Our reference
LC/MN/MIRV11189-9204467

Quay Quarter Tower
50 Bridge Street, Sydney NSW 2000, Australia
GPO Box 9925, Sydney NSW 2001, Australia
Tel +61 2 9210 6500
Fax +61 2 9210 6611
www.corrs.com.au

CORRS CHAMBERS WESTGARTH

Sydney
Melbourne
Brisbane
Perth
Port Moresby

28 March 2025

By email: ipcn@ipcn.nsw.gov.au
Office of the Independent Planning Commission NSW
Level 3, 201 Elizabeth Street
Sydney NSW 2000

Contact
Max Newman (02) 9210 6822
Email: max.newman@corrs.com.au

Partner
Louise Camenzuli

Dear Panel Chair

Georges Cove Marina - Flooding Assessment

1 Background

1.1 We refer to the planning proposal PP-2024-658 (**PP**), which seeks to amend development standards for land at 146 Newbridge Road, Moorebank (**Site**). The PP is currently before the Independent Planning Commission (**IPC**) for Gateway Review.

1.2 We act for Mirvac, one of the proponents of the PP, and have been asked to provide an appraisal of the additional information prepared for the purposes of assisting the IPC during the Gateway Review.

1.3 A central tenet of the Gateway determination under review was that the PP did not adequately demonstrate that flood risk could be managed during the future mixed use development of the Site. In particular, the PP:

(i) was inconsistent with Local Planning Direction 4.1 Flooding (**Direction 4.1**). Further, according to the Biodiversity, Conservation and Science division of DCCEEW, the PP does not rely on the latest data available in relation to flood risk;

(ii) does not demonstrate site-specific merit in relation to flood risk, particularly as it is inconsistent with the NSW Flood Prone Land Policy; and

(iii) will facilitate development that absorbs evacuation capacity for future development within Moorebank East and Chipping Norton.

1.4 Flood risk was also a principal concern of Liverpool City Council, as cited in the Gateway Review Justification Assessment.

1.5 As a consequence, Corrs commissioned a further assessment of flood risk by a consultant that had not been involved in the preparation of the PP. We recommended Dr Daniel Martens at Martens & Associates for this purpose, given

his reputation as a highly respected hydrologist who regularly gives evidence in the NSW Land and Environment Court in contested matters.

1.6 Dr Martens has prepared a *Flood Risk Assessment* of today's date (**Martens Report**) to assist the IPC during its assessment of the Gateway Review. Dr Martens, having not been involved in the PP to date, prepared updated flood modelling to test the conclusions of previous flood risk assessments and derive the conclusions reached in the Martens Report. The updated modelling was based on the latest regional-scale model available, part of the *BMT Georges River Flood Study* (2020) (**BMT Model**), which itself responds to a critique that underscored the Gateway determination about the PP's reliance on superseded flood data.

1.7 We have briefly summarised the key conclusions from the Martens Report, as they relate to the reasons for refusal in the Gateway determination, below.

1.8 In our view, with the further work having been undertaken and documented in the Martens Report, the IPC has the information it needs to be satisfied that the concerns that underscored the Gateway determination in relation to flooding have been overcome, or are demonstrably able to be overcome through the implementation of suitable conditions and controls as part of the PP and local environmental plan (**LEP**) making process.

1.9 The Martens Report also makes a number of additional findings and recommendations on matters not cited in the Gateway determination Statement of Reasons. These demonstrate that the Report is a comprehensive assessment commensurate to the scale of development proposed to be facilitated by the PP, and that all necessary measures have been considered in reaching the Report's conclusions about the acceptability of the PP from a flood risk perspective.

1.10 Finally, we acknowledge that the Gateway determination cited a small number of other reasons for not proceeding with the PP. These are addressed in a separate submission prepared by EMM.

2 Consistency with Direction 4.1

2.1 The Gateway determination found that the PP had not demonstrated consistency with Direction 4.1, and that any inconsistency with Direction 4.1 had not been adequately justified.

2.2 The Martens Report finds that the PP is in fact *consistent* with Direction 4.1. It would be repetitious to repeat the Martens Report summary of its assessment against Direction 4.1 in *Section 4.1* of the Report. However, the central reasons for finding this consistency, as we understand them, are that the PP, informed by the Martens Report, now:

(i) relies on updated flood modelling and contemporary information on local conditions;

(ii) is consistent with the NSW Flood Prone Land Policy (**FPLP**) – see Section 3 below;

(iii) is consistent with the principles of the *Flood risk management manual* (2023), which superseded the *Floodplain Development Manual* (2005) cited in the Gateway determination;

(iv) relies on updated evacuation modelling, including contemporary information on local conditions – see Section 4 below;

(v) will deliver residences that are all capable of being located above the Probable Maximum Flood (**PMF**) level. The carpark entry and retail levels will also be over 1 metre above the 0.02% AEP (1 in 5,000 year ARI) flood level and 1.6 m above Council's flood planning level (**FPL**). No residential development would occur between the FPL and PMF;

(vi) situates urban uses on piers above water within the marina, which is common practice across Australia, including Sydney Harbour and over rivers. There is no reason why a future development would not be able to be constructed on appropriately designed piers; and

(vii) there will be no off-site impacts on communities and owners of flood prone properties.

2.3 It is apparent that, having regard to this assessment and the relevant information found throughout the Martens Report, it is now open for the IPC to conclude that the PP is not inconsistent, and certainly not unjustifiably inconsistent, with Direction 4.1.

3 Compliance with NSW Flood Prone Land Policy

3.1 One of the primary requirements of Direction 4.1 is consistency with the FPLP. The Gateway determination found that the PP was inconsistent with the FPLP as it did not satisfy the Policy's primary objective which is to reduce the impacts of flooding and flood liability on communities. It is apparent that this was the central justification for the finding in the Gateway determination that the PP lacked site-specific merit.

3.2 The Martens Report, having regard to the updated modelling undertaken for the purposes of preparing that Report, demonstrates consistency with the FPLP. In particular, it concludes that the PP is consistent with the FPLP because:

a. Updated flood modelling for a full range of events up to the PMF demonstrate that the PP would not result in any off-site impacts on communities and individual owners of flood prone property.

b. The updated modelling demonstrates that future development on the PP site can be readily protected from flood damage through design which elevates floors and protects structures from harm through conventional construction techniques.

c. The PP will, as demonstrated by the updated flood modelling and detailed evacuation modelling, be able to realise the highest and best use of the land.

3.3 Supporting detail for the above conclusions are found throughout the Martens Report. The principal justification for these conclusions is the updated modelling undertaken by Dr Martens, which adopts and improves upon the BMT Model to account for current conditions, and results in a more comprehensive understanding of the flood risk and effectiveness of proposed mitigation measures at the Site compared to those that were before the Minister prior to Gateway determination.

3.4 In our view, the IPC can be satisfied, on the basis of the Martens Report, that the PP does now demonstrate site-specific merit in relation to flooding risk, and that the concerns expressed in the Gateway determination in this regard have been overcome.

4 Evacuation capacity

4.1 The Gateway determination found that the PP should not proceed as it would absorb evacuation capacity for future development within Moorebank East and Chipping Norton. This conclusion was based on a *Georges River Evacuation Modelling* report prepared by Molino Stewart (2022). That report applied a Life Safety Model (**LSM**), which models evacuees leaving the local floodplain during a critical duration PMF event.

4.2 The Martens Report contains an updated evacuation capability assessment (*Section 3.4*). That assessment relies, for consistency, on the LSM, despite noting its numerous conservative assumptions and limitations of the LSM (*Section 3.4.5.4*). It also updated the LSM to account for new information including planning approvals since the Molino Stewart (2022) report was prepared (*Section 3.4.6.3*).

4.3 The Martens Report finds that there are opportunities to improve the evacuation capability of the Site, particularly if a site-specific flood evacuation management plan (**FEMP**) is prepared, accompanied with a warning system and managed by a body corporate for the future development on the Site (*Section 3.4.6.4*). If these measures are implemented, the Martens Report concludes (*Section 3.4.7*) that:

> *… all vehicles from the [S]ite were able to safely evacuate in both approved and proposed conditions, and the number of vehicles caught by flood waters throughout the floodplain reduced in proposed conditions.*

4.4 In our view, the recommendation for a FEMP, early warning system and body corporate management could be readily incorporated into any LEP instrument that ensures that these requirements are translated into conditions of future development consents for the Site.

5 Shelter-In-Place Guideline

5.1 The Martens Report also addresses, at the request of the IPC, the Shelter-In-Place Guideline (Department of Planning, Housing and Infrastructure, January 2025) (**SIP Guideline**).

5.2 The Report concludes that development facilitated by the PP would not need to rely on a shelter-in-place (**SIP**) strategy. However, the option could be made

available as a measure of last resort because all residential units would have floor levels above the PMF, being the level above which any SIP would need to be located.

5.3 Significantly, as the Site is not affected by flash flooding (defined in the SIP Guideline as inundation within 6 hours of a precipitation event), there will be ample warning for occupants of a potential flood before evacuation routes become affected. For those that choose to stay, or are unable to leave, SIP can be accommodated on all residential floors as they would be at or above the PMF level of 11.78 mAHD, in accordance with the requirements of the SIP Guideline.

5.4 All other relevant matters from the SIP Guideline are addressed in *Section 4.2* of the Martens Report.

Yours faithfully
Corrs Chambers Westgarth

Louise Camenzuli
Partner

Georges Cove Marina Residential PP-2024-658

IPC submission

Prepared for Mirvac

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Georges Cove Marina Residential PP-2024-658

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Approved by

Allan Young
Technical Lead, Urban and Regional Planning
28 March 2025

Level 10 201 Pacific Highway
St Leonards NSW 2065
ABN: 28 141 736 558

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ABN: 28 141 736 558

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1 Introduction

Planning Proposal PP-2024-658 seeks to amend development standards for land at 146 Newbridge Road Moorebank (part Lot 3 DP 1246745) by introducing a new additional permitted use for residential flat buildings, multi dwelling housing and restaurants/cafes with a maximum total gross floor area of 1,500m2, increasing the maximum height of building and floor space ratio controls. The initial Gateway assessment by the Department of Planning, Infrastructure and Housing (the Department) did not support the proposal, and a Gateway Review was requested.

A Gateway Review assessment conducted by the Department did not alter the position of the Department that the proposal should not proceed.

The Gateway Determination Review is currently before the Independent Planning Commission (IPC) and a stakeholder meeting was convened by the IPC on 13 February 2025.

A request for an extension of time was made at the conclusion of the stakeholder meeting to enable further analysis of the flood risk, and for that information to be provided to the IPC to inform their deliberations.

The IPC agreed to further information being provided by 14 March 2025, with specific focus on:

- Section 9.1 Ministerial Direction 4.1 Flooding; and
- Shelter-In-Place Guideline (Department of Planning, Housing and Infrastructure, January 2025).

A further extension of 14 days was requested and given to allow the proponent to finalise modelling, this provided a submission due date of 28 March 2025.

This submission provides a brief summary of the strategic merit considerations, and specific information regarding flood risk and evacuation.

2 Strategic merit

The Department's position is based on four factors:

- the planning proposal remains inconsistent with the Greater Sydney Region Plan – a Metropolis of Three Cities and Western City District Plan
- the planning proposal remains inconsistent with the Liverpool City Council's LSPS and Liverpool Housing Strategy.
- the proposal remains unjustifiably inconsistent with Local Planning Directions 1.1 Implementation of Regional Plans and 4.1 Flooding
- the proposed phased evacuation is not supported by BCS and SES.

We believe there is strategic and site specific merit for this planning proposal and therefore provide a brief response to the Department's concerns below.

2.1 The planning proposal remains inconsistent with the Greater Sydney Region Plan – a Metropolis of Three Cities and Western City District Plan

2.1.1 Greater Sydney Region Plan

The Department's key argument is that Strategy 37.1 of the Regional Plan seeks to avoid locating new urban development in areas exposed to natural and urban hazards.

A closer examination of the Region Plan confirms that this is not new urban development – which refers to greenfield sites. The site is already urbanised and has an approved marina. The Department's Gateway Justification Assessment (p 7) itself states that the site is classified as 'urban renewal'.

Options to limit intensification have been considered. All habitable areas are above the PMF, and therefore exposure to the hazard is reduced.

We also note the relevant statement (Region Plan p 30) that "development will need to better capitalise on air rights rather than making space by expanding the urban footprint" – which is what this proposal facilitates.

2.1.2 Western City District Plan

The Department's key view is that development of the Moorebank East Precinct is considered to be a "urban renewal" and when considered against the criteria of an urban renewal development, the planning proposal is:

- not located in proximity to any regional and district infrastructure, such as Sydney Metro - City and Southwest
- not located within walking distance of centres with public transport access
- not located near an area with higher social housing concentration, nor does it propose any form of social housing
- inclusive of commercial land uses which could enable provisions of jobs within the site.

The District Plan considers urban renewal as part of the overarching aim to provide "more housing in the right locations". The locational criteria for urban renewal sites (District Plan p 42) is not a checklist but rather a guide to the likely areas where investigation is encouraged. The clear intention is to make housing 'well located'.

In this respect the site is in proximity to regional and district infrastructure albeit not the Sydney Metro, however the District Plan is clearly not limiting urban renewal to land adjacent to the Sydney Metro. It is simply acknowledging the Metro as a catalysing element for urban renewal.

The site is 500 m from public transport (Newbridge Road) and 250 m from the future walking and cycling network along the foreshore of the river.

The site is not near a social/affordable housing concentration but arrangements can be put in place at development application stage to address local affordable housing provision.

The Department has taken a narrow view of the provisions in strategic plans. Moorebank East is emerging as a precinct which provides a unique riverside lifestyle and a rare marina facility for Western Sydney, and is a catalysing element in its own right. It represents a unique opportunity to deliver the commitment under the District Plan (p 39) that "new housing must be in the right places to meet demand for different housing types, tenure, price points, preferred locations and design".

2.2 The planning proposal is consistent with the Liverpool City Council LSPS and Liverpool Housing Strategy

2.2.1 Local Strategic Planning Statement

The Department's view is that the planning proposal is inconsistent with the LSPS as it proposes housing density outside the Liverpool City Centre, is not close to an existing centre, and does not have good public transport accessibility.

In our view, this ignores the LSPS principle that Liverpool will "capitalise on … the amenity of the Georges River" and that the top two liveability priorities for the community are 'access to parks and recreation options' and 'walkable neighbourhoods' (p 37).

The Department's analysis also overlooks the wording in the LSPS (p 44) that "Council's preference is for any increases in the density of current controls to be focused in the City Centre and close to centres". There is clearly flexibility intended.

While the site is not close to an "existing centre", the Department's consideration overlooks the 'emerging centre' of Georges Cove Village which will provide for a supermarket, retail shops and light industries.

2.2.2 Housing Strategy

The Department's reservation is that the site is not in an identified investigation area under the Strategy.

A closer reading of the Housing Strategy however reveals that the Strategy states "in certain circumstances it may be appropriate for Council to consider rezoning for residential uplift in appropriate locations outside of the identified Investigation Areas" (p 75).

The Housing Strategy identifies areas where demand for the preferred housing types (notably apartments and townhouses) can be accommodated – such as Liverpool City Centre and Miller precinct – but this is a supply constraining response and may not align with market demand for particular locations.

It is worth noting the Productivity Commission report *Building more homes where people want to live* (2023) found that "the locating of new houses needs to consider both consumer preferences *and* existing infrastructure capacity" (p 10). The key message is that "to address this [housing supply] shortage, the state should prioritise increasing housing supply where households want to live" (p 20).

Mixed marina and residential development examples such as The Waterfront (Shell Cove) indicate that demand for 'lifestyle' communities remains strong. This suggests that demand for the proposed townhouses and apartments will be high and thereby stimulate mobility and relieve local housing pressures.

2.3 The proposal is consistent with Local Planning Directions 1.1 Implementation of Regional Plans and 4.1 Flooding

2.4 Local Planning Direction 1.1 Implementation of Regional Plans

The matter of alignment with regional plans is addressed in Section 2.1 of this submission.

2.5 Local Planning Direction 4.1 Flooding

Please refer to the dedicated section of this submissions regarding flooding and evacuation.

2.6 The proposed phased evacuation is not supported by BCS and SES

Please refer to the dedicated section of this submissions regarding flooding and evacuation.

3 Flood risk and evacuation

A Flood Risk Assessment has been prepared by Martens and Associates Pty Ltd (Martens) which considers site specific and local area flood risk and evacuation arrangements.

The Martens report provides a consolidated assessment of flood risks as they relate to the planning proposal PP-2024-658, with a focus on flood behaviour and impacts, flood resilience and evacuation.

A copy of the Martens report is provided as a companion document to this submission.

The key findings are:

3.1 Flood impacts

The site is capable of supporting the proposed residential land use and that there is sufficient flexibility available to accommodate a range of design solutions to ensure no adverse off-site flood impacts.

3.2 Flood resilience

The site is capable of supporting a future residential development that provides for adequate flood resilience measures incorporated into the urban design. In particular, a future development would be capable of ensuring that all residential floors would be above the PMF to protect private property and that basements could be protected to the 0.02% AEP flood. It is conceivable that a basement design could be produced that provides flood immunity to the PMF.

3.3 Structural risks

The site is capable of delivering a future urban development footprint supported by piers over open water, this being consistent with other similar developments found in Sydney Harbour, and that the design details are matters capable of being addressed at a future development application stage.

3.4 Evacuation route capacity

A future development of the site, if managed and controlled by a body corporate, is capable of being fully evacuated during a flood emergency without detrimentally impacting on the evacuation capable of other persons on the floodplain or on public resources such as the SES.

3.5 Flood emergency response

A future development should be managed by a body corporate able to remain informed of any changes in flood information and risk and adapt continuing risk management processes and procedures for the entire community it serves. The body corporate would provide a single point of contact for the SES and other emergency response agencies.

3.6 Local planning directions

The PP proposal is consistent with the requirements of Section 9.1 Ministerial Directions 4.1 Flooding, and a future development of the site consistent with the PP would be capable of being designed to meet flood planning controls in respect of risk to life and property. A more detailed examination of Local Planning Directions is provided at Section 4.

3.7 Shelter in place

The PP site and evacuation route to the M5 are not affected by flash flooding and will not need to rely on sheltering in place. A future urban development will be able to implement off-site evacuation as the primary evacuation strategy, and as a measure of last resort, will be able to provide on-site shelter above the PMF to all persons.

4 Local planning directions

4.1 Direction 1.1 Implementation of regional plans.

An assessment of the proposal against the relevant provisions contained the Local Planning Direction 1.1 is addressed in detail at Section 2.1 of this submission.

The assessment concludes that the proposal is consistent with all relevant terms of the Direction.

Table 4.1 Compliance with Local Planning Direction 1.1 Implementation of regional plans

Clause	Provision	Assessment
1	*Planning proposals must be consistent with a Regional Plan released by the Minister for Planning:*	The relevant strategic plans are the Greater Sydney Region Plan and the Western City District Plan.

4.1 Direction 4.1 Flooding

An assessment of the proposal against the relevant provisions contained the Section 9.1 Local Planning Direction 4.1 Flooding is provided in Table 4.2.

The assessment concludes that the proposal is consistent with all relevant terms of the Direction.

