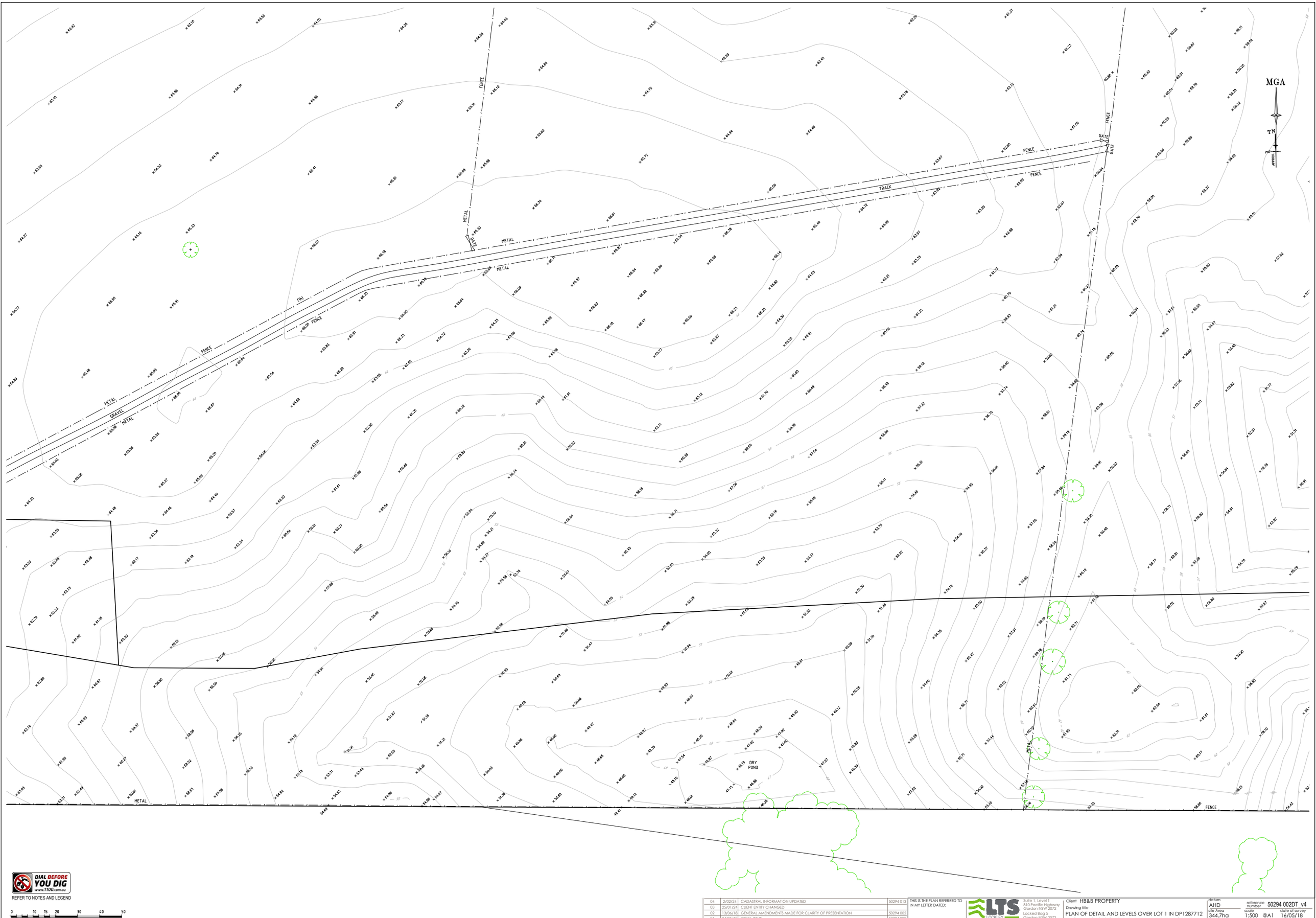
SHEET 9 OF 28



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MGA

TN

GRID NORTH

HEAVILY WOODED AREA

DRY POND

DRY POND

CREEK

BADGERYS

FENCE

CYCLONE

FENCE

CYCLONE

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MGA

TN

CREEK