Table 4.2 Compliance with Local Planning Direction 4.1 Flooding

Clause	Provision	Assessment
1	*A planning proposal must include provisions that give effect to and are consistent with:*	(1) See below.
1(a)	*the NSW Flood Prone Land Policy,*	(2) The primary objective of the FPLP is to reduce the impacts of flooding and flood liability on developable land within and outside the site and reduce public and private losses. (3) The PP is consistent with the FPLP because: a. Updated flood modelling for a full range of events up to the PMF demonstrate that the PP would not result in any off-site impacts on communities and individual owners of flood prone property. b. The updated modelling demonstrates that future development on the PP site can be readily protected from flood damages through design which elevates floors and protects structures from harm through conventional construction techniques. c. The PP will, as demonstrated by the updated flood modelling and detailed evacuation modelling, be able to realise the highest and best use of the land.
1(b)	*the principles of the Floodplain Development Manual 2005,*	(4) The FDM (2005) has been superseded by the FRMM (2023). (5) The PP is consistent with the flood risk management principles contained in Section 2 of the FRMM because: a. The PP is sustainable and will be capable of being developed with consideration of climate change and extreme flood events up to the PMF. b. The PP is strategic because it has considered flood risks across the LGA and Georges River floodplain. Updated evacuation modelling demonstrates that the PP will not detrimentally impact on the evacuation capacity of others on the floodplain,

Clause	Provision	Assessment
		and provides an opportunity to improve existing evacuation capability through early co-ordinated site evacuation. c. The PP has progressed through various stages of consultation, including the preparation of updated flood impact modelling and flood evacuation modelling presented in this report. d. The flood impact modelling and flood evacuation modelling provided in this report is based on the latest 2020 BMT flood modelling and 2022 Molino flood evacuation information. e. The updated flood modelling considers a full range of floods up to the PMF. f. The updated flood modelling considers how flood risks may change over time by consideration of climate change based on the latest available 2020 BMT flood modelling. g. The PP does not seek to materially change any existing waterway. h. The PP will not impact on the natural function of any waterway or floodplain flow characteristics. i. The PP would see a future development managed by a body corporate which would function to ensure that any continuing flood risks would be centrally managed, ensuring that risk management measures such as signage, warning systems, flood alarms, evacuation procedures and flood wardens, would be funded and operational in perpetuity. j. The PP would see a future development managed by a body corporate able to remain informed of any changes in flood information and risk and adapt continuing risk management processes and procedures for the entire community it serves.
1(c)	*the Considering flooding in land use planning guideline 2021, and*	(6) PP is consistent with the 2021 planning guidelines because: a. The PP has considered a full range of events including the 1% AEP, 1% AEP + CC, 0.05% AEP, 0.02% AEP and PMF flood events. b. The PP would deliver future urban development that is significantly better protected against flood risks than current planning standards. The carpark entry and retail levels at 7.6 mAHD will be 1.02 m above the 0.02% AEP (1 in 5,000 year ARI) flood level and 1.6 m above Council's FPL. All residences would be capable of being located above the PMF. c. Updated evacuation modelling based on the latest 2022 Molino Life Safety Model (LSM) demonstrates that future occupants can be evacuated in accordance with best practice and SES recommendations, before being cut off by flood waters, and do so without impacting others evacuating from the floodplain. In the event that some persons are not evacuated, all residences would be able to safely shelter on-site. d. Updated flood modelling for a full range of events up to the PMF demonstrate that the PP would not result in any off-site impacts on communities and individual owners of flood prone property. e. The updated modelling demonstrates that future development on the PP site can be readily protected from flood damages through design which elevates floors and protects structures from harm through conventional construction techniques
1(d)	*any adopted flood study and/or floodplain risk management plan prepared in accordance with the principles of the Floodplain Development Manual 2005 and adopted by the relevant council.*	(7) This is achieved because: a. This assessment includes updated flood modelling which has been carried out based on the BMT (2020) *Georges River Flood Study* and using the BMT (2020) TUFLOW model which is considered by DPHI and SES to be the latest available flood modelling for the floodplain and site.

Clause	Provision	Assessment
		b. The flood modelling contained in the Georges River Floodplain Risk Management Study (GRFRMS, 2004) has been superseded by the most recent BMT (2020) flood modelling which has been relied upon by this report. The PP is not inconsistent with the recommendations or outcomes of the GRFRMS. Significantly, the 1% AEP + 0.5 m freeboard was the recommended principal floor level control for residential uses. The PP provides for floor levels significantly exceeding this requirement.
2	*A planning proposal must not rezone land within the flood planning area from Recreation, Rural, Special Purpose or Conservation Zones to a Residential, Business, Industrial or Special Purpose Zones.*	(8) This PP does not seek to rezone land within the flood planning area from a Recreation zone to a Residential zone. The planning proposal seeks additional permitted uses with the existing RE2 Private Recreation zone.
3	*A planning proposal must not contain provisions that apply to the flood planning area which:*	(9) See below.
3(a)	*permit development in floodway areas,*	(10) This is achieved because: a. The urban use will be located on structural piers above water within the marina and will not be located within a floodway. b. The piers will be located in an area mapped as floodway by application of the BMT (2020) definition, however this is common practice in Australia where many structures are supported over piers within harbours, over the ocean or over rivers (e.g. bridges, causeways). In Sydney Harbour there are numerous examples where urban development has successfully occurred suspended on piers over deep water. c. The area mapped as a floodway arises artificially because of historical extraction activities at the site which has created a large pool of open water. In this area velocities are very low and do not present any difficulty for future structural design and construction. d. The floodway categorisation in this area is a modelling artifact arising from structures represented as layered flow constrictions which allow water to pass through. Flood mapping does not account for the restriction of flood depths to 1.95 m due to the basement structure. These areas should therefore be classified as flood storage.
3(b)	*permit development that will result in significant flood impacts to other properties,*	(11) This is achieved because: a. Updated flood modelling for a full range of events up to the PMF demonstrate that the PP would not result in any off-site impacts on communities and individual owners of flood prone property.
3(c)	*permit development for the purposes of residential accommodation in high hazard areas,*	(12) This is achieved because: a. The urban use will be located on structural piers above water within the marina and will not be located within an area of high hazard. b. The piers will be located in an area mapped as H5 in the 1% AEP and H6 in the PMF, however this is common practice in Australia where many structures are supported over piers within harbours, over the ocean or over rivers, and is no reason why a future development would not be capable of constructing appropriate structural piers.
3(d)	*permit a significant increase in the development and/or dwelling of that land,*	(13) This is achieved because: a. The PP does not propose to increase future development below the FPL. All future urban development would be raised significantly above the FPL.

Clause	Provision	Assessment
		b. The carpark entry and retail levels at 7.6 mAHD will be 1.02 m above the 0.02% AEP (1 in 5,000 year ARI) flood level and 1.6 m above Council's FPL. All residences would be capable of being located above the PMF
3(e)	*permit development for the purpose of centre-based childcare facilities, hostels, boarding houses, group homes, hospitals, residential care facilities, respite day care centres and seniors housing in areas where the occupants of the development cannot effectively evacuate,*	(14) This is achieved because: a. The PP does not propose any sensitive uses of the site.
3(f)	*permit development to be carried out without development consent except for the purposes of exempt development or agriculture. Dams, drainage canals, levees, still require development consent,*	(15) This is achieved because: a. Future development would require development consent.
3(g)	*are likely to result in a significantly increased requirement for government spending on emergency management services, flood mitigation and emergency response measures, which can include but are not limited to the provision of road infrastructure, flood mitigation infrastructure and utilities, or*	(16) This is achieved because: a. Updated evacuation modelling based on the latest 2022 Molino Life Safety Model (LSM) demonstrates that future occupants can be evacuated in accordance with best practice and SES recommendations, before being cut off by flood waters, and do so without impacting others evacuating from the floodplain. In the event that some persons are not evacuated, all residences would be able to safely shelter on-site b. The PP would see a future development managed by a body corporate which would function to ensure that any continuing flood risks would be centrally managed, ensuring that risk management measures such as signage, warning systems, flood alarms, evacuation procedures and flood wardens, would be funded and operational in perpetuity c. The PP would not increase the requirement for government spending on emergency management services or flood mitigation measures in events up to and including the PMF due to the flood resilience that can and would be incorporated into a future development of the site.
3(h)	*permit hazardous industries or hazardous storage establishments where hazardous materials cannot be effectively contained during the occurrence of a flood event.*	(17) This is achieved because: a. All future commercial floor levels would be 1.6 m above the FPL. b. No hazardous materials would be stored at lower levels.
4	*A planning proposal must not contain provisions that apply to areas between the flood planning area and probable maximum flood to which Special Flood Considerations apply which:*	(18) This is achieved because: a. There are no uses within the PP that apply to the Special Flood Considerations.
4(a)	*permit development in floodway areas,*	(19) Achieved. Refer to response to provision 3(a) and 4.
4(b)	*permit development that will result in significant flood impacts to other properties,*	(20) Achieved. Refer to response to provision 3(b) and 4.
4(c)	*permit a significant increase in the dwelling density of that land,*	(21) Achieved. Refer to response to provision 3(d) and 4.
4(d)	*permit the development of centre-based childcare facilities, hostels, boarding houses, group homes, hospitals, residential care facilities, respite day care centres and seniors housing in areas*	(22) Achieved. Refer to response to provision 3(e) and 4.

Clause	Provision	Assessment
	where the occupants of the development cannot effectively evacuate,	
4(e)	*are likely to affect the safe occupation of and efficient evacuation of the lot, or*	(23) Achieved. Refer to response to provision 3(g) and 4.
4(f)	*are likely to result in a significantly increased requirement for government spending on emergency management services and flood mitigation and emergency response measures, which can include but not limited to road infrastructure, flood mitigation infrastructure and utilities.*	(24) Achieved. Refer to response to provision 3(g) and 4.
5	*For the purposes of preparing a planning proposal, the flood planning area must be consistent with the principles of the Floodplain Development Manual 2005 or as otherwise determined by a Floodplain Risk Management Study or Plan adopted by the relevant council.*	(25) Achieved. Refer to response to provisions 1(b) and 1(d).

5 Conclusion

The Moorebank East precinct represents something special and unique for western Sydney. The centrepiece of the marina, open space, walkable neighbourhood and river frontage responds to the lifestyle preferences of the community, as evidenced by the community input to the Local Strategic Planning Statement.

While the proposal is compatible with strategic planning at the regional or district scale, an equally important consideration is how to deliver the NSW Government's placemaking vision – which is guided by the mantra to "make special places thrive".

The strategic plans, housing strategies, the local planning directions, and other contextual documents all include provisions which recognise the need for flexibility. While those high-level plans are tailored to guide the 90% of planning proposals which seek to intensify residential development, they also acknowledge that there can be special places which do not fit with the run-of-the-mill scenarios, but which nevertheless possess merit.

This planning proposal is a case in point.

The technical assessments in support of this planning proposal, prepared by recognised experts, confirm that there are solutions available to address all concerns, including flood risk and evacuation capacity.

We also believe that there are valid urban planning merits in the planning proposal which, together with the technical information provided, outweigh or overcome the Department's concerns which underpinned the Gateway assessment.

We appreciate the opportunity to have provided this additional information to the IPC.

Appendix A

Flood risk assessment (Martens 2025)

EMM
creating opportunities

A.1 Flood risk assessment (Martens 2025)

Australia

SYDNEY
Level 10 201 Pacific Highway
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE
Level 3 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE
Level 1 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA
Suite 2.04 Level 2
15 London Circuit
Canberra City ACT 2601

ADELAIDE
Level 4 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
Suite 9.01 Level 9
454 Collins Street
Melbourne VIC 3000
T 03 9993 1900

PERTH
Suite 3.03
111 St Georges Terrace
Perth WA 6000
T 08 6430 4800

Canada

TORONTO
2345 Yonge Street Suite 300
Toronto ON M4P 2E5
T 647 467 1605

VANCOUVER
2015 Main Street
Vancouver BC V5T 3C2
T 604 999 8297

CALGARY
700 2nd Street SW Floor 19
Calgary AB T2P 2W2

linkedin.com/company/emm-consulting-pty-limited

emmconsulting.com.au

Flood Risk Assessment

A Review of Flooding and Evacuation for the Georges Cove Marina Planning Proposal, Moorebank NSW

Final Report

P2410708JR02V01

March 2025

Prepared for Mirvac

Project Details

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Manager	Stanley Leung
Principal Authors	Daniel Martens, Ryan Doyle, Mark O'Brien

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© Copyright Martens & Associates Pty Ltd
Suite 201, 20 George St, Hornsby, NSW 2077, Australia
ACN 070 240 890 ABN 85 070 240 890
P +61-2-9476-9999 | mail@martens.com.au | www.martens.com.au

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Executive Summary

Scope of Study

This report provides a consolidated assessment of flood risks as they relate to a planning proposal (**PP**) to amend the Liverpool Local Environmental Plan 2008 (**LEP**) and include an additional permitted use clause to enable construction of a mixed-use development at Lot 3 DP1246745, 146 Newbridge Road, Mooorebank, NSW (the **Site**). The scope of work covered by this study includes:

1. Review of the flood investigations completed to date.
2. Assessment of flood behaviour and impacts based on the recent BMT 2020 Georges River flood model.
3. Assessment of site evacuation capacity by application of the Life Safety Model (LSM) documented in the 2022 Molino Stewart 2022 *Georges River Evacuation Modelling* report.
4. Assessment of the PP against planning controls, notably the Section 9.1 Local Planning Directions 4.1 Flooding, the Department of Planning, Housing and Infrastructure (DPHI) Planning Circular PS 24-001 and the DPHI 2025 Shelter-in-Place Guideline for Flash Flooding.

Summary of Findings

Flood Behaviour and Impacts

Updated flood modelling for a full range of events including the 20%, 10%, 5%, 2%, 1%, 0.5%, 0.2%, 0.05%, 0.02% AEP and PMF (EFE) flood events has been completed using the most recent 2020 BMT flood model, comparing the existing approved site conditions with conditions that would likely be present under a future development scenario. Key planning levels obtained from the model were 5.50 mAHD for the 1% AEP (100 year ARI), 6.04 mAHD for the 0.2% AEP flood (500 year ARI), this being a surrogate for climate change assessment purposes, and 11.78 mAHD for the PMF.

Modelling indicated that off-site flood impacts, in terms of changes to flood levels, peak flow velocities or changes to flood hazard categories, or impacts to the local environment are not likely and could be readily mitigated through standard engineering design and practice.

Flood Resilience

Based on the updated flood modelling using the 2020 BMT flood model, a future urban development would be capable of providing appropriate flood resilience measures to protect property from flood damages. Specifically, all residential floors could be located at or above the PMF of 11.78 mAHD.

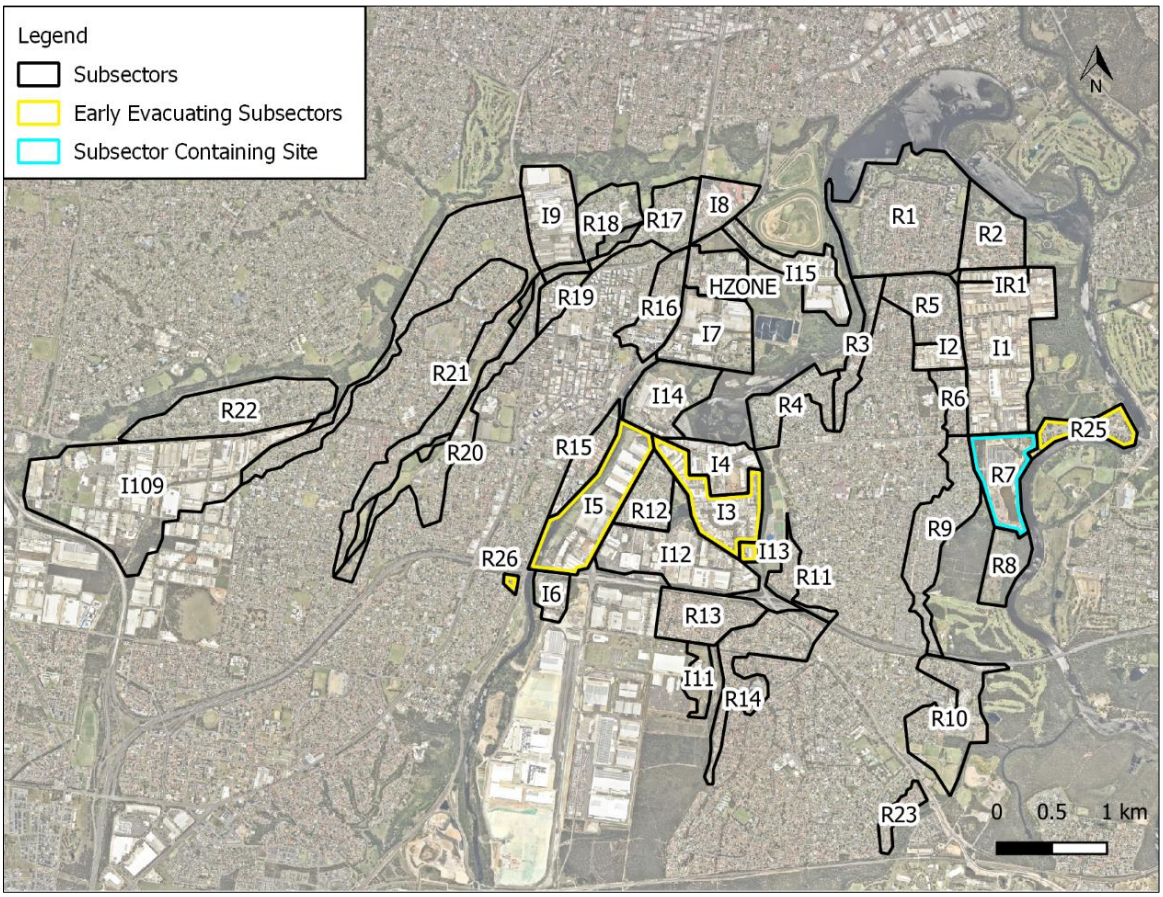
The carpark entry and ground floor retail spaces are readily capable of being protected to a level of 7.6 mAHD (the level currently proposed under the PP), which is approximately equivalent to a 0.006% AEP (1 in 17,500 year ARI) flood event. At this level, the carpark is 2.1 m

above the 1% AEP flood level, and 1.56 m above the 0.2% AEP (1 in 500 year ARI) flood representing a conservative approximation of 1% AEP climate change conditions.

Evacuation

An updated evacuation capability assessment was completed for the PP by application of the Life Safety Model (LSM) as documented in the Molino Stewart 2022 *Georges River Evacuation Modelling* report, that being the most recent and up to date assessment of evacuation for the floodplain. Scenario A (as documented in the 2022 Molino report) was used to assess present day baseline conditions, but was updated to reflect current conditions, removing the M5 upgrade works which have not yet commenced, but including recent road works and developments and planning approvals granted since 2022. The exception to this was land known as Site F which has received gateway approval but will require significant infrastructure upgrades which are presently unknown.

The 2022 Molino LSM models evacuees leaving the floodplain during a critical duration PMF flood event and conservatively assumes that all persons leave by vehicle, ultimately entering the M5. Evacuation is modelled by sub-sector, with sub-sector vehicle movements scheduled to optimise overall evacuation efforts. Sub-sectors are shown in the figure below.



The first sub-sector to evacuate is R25, this being located in the very eastern part of the floodplain and immediately adjacent to the PP site which is located in sub-sector R7. 2.5 hours after sub-sector R25 is notified, sub-sectors I3, I5, I 13 and R26, which are located some 3-4 km

to the west, are the next sub-sectors to be notified to evacuate. Sub-sector R7 is modelled to be notified to evacuate 4.5 hours after sub-sector R25. Given the close proximity of sub-sector R7 to R25 and the 2.5 hour gap between warning sub-sector R25 and then the sub-sectors further west, this presented an opportunity to further optimise the LSM model and evacuate some or all of sub-sector R7 after evacuation of sub-sector R25.

The PP proposes a future urban use that would be managed by an overarching body corporate which would function to ensure that any continuing flood risks and flood emergency response would be centrally managed through a flood emergency management plan (FEMP), ensuring that risk management measures such as signage, warning systems, flood alarms, evacuation procedures and flood wardens, would be funded and operational in perpetuity. The body corporate would provide a key single point of contact with the SES, ensuring that SES resources would not be burdened and would be most efficiently utilised.

Based on the above, the LSM model was amended to reflect a 3 hour earlier warning time of 1.5 hours after sub-sector R25 for sites A (Georges Cover Village) and D (this PP site) located with the Moorebank East Precinct (MEP) sub-sector R7. These two locations would be managed by a body corporate and would be capable of initiating an earlier evacuation either by direct communications from the NSW SES or by a self-evacuation trigger through a FEMP. Because these two sites would be highly managed developments, there would be no material additional burden on the SES or other emergency response agencies.

There are some 32,000 vehicles which presently would need to be evacuated from the floodplain during a critical duration PMF event. The completed modelling indicated that under existing conditions and the LSM modelling assumptions presented in the 2022 Molino Stewart report, some 296 evacuating vehicles, or around 1% of the floodplain, would potentially be trapped by floodwater in the PMF. Given the model has been conservatively constructed, it is therefore likely that during a real world event with advanced weather warnings enabling significant catchment preparation, that the floodplain could be fully evacuated.

In the proposed case with the PP site (Site D) included and, together with the Georges River Cove site (Site A), evacuated using the earlier trigger, the LSM modelling indicates that the number of vehicles trapped on the floodplain is reduced to 277, a reduction of 19 vehicles, with all of the PP site and site A vehicles capable of safely evacuating. The evacuation modelling therefore demonstrates that safe off-site evacuation can be readily achieved for a future urban development at the PP site.

Planning Controls

An analysis of the PP against the Section 9.1 Local Planning Directions 4.1 Flooding indicated that all Directions are complied with on the basis that a future urban development can be designed so that it would not result in any adverse off-site impacts, that it would not be located in a floodway or in high hazard floodwater, and was consistent with flood planning policies such as the NSW flood prone land policy, the principles of the 2023 NSW flood risk management manual, the Department of Planning, Housing and Infrastructure Planning Circular PS 24-001 and the 2004 Georges River floodplain risk management study.

An analysis of the PP against the 2025 Shelter-in Place Guideline indicated that the PP would not be inconsistent with the Guideline. Based on the updated flood modelling contained in this

report, the PP site or the evacuation route to the M5 are not affected by flash flooding, that being because flooding occurs significantly after the 6 hour period following a precipitation event (as defined in the Guideline). At this site, updated evacuation modelling demonstrates that there is ample warning time available to evacuate to land above the PMF via the M5 before evacuation routes become affected by flood water. The primary evacuation strategy for the PP is therefore to evacuate off-site in accordance with SES requirements and best practice flood planning.

The PP will not need to rely on a shelter-in-place (SIP) strategy, which is defined as requiring a building's occupants to move to an area within the building above the PMF level before their property becomes inundated by flood waters. This option is however available as a measure of last resort because all residential units would have floor levels above the PMF.

Recommendations

On the basis of our investigations, the following recommendations are made:

Recommendation 1 – Flood Impacts

Detailed updated flood modelling has been completed using the most recent 2020 flood models developed and documented by BMT. Modelling compared the existing approved site conditions with conditions that would likely be present under a future development scenario. Modelling was undertaken for a full range of events including the 20%, 10%, 5%, 2%, 1%, 0.5%, 0.2%, 0.05%, 0.02% AEP and PMF (EFE) events. Modelling indicated that off-site flood impacts or impacts to the local environment are not likely. On this basis we recommend:

- *The site is capable of supporting the proposed residential land use and that there is sufficient flexibility available to accommodate a range of design solutions to ensure no adverse off-site flood impacts.*

Recommendation 2 – Flood Resilience

The updated flood modelling was undertaken on the basis that future residential floors would be located at or above the PMF and that the carpark and ground floor retail spaces would be protected from flooding up to the 0.006% AEP or 1 in 17,500 year ARI flood event. On this basis, we recommend that:

- *The site is capable of supporting a future residential development that provides for adequate flood resilience measures incorporated into the urban design. In particular, a future development would be capable of ensuring that all residential floors would be above the PMF to protect private property and that basements could be protected to the 0.006% AEP flood. It is conceivable that a basement design could be produced that provides flood immunity to the PMF.*

Recommendation 3 – Structural Risks

The updated flood modelling was completed on the basis that the urban use will be located on structural piers above water within the marina. On this basis, the urban footprint would not be located within a floodway or in a high hazard flood zone. In Australia it is not uncommon to find structures which are successfully supported over piers within harbours, the ocean or over rivers. In Sydney Harbour there are numerous examples where urban development has

successfully occurred suspended on piers over deep water. Importantly for this site, flooding conditions below the future urban footprint arise artificially because of historical extraction activities at the site which has created a large pool of open water where velocities are very low and do not present any difficulty for future structural design and construction. On this basis, we recommend that:

- *The site is capable of delivering a future urban development footprint supported by piers over open water, this being consistent with other similar developments found in Sydney Harbour, and that the design details are matters capable of being addressed at a future development application stage.*

Recommendation 4 – Evacuation Route Capacity

Detailed flood evacuation modelling was undertaken based on the LSM model documented in the Molino 2022 Georges River Evacuation Modelling report, which documents floodplain evacuation during a critical duration PMF event. The model was reviewed and updated to reflect approvals, gateway determinations (with the exception of Site F which will require road upgrades presently unknown), and road upgrade works that had occurred since the Molino modelling.

It was identified that there was an opportunity to refine the model by adjusting the evacuation timing so that the PP site within sub-sector R7, which includes the site, could be evacuated shortly after sub-sector R25, which is the first sub-sector to be evacuated and is adjacent to the site and located in the very eastern most part of the floodplain evacuation area. This would be either by SES control or by a self-evacuation trigger actioned by the body corporate through implementation of a flood emergency management plan. Modelling demonstrated that the entire site would be capable of evacuating without impacting other persons on the floodplain also evacuating. On this basis, we recommend that:

- *A future development of the site, if managed and controlled by a body corporate, is capable of being fully evacuated during a flood emergency without detrimentally impacting on the evacuation capable of other persons on the floodplain or on public resources such as the SES.*

Recommendation 5 – Flood Emergency Response

The PP would see a future development managed by a body corporate which would function to ensure that any continuing flood risks and flood emergency response would be centrally managed, ensuring that risk management measures such as signage, warning systems, flood alarms, evacuation procedures and flood wardens, would be funded and operational in perpetuity. The body corporate would provide a key single point of contact with the SES, ensuring that SES resources would not be burdened and would be most efficiently utilised.

This approach would be consistent with best practice development on flood constrained land. For example, the June 2022 Penrith Lakes Stage 1 Development Control Plan requires that all new development must be either strata or community title, and that the managing body must implement a flood emergency management plan to ensure evacuation requirements. On this basis, we recommend that:

- *A future development should be managed by a body corporate able to remain informed of any changes in flood information and risk and adapt continuing risk management processes and*

procedures for the entire community it serves. The body corporate would provide a single point of contact for the SES and other emergency response agencies.

Recommendation 6 – s9.1 Local Planning Directions

A detailed analysis of the PP against the Section 9.1 Local Planning Directions 4.1 Flooding has been completed and shows that all Directions are complied with on the basis that a future urban development can be designed so that it would not result in any adverse off-site impacts, that it would not be located be located in a floodway or in high hazard floodwater, and was consistent with flood planning policies such as the NSW flood prone land policy, the principles of the 2023 NSW flood risk management manual, the Department of Planning, Housing and Infrastructure Planning Circular PS 24-001 and the 2004 Georges River floodplain risk management study. On this basis, we recommend that:

- *The PP is consistent with all relevant terms of the Section 9.1 Local Planning Directions 4.1 Flooding, and a future development of the site consistent with the PP would be capable of being designed to meet flood planning controls in respect of risk to life and property.*

Recommendation 7 – Shelter-in-place Guideline for Flash Flooding

Based on the updated flood modelling contained in this report, the PP site or the evacuation route to the M5 are not affected by flash flooding, that being because flooding occurs significantly after the 6 hour period following a precipitation event (as defined in the Guideline). At this site, the detailed evacuation modelling using the updated Molino LSM model demonstrates that there is sufficient warning period available to evacuate to land above the PMF via the M5 before evacuation routes become affected by flood water. The primary evacuation strategy for the PP is therefore to evacuate off-site in accordance with SES requirements.

The PP proposal will not need to rely on a shelter-in-place (SIP) strategy which is defined as requiring a building's occupants to move to an area within the building above the PMF level before their property becomes inundated by flood waters. This option is however available as a measure of last resort because all residential units would have floor levels above the PMF. On this basis, we recommend that:

- *The PP site and evacuation route to the M5 are not affected by flash flooding and the PP will therefore not need to rely on sheltering in place. A future urban development will be able to implement off-site evacuation as the primary evacuation strategy, and as a measure of last resort, will be able to provide on-site shelter above the PMF to all persons.*

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Glossary of Terms and Acronyms

AEP	Annual exceedance probability (%)
ARI	Average recurrence interval (years)
BCS	DCCEEW Biodiversity, Conservation and Science division
BoM	Bureau of Meteorology
Council	Liverpool City Council
DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
DCP	Development Control Plan
DPHI	Department of Planning, Housing and Infrastructure
EFE	Extreme flood event
FEMP	Flood emergency management plan
FRMM	Flood risk management manual
LEP	Local Environmental Plan
LGA	Local government area
LSM	Life Safety Model
MA	Martens & Associates Pty Ltd
MEP	Moorebank East Precinct
PMF	Probable maximum flood
PP	Planning proposal
TSF	Traffic safety factor
WAF	Warning acceptance factor
WLF	Warning lag factor

1 Introduction

1.1 Overview

Martens have been commissioned by Mirvac to undertake an assessment of flood risk in relation to a planning proposal (**PP**) to amend the Liverpool Local Environmental Plan 2008 (**LEP**) and include an additional permitted use clause to enable construction of a mixed-use development at Lot 3 DP1246745, 146 Newbridge Road, Mooorebank, NSW (the **site**). The report provides:

1. A brief review of the flood risk related work completed to date.
2. Evaluates likely flood characteristics and potential impacts arising from the PP based on the latest BMT 2020 flood model for the Georges River.
3. Evaluates flood evacuation constraints on the Georges River floodplain and how these impact on the PP by application of the Life Safety Model (**LSM**) evacuation assessment documented in the Molino 2022 report.
4. Assesses the PP against relevant planning controls, notably the Section 9.1 Local Planning Directions 4.1 Flooding, and the Department of Planning, Housing and Infrastructure Planning Circular PS 24-001.

1.2 Site Identification and Details

Site details are summarised in Table 1. The site is also identified as **site D** of the Moorebank East Precinct (**MEP**, aka 'Georges Cove') and local area is shown in Figure 1.

Table 1 Site details.

Item	Description
Address	146 Newbridge Road, Moorebank, NSW
Lot / DP	Lot 3 in DP1246745
Site Area	Approximately 12.36 ha
Local Government Area (**LGA**)	Liverpool
History / Land Use	Formerly a resource extraction and recycling facility, now a construction site for the approved Georges Cove Marina (DA-611/2018).
Current Zoning	RE2 – Private Recreation RE1 – Public Recreation SP2 – Infrastructure – Drainage
Site Description	At the time of writing this report, the site primarily consisted of bare earth, with earthworks underway to create construction pads for the approved Georges Cove marina. The western and southern sections remain undeveloped, while the northeastern corner is built up, with a footpath connecting to site C.

Item	Description
	A large dredging pond occupies much of the eastern side of the Site, extending from the central area to the embankment that separates the pond from the Georges River, which is on the site's eastern boundary.
Surrounding Land Uses	To the west, medium density residential areas. To the north, there are both medium density residential and industrial zones. To the south, there is environmental conservation and private recreation land. The Georges River lies to the east of the site.
Site Drainage	The site drains to the large dredge pond on the east side of the site. The dredge pond is blocked at the time of writing but will eventually be connected to the Georges River. There is also a drainage channel which runs along the site's south and west boundaries.

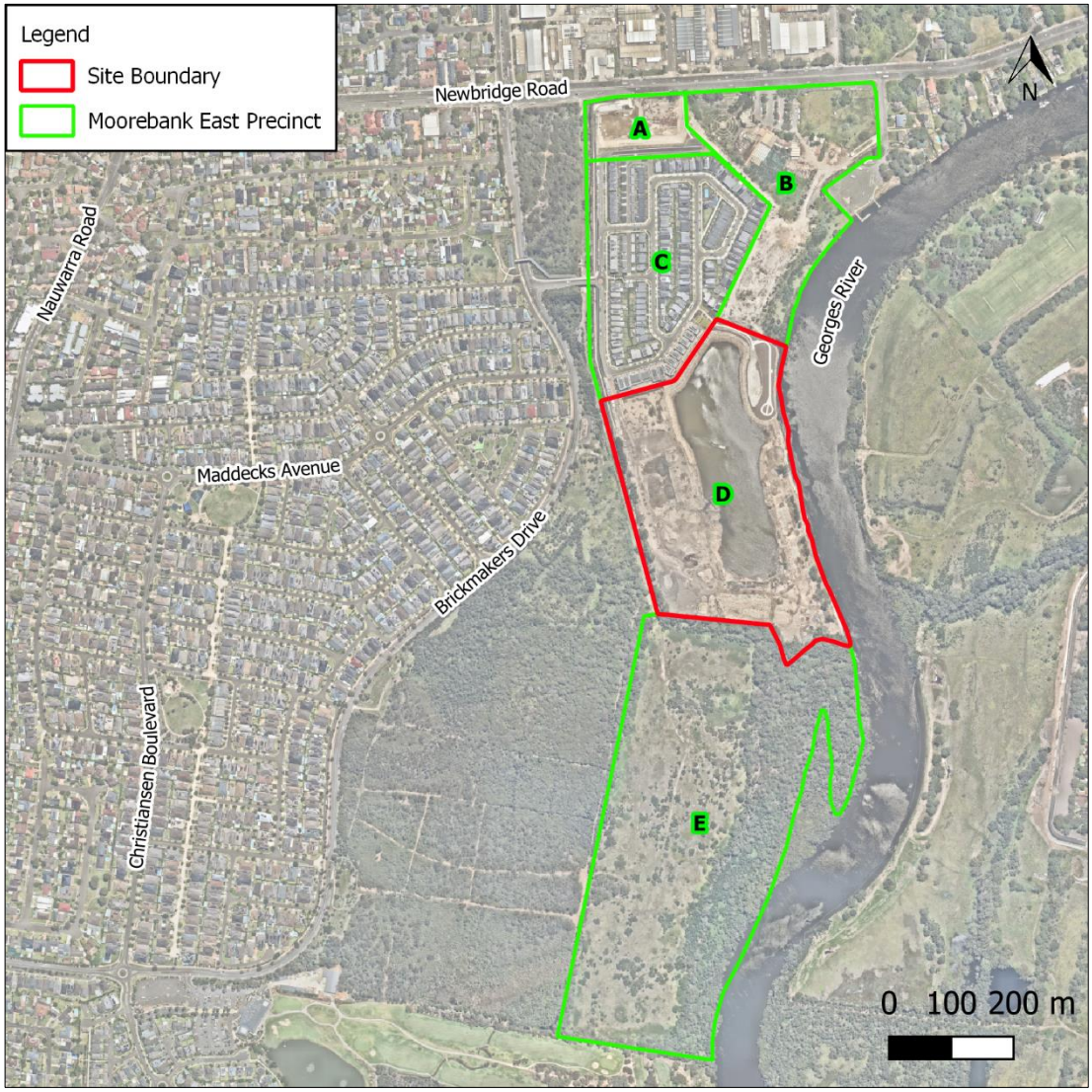

Figure 1 PP site (Site 'D') location with the Moorebank East Precinct (MEP).

1.3 Existing Site Approvals

The Sydney Western City Planning Panel approved DA 611/2018 for the construction and operation of a marina (the **Georges Cove Marina**) on 7 May 2021. Architectural plans of the approved marina are provided in Appendix E which indicate the approved existing conditions for the site include:

- A maritime building including 250 craft dry berth facility, function centre, tourist, entertainment, recreation and club facilities, and petrol and diesel storage tanks on the western side of the site with a portion of the building suspended above a 1.65 mAHD finished ground level at the southern end.
- A marina basin consisting of a 186 craft wet berth facility, construction of a navigation channel connecting Georges River to the marina basin, public recreational facilities, floating berths, walkways, fuel and sewerage pumping facilities, and emergency berth access.
- Three external carparks and two basement carparks providing a total of 637 car spaces.
- A private marina club house.
- Servicing infrastructure including a site access road, power, water and sewerage.
- A series of wetlands with a finished level of 0.541 mAHD, and vegetated areas with a finished level of 1.8 mAHD located along the eastern side of the site located within the 40 m buffer zone of the Georges River.
- A portion of landscaped area in the north-west corner of the site raised to 4.6 mAHD.

1.4 Other Relevant Developments

A summary description of the current status of other relevant developments in the floodplain is provided in Table 2, with their locations annotated in Figure 2.

Table 2 Relevant approvals and developments.

Site[1]	Approval Status & Type	Date	Description
Site A	Approved Gateway Determination by NSW DPHI	31/07/24	**Georges Cove Village** Benedict's controlled site located at Lot 1 of 146 Newbridge Road, Moorebank, the development comprises large format supermarket, and supporting specialty retail, along with commercial office space and light industrial units.
Site B	Stalled. No recent progress.	N/A	**124 Newbridge Road, Moorebank** Part of the site is zoned E3 Productivity Support of which schedule 1, clause 35 of Liverpool LEP permits shop top housing development. There has been no meaningful progress in recent years.

Site[1]	Approval Status & Type	Date	Description
Site C	Approved Development Application by Local Planning Panel	24/02/20	**Georges Cove Residences** Located at Lot 2 of 146 Newbridge Road, Moorebank, the development consists of a 179 lot residential subdivision containing two storey residences and an open community area. Construction is/is almost completed.
Site E	Rejected planning proposal	N/A	**Lot 2 Newbridge Road Moorebank** The planning proposal was to rezone the site from C2 Environmental Conservation to E4 General Industrial for the predominantly cleared, rectangular-shaped portion of the land, with a portion of it designated as RE1 Public Recreation, and the remaining area to remain as C2 Environmental Conservation.
Site F	Approved Gateway Determination by NSW DPE	03/04/23	**Moore Point Precinct** Located across 3, 5, 6, 7 and 11 Bridges Road, as well as 361 Newbridge Road, Moorebank, the Precinct is planned to include approximately 11,000 dwellings, 160,000m^2 of office space, 167,000m^2 of retail space, a primary school, up to 10ha of publicly accessible open space and communities facilities including two pedestrians bridges connecting the Precinct to the Liverpool CBD.
Site G	Stalled. No recent progress.	N/A	**Moore Point Rose Group** Located at 335-349 Newbridge Road, Moorebank, the proposal planned to rezone the site from IN2 Light Industrial to B4 Mixed Use and to amend the site's height and floor space ratio controls. However, there has been no meaningful progress in recent years.
Site H	Approved Gateway Determination by NSW DPE	01/07/21	**The Grove** Located at 10, 16 and 18 Orange Grove Road as well as 5 Viscount Place, Warwick Farm, the Grove PP was to increase the cap for 'retail premises' from 19,000m^{2}to 21,000m^2 and include 'business premises' as an additional permitted use at the site.
Site I[2]	Approved Development application in LEC	05/01/23	**Warwick Farm Village** Located at 240 Governor Macquarie Drive the development consists of large format retail, food and drink premises, centre-based child care facility and health services facilities.
Site J[2]	Stalled. Alternative option under investigation.	N/A	**Warwick Farm Structure Plan** Bounded by Munday Street to the north, the railway corridor to the west, Priddle Street to the south and Horseshoe Pond to the east the plan proposed was for the redevelopment of the Warwick Farm racing precinct for a mix of uses including B4 Mixed Use, R4 High Density Residential and RE1 Public Recreation. More recently in 2024 Liverpool Council endorsed investigation to occur for an Industrial Precinct in the area.
Site K[3]	Approved	Varies	**Sheperd Street Precinct** Located 20, 26-28, 32 and 31-33 Shepherd Street, as well as 21 Atkinson Road the Sheperd Street Precinct comprises of high-density residential towers. All towers have been constructed

Site[1]	Approval Status & Type	Date	Description
			except for 31-33 Shepherd Street which was recently approved in LEC on the 18/03/25.

Notes

1 The site ID is from Molino Stewart (2022) *Georges River Evacuation Modelling Flood Evacuation Analysis Final Report*. The MEP sites are also labelled in Figure 1.

2 In the past these two sites were sought to be planned together, this is reflected in early planning documentation. However, Site I has since seen approved whole Site J has stalled.

3 Site K is incorrectly referred to as 33 Shepherd Street in the Molino Stewart (2022) report. The population referred to as Site K within the report actually represents a number of developments in the Shepherd Street Precinct.

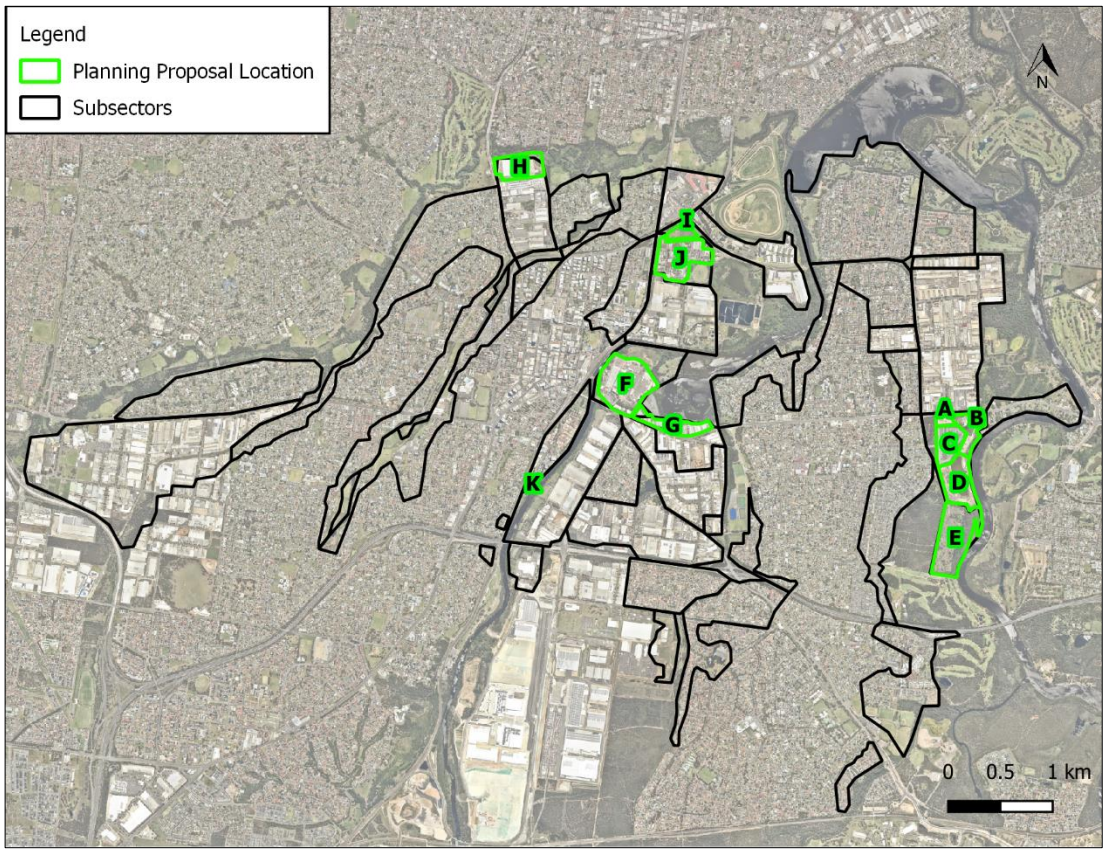

Figure 2 Development sites within the floodplains.