HEAVILY WOODED AREA

NOTE: POSITION OF CREEK OUTLET IS DIAGRAMMATIC ONLY

GATE

BARBED WIRE FENCE

FENCE

DRAINAGE

CHANNEL

HEAVILY WOODED AREA

HEAVILY WOODED AREA

CYCLONE

GATE

METAL

FENCE

COSGROVES

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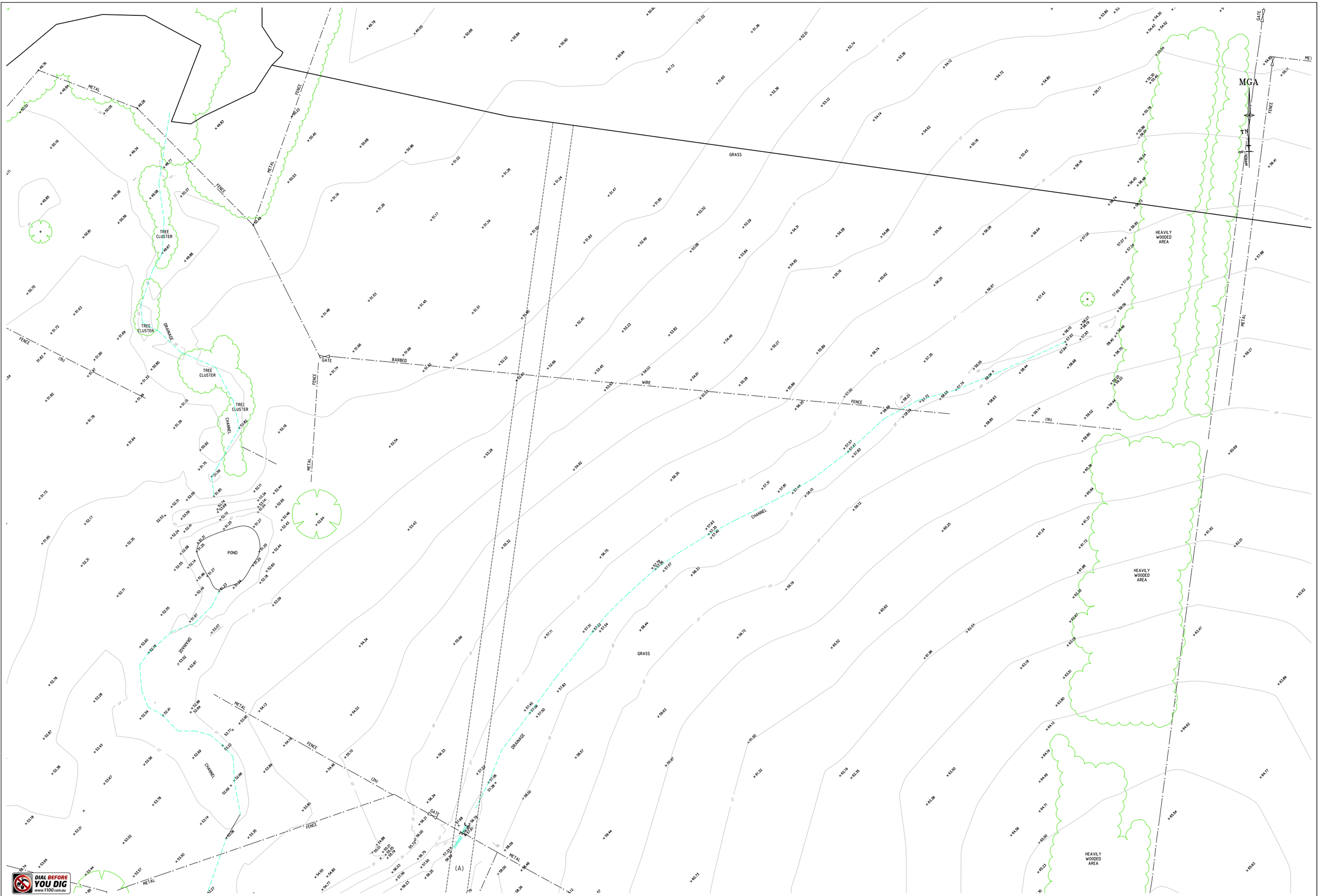

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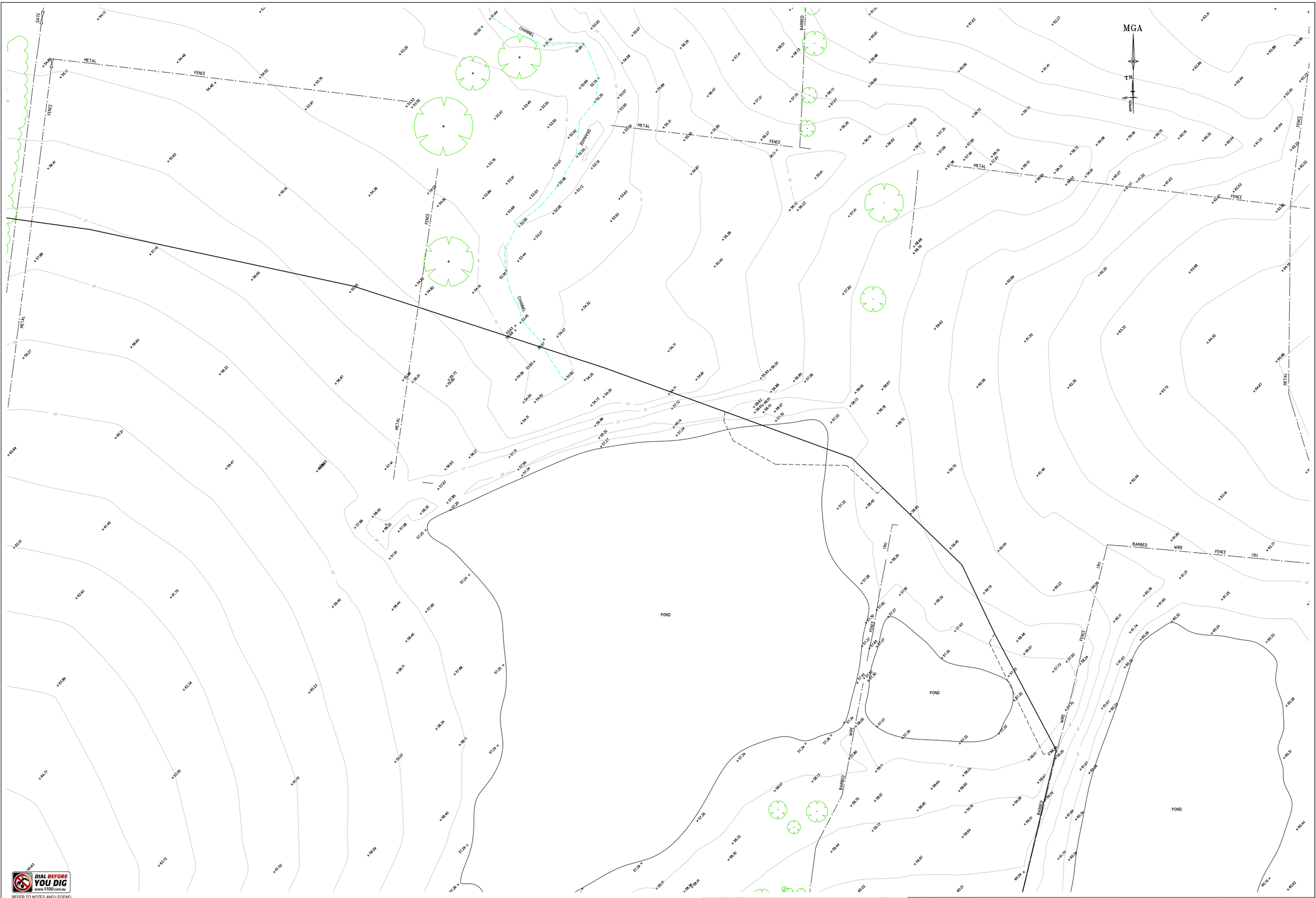
Client HB&B PROPERTY

Drawing title
PLAN OF DETAIL AND LEVELS OVER LOT 1 IN DP1287712 KNOWN AS 1953-2109 ELIZABETH DRIVE, BADGERYS CREEK

datum AHD
site Area 344.7ha
LGA PENRITH

reference number 50294 002DT_v4
scale 1:500 @A1
date of survey 16/05/18

SHEET 28 OF 13



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REFER TO NOTES AND LEGEND

SCALE 1:500 @ A1

CAD FILE REFERENCE:-S:\BADGERYS CREEK Elizabeth Drive No 1953-2109 - Northern Gateway - 50294\CAD Drawings\Detail & Levels\50294 002DT\GDA 2020\Issue 004\50294 002DT_v4.dwg

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02	13/06/18	GENERAL AMENDMENTS MADE FOR CLARITY OF PRESENTATION	50294 002
01	24/05/18	INITIAL ISSUE	50294 002

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datum	AHD
site Area	344.7ha
LGA	PENRITH
reference number	50294 002DT_v4
scale	1:500 @A1
date of survey	16/05/18
SHEET OF	14 OF 28