1.5 Planning Proposal Overview

The planning proposal (PP-2024-658), prepared by Mirvac, seeks to amend the Liverpool Local Environmental Plan 2008 (**LEP**) to enable modification of the approved Benedict Georges Cove Marina development and facilitate a mixed-use development. The PP would, in its present form, envisage some 340 dwellings (319 apartments and 21 terraces) above ground-floor retail spaces, incorporating restaurants and cafes within the marina precinct.

The current PP is based on an amended design (**Modification 2**) of the original PP as established in the Tooker and Associates (August 2023) *Flood Impact and Flood Emergency Response Plan*. The PP Modification 2 plan is provided in Appendix F which the PP envisages a future development with:

- Retention of the elevated marina building platform from the approved marina development (DA 611/2018) and originally expanded to cover the length of the site creating a 1.95 m high void under the terraces, apartment buildings and boat shed to enhance site flood storage capacity. Modification 2 added filling of the void under the terraces and boat shed to utilise the surplus flood storage.
- All commercial floor levels will be 7.6 mAHD which is 1.6 m above the flood planning level and above the 1 in 5,000 year ARI (0.02% AEP) flood level. Habitable residential floors will be at PMF level, previously modelled as 11.6 mAHD, but based on the updated modelling contained herein would be 180 mm higher at 11.78 mAHD.
- The PP includes a tanked basement car parking facility for 500 vehicles below the terraces and apartment buildings with a finished floor level (**FFL**) of 3.95 mAHD. The portion of the basement car park below the proposed apartment buildings would be suspended on piers above a ground surface level of 1.65 mAHD.
- Additional open parking in the south of the site.
- Vehicle access would be via Brickmakers Drive and the recently dedicated Promontory Way bridge into the Mirvac Georges Cove Residences north of the site.
- The PP includes public open spaces, community areas, and a flood-resilient design with low-hazard settings at the ground level. The residential and commercial elements have been strategically positioned above major flood levels, with egress routes leading to flood-free areas via Nuwarra Road to the M5.

1.6 Project Scope

Project scope includes the following:

1. Update the BMT (2020) Georges River hydraulic model (TUFLOW) and to allow modelling of the 0.05% and 0.02% annual exceedance probability (**AEP**) flood events and incorporate the existing approved and PP design elements to enable modelling of the site under the approved and PP conditions (refer to Sections 1.3 and 1.5).
2. Determine site flood characteristics for a full range of floods including the 20%, 10%, 5%, 2%, 1%, 0.5%, 0.2%, 0.05%, 0.02% AEP and PMF events under approved and PP and assess the potential impacts of the proposed development.
3. Prepare relevant flood maps including flood extents, depths, levels, velocities, hazards, and forecast impacts (on water levels, velocities and hazards), and comment on model outcomes.

4. Update the Council Life Safety Model (**LSM**) documented in the Molino (2022) *Georges River Evacuation Modelling* report (which models floodplain evacuation during a critical duration PMF event), to reflect current approvals and assess the capacity of the PP site to be evacuated and determine what impact the PP would have on other persons evacuating from the floodplain.

5. Demonstrate a flood emergency response strategy which would enable the safe evacuation of the site without adversely affecting the evacuation outcome of the surrounding area and floodplain.

6. Assess PP compliance against:

    a. Direction 4.1 Flooding of the Section 9.1 Local Planning Directions 2022.

    b. NSW Department of Planning, Housing and Infrastructure (**DPHI**) Planning Circular PS 24-001 *Update on addressing flood risk in planning decisions*.

    c. Findings and recommendations of the 2022 NSW Flood Enquiry.

    d. Flood risk management principles within the 2023 *Flood Risk Management Manual* (**FRMM**).

    e. Principals for emergency management as set out in the 2023 *Support for emergency management* planning (Flood Risk Management Guide EM01).

    f. The 2025 Shelter in place for flash flooding guideline.

    g. Council's relevant Liverpool Local Environmental Plan (**LEP**) clauses and Development Control Plan (**DCP**) controls.

7. Respond to gateways submission comments from the NSW DPHI, Council, NSW SES and the NSW Department of Climate Change, Energy, the Environment and Water (**DCCEEW**).

1.7 Documents and Data

The following additional documents and data were relied upon in the preparation of this flood risk review:

1. Commonwealth of Australia (2019), Australian Rainfall and Runoff – *A Guide to Flood Estimation.*

2. Liverpool City Council (2008), *Liverpool Local Environmental Plan (LEP).*

3. Liverpool City Council (2008), *Liverpool Development Control Plan (DCP).*

4. NSW Department of Planning and Environment, Environment and Heritage Group, (2023), *Flood risk management manual (FRMM).*

5. NSW Department of Planning and Environment, Environment and Heritage Group, (2023), *Support for emergency management planning.*

6. NSW Department of Planning, Housing and Infrastructure (2025), *Shelter in place guideline for flash flooding.*

7. NSW Government (2022), *2022 Flood Inquiry Volume 1: Summary Report.*

8. NSW Government (2022), *2022 Flood Inquiry Volume 2: Full Report.*

9. NSW State Emergency Service (2023), *Liverpool City Flood Emergency Sub Plan Volume 1.*

10. NSW State Emergency Service (2023), *Georges & Woronora Valley Volume 1 Flood Emergency Sub Plan.*

Previously prepared flood related documents are summarised in Table 3.

Table 3 Summary of previous flood documentation.

Document Title	Year	Summary / Key Finding
Georges River Floodplain Risk Management Study & Plan	2004	The 1% AEP + 0.5 m freeboard was the recommended principal floor level control for residential uses.
Cardno Flood Impact Assessment	2018	Assessed flood impacts and flood storage capacity. Concluded that the proposed development would not have adverse flood impacts and remains within acceptable thresholds.
BMT Georges River Flood Study	2020	Identified the site as being in a high flood hazard (H5/H6) zone. Recommended limitations on residential development without sufficient mitigation measures.
Molino Stewart Flood Evacuation Study	2022	Evaluated evacuation feasibility and highlighted concerns regarding road capacity constraints. Suggested improvements to emergency planning and identified potential bottlenecks in evacuation routes.
Stantec Updated Flood Modelling	2022	Provided updated flood levels and reclassified the site to reflect actual flood risk. Demonstrated compliance with modern flood risk management guidelines and found that the proposed development does not increase flood risks.
Tooker & Associates Flooding Response	2023	Conducted a detailed flood impact assessment and emergency response planning. Recommended site classification as flood storage instead of floodway. Proposed improvements to structural resilience and emergency planning strategies.
Tooker & Associates Flood Emergency Response Plan	2023	Provided a framework for emergency response planning, including shelter-in-place feasibility and phased evacuation processes. Addressed SES concerns and validated flood risk mitigation strategies.
Risk-E Business Evacuation Response	2024	Developed a phased evacuation strategy and analysed evacuation timeframes. Confirmed that residents have adequate lead time for evacuation during extreme events.
Mirvac PP Marina Response to SES & BCS	2024	Addressed regulatory concerns raised by SES and BCS. Demonstrated that flood mitigation measures exceed standard requirements and confirmed compliance with NSW flood planning regulations.
DPHI Review on Flood Planning	2024	Evaluated the planning proposal against NSW Flood Risk Management Guidelines.

2 Flood Characteristics and Impacts

2.1 Overview

This section summarises previous flood studies that cover the site and/or the PP, and provides an updated assessment of flood characteristics and potential flood impacts arising from the PP based on the most recent BMT 2020 model for a full range of floods including the 20%, 10%, 5%, 2%, 1%, 0.5%, 0.2%, 0.05%, 0.02% AEP and PMF (also referred to as the extreme flood event or EFE).

2.2 Previous Modelling

2.2.1 Cardno / Stantec

A summary of various Stantec (formally Cardno) flood assessment reports submitted to Council with respect to development of the site and other Goerges Cove sites dated from October 2012 to August 2024 is provided in Table 4.

Table 4 Stantec flood reports for the Georges Cove Marina.

Title / Description	Date	Summary / Findings
Multiple flood impact assessments for the approved Marina and other Moorebank precinct sites.	30/10/2012 to 4/8/2016	• Stantec (then Cardno) conducted multiple flood impact assessments for the Georges Cove site including the approved marina and documented their findings in several reports dated from October 2012 to August 2016. • The initial 2012 assessment involved developing a detailed two-dimensional TUFLOW model of the Georges River floodplain, covering the area from upstream of the Newbridge Road crossing to downstream of the Western Highway crossing, with model inflows extracted from the Bewsher Consulting (2004) *Georges River Flood Risk Management Study* MIKE-11 model. • The Stantec 2012 model has since undergone detailed review by Liverpool City Council and forms the basis of all modelling carried out by Stantec since 2012 with respect to development the Georges Cove site. • Stantec modelling assessed impacts for the 5% and 1% AEP 36 hour critical duration flood events based on comparison with Council's established baseline scenario. Based on this modelling Council required all future Georges Cove developments to maintain baseline flood storage capacities under the 1% AEP event.
Update of Flood Impact Assessment for Mirvac Development, Newbridge Road, Moorebank	13 April 2018	• Updated the 2012-2016 Stantec flood model to conduct a flood impact assessment for the proposed marina development as well as Georges Cove site's A and C. • Modelling assessed impacts for the amended marina design included a 1.95 m void below a "tanked" basement carpark spanning the length of the western portion of the Site underneath the proposed residential terraces, marina complex and apartment buildings as well as the boat shed located in the southwest corner of the site.

Title / Description	Date	Summary / Findings

		• As part of their assessment Stantec modelled the sites A, C and D as an integrated development, whereby the 1% AEP flood storage across all three sites was maintained compared to Council's baseline scenario.
		• The assessment concluded that:
		  ○ In both the 20 yr ARI and 100yr ARI flood it was assessed that the PP had nil adverse impact on water levels (less than 0.01 m) at any location in the floodplain in comparison to Council's baseline conditions.
		  ○ Modest velocity impacts were present west of the northern section of the elevated car park in both the 20yr and 100yr ARI events, however these were considered to be acceptable due to overall velocities remaining much lower than 1 m/s and consequently not posing a scour risk.
		  ○ The modified designs provided an additional flood storage of 22,600m^3 compared to Council's baseline condition.

Update of Flood Impact Assessment for Georges Cove Development, Newbridge Road, Moorebank	12 April 2022	• Updated the 2018 flood impact assessment to evaluate modifications to the 2018 Mirvac Marina PP and assess feasibility of utilising the surplus 22,600 m³ of flood storage. Two scenarios were assessed:
		  ○ Modification 1 involved filling of the void under the proposed terraces to the underside of the basement carpark at 3.6 mAHD, utilising 16,185 m³ of the surplus flood storage.
		  ○ Modification 2 provided additional fill to modification 1 under the proposed boatshed (3.95 mAHD), utilising 100% of the surplus flood storage compared with the 2013 flood assessment baseline.
		• Hydraulic modelling was carried out for the 5% and 1% AEP events and identified Modification 2 as the preferred design option, with no adverse impacts to neighbouring properties identified. The assessment also updated flood levels, reclassified the site to reflect actual flood risk, and confirmed compliance with modern flood risk management guidelines, ensuring no increased flood risk.
		• Stantec has provided to MA the 2022 TUFLOW model which MA has relied on for hydraulic comparison purposes. Surface level data from the 2022 model was also used to represent approved Moorebank precinct surface levels in the detailed hydraulic modelling discussed in Section 2.3.

Flood Hazard Assessment at Georges Cove Development, Newbridge Road, Moorebank	26 August 2024	Assessment of site flood hazards to inform consideration of the impact, or otherwise, of flood hazards on the stability of the proposed marina building in response to concerns raised by DPHI.

2.2.2 BMT 2020 Model

BMT conducted a flood assessment for this catchment on behalf of LCC and Canterbury-Bankstown Council and summarised the assessment in the report *Georges River Flood Study* (2020), hereafter referred to as the **BMT flood study**. As part of their study, BMT undertook the follow:

1. Used TUFLOW for hydraulic modelling, adopting a 10 m topographic grid and calibrating the model to the August 1986, April 1988, April 2015 and June 2016 flood events.
2. Retained the inflow hydrographs previously adopted for the 1991 *Georges River Flood Study* for design flood event modelling.
3. Adopted the 1991 *Georges River Flood Study* extreme flood event (EFE) as a surrogate for the PMF event.
4. Produced the 0.5% and 0.2% AEP flood events as a surrogates for the 1% AEP climate change scenario based on interpolation of 1991 1% AEP and EFE peak inflows.
5. Produced flood mapping for the 20%, 10%, 5%, 2%, 1%, 0.5% and 0.2% AEP flood and PMF events.

MA have used the BMT 2020 TUFLOW flood model to review current flood characteristics at the PP site and determine the potential impacts of a future development compared to existing approved conditions on the basis that it:

1. Is calibrated to recent flood events and represents the latest and most up to date flood modelling for the catchment and site.
2. Covers the site, and surrounding river system.
3. Includes the 0.5% and 0.2% AEP events as a surrogate for the 1% AEP flood with climate change scenario.
4. Allows for the 0.05% and 0.02% AEP flood events to be modelled based on the 1991 *Georges River Flood Study* EFE inflow hydrograph.
5. Is provided in sufficient detail to enable assessment of site flood characteristics under existing approved and likely future conditions and the potential impacts of the PP.

A comparison of BMT (2020) and Stantec (2012 - 2022) modelled design flood levels in the vicinity of the proposed marina building is provided in Table 5. In summary, the models produce similar results for the 1% AEP, with Stantec modelling a 1% AEP event 0.05 m higher than BMT, but differ in the estimation of a PMF event, with the BMT model indicating a PMF some 1.46 m high than the Stantec model.

Table 5 BMT(2020) and Stantec (2022) modelled site flood levels.

	Flood Level (mAHD)	
Event	**BMT(2020) [3]**	**Stantec (2022) [2]**
20% AEP	2.67	-
10% AEP	3.22	-
5% AEP	4.51	4.63 [1]
2% AEP	5.25	-
1% AEP	5.50	5.55
0.5% AEP	5.68	-
0.2% AEP	5.96	-
0.02% AEP[4]	-	7.51
PMF	11.77	10.31

[1] Stantec existing condition only.

[2] Cardno / Stantec levels taken from Stantec TUFLOW model.

[3] Obtained from BMT (2020) TUFLOW model.

[4] Approximate level of PP ground floor retail and basement carpark entry.

2.3 Updated Modelling

2.3.1 Objectives

Updated flood modelling has been undertake the most recent 2020 flood models developed and documented by BMT so that the results of previous modelling undertaken by Stantec could be reviewed and validated. Modelling objectives included:

1. Modify the BMT 2020 TUFLOW model (described at Section 2.2.2) to represent existing approved conditions and simulation conditions as proposed under the PP.

2. Determine the 0.05% AEP (1 in 2,000 AEP) and 0.02% (1 in 5,000 AEP) flood event flow rates in accordance with the BMT 2020 'very rare flood event estimation' methodology.

3. Model the 20%, 10%, 5%, 2%, 1%, 0.5%, 0.2%, 0.05%, 0.02% AEP and PMF flood events under existing approved and PP conditions to identify site flood characteristics, hazards, risks and potential impacts of the proposed development.

2.3.2 Methodology

2.3.2.1 Very Rare Flood Event Estimation

Estimation of the 0.05% AEP and 0.02% AEP flood events was undertaken using the methodology in the 2020 BMT flood study for the 0.5% and 0.2% AEP design flood events whereby:[1]

1. The BMT 2020 adopted EFE event was estimated to be equivalent to a 0.000035% AEP flood (approximately a 1 in 2.9 million AEP event).
2. The 0.05% and 0.02% AEP peak inflows were interpolated and determined to be approximately 2,320 m^3/s and 2,460 m^3/s respectively (Figure 3).
3. The 1% AEP inflow hydrograph was scaled to match the peak 0.05% and 0.02% AEP peak inflows.

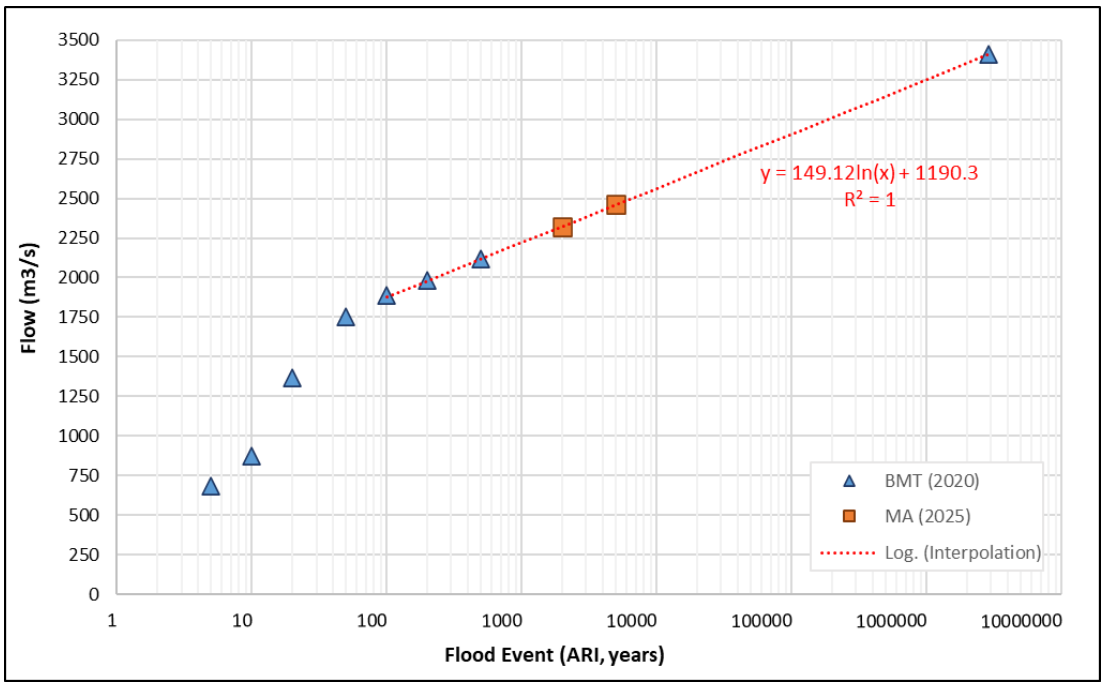

Figure 3 Very rare flood event estimation.

2.3.2.2 Model Setup

The following modifications were made to the BMT 2020 TUFLOW model to allow detailed modelling of the site under approved and PP conditions:

1. The model was run using the more recent 2018-03-AE TUFLOW version (compared to 2017-09-AC used by BMT) as recommended by TUFLOW and to enable output of Australian Rainfall and Runoff (**ARR**) 2019 hazard categories.

[1] Refer to Section 6.5.2 of the 2020 BMT flood study for details on very rare flood event estimation.

2. Inclusion of the 2022 Stantec base topographic surface to represent approved grading surface for the Moorebank precincts north of the site including Moorebank East sites A B, and C.

2.3.2.3 Approved Conditions

The approved condition scenario is the baseline scenario for this assessment and represents:

- The floodplain in is existing condition as per the BMT 2020 flood model; and
- The site and Moorebank precinct in its approved condition as described in Sections 1.3 and 1.4.

The following modifications were made to the BMT 2020 model to represent approved conditions:

1. Inclusion of modifications to represent the approved site grading surface. Levels were adopted based on approved architectural plans produced by Micheal Fountain Architects Pty Ltd, dated 15 April 2020 (Appendix E).
2. Inclusion of the section of Promontory Way atop the fill pad connected to Brickmakers Drive.
3. Inclusion of layered flow constrictions to represent several features including the club house, approved marina complex and the recently constructed bridge (Promontory Way) to Brickmakers Drive. The approved marina complex was represented as several different layer flow features based on the architectural plans (Appendix E).
4. Inclusion of Manning's zones based on approved site architectural plans, with roughness coefficients set as per Table 6. Areas without any suspended structures were modelled consistent with BMT 2020 model landuses, and approved suspended structures were modelled using depth varying roughness coefficients.
5. Inclusion of Manning's zones based on approved site architectural plans (Appendix E). Site manning's were set to BMT material 7 (*waterbody DS Liverpool Weir*) for the marina basin, BMT material 4 (*vegetation*) for the wetland areas, and BMT material 11 (*cleared parkland*) for the rest of the site.
6. Manning's zones using depth varying roughness coefficients were included in the model to represent approved site buildings, including basement carparks and elevated building platforms with roughness coefficients set as per Table 6.