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REFER TO NOTES AND LEGEND

0 10 15 20 30 40 50
SCALE 1: 500 @ A1

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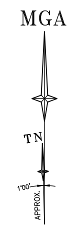
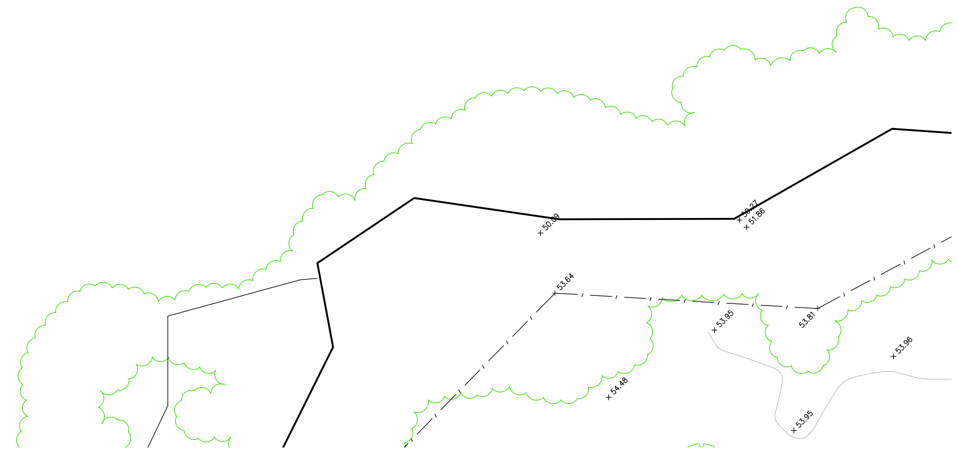
LGA PENRITH

reference number 50294 002DT_v4
scale 1:500 @A1
date of survey 16/05/18
SHEET 15 OF 28

NOTE 11
CENTRELINE OF CREEK IS THE BOUNDARY
- BOUNDARY WAS NOT SURVEYED
- POSITION OF CENTRELINE OF CREEK IS DIGITISED FROM DP848215 & IS SUBJECT TO SURVEY





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datum AHD
site Area 344.7ha
LGA PENRITH
reference number 50294 002DT_v4
scale 1:500 @A1
date of survey 16/05/18
SHEET 16 OF 28

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MGA

TN

COSGROVES CREEK

HEAVILY WOODED AREA

HEAVILY WOODED AREA

HEAVILY WOODED AREA

TREE CLUSTER

TREE CLUSTER

TREE CLUSTER

TREE CLUSTER

LINE OF TREES

PADDOCKS

DRAINAGE CHANNEL

FENCE

METAL

ELECTRIFIED

BARBED WIRE

CYCLONE

GATE

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REFER TO NOTES AND LEGEND

SCALE 1:500 @ A1

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reference number 50294 002DT_v4
scale 1:500 @A1
date of survey 16/05/18
SHEET 17 OF 28

POND

HEAVILY WOODED AREA

HEAVILY WOODED AREA

(A)

PADDOCKS

TREE CLUSTER

TREE CLUSTER

TREE CLUSTER

TREE CLUSTER

TREE CLUSTER

WATER TANK

CULVERT

CHANNEL

DRAINAGE

DRAINAGE

FENCE

METAL

GATE

MGA

TN

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site Area	344.7ha
LGA	PENRITH
reference number	50294 002DT_v4
scale	1:500 @A1
date of survey	16/05/18
SHEET OF	18 28

MGA

TN

APPROX

POND (DRY)

POND

METAL SHED

TREE CLUSTER

GATE GATE

CHANNEL

DRAINAGE

FENCE

METAL

CYCLONE

GRAVEL

TRACK

COLLAPSED FENCE

(2h)

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SCALE 1:500 @ A1

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site Area 344.7ha
LGA PENRITH

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scale 1:500 @A1
date of survey 16/05/18

SHEET 19 OF 28

METAL ANIMAL ENCLOSURE
GATE
BK. BLDG
METAL SHED
METAL SILO
METAL SHED
METAL SHED
METAL SHED
METAL SHED
TRACK
GRAVEL
METAL TANK
METAL
SINGLE STOREY W/B BLDG. METAL ROOF
METAL SHED
SINGLE STOREY BK BLDG. METAL ROOF
METAL SHEDS
METAL SHEDS
SINGLE STOREY W/B BLDG. METAL ROOF
FENCE
POST
FENCE
TRACK
TREE CLUSTER
METAL SHED
GRAVEL
METAL
FENCE
GRAVEL
TRACK
GATE
GATE
CYCLONE
CYCLONE
FENCE
POST
MGA
TN

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datum AHD
site Area 344.7ha
LGA PENRITH

reference number 50294 002DT_v4
scale 1:500 @A1
date of survey 16/05/18
SHEET 20 OF 28

NOTE 11
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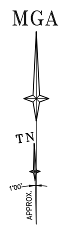

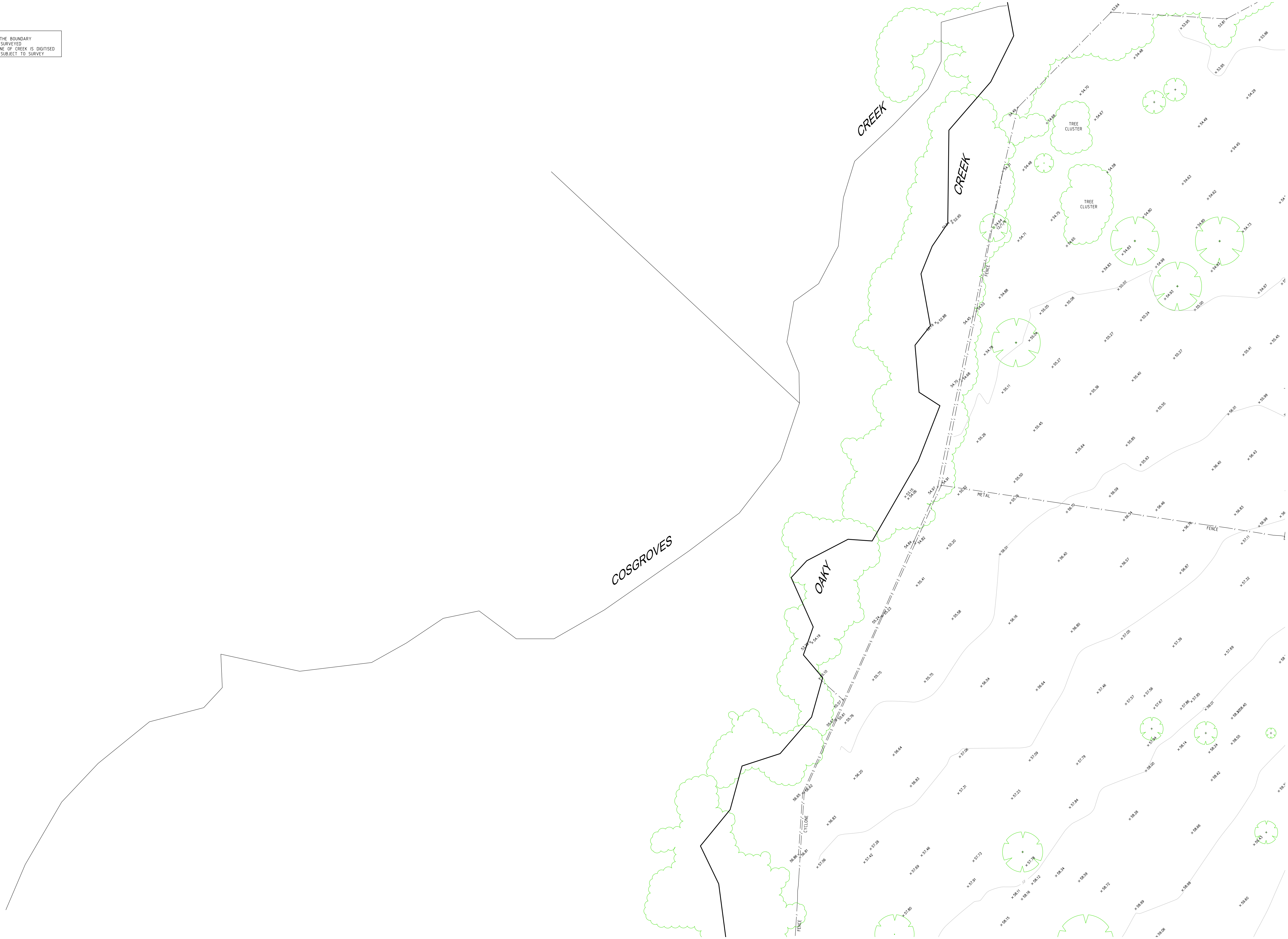

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PLAN OF DETAIL AND LEVELS OVER LOT 1 IN DP1287712 KNOWN AS 1953-2109 ELIZABETH DRIVE, BADGERYS CREEK

datum AHD
site Area 344.7ha
LGA PENRITH

reference number 50294 002DT_v4
scale 1:500 @A1
date of survey 16/05/18
SHEET 21 OF 28