All other model inputs and assumptions remained unchanged from the BMT 2020 flood model.

2.3.2.4 Proposed PP Conditions

The proposed conditions scenario under the PP represents:

- The floodplain in is existing condition as per the BMT 2020 flood model;
- The Moorebank precinct in its approved condition as described in Sections 1.3 and 1.4; and
- The site in its proposed state under the PP as described in Section 1.5.

The following modifications were made to the BMT 2020 TUFLOW model to represent conditions under the PP:

1. Modifications to represent the proposed site grading surface. Levels were adopted based on the Modification 2 plans (Appendix F).
2. Inclusion of layered flow constrictions to represent the proposed marina complex.
3. Site manning's zones were updated to represent proposed condition surfaces.

Table 6 Mannings roughness adopted for site.

Material	Mannings Roughness[1]
Basement carpark	0.100
Void under building / platform	0.050
Elevated public access path above void	0.040
Site buildings	0.300
Combined tanked carpark and open space above	0.200

[1] Assigned based on comparison with materials used in BMT flood model.

2.3.3 Model Outcomes

2.3.3.1 Flood Mapping

Flood mapping results (flood levels, depths, velocities, and hazard categories) for the 20%, 10%, 5%, 2%, 1%, 0.5%, 0.2%, 0.05% and 0.02% AEP flood and PMF (EFE) events under existing approved and proposed PP conditions are provided in Appendices A and B respectively, with drawing references summarised in Table 7.

Table 7 Flood map drawing references in Appendices A & B.

Flood Condition Scenario	Flood Event	Water Level & Depth	Water Velocity	ARR Flood Hazard Categories [1]
Existing Approved Conditions	20% AEP	Map E1	Map E2	Map E3
	10% AEP	Map E4	Map E5	Map E6
	5% AEP	Map E7	Map E8	Map E9
	2% AEP	Map E10	Map E11	Map E12
	1% AEP	Map E13	Map E14	Map E15
	0.5% AEP	Map E16	Map E17	Map E18
	0.2% AEP	Map E19	Map E20	Map E21
	0.05% AEP	Map E22	Map E23	Map E24
	0.02% AEP	Map E25	Map E26	Map E27
	PMF	Map E28	Map E29	Map E30
Proposed PP Conditions	20% AEP	Map P1	Map P2	Map P3
	10% AEP	Map P4	Map P5	Map P6
	5% AEP	Map P7	Map P8	Map P9
	2% AEP	Map P10	Map P11	Map P12
	1% AEP	Map P13	Map P14	Map P15
	0.5% AEP	Map P16	Map P17	Map P18
	0.2% AEP	Map P19	Map P20	Map P21
	0.05% AEP	Map P22	Map P23	Map P24
	0.02% AEP	Map P25	Map P26	Map P27
	PMF	Map P28	Map P29	Map P30

[1] ARR flood hazard categories based on ARR flood hazard curve (2019) definitions (see Figure 4).

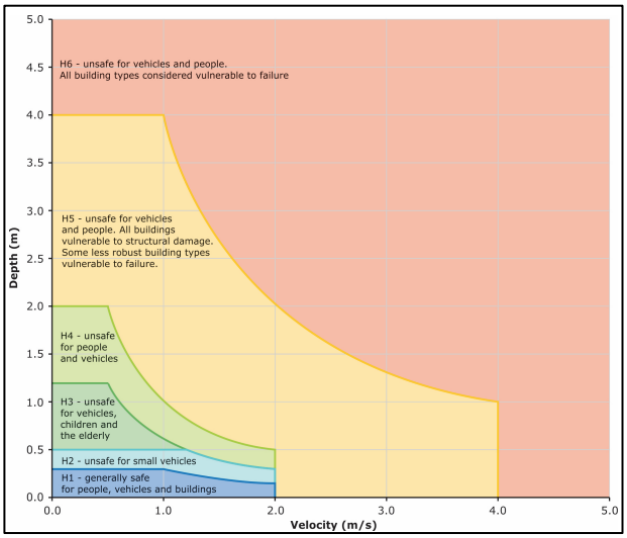

Figure 4 Flood hazard curves (Geoscience Australia, 2019).

2.3.3.2 Flood Levels

Modelled flood levels under existing approved and proposed PP conditions are mapped in Appendix A and Appendix B respectively. Design flood levels at the proposed marina building platform are not materially different between approved and proposed conditions, and are summarised in Table 8.

Table 8 Flood levels adjacent to proposed marina complex.

Flood Event	Water Level (mAHD)[1]
20% AEP	2.65
10% AEP	3.20
5% AEP	4.49
2% AEP	5.24
1% AEP	5.50
0.5% (1 in 200) AEP	5.68
0.2% (1 in 500) AEP	6.04
0.05% (1 in 2000) AEP	6.35
0.02% (1 in 5000) AEP	6.58
PMF (EFE)	11.78

[1] Levels under existing approved and proposed PP conditions are the same.

2.3.3.3 Flood Hazards

We note the following regarding site flood hazards:

1. Hazards within the marina basin are H6 for all flood events due to the depth of the basin (-2.8 mAHD).

2. Flood hazards outside of the marina basin are H3 for the 20% AEP event, H4 for the 10% AEP flood event, H5 for the 5% to 0.5% AEP flood events, and H6 for the 0.2% AEP flood event and greater.

3. The carpark entry and retail areas will not be exposed to any flood hazards up to the 0.006% AEP (1 in 17,500 year ARI) flood due to their elevation above flood waters. In events between the 0.006%AEP and PMF, these areas would be subject to H1 to H5 hazard due to slow moving floodwater. Flood water up to 9.6 mAHD (0.0017% AEP or a 1 in 60,000 year ARI flood), producing depths up to 2 m through the retail level, would experience hazards between H1 to H4. Above this hazard would increase to H5.

4. Hydraulic hazards in the vicinity of the proposed marina building platform are controlled by water depths for all flood events due to water velocities being low (approximately 0.2 m/s in the 20% AEP flood event up to 0.6 m/s PMF event).

2.3.3.4 Flood Categorisation

Flood hydraulic categorisation was completed using the methodology adopted in the BMT 2020 report (refer to Figure 5). Refer to Maps E31 and P31 for flood categories under existing approved and proposed PP conditions. We note:

- Both Maps E31 and P31 show the area in the vicinity of the elevated marina building platform as being classed as a floodway. Floodway categorisation in this area is due to a limitation of TUFLOW modelling whereby buildings have been represented using layered flow constrictions and manning roughness which allow water to 'pass through' the buildings. Flood mapping does not account for the restriction of flood depths to 1.95 m due to the proposed basement carpark. These areas should more properly be classified as flood storage.
- A large portion of the site to the east of the marina building under both existing approved and proposed conditions is classed as floodway. Floodway classification in this area arises from historical extraction activities and the existing approval which have lowered natural ground levels and created an open water area.

Hydraulic Category	Categorisation Criteria	Description
Floodway	VxD > 1.0 at the 1% AEP event	Areas and flowpaths where a significant proportion of floodwaters are conveyed (including all bank-to-bank river sections).
Flood Storage	VxD < 1.0 and d > 1.0 at the 1% AEP event	Areas where floodwaters accumulate before being conveyed downstream. These areas are important for detention and attenuation of flood peaks.
Flood Fringe	The extent of the Extreme Flood event floodplain not classified as floodway or flood storage	Areas that are low-velocity backwaters within the floodplain. Filling of these areas generally has little consequence to overall flood behaviour.

Figure 5 BMT 2020 flood category definitions.

2.3.4 Flood Impacts

Water level, velocity, and hazard impacts (proposed conditions minus approved conditions) are provided in Appendix C with map references summarised in Table 9. Impact mapping shows that a future development designed generally in accordance with the PP would result in negligible change to flood extents, levels, velocities and hazards on neighbouring properties and roads compared to approved conditions.

An assessment of the potential impacts of proposed development against the matters raised in Table 3.3 of Flood Risk Management Guide LU01 is provided in Table 10, which finds that a future development of the site in accordance with the PP would not result in unacceptable flood impacts.

On this basis, the updated flood modelling demonstrates that site is capable of supporting the proposed residential land use and that there is sufficient flexibility

available to accommodate a range of design solutions to ensure no adverse off-site flood impacts.

Table 9 Flood water level afflux map references.

Flood Event	Water Level Impacts	Water Velocity Impacts	Hazard Impacts
20% AEP	Map I1	Map I2	Map I3
10% AEP	Map I4	Map I5	Map I6
5% AEP	Map I7	Map I8	Map I9
2% AEP	Map I10	Map I11	Map I12
1% AEP	Map I13	Map I14	Map I15
0.5% AEP	Map I16	Map I17	Map I18
0.2% AEP	Map I19	Map I20	Map I21
0.05% AEP	Map I22	Map I23	Map I24
0.02% AEP	Map I25	Map I26	Map I27
PMF (EFE)	Map I28	Map I29	Map I30

Table 10 Impact assessment as per Flood Risk Management Guide LU01.

Key Considerations	Reasons for Considering	Assessment
Flood level change	• May increase inundation and damage to existing development • May inundate additional existing development • May create new or larger floodways or flowpaths • May isolate new areas	(1) The hydraulic modelling results show that the a future development in accordance with the PP would result in a negligible change to offsite flood levels (less than 20mm increase) in all flood events up to and including the PMF, and therefore will not result in increased inundation to existing properties, alter flood flows, or cause any existing properties to become flood affected or isolated.
Change in duration of flooding	• May increase damage • May increase duration of isolation	(2) Hydraulic modelling results show that the PP would result in a negligible change to flood levels, extents, velocities and hazards in all flood events up to and including the PMF, and thus will not result in increased damage or duration of isolation.
Velocity change	• May increase scour potential and/or damage to structures	(3) Hydraulic modelling results show that the PP would result in a negligible change to flood velocities and thus will not increase erosion or scour potential within the floodplain compared to approved conditions.
Change in warning and evacuation time	• May decrease available warning time and time available for evacuation	(4) Hydraulic modelling results show that the proposed development would result in a negligible change to flood characteristics within the floodplain and thus will not decrease available warning times and times available for evacuation.

Key Considerations	Reasons for Considering	Assessment
Change in frequency of inundation	• Properties may become flood affected in more frequent events • Access may be cut more frequently • Areas may be isolated more frequently	(5) Hydraulic modelling shows no material change to flood characteristics in all flood events and thus will not change the frequency of inundation or isolation for existing properties or evacuation routes.
Flood function categorisation change	• May change categorisation (e.g. flood storage to floodway) and change impacts on flooding on existing development	(6) Flood hydraulic categorisation would not significantly change as result of the PP remaining largely contained to within the marina basin, with some reduction in floodway categorisation to the southwest of the site.
Hazard categorisation change	• May reduce safety to vehicles, people or buildings	(7) The PP would result in an insignificant change to flood hazards, and thus would not pose an increased risk to vehicles buildings or people.

3 Flood Risk Assessment

3.1 Resilience Measures

Based on the updated flood modelling using the 2020 BMT flood model, a future urban development would be capable of providing appropriate flood resilience measures to protect property from flood damages. Specifically:

1. Floor level protection:
    a. Councils flood planning level (**FPL**) is the 1% AEP flood level plus 500 mm freeboard. For the proposed marina the FPL is 6.0 mAHD.
    b. Proposed apartment building retail and terrace building non-habitable floors will have a FFL of 7.6 mAHD which is 1.02 m above the 0.02% AEP (1 in 5,000 AEP) flood level and 1.6 m above Council's FPL. At this level retail spaces would have a flood immunity approximately equivalent to a 0.006% AEP (1 in 17,500 year ARI) flood event. This is 2.1 m above the 1% AEP flood level, and 1.56 m above the 0.2% AEP (1 in 500 year ARI) flood representing a conservative approximation of 1% AEP climate change conditions.
    c. Proposed apartments and terraces will have habitable floor levels will be capable of being sited at or above the PMF level of 11.78 mAHD.
2. Vehicular protection:
    a. The PP proposes a tanked basement carpark construction with an entry level at 7.6 mAHD, which is approximately equivalent to a 0.006% AEP (1 in 17,500 year ARI) flood event. At this level, the carpark entry would be 2.1 m above the 1% AEP flood level, and 1.56 m above the 0.2% AEP (1 in 500 year ARI) flood representing a conservative approximation of 1% AEP climate change conditions.
    b. Car access to the proposed development is from Brickmakers Drive over the Promontory Way vehicle bridge onto Spinnaker Drive and then through to the entry road for the marina from the site's northwest corner. The low point on this route is at the access point with Brickmakers Drive which has an elevation of approximately 5.7 mAHD, and would therefore be cut off for vehicular access at 6.0 mAHD (i.e. 300 mm depth) by flooding in events as frequent as the 0.2% (1 in 500 AEP) flood event, representing a conservative approximation of 1% AEP climate change conditions.

3.2 Property Risks

Elements of the PP are subject to hydraulic hazards up to H6 in the PMF event (refer Figure 4 for definitions). The NSW Department of Planning and Environment 'Flood Risk Management Guide FB03' (**FB03**, part of the FRMM) states that buildings in H6 areas are 'vulnerable to failure', however design and construction is possible, and 'building

requirements would include a range of additional structural building and foundation controls'. Further, as the proposed development is only affected by low flood velocities, hydrodynamic forces and debris loading will likely be insignificant.

In relation to the PP, we note the following in terms of the distribution of hazards within the urban footprint:

- The carpark entry and retail areas will not be exposed to any flood hazards up to the 0.006% AEP (1 in 17,500 year ARI) flood due to their elevation above flood waters and the carpark being tanked.
- In events between the 0.006% AEP (1 in 17,500 year ARI) flood and the PMF, these areas would be subject to H1 to H5 hazard due to slow moving floodwater, however:
    - In events between the 0.006% AEP (1 in 17,500 year ARI) flood and up to the 9.6 mAHD which is the 0.0017% AEP (1 in 60,000 year ARI flood), producing depths up to 2 m through the retail level, hazards would be between H1 to H4.
    - Only above this hazard would increase to H5 up to the PMF. Residential levels which are at or above the PMF would not be exposed to flood water.

We therefore consider that with appropriate design and construction, all proposed building elements can be engineered to withstand flood forces up to and including the PMF event. We note that in Australia it is not uncommon to find structures which are successfully supported over piers within harbours, the ocean or over rivers. In Sydney Harbour there are numerous examples where urban development has successfully occurred suspended on piers over deep water.

3.3 Flood Emergency Management Plan

A detailed combined flood emergency management plan (**FEMP**) for the PP site (and Site A) would be prepared as part of any future development application(s). The site will be strata managed through a body corporate and would therefore enable coordinated emergency responses in the event of a flood. This accords with best practice flood risk management and consistent with the recent *Penrith Lakes DCP Stage 1 Development Control Plan* (2022) which requires all developments to be strata or community title, and that a body corporate would fund and implement in perpetuity a FEMP to ensure all flood risk management measures and evacuation requirements are in place.

The primary emergency response strategy for the site will be early vehicular evacuation based on BoM flood warnings and SES evacuation orders to a nominated evacuation centre or alternative accommodation outside the floodplain. The key elements of a future FEMP are summarised in Table 11 below.

We note that as a backup to vehicular evacuation, occupants would also be able to utilise the newly constructed footbridge over Brickmakers Drive (which currently services Site C) to safely evacuate outside of the PMF extents. The habitable floor levels of apartments

and terraces would also be at or above the PMF, which ensures that if any occupants are not evacuated, they can still safely shelter above the PMF.

Table 11 Key elements of future FEMP.

Element	Description
Flood Management Trained Staff	• A Chief Flood warden and Flood Wardens would be appointed and trained in emergency management and on how to implement the site's specific FEMP procedures in the event of a major flood. • Much like fire wardens they will assist in dissemination of NSW SES instructions to avoid confusion and ensure that all complying occupants are able to safely evacuate.
Flood Warnings Signage and Information	• Flood warning signage notifying occupants of the need to evacuate in a major flood and the site's evacuation procedures would be posted in the residences and car parks. Evacuation plans detailing the site's evacuation procedures would also be provided to each tenant as part of their handover manual.
Flood Response	• In the event of a major flood the BoM and the NSW SES will provide numerous warnings. Chief Flood Wardens would either receive a direct warning or receive warning via several subscribed weather alert services. • The Chief Flood Warden would forward the warning to all Flood Wardens onsite, and an alarm would then be activated to initiate a flood evacuation according to the FEMP. • A message over the loudspeakers would be given over all levels for people to go to their cars and evacuate. The Flood Wardens would ensure that people were directed to the carparks and out of the development. • Following a flood event, people on site would notify family and friends of their location. The site Manager and/or the Flood Wardens would inspect the site to organise any repairs, removal of debris and other works to ensure safe operations.

3.4 Evacuation Capability

3.4.1 Flood Warnings

Flood warnings for at risk areas near the Georges River are provided by the Bureau of Meteorology (**BoM**) and are disseminated through the assistance and guidance of the NSW SES, the agency responsible for emergency and rescue services in times of natural and man-made disasters. Flood warnings are derived from BOMs flood forecasting service that utilises rainfall, water level and stream gauges within the catchment.

The relevant water level gauges for the Liverpool LGA are the Liverpool (213400) and Milperra (213405B) water level gauges. The minimum warning time for critical flood levels at both gauges is 12 hours,[2] based on the travel time of upstream rainfall and river flows.

[2] Based on Schedule 2 from the Service Level Specification for Flood Forecasting and Warning Services for New South Wales and the Australian Capital Territory – Version 3.15 (BoM, 2024).

3.4.2 Evacuation Routes

The primary evacuation from the MEP is for vehicles to travel from the site onto the M5 before continuing to either an evacuation centre nominated by the NSW SES or alternative accommodation outside of the floodplain. As a backup there is also a pedestrian evacuation route out of the PMF extents. The evacuation routes are shown in Figure 6 with details provided in the following section.

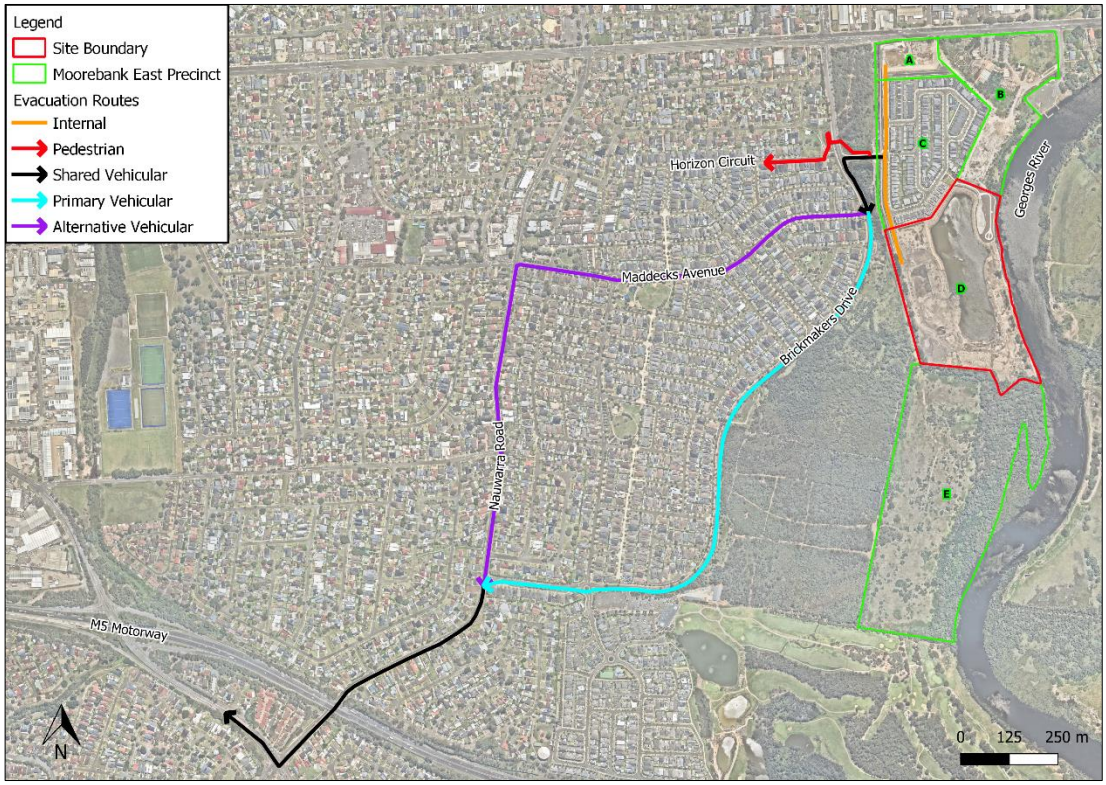

Figure 6 Site and MEP evacuation routes.