POND

EQUESTRIAN PADDOCK

TREE CLUSTER

METAL SHED

CULVERT

CHANNEL

DRAINAGE

FENCE

METAL

GATE

GRAVEL

TRACK

MGA

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SCALE 1:500 @ A1

0 10 15 20 30 40 50

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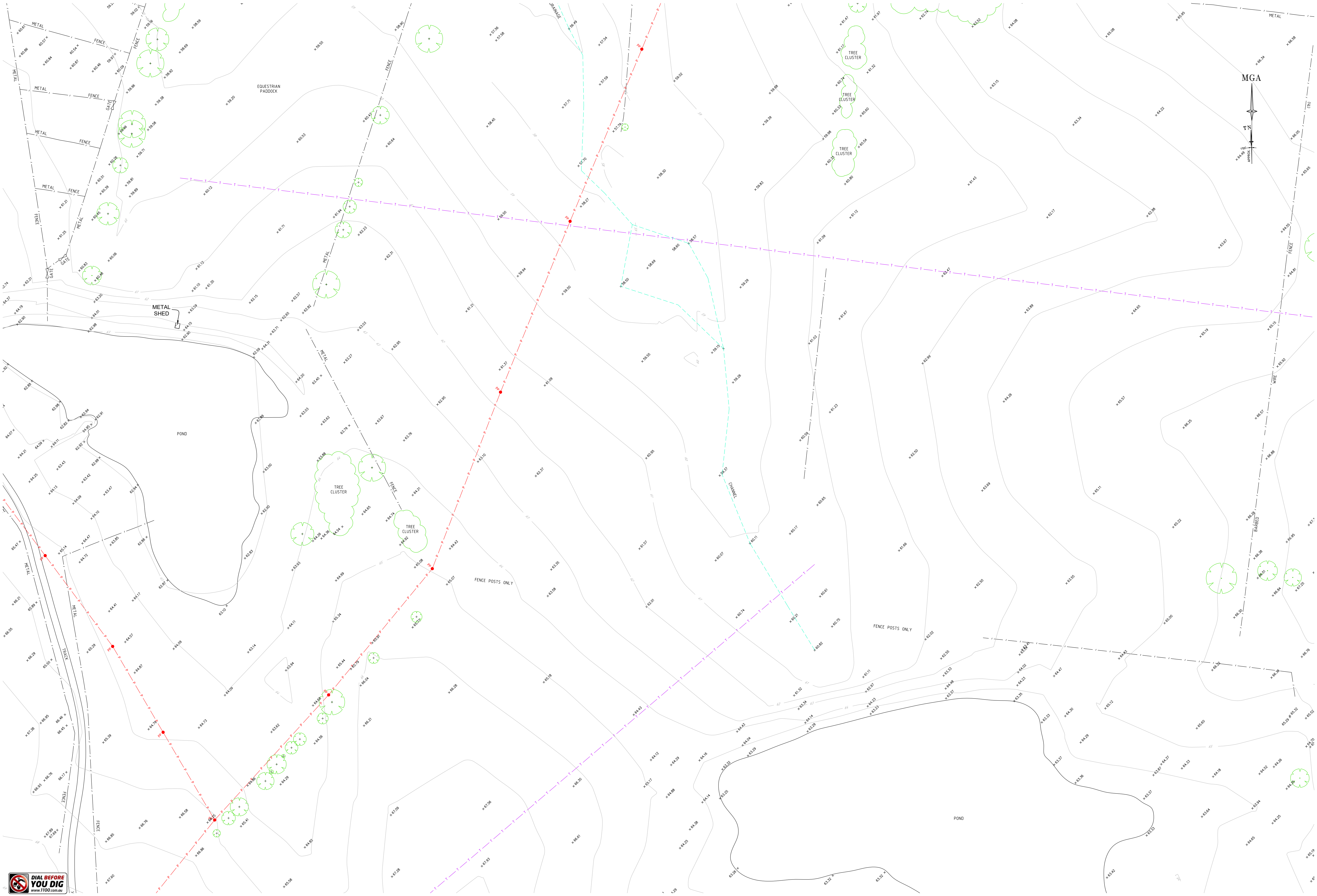
Drawing title
PLAN OF DETAIL AND LEVELS OVER LOT 1 IN DP1287712
KNOWN AS 1953-2109 ELIZABETH DRIVE, BADGERYS CREEK

datum AHD
site Area 344.7ha
LGA PENRITH

reference number 50294 002DT_v4
scale 1:500 @A1
date of survey 16/05/18

SHEET 22 OF 28



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SCALE 1: 500 @ A1 (0 – 10 – 15 – 20 – 30 – 40 – 50)

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datum AHD
site Area 344.7ha
LGA PENRITH

reference number 50294 002DT_v4
scale 1:500 @A1
date of survey 16/05/18
SHEET 23 OF 28

MGA

TN

GRID NORTH

REFER TO NOTES AND LEGEND

SCALE 1:500 @ A1

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SHEET 28 OF 28 | 24

NOTE 11
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ELEVATION A-A STORMWATER CULVERT
1:100

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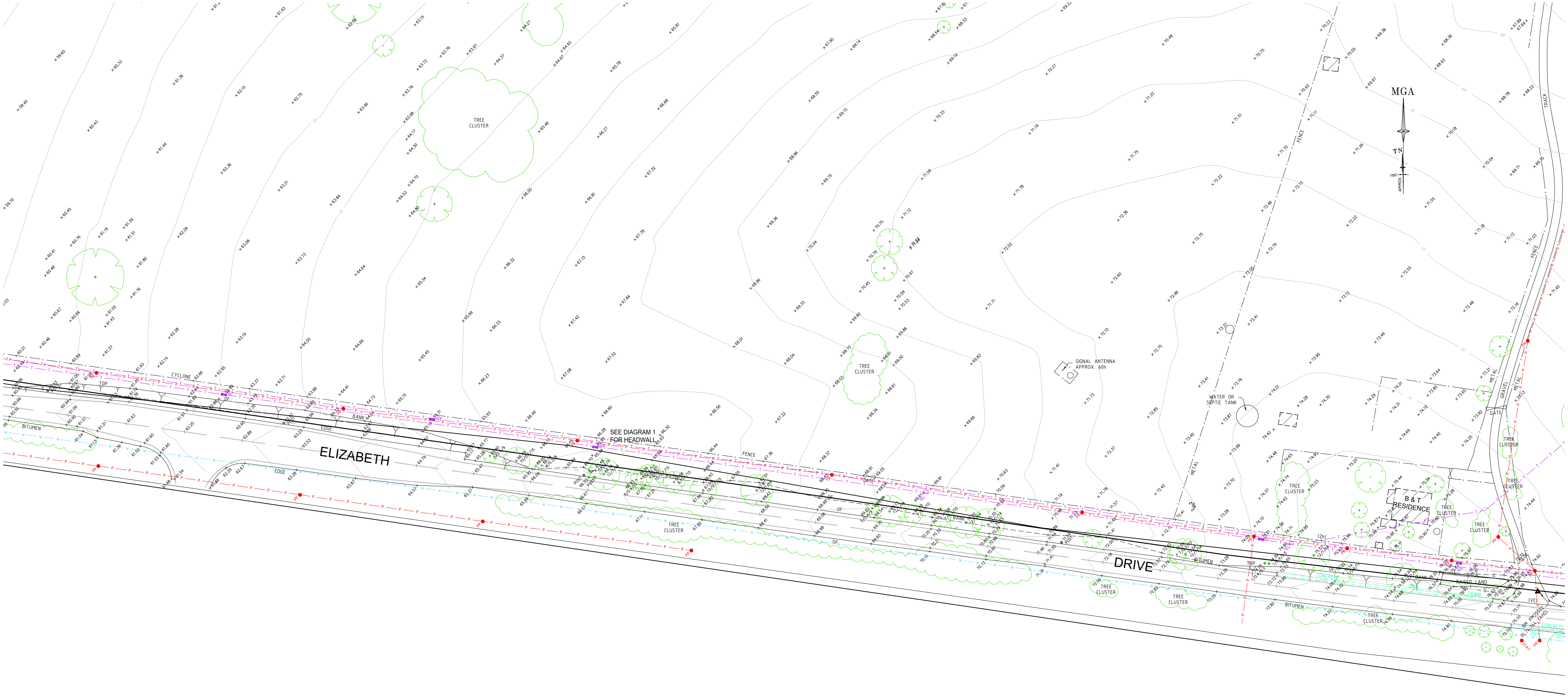