3.4.3 Evacuation Route Details

The offsite evacuation route for the site (Site D) is as follows:

1. North via the internal road along the western Site boundary.
2. West via the Promontory Way Bridge from Site C onto Brickmakers Drive.
3. South via Brickmakers Drive.
4. Southwest via Nuwarra Road.
5. Northwest via Heathcote Road and onto the M5 either east or west.

There are two options for evacuation from Site A which is also controlled by Benedicts:

1. Option 1 – North onto Newbridge Road, and then south onto Brickmakers Drive and onto the Site D evacuation Route; or

2. Option 2 – South via Spinnaker Drive, and then south onto Brickmakers Drive via the Promontory Way Bridge, and then onto the Site D evacuation Route.

There is a low point on Brickmakers Drive just north of the intersection with Conlon Avenue with an elevation of approximately 4.7 mAHD which can be cut off by high hazard flooding in events as frequent as the 2% AEP (1 in 50 AEP) flood.

If Brickmakers Drive is cutoff by flooding an alternative route to Nuwarra Road is available via Maddecks Avenue.

The critical low point for Site A option 1 is at the Site A entrance with Newbridge Road which gets cut off when flood waters reach about 3.0 mAHD, which is equivalent to approximately a 10 AEP event.

The Site D and Site A option 2 offsite evacuation route is first cut off when Brickmakers Drive at the intersection with Promontory Way becomes inundated which occurs when flood waters reach around 6.0 mAHD, which is equivalent to approximately the 0.2% AEP (1 in 500 AEP) flood event. Inundation at this location first occurs around 10.5 hours after the start of the PMF event, approximately 18 hours after BoM warnings would be issued.

Considering the availability of alternative evacuation routes, the critical evacuation route cutoff point is at the intersection of Brickmakers Drive and Promontory Way, which is cutoff approximately once every 500 years.

3.4.4 Evacuation Route Inundation and Warning Times

Evacuation route inundation and worst case warning times under PMF conditions at key locations along the evacuation route is provided in Table 12.

Table 12 Warning times prior to inundation in BMT 2022 PMF event.

Location	Cutoff Level (mAHD)	Equivalent Event	Cutoff Time from Start of PMF (hrs)	Minimum Available Warning Time (hrs)
Evacuation via Newbridge Road (Site A option 1)	3.0	1 in 10 AEP	8.5	16.0
Evacuation Route (Site A option 2, Sites C & Site D)	6.0	1 in 500 AEP	10.5	18.0
Site Ground Floor	7.6	> 1 in 5000 AEP	13.0	20.5
M5 Westbound (Moorebank Ave Underpass)	11.0	> 1 in 5000 AEP	13.0	20.5
M5 Eastbound (West of Georges River Bridge)	6.0	> 1 in 2000 AEP	11.5	19.0

3.4.5 Previous Modelling

3.4.5.1 Overview

Molino Stewart conducted a flood evacuation analysis on behalf of Council using the Life Safety Model (**LSM**) and summarised the analysis in the report *Georges River Evacuation Modelling Flood Evacuation Analysis Final (2022)*, hereafter referred to as the Molino Stewart Evacuation report.

The flood evacuation analysis investigated the road transport capacity throughout the Liverpool local LGA to evacuate during an EFE in the Georges River. The BMT 2020 model EFE results were used in the LSM to represent the maximum flood extent and fastest (most conservative) rising flood which evacuees would need to respond to.

3.4.5.2 Model Setup

Molino Stewart adopted sub-sectors to delineate the LGA based on draft sub-sectors provided by the NSW SES to manage the evacuation of the floodplain. This enabled sequencing of the evacuation based on each subsector's flood risk and how / when it is cut off by floodwaters. Molino Stewart assumed each sub-sector would receive an emergency warning to evacuate hours before either its evacuation route is cut, or properties are flooded by the EFE. Refer to Figure 7 for the LSM subsector locations.

The Molino Stewart Evacuation report included several LSM scenarios to understand current day and potential future conditions. The two scenarios relevant to this assessment are:

1. Scenario A:
    a. A potential future scenario dated 2036 with infill developments under existing zoning and some road upgrades.
    b. Scenario A modelled approximately 29,000 vehicles evacuating the floodplain.
2. Scenario B:
    a. As per Scenario A but with the addition of development from 11 future PPs under investigation at the time of LSM preparation (which included the site) as shown in Figure 2, as well as further road upgrades.
    b. Scenario B modelled approximately 69,000 vehicles evacuating the floodplain, this including Site F.

MA have previously obtained the Molino Stewart Evacuation report and the LSM from Council and Molino Stewart. MA have used the LSM as the basis for undertaking updated evacuation modelling to extract relevant site and local evacuation information to inform site assessment.

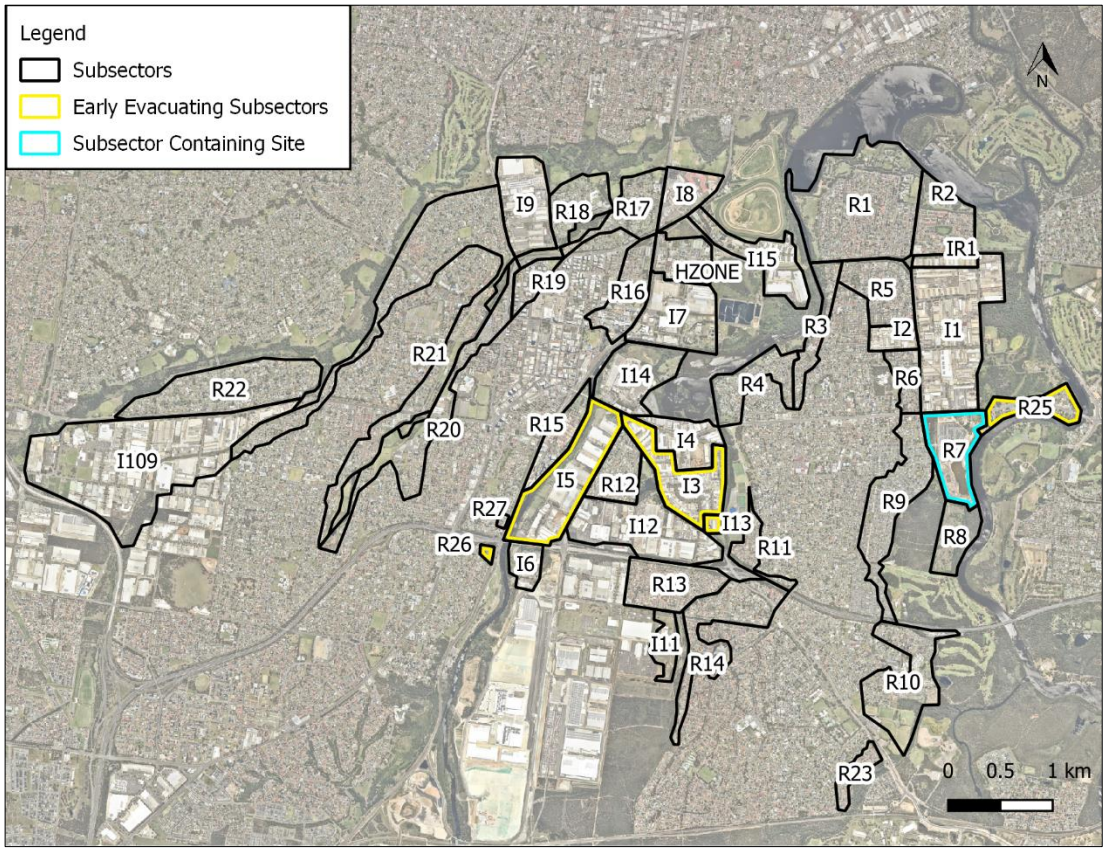

Figure 7 Subsector locations in LSM domain noting early evacuating subsectors and subsector R7.

3.4.5.3 Subsector Evacuation Timing

In the LSM the site is located within subsector R7, which also comprises 4 of the other 5 sites that make up the MEP, as shown in Figure 8. In the LSM the initial warning is received by NSW SES 12 hours prior to the BoM critical levels, and 4.5 hours later (i.e. 7.5 hours before flood waters reach the BoM critical levels) subsector R7 is notified to evacuate.

There are several subsectors which evacuate prior to subsector R7. Five of these, which are important for consideration in the site's early evacuation strategy, include R25, which is notified upon the receipt of the initial warning, as well as subsectors I5, I3, I13, and R26, which are notified 2.5 hours after the initial warning. Details of the subsector sequencing are located at Appendix A of the Molino Stewart Evacuation report.

The LSM assumes subsectors are delayed from initially evacuating and during evacuation based on the following factors which have been adopted from the SES Timeline Evacuation Model (**TEM**):

1. Warning Acceptance Factor (**WAF**): Delays evacuation 1 hour from initial warning to account for delay between receiving an evacuation order and acting upon it.

2. Warning Lag Factor (**WLF**): Delays evacuation 1 hour from initial warning to account for the time taken by occupants to prepare for evacuation.

3. Traffic Safety Factor (**TSF**): Added to the travel time to account for any delays that occur along the evacuation route. This includes potential for incidents such as vehicle accidents or breakdowns, fallen trees or power lines or water across the road. The NSW SES has developed a table of TSFs, where the safety factor is proportional to the travel time, ranging from one hour to three and a half hours (this factor is not accounted for by the LSM but is applied to the final results).

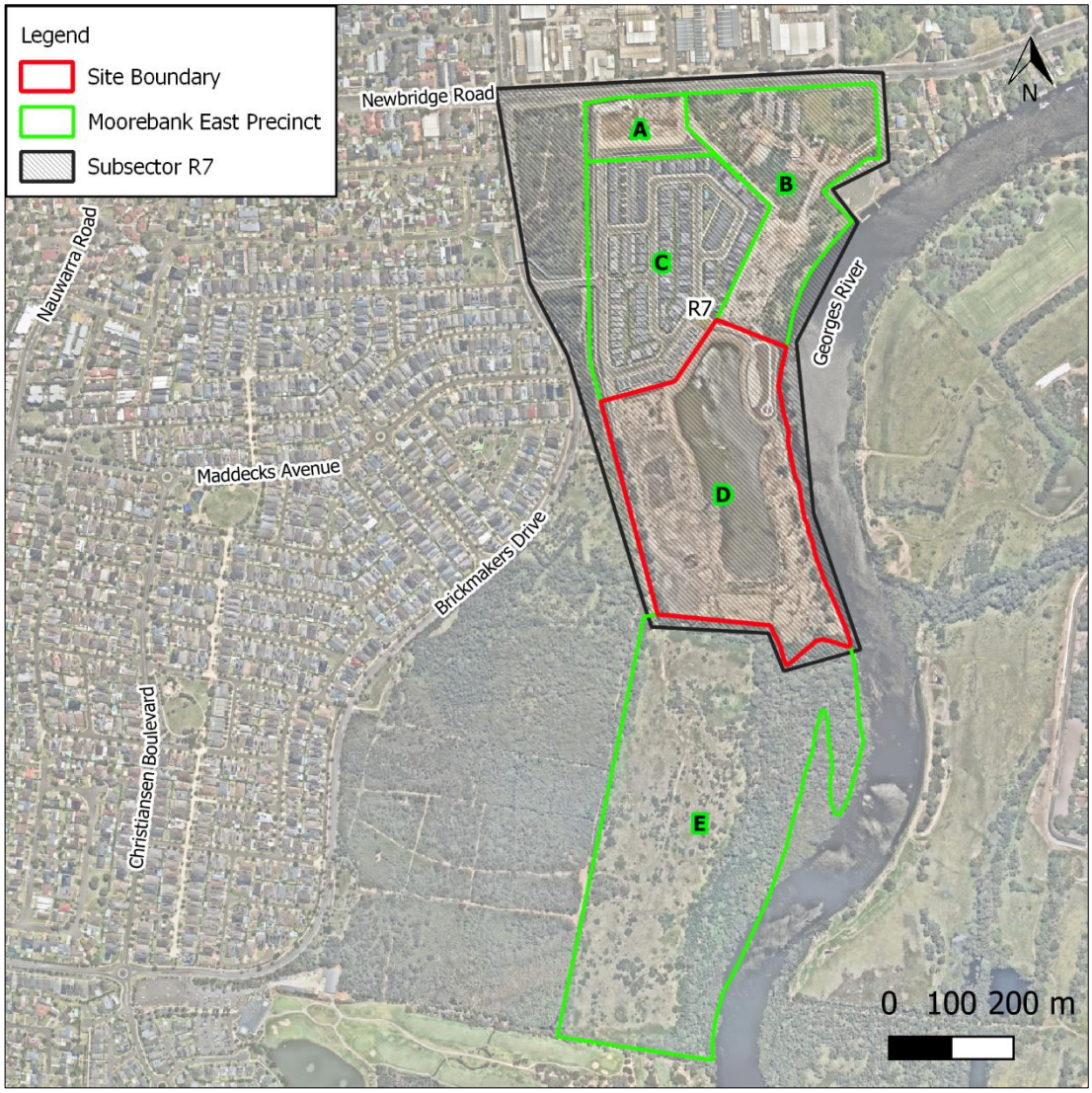

Figure 8 Subsector R7 location with respect to the site and Moorebank Precinct.

3.4.5.4 Conservative Assumptions

The LSM makes several conservative assumptions as follows, some of which are acknowledged in the report:

1. The LSM assumes all residents are home and all businesses are operational. For instance, the LSM does not allow for residents who are working outside the floodplain or are travelling. The LSM further assumes all businesses are operating, whereas in reality if a flood occurred at night most businesses would

not have any staff present, and some businesses may choose to close for the day if flooding is imminent.

2. The LSM assumes all floodplain occupants will evacuate, however in reality there will be some proportion of people who will choose to SIP.

3. The LSM assumes no one in the floodplain receives any electronic notifications of flood warnings or has operational FEMP(s), and rather is completely reliant on doorknocking teams, which significantly slows down the dissemination of flood warnings.

4. The LSM only considered the worst-case flood event, i.e. the EFE. All smaller floods will have more time available to effect an evacuation.

5. The LSM assumes that 12 hours of warning time will be available. However, in the event of a flood the magnitude and duration of the EFE, it is likely that several days of warning time will be available.

6. The LSM assumes a low road capacity of 600 vehicles / lane / hour, whereas we understand that Council's design standards are for a road capacity of 1,400 vehicles / lane / hour.

7. The LSM does not consider pedestrian evacuation. Some floodplain occupants will choose to walk instead of drive (or may not have a vehicle they can drive), and would therefore not contribute to vehicular traffic. Further, in reality, in the case of traffic congestion and rising flood waters, vehicle occupants can exit their vehicle and walk.

8. The LSM setup for Scenario A models infill development of the study area by assuming a large amount of lots zoned for potential intensification are developed, this equates to an additional 1,541 additional vehicles.

3.4.6 Methodology

3.4.6.1 Objectives

In the Molino LSM the MEP is modelled in Scenario B, as when the model was created it was grouped with several future planning proposals. In the Molino Stewart Evacuation report findings, Section 7.2.6 summarised the future challenges associated with the MEP. The conclusions identified the modelled population was able to safely evacuate, but it was only able to do so by blocking the evacuation of vehicles originating from Chipping Norton.

In Section 7.2.6 Molino also concluded that based on the number of vehicles caught in Chipping Norton and the number of vehicles originating from the MEP that only approximately 700 vehicles could be added to the MEP before additional vehicles were caught by flood waters. This section also stated that, considering Site C had already received development approval, there weas only approximately 350 vehicles worth of spare capacity remaining in the MEP.

However, Molino noted that the 'spare' evacuation capacity referred to is a high-level calculation, and the capacity would have to be modelled in order to test the impact of a reduction in vehicles from certain developments.

Based on this recommendation, to evaluate whether evacuation capacity is available for the proposed development without impacting Chipping Norton and the wider floodplain, MA undertook the following steps to update the LSM:

1. Update the Molino LSM to determine current evacuation conditions including already approved developments (Approved Conditions).
2. Further update the Molino LSM to determine the proposed evacuation conditions including the proposed site and associated emergency response measures (Proposed Conditions).
3. Assess whether the proposed development can safely evacuate without negatively affecting the existing evacuation capability.

3.4.6.2 Base Scenario

The Molino Stewart LSM Scenario A described at Section 5.5.2 of the Molino Stewart Evacuation report has been used as the basis for undertaking detailed evacuation route capacity analysis for the site.

Scenario A was chosen as the basis for modelling instead of Scenario B as it required fewer modifications to best represent approved and proposed conditions. Adoption of Scenario B would have required more modifications due to its inclusion of all PPs under investigation at the time (accounting for almost 41,000 new vehicles), most of which have not yet been approved or have had their population significantly reduced. Modifications to the modelled road network would have also been required to ensure its consistency with current conditions.

3.4.6.3 Approved Conditions LSM Setup

The following modifications were made to the Molino Stewart LSM Scenario A model to allow detailed modelling of the site under approved conditions:

1. The road network was updated to reflect the current conditions:
    a. The Molino Stewart LSM Scenario A included future committed road upgrades, most of which have since been completed, but are slightly different to what was modelled.
    b. To be conservative MA updated the LSM to reflect road current (2025) conditions.
    c. These changes were relatively minor, with the exception of the M5 Motorway upgrade, which has not been constructed and is still in the detailed design and construction tender stages. The key feature of the M5 Motorway upgrade is a two-lane westbound M5 Motorway exit for Hume Highway traffic which will be on a 290 m long bridge between

Moorebank Avenue, Moorebank and the Hume Highway, Casula over the Georges River and adjacent rail lines.

d. Refer to Section 5.4.4 of the Molino Stewart Evacuation report for additional details of the other upgrades.

2. The vehicle population was updated to account for approved developments:

   a. Since the Molino Stewart Evacuation report was published there have been several changes to the status of the modelled planning proposals and their proposed vehicle populations.

   b. MA investigated these changes and updated the LSM to reflect the revised vehicle populations.

   c. A summary of these PP statuses and general details is provided in Sections 1.4 and 1.5, and a breakdown of the approved PP's vehicle populations is provided below in Table 15.

   d. The evacuating vehicle population of the site (Site D) was modelled based on the approved Georges Cove Marina detailed in Section 1.3.

   e. The approved conditions model considered approximately 32,000 vehicles evacuating the floodplain, approximately 3,000 more than the Molino Stewart LSM Scenario A.

Table 13 Summary of LSM PP evacuating vehicle populations across scenarios.

Site[1]	Molino LSM Vehicle Population[2]	Approved MA LSM Vehicle Population
Site A – Georges Cove Village	585	176[3]
Site B - 124 Newbridge Road, Moorebank	795	0[4]
Site C – Georges Cove Residences	363	363
Site D – Georges Cove Marina	374	319[3]
Site E - Lot 2 Newbridge Road Moorebank	1,611	0[4]
Site F – Moore Point Precinct	25,088	0[5]
Site G - Moore Point Rose Group	6,771	0[4]
Site H – The Grove	462	462
Site I – Warwick Farm Village	996	146[3]
Site J - Warwick Farm Structure Plan	2,713	0[4]
Site K – Shepherd Street Precinct	1,200	1,424

Notes

[1] Refer to Figure 2 for the annotated PP locations.

[2] Vehicle population is from extracted from Scenario B of Molino's LSM. Refer to Table 11 in the Molino Stewart Evacuation report for reference.

[3] To be conservative the vehicle populations were calculated by the assuming the approved car parks were at 50% capacity. By comparison, the Molino Stewart LSM did not allow for traffic from these carparks.

[4] Developments have not received approval.

[5] Site F was not included in the MA LSM as its population relies on several significant future road upgrades and pedestrian footbridges which are not fully known.

3.4.6.4 Proposed Conditions Evacuation Timing

Reviewing the Molino Stewart LSM and Evacuation report it was found that there is an opportunity for early evacuation of Sites A and D. The early evacuation opportunity is possible due to the following:

1. There are 2.5 hours between the warning of subsector R25 and the following sectors.
2. Subsector R25 is located adjacent to the MEP and contains a small number of dwellings, hence it is sensible that Sites A and D are warned following Subsector R25.
3. Sites A and D are both managed by Benedict / Mirvac.
4. The NSW SES can communicate evacuation orders to site management and site management can then action and assist with / manage the evacuation.
5. There is no material change in demand to the NSW SES resourcing to provide the earlier warning.
6. There is no material change in the timing of other sectors evacuations.

7. No road upgrade works would be required.

8. It can be readily implemented either through a site specific FEMP with warning system managed by Body Corporate enforced via consent conditions, NSW SES consultation and/or SES sub-plan amendments.

We therefore propose that Sites A and D evacuate 1.5 hours following the NSW SES receiving the initial warning from BoM, compared to the initial Molino LSM assumption of 4.5 hours following initial warning.

3.4.6.5 Proposed Conditions LSM Setup

The following modifications were made to the MA Approved Conditions scenario to allow detailed modelling of the Site under proposed conditions:

1. The initial warning time of Site A and Site D was modified to allow for an early evacuation strategy:

    a. As per Section 3.4.6.4, the LSM model was modified such that Site A and Site D evacuate independently of the remainder of subsector R7 (Site C) 1.5 hours following the NSW SES receiving the initial warning from BoM.