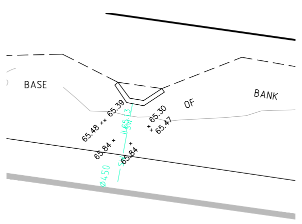

DIAGRAM 1
1:100

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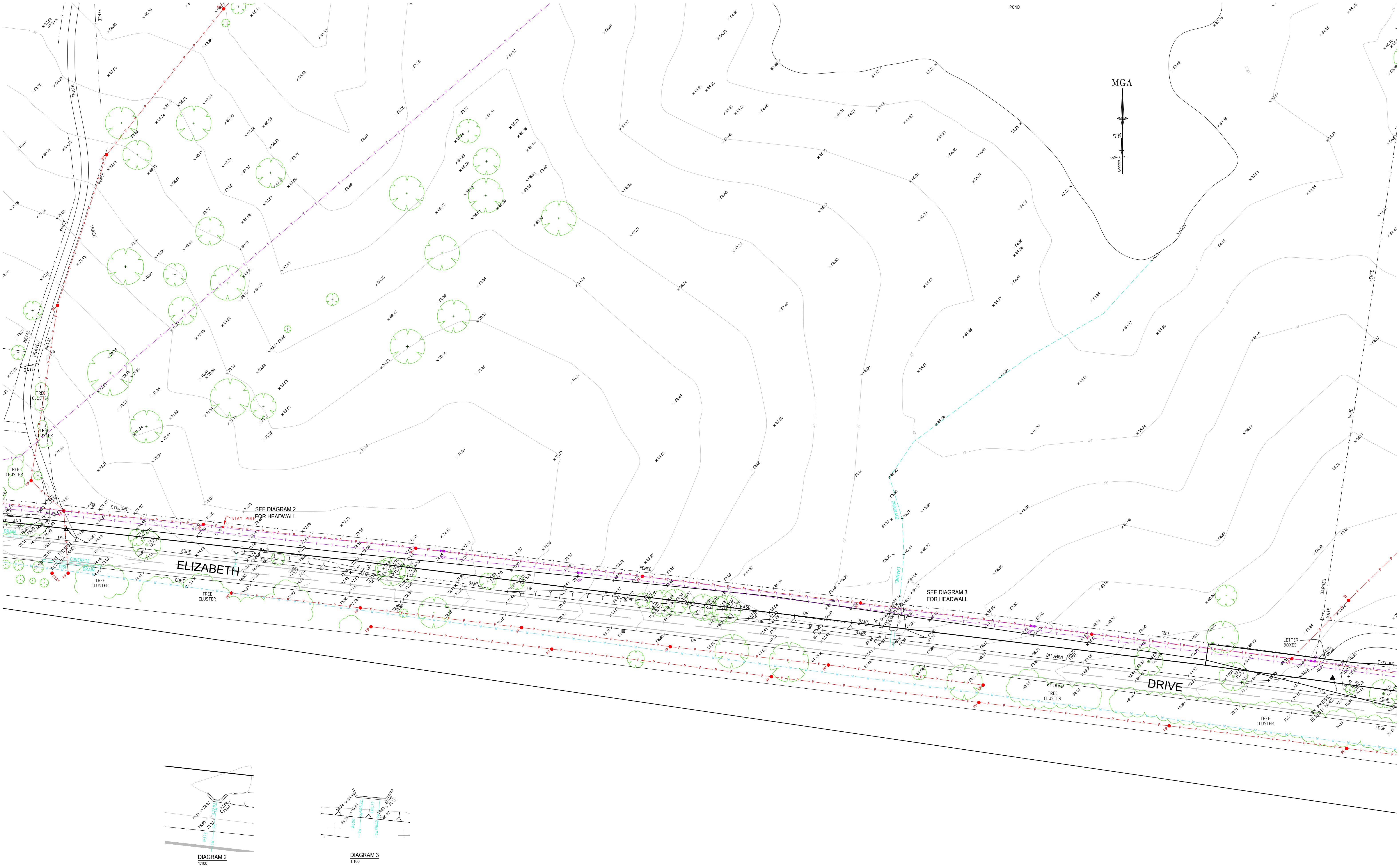

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Client HB&B PROPERTY

Drawing title
PLAN OF DETAIL AND LEVELS OVER LOT 1 IN DP1287712 KNOWN AS 1953-2109 ELIZABETH DRIVE, BADGERYS CREEK

datum AHD
site Area 344.7ha
LGA PENRITH
reference number 50294 002DT_v4
scale 1:500 @A1
date of survey 16/05/18
SHEET 28 OF 28