2. The vehicle population was updated to account for approved developments included in Molino Stewart LSM Scenario B:

    a. The evacuating vehicle population of the site (Site D) was modelled based on the Planning Proposal Modification 2 Plans (Appendix F).

    b. The number of evacuating vehicles were determined assuming that in a major flood event all the residential parking spaces will be occupied, and half the non-residential spaces would be occupied.

    c. These assumptions result in a evacuating vehicle population of 528 for the site.

    d. Refer to Table 14 for a breakdown of the vehicle population and a comparison to approved.

Importantly, no further road upgrades have been modelled compared to the approved conditions LSM setup.

Table 14 Summary of site LSM evacuating vehicle populations across scenarios.

Scenario & Site Description	Residential Vehicles	Non-Residential Vehicles	Total
Approved – Georges Cove Marina	0	319	**319**
Proposed – Revised Georges Cove Marina	408	120	**528**

3.4.7 Model Outcomes

Firstly, the approved conditions LSM results show that in approved conditions, 296 vehicles are caught by floodwaters, which represents 1.4% of the floodplain modelled population. However, considering the conservative LSM assumptions detailed at Section 3.4.5.4, it is likely that in a real world extreme flood event, the number of people caught by flood waters would be lower or that all persons could be evacuated.

The updated LSM results showed that all vehicles from the site were able to safely evacuate in both approved and proposed conditions, and the number of vehicles caught by flood waters throughout the floodplain reduced in proposed conditions. Refer to Table 15, Figure 9 and Figure 10 for a comparison of the evacuation outcomes. LSM timeseries results are also provided in Appendix D with map references summarised in Table 16.

Despite the additional site population in proposed conditions, early evacuation allows Site A and Site D to have a reduced impact on the road network, leaving prior to peak of the catchment wide evacuation. This reduction in congestion enables additional vehicles from Chipping Norton to evacuate and does not materially impact the evacuation outcome of the wider floodplain, therefore resulting in a net benefit to affected areas.

Table 15 Evacuation capability outcomes.

Scenario	Caught by Flood Waters	Difference
Approved Conditions	296	N/A
Proposed Conditions	277	**-19**

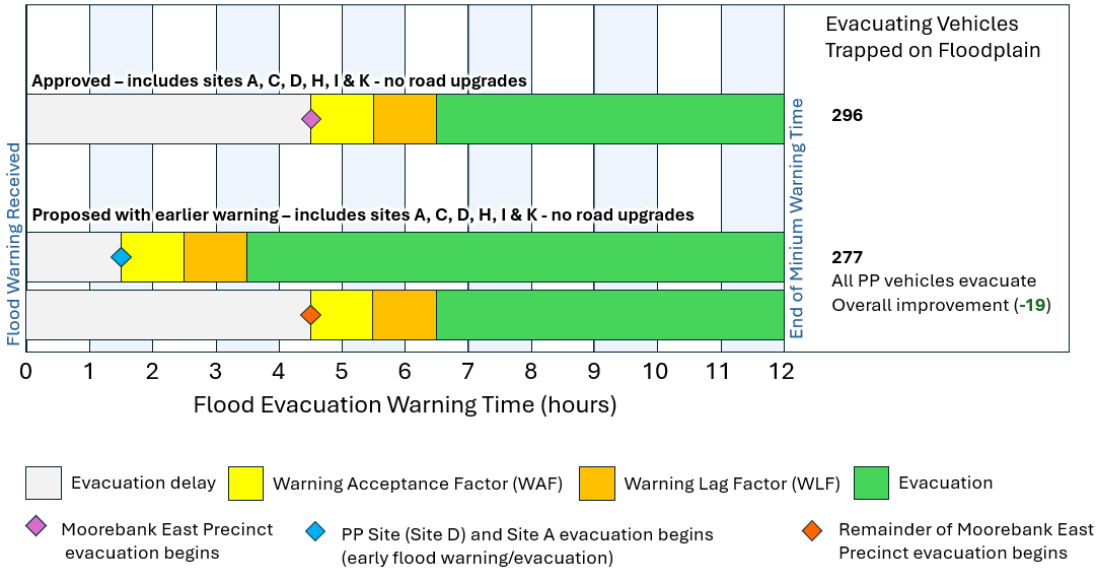

Figure 9 Evacuation modelling summary.

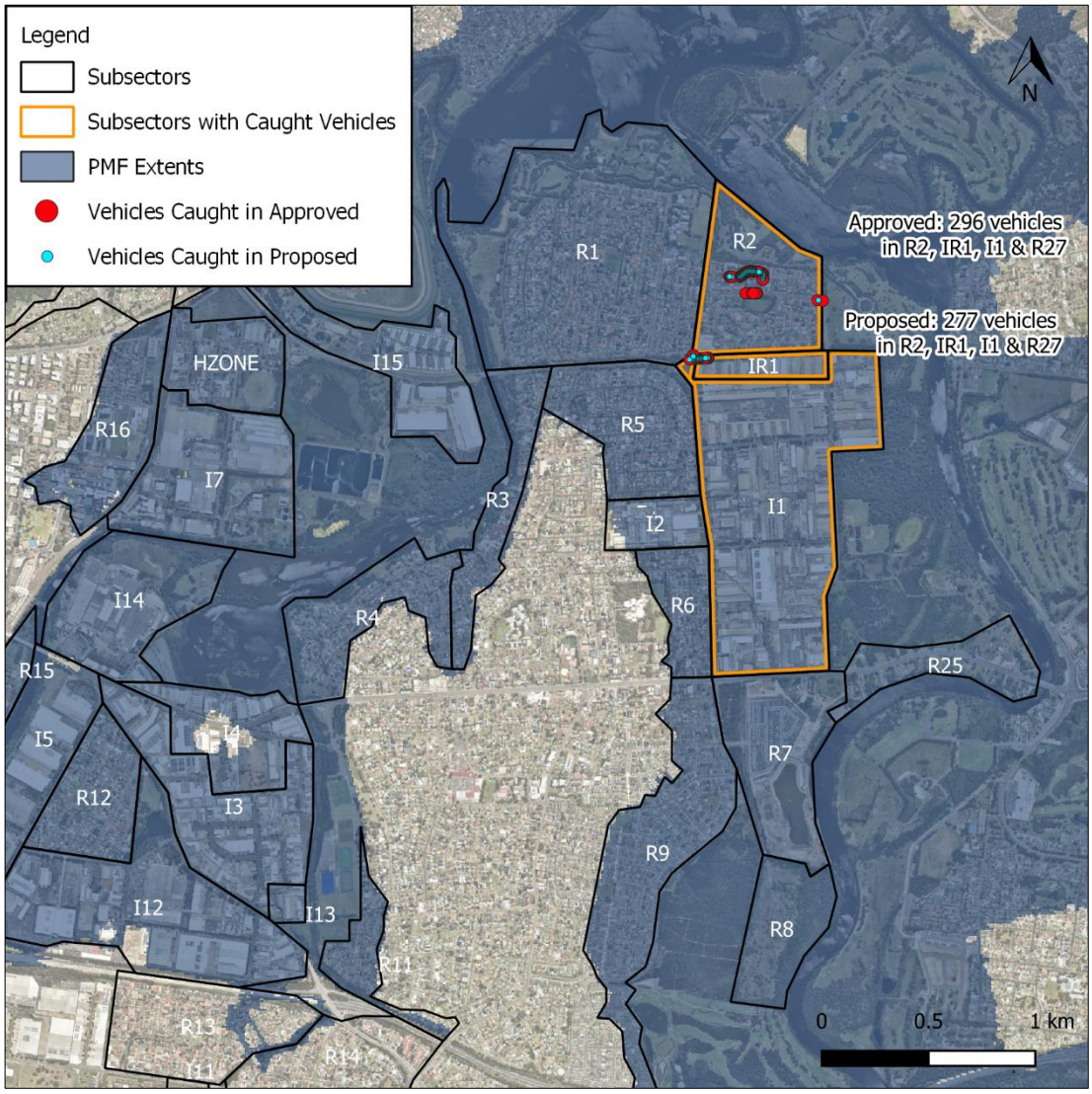

Figure 10 Evacuation modelling results identifying critical sectors.[3]

Table 16 LSM evacuation modelling timeseries map references in Appendix D.

	Time in Timeseries (hours)						
Modelled Condition	**-5:25**	**-3:30**	**-2:55**	**0:00**	**5:00**	**8:35**	**28:30**
Approved	Map L1	Map L2	Map L3	Map L4	Map L5	Map L6	Map L7
Proposed	Map L8	Map L9	Map L10	Map L11	Map L12	Map L13	Map L14

[3] Note that 1 vehicle is caught in both scenarios in subsector R27, which is outside the figure extents.

3.4.8 Sensitivity Analysis

The previous analysis relies upon current road conditions, omitting the committed upgrades of the M5 discussed in Section 3.4.6.3, which will increase the evacuation capacity for trapped vehicles.

To understand the impact of the M5 upgrades on the floodplain evacuation outcomes, both approved and proposed conditions were re-run with the M5 upgrade reinstated as per the original LSM Scenario A setup. All other inputs are consistent with those described in previous sections.

Refer to Table 17, Figure 11 and Figure 12 for a comparison of the evacuation outcomes with the M5 upgrade. LSM timeseries results are also provided in Appendix D with map references summarised in Table 18. The sensitivity test LSM results showed that all vehicles from the site were still able to safely evacuate. The number of vehicles caught by flood waters in approved existing conditions reduced from 296 (Table 15) to 273 (Table 17) with the additional M5 lanes. Further, the number of vehicles caught by flood waters in proposed conditions reduced from 277 (Table 15) to 121 (Table 17) with the additional M5 lanes, indicating that the proposed early evacuation strategy coupled with the future M5 upgrade would further reduce the number of vehicles trapped in the floodplain.

Table 17 Sesntivity analysis evacuation capability outcomes.

Scenario	Caught by Flood Waters	Difference
Approved Conditions with M5 upgrade	273	N/A
Proposed Conditions with M5 upgrade	121	**-152**

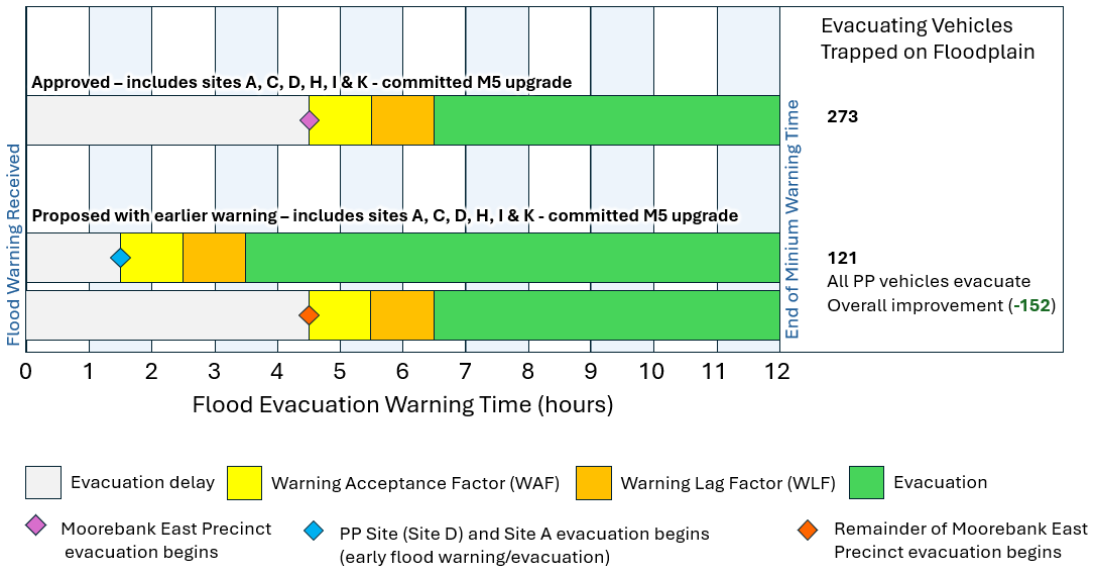

Figure 11 Sesntivity analysis evacuation modelling summary.

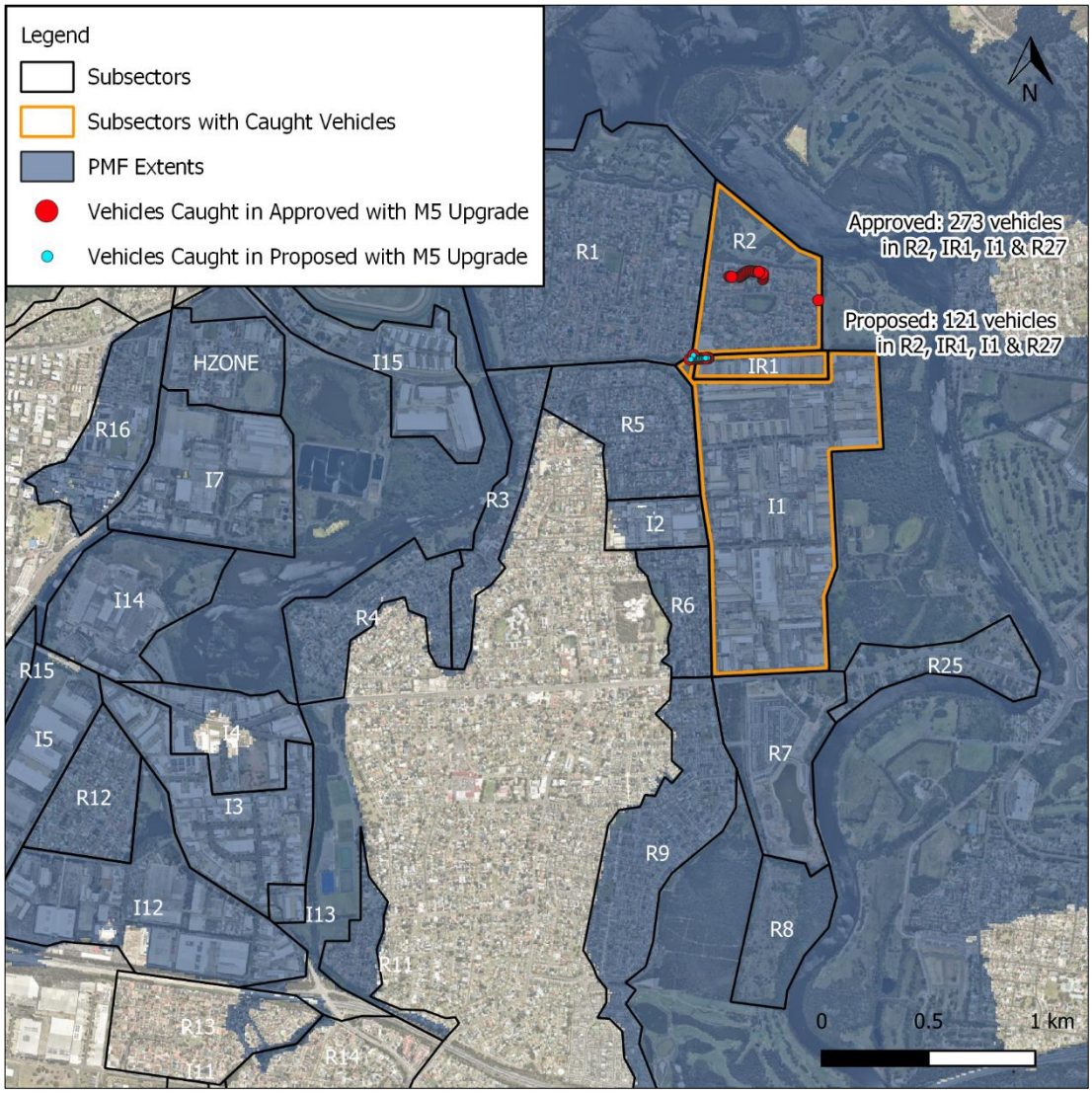

Figure 12 Sesntivity analysis evacuation modelling results identifying critical sectors.[4]

Table 18 LSM sensitivity evacuation modelling timeseries map references in Appendix D.

	Time in Timeseries (hours)						
Modelled Condition	**-5:25**	**-3:30**	**-2:55**	**0:00**	**5:00**	**8:35**	**28:30**
Approved with M5 Upgrade	Map L15	Map L16	Map L17	Map L18	Map L19	Map L20	Map L21
Proposed with M5 Upgrade	Map L22	Map L23	Map L24	Map L25	Map L26	Map L27	Map L28

[4] Note that 1 vehicle is caught in both scenarios in subsector R27, which is outside the figure extents.

4 Planning Considerations

4.1 Section 9.1 Local Planning Directions 4.1 Flooding

An assessment of the proposal against the relevant provisions contained the Section 9.1 Local Planning Directions 4.1 Flooding is provided in Table 19, which demonstrates that the proposal is consistent with all relevant terms of the Directions.

Table 19 Compliance with Section 9.1 Local Planning Directions 4.1 Flooding (2022) controls.

Clause	Provision	Assessment
1	*A planning proposal must include provisions that give effect to and are consistent with:*	(1) See below.
1(a)	*the NSW Flood Prone Land Policy,*	(2) The primary objective of the FPLP is to reduce the impacts of flooding and flood liability on developable land within and outside the site and reduce public and private losses. (3) The PP is consistent with the FPLP because: a. Updated flood modelling for a full range of events up to the PMF demonstrate that the PP would not result in any off-site impacts on communities and individual owners of flood prone property. b. The updated modelling demonstrates that future development on the PP site can be readily protected from flood damages through design which elevates floors and protects structures from harm through conventional construction techniques. c. The PP will, as demonstrated by the updated flood modelling and detailed evacuation modelling, be able to realise the highest and best use of the land.
1(b)	*the principles of the Floodplain Development Manual 2005,*	(4) The FDM (2005) has been superseded by the FRMM (2023). (5) The PP is consistent with the flood risk management principles contained in Section 2 of the FRMM because: a. The PP is sustainable and will be capable of being developed with consideration of climate change and extreme flood events up to the PMF. b. The PP is strategic because it has considered flood risks across the LGA and Georges River floodplain. Updated evacuation modelling demonstrates that the PP will not detrimentally impact on the evacuation capacity of others on the floodplain, and provides an opportunity to improve existing evacuation capability through early co-ordinated site evacuation. c. The PP has progressed through various stages of consultation, including the preparation of updated

Clause	Provision	Assessment
		flood impact modelling and flood evacuation modelling presented in this report. d. The flood impact modelling and flood evacuation modelling provided in this report is based on the latest 2020 BMT flood modelling and 2022 Molino flood evacuation information. e. The updated flood modelling considers a full range of floods up to the PMF. f. The updated flood modelling considers how flood risks may change over time by consideration of climate change based on the latest available 2020 BMT flood modelling. g. The PP does not seek to materially change any existing waterway. h. The PP will not impact on the natural function of any waterway or floodplain flow characteristics. i. The PP would see a future development managed by a body corporate which would function to ensure that any continuing flood risks would be centrally managed, ensuring that risk management measures such as signage, warning systems, flood alarms, evacuation procedures and flood wardens, would be funded and operational in perpetuity. j. The PP would see a future development managed by a body corporate able to remain informed of any changes in flood information and risk and adapt continuing risk management processes and procedures for the entire community it serves.
1(c)	*the Considering flooding in land use planning guideline 2021, and*	(6) PP is consistent with the 2021 planning guidelines because: a. The PP has considered a full range of events including the 1% AEP, 1% AEP + CC, 0.05% AEP, 0.02% AEP and PMF flood events. b. The PP would deliver future urban development that is significantly better protected against flood risks than current planning standards. The carpark entry and retail levels at 7.6 mAHD will provide flood immunity to the 0.006% AEP flood event (1 in 17,500 year ARI), will be 1.02 m above the 0.02% AEP (1 in 5,000 year ARI) flood level and 1.6 m above Council's FPL. All residences would be capable of being located above the PMF. c. Updated evacuation modelling based on the latest 2022 Molino Stewart Life Safety Model (LSM) demonstrates that future occupants can be evacuated in accordance with best practice and SES recommendations, before being cut off by flood waters, and do so without impacting others evacuating from the floodplain. In the event that some persons are not evacuated, all residences would be able to safely shelter on-site.

Clause	Provision	Assessment
		d. Updated flood modelling for a full range of events up to the PMF demonstrate that the PP would not result in any off-site impacts on communities and individual owners of flood prone property. e. The updated modelling demonstrates that future development on the PP site can be readily protected from flood damages through design which elevates floors and protects structures from harm through conventional construction techniques
1(d)	*any adopted flood study and/or floodplain risk management plan prepared in accordance with the principles of the Floodplain Development Manual 2005 and adopted by the relevant council.*	(7) This is achieved because: a. This assessment includes updated flood modelling which has been carried out based on the BMT (2020) *Georges River Flood Study* and using the BMT (2020) TUFLOW model which is considered by DPHI to be the latest available flood modelling for the floodplain and site. b. The flood modelling contained in the Georges River Floodplain Risk Management Study (GRFRMS, 2004) has been superseded by the most recent BMT (2020) flood modelling which has been relied upon by this report. The PP is not inconsistent with the recommendations or outcomes of the GRFRMS. Significantly, the 1% AEP + 0.5 m freeboard was the recommended principal floor level control for residential uses. The PP provides for floor levels significantly exceeding this requirement.
2	*A planning proposal must not rezone land within the flood planning area from Recreation, Rural, Special Purpose or Conservation Zones to a Residential, Business, Industrial or Special Purpose Zones.*	(8) This PP does not seek to rezone land within the flood planning area from a Recreation zone to a Residential zone. The planning proposal seeks additional permitted uses with the existing RE2 Private Recreation zone.
3	*A planning proposal must not contain provisions that apply to the flood planning area which:*	(9) See below.
3(a)	*permit development in floodway areas,*	(10) This is achieved because: a. The urban use will be located on structural piers above water within the marina and will not be located within a floodway. b. The piers will be located in an area mapped as floodway by application of the BMT (2020) definition, however this is common practice in Australia where many structures are supported over piers within harbours, over the ocean or over rivers (e.g. bridges, causeways). In Sydney Harbour there are numerous examples where urban development has successfully occurred suspended on piers over deep water. c. The area mapped as a floodway arises artificially because of historical extraction activities at the site

Clause	Provision	Assessment
		which has created a large pool of open water. In this area velocities are very low and do not present any difficulty for future structural design and construction. d. The floodway categorisation in this area is a modelling artifact arising from structures represented as layered flow constrictions which allow water to pass through. Flood mapping does not account for the restriction of flood depths to 1.95 m due to the basement structure. These areas should therefore be more correctly classified as flood storage.
3(b)	*permit development that will result in significant flood impacts to other properties,*	(11) This is achieved because: a. Updated flood modelling for a full range of events up to the PMF demonstrate that the PP would not result in any off-site impacts on communities and individual owners of flood prone property.
3(c)	*permit development for the purposes of residential accommodation in high hazard areas,*	(12) This is achieved because: a. The urban use will be located on structural piers above water within the marina and will not be located within an area of high hazard. b. The piers will be located in an area mapped as H5 in the 1% AEP and H6 in the PMF, however this is common practice in Australia where many structures are supported over piers within harbours, over the ocean or over rivers, and there is no reason why a future development would not be capable of constructing appropriate structural piers or similar support system.
3(d)	*permit a significant increase in the development and/or dwelling of that land,*	(13) This is achieved because: a. The PP does not propose to increase future development below the FPL. All future urban development would be raised significantly above the FPL. b. The carpark entry and retail levels at 7.6 mAHD will flood immune to the 0.006% AEP (1 in 17,500 year ARI) flood, and will be 1.02 m above the 0.02% AEP (1 in 5,000 year ARI) flood level and 1.6 m above Council's FPL. All residences would be capable of being located above the PMF
3(e)	*permit development for the purpose of centre-based childcare facilities, hostels, boarding houses, group homes, hospitals, residential care facilities, respite day care centres and seniors housing in areas where the occupants of the development cannot effectively evacuate,*	(14) This is achieved because: a. The PP does not propose any sensitive uses of the site.
3(f)	*permit development to be carried out without development consent*	(15) This is achieved because:

Clause	Provision	Assessment
	except for the purposes of exempt development or agriculture. Dams, drainage canals, levees, still require development consent,	a. Future development would require development consent.
3(g)	*are likely to result in a significantly increased requirement for government spending on emergency management services, flood mitigation and emergency response measures, which can include but are not limited to the provision of road infrastructure, flood mitigation infrastructure and utilities, or*	(16) This is achieved because: a. Updated evacuation modelling based on the latest 2022 Molino Life Safety Model (LSM) demonstrates that future occupants can be evacuated in accordance with best practice and SES recommendations, before being cut off by flood waters, and do so without impacting others evacuating from the floodplain. In the event that some persons are not evacuated, all residences would be able to safely shelter on-site b. The PP would see a future development managed by a body corporate which would function to ensure that any continuing flood risks would be centrally managed, ensuring that risk management measures such as signage, warning systems, flood alarms, evacuation procedures and flood wardens, would be funded and operational in perpetuity c. The PP would not increase the requirement for government spending on emergency management services or flood mitigation measures in events up to and including the PMF due to the flood resilience that can and would be incorporated into a future development of the site and centralised management of the site by a body corporate providing a single point of contact for the SES during a flood emergency.
3(h)	*permit hazardous industries or hazardous storage establishments where hazardous materials cannot be effectively contained during the occurrence of a flood event.*	(17) This is achieved because: a. All future commercial floor levels would be 1.6 m above the FPL. b. No hazardous materials would be stored at lower levels exposed to flood risks.
4	*A planning proposal must not contain provisions that apply to areas between the flood planning area and probable maximum flood to which Special Flood Considerations apply which:*	(18) This is achieved because: a. There are no uses within the PP that apply to the Special Flood Considerations.
4(a)	*permit development in floodway areas,*	(19) Achieved. Refer to response to provision 3(a) and 4.
4(b)	*permit development that will result in significant flood impacts to other properties,*	(20) Achieved. Refer to response to provision 3(b) and 4.
4(c)	*permit a significant increase in the dwelling density of that land,*	(21) Achieved. Refer to response to provision 3(d) and 4.
4(d)	*permit the development of centre-based childcare facilities, hostels,*	(22) Achieved. Refer to response to provision 3(e) and 4.

Clause	Provision	Assessment
	boarding houses, group homes, hospitals, residential care facilities, respite day care centres and seniors housing in areas where the occupants of the development cannot effectively evacuate,	
4(e)	*are likely to affect the safe occupation of and efficient evacuation of the lot, or*	(23) Achieved. Refer to response to provision 3(g) and 4.
4(f)	*are likely to result in a significantly increased requirement for government spending on emergency management services and flood mitigation and emergency response measures, which can include but not limited to road infrastructure, flood mitigation infrastructure and utilities.*	(24) Achieved. Refer to response to provision 3(g) and 4.
5	*For the purposes of preparing a planning proposal, the flood planning area must be consistent with the principles of the Floodplain Development Manual 2005 or as otherwise determined by a Floodplain Risk Management Study or Plan adopted by the relevant council.*	(25) Achieved. Refer to response to provisions 1(b) and 1(d).

4.2 Shelter-in-Place Guideline for Flash Flooding

The NSW Department of Planning and Housing and Infrastructure (**DPHI**) *Shelter-in-Place Guideline for flash flooding* (**SIP guide**) was released in January 2025. Based on the updated flood modelling contained in this report, the PP site or the evacuation route to the M5 are not affected by flash flooding, that being because flooding occurs significantly after the 6 hour period following a precipitation event (as defined in the Guideline).

Whilst the PP site is not affected by flash we have, however, considered the SIP Guide for the sake of completeness. Table 20 demonstrates that all SIP considerations have been effectively addressed by this assessment.

Table 20 Consideration of 2025 NSW Shelter-in-place guideline.

Guideline Consideration	Compliance Assessment
• The SIP guide defines SIP as follows: *Shelter-in-place is the internal movement of a building's occupants to an area within the building above the probable maximum flood (PMF) level before their property becomes inundated by flood waters.*	(1) Based on this definition, SIP is not proposed for the site because the primary flood emergency response is to evacuate the site. However, as the proposed residences will be above the PMF level, SIP is available as a measure of last report, notwithstanding that flood wardens and warning systems will be in place to ensure the site is evacuated in the event of a flood.

Guideline Consideration	Compliance Assessment
	(2) The evacuation modelling (refer to Section 3.4.7) demonstrates that evacuation can be completed in a timely manner before the evacuation route is cut.
• Flash flooding is 'flooding that occurs within 6 hours of the precipitating weather event, and often involves rapid water level changes/	(3) The site is not affected by flash flooding because flooding occurs significantly after the 6 hour period following a precipitation event (as defined in the SIP Guide). At this site there is ample warning period available before evacuation routes become affected.
• Evacuation off-site is the primary emergency management strategy for flooding in NSW.	(4) The primary emergency response for the site is evacuation in line with the (2023) SES Liverpool City, and Georges & Woronora Valley Flood Emergency Sub Plans and consistent with the SIP guide requirements. (5) The proposed residences will be located above the PMF. SIP in site residences is only as a precaution for site occupants who have not managed to evacuate the site prior to evacuation route cut off as a measure of last resort, which will provide evacuees a refuge above the PMF level, with access to food, water, backup power, medical supplies and connection to the internet. (6) A future FEMP implemented over the PP site by a body corporate, would provide details on all evacuation triggers, measures and requirements for evacuation, and any SIP procedures, including actions during and after a flood, and how messages will be communicated to site occupants and visitors for the life of the development. The FEMP would ensure on-going community education and understanding of site flood risks and risk management measures.
• The floor level of a shelter should be above the PMF.	(7) Future residential floors would be at or above the PMF level 11.78 mAHD.
• Structural soundness of the shelter.	(8) Proposed buildings would be constructed from flood compatible materials and designed by a suitably qualified structural engineer to withstand flood forces including from buoyancy and debris for flooding up to the PMF level.
• Access to the shelter does not rely on electricity and is self directing.	(9) All residents and visitors are readily able to evacuate via internal stairs to the carpark without relying on electricity.
• Access to personal hygiene facilities such as a toilet.	(10) Future residential floors would be at or above the PMF level 11.78 mAHD which will ensure access to personal hygiene facilities.
• Shelter to have a minimum floor space of $2m^2$ per person.	(11) Future residential floors would be at or above the PMF level 11.78 mAHD and would therefore satisfy this requirement.
• Items for self-sufficiency that are stored, maintained and are regularly updated in an accessible location above the PMF.	(12) Future residential floors would be at or above the PMF level 11.78 mAHD and would therefore satisfy this requirement. (13) The body corporate, through the FEMP it would fund and implement over the PP site, would also ensure that spaces and other items required for self sufficiency would be available to any non-residential occupants who had not evacuated the site.

Guideline Consideration	Compliance Assessment
• Provision of back-up on-site power	(14) Site buildings will be provided backup power in the form of a backup generator or a solar panel array and battery backup. The body corporate, through the FEMP it would fund and implement over the PP site, would ensure that these measure are permanently in place and operational.
• The development is not located in an area of high flood risk.	(15) Flood modelling demonstrates that the proposed buildings are not subject to high flood risk. The carpark and retail levels would be flood immune to the 0.006% AEP (1 in 17,500 year ARI) flood level. All residential floors would be above the PMF. (16) In the PMF whilst hazard is mapped as H6, this arises due to flood water depth and not velocity, which is extremely low at ≤ 0.6 m/s. The marina platform and proposed buildings will be readily capable of being designed to structurally resist flood forces using standard commercial construction techniques.
• Ensure community engagement so that the community is aware of actions they must take before, during and after sheltering in place and the key triggers that require shelter in place.	(17) A future FEMP implemented over the PP site by a body corporate, would provide details on all evacuation triggers, measures and requirements for evacuation, and any SIP procedures, including actions during and after a flood, and how messages will be communicated to site occupants and visitors for the life of the development. The FEMP would ensure on-going community education and understanding of site flood risks and risk management measures. (18) Under the FEMP, management would be responsible for ensuring that a public address (PA) and alarm system is installed within the buildings such that it is audible to all site occupants, is maintained in working condition, and is tested at a minimum every 12 months.

4.3 2024 Planning Circular PS 24-001

The Department of Planning, Housing and Infrastructure Planning Circular PS 24-001 recommends that development proposals are designed and assessed according to a risk based approach which should take account of the proposal's risk profile.

Table 21 provides a risk assessment of the PP against a range of floods up to the PMF. The risk assessment was completed based on the implementation of risk mitigation measures outlined in Section 3. Issues considered in the risk assessment are consistent with matters raised in the NSW Planning Circular PS 24-001 including location of the proposed development, flood characteristics at the site, nature and type of the proposed development, evacuation capacity, impacts on surrounding property and flood behaviour, and risks to life and property.

The assessment finds that flood risks arising from the PP can be readily managed and mitigated to an appropriate level.

Table 21 Consideration of planning circular PS 24-001.

Risk Element	Issue	Assessment
Location of development	The site is located within a high risk catchment (Georges River) as identified in the NSW Flood Inquiry.	**Risk mitigated** • Evacuation is available to outside of the floodplain to friends and family or SES evacuation centres. • Evacuation capability modelling in Section 3.4 demonstrates that the site is capable of being fully evacuated without impacting other evacuees on the floodplain.
Site flood characteristics	The proposed marina complex is affected by flooding in the 20% AEP event with hazards ranging from H3 in the 20% AEP event up to H6 in the 0.5% AEP event and greater.	**Risk mitigated** • Proposed apartment building retail and terrace building non-habitable floors will have an FFL of 7.6 mAHD which provides a flood immunity to the 0.006% AEP (1 in 17,500 year ARI) flood, and is 1.02 m above the 0.02% AEP (1 in 5,000 year ARI) flood level and 1.6 m above Council's FPL. • Proposed apartments and terraces will have habitable floor levels above PMF level. • The terrace and apartment basement carpark are of a tanked construction with an entry level at 7.6 mAHD which provides a flood immunity to the 0.006% AEP (1 in 17,500 year ARI) flood. • The proposed marina superstructure and associated buildings can be structurally designed to resist flood forces up to the PMF level including from hydrostatic and hydrodynamic pressures, buoyancy, and debris.
Nature and type of development	The proposal is a mixed used development including a marina, boat shed, recreational spaces, ground floor commercial with high density residential above and medium density residential in the north of the site.	**Risk mitigated** • The PP does not propose any special high risk uses such as child care, seniors living or medical facilities. • The basement carpark would be a tanked construction with an entry level at 7.6 mAHD which provides a flood immunity to the 0.006% AEP (1 in 17,500 year ARI) flood. • All residential components would have habitable floor levels above PMF level. • The body corporate will fund and implement in perpetuity a flood emergency management plan (FEMP) to provide measures required to prepare for (e.g. training, flood wardens, education, signage), respond to and recover from flood emergency situations including monitoring of flood warnings and evacuation of the site.
Evacuation capability	Residents will need to evacuate prior to extreme flooding leading to isolation.	**Risk mitigated** • Updated evacuation modelling based on the latest 2022 Molino Stewart Life Safety Model (LSM) demonstrates that future occupants can be evacuated in accordance with best practice and SES recommendations, before being cut off by flood waters, and do so without impacting others evacuating from the floodplain. In the event that

Risk Element	Issue	Assessment
		some persons are not evacuated, all residences would be able to safely shelter on-site. • A range of viable flood evacuation triggers are available. • Evacuation and sufficient warning times are available for site occupants to evacuate to outside of the floodplain to friends and family or to SES evacuation centres. • The body corporate will fund and implement in perpetuity a flood emergency management plan (FEMP) to provide measures required to prepare for (e.g. training, flood wardens, education, signage), respond to and recover from flood emergency situations including monitoring of flood warnings and evacuation of the site.
Impact on surrounding property	Impact of the proposed marina structure, landform, and buildings on surrounding property or buildings	**Risk mitigated** • Flood impact modelling (refer to Section 2.3.4) shows that the proposed development would have an insignificant impact on existing properties and the floodplain environment.
Impact on flood behaviour	Impact of the proposed marina structure and buildings or flood behaviour	**Risk mitigated** • Refer to Section 2.3.4. Flood modelling shows that the proposed development would have an insignificant impact on existing properties and the floodplain environment for the full range of floods from the 20% AEP up to and including the PMF.
Risk to life of future residents	Evacuating residents may be exposed to flood water	**Risk mitigated** • The primary flood emergency response strategy is to evacuate residents from the site in the event of a flood that would likely cause the site to become isolated. • A range of viable flood evacuation triggers and sufficient warning times are available that will enable evacuation to outside of the floodplain to friends and family or to SES evacuation centres. • Updated evacuation modelling based on the latest 2022 Molino Stewart Life Safety Model (LSM) demonstrates that future occupants can be evacuated in accordance with best practice and SES recommendations, before being cut off by flood waters, and do so without impacting others evacuating from the floodplain. • In the event that some persons are not evacuated, all residences would be able to safely shelter on-site as a backup measure. • The body corporate will fund and implement in perpetuity a flood emergency management plan (FEMP) to provide measures required to prepare for (e.g. training, flood wardens, education, signage), respond to and recover from flood emergency situations including monitoring of flood warnings and evacuation of the site.

Risk Element	Issue	Assessment
Risk to life to others in the catchment	Impact of the PP to others on the floodplain.	**Risk mitigated** • The proposal will not modify flood behaviour to others in the catchment potentially exposed to flooding up to the PMF. • Evacuation modelling in Section 3.4 demonstrates that the site can evacuate successfully in proposed conditions while improving the evacuation outcome of vehicles originating from Chipping Norton and the wider floodplain.
Risk to property	Dwellings and infrastructure subject to flood waters may be damaged or destroyed.	**Risk mitigated** • The apartment building retail and terrace building non-habitable floors will have an FFL of 7.6 mAHD which provides flood immunity to the 0.006% AEP (1 in 17,500 year ARI) flood, and is 1.02 m above the 0.02% AEP (1 in 5,000 year ARI) flood level and 1.6 m above Council's FPL. • Residential floors will be above the PMF level. • The basement carpark would be a tanked construction with an entry level at 7.6 mAHD which provides a flood immunity to the 0.006% AEP (1 in 17,500 year ARI) flood.

4.4 2023 Flood Risk Management Manual

Section 2 of the *Flood Risk Management Manual June 2023* (FRMM 2023) outlines 10 principles for flood risk management to guide councils in implementing the FRM framework. Responses to these principles are summarised in Table 22, which demonstrates that the proposed development satisfies the principals of the FRMM.

Table 22 Assessment of PP against FRMM (2023) flood risk management principles.

#	Principle	MA Response
1	*Establish sustainable governance arrangements*	(1) The PP is consistent with this principle because: a. The PP is sustainable and will be capable of being developed with consideration of climate change and extreme flood events up to the PMF.
2	*Think and plan strategically*	(2) The PP is consistent with this principle because: a. The PP is strategic because it has considered flood risks across the LGA and Georges River floodplain. b. Updated evacuation modelling demonstrates that the PP will not detrimentally impact on the evacuation capacity of others on the floodplain, and provides an opportunity to improve existing evacuation capability through early co-ordinated site evacuation. c. The PP would not cause any adverse off-site impacts to other properties or environments on the floodplain.
3	*Be consultative*	(3) The PP is consistent with this principle because: a. The PP has progressed through various stages of consultation, including the preparation of updated flood impact modelling and flood evacuation modelling presented in this report.

#	Principle	MA Response
4	*Make flood information available*	(4) The PP is consistent with this principle because: a. The flood impact modelling and flood evacuation modelling provided in this report is based on the latest 2020 BMT flood modelling and 2022 Molino flood evacuation information.
5	*Understand flood behaviour and constraints*	(5) The PP is consistent with this Principal because: a. Flood Modelling has considered the full range of flood events up to and including the PMF including flood mapping and discussion of flood behaviour, hazards, impacts, flood function, and emergency management issues. b. Flood modelling results have been used to inform the PP including site flood risk management measures. Further, the PP has been strategically designed to be compatible with the local flood function and behaviour, and as demonstrated by the flood modelling, will not result in any off-site impacts on communities and individual owners of flood prone property. c. Updated evacuation modelling based on the latest 2022 Molino LSM demonstrates that future occupants can be evacuated in accordance with best practice and SES recommendations, before being cut off by flood waters, and do so without impacting others evacuating from the floodplain.
6	*Understand flood risk and how it may change*	(6) This is achieved because: a. Updated flood modelling has considered the full range of events up to the PMF including projected changes as a result of climate change and demonstrates that the PP would not result in any off-site impacts on communities and individual owners of flood prone property and would not result in an increase in flood risk to neighbouring properties whilst providing an acceptable flood risk for the site. b. Evacuation modelling has been conducted to understand risks associated with emergency management and evacuation. Modelling demonstrates that the entire site can evacuate successfully while improving the evacuation outcome of vehicles originating from Chipping Norton and the wider floodplain. Any residual flood risks associated with the PP can be mitigated via an evacuation strategy and a backup SIP response.
7	*Consider variability and uncertainty*	(7) This is achieved because: a. As discussed at (2) modelling is based on the latest available information including the BMT 2020 flood model which has been calibrated to historical flood events. b. Flood modelling has considered the full range of flood events up to the PMF event including projected changes as a result of climate change (using the 0.2% AEP or 500 year ARI flood as a surrogate for climate change) and demonstrated that the PP would not have any offsite impacts on local flood behaviour, or result in increases to the extent, severity or frequency of flooding on neighbouring properties or evacuation routes. c. PP evacuation constraints and impacts have been assessed using the 2020 Melino LSM which is considered by numerous state agencies and the DPHI as the latest available data which should be considered for assessing development proposals. Evacuation modelling shows that the development can safely evacuate in the

#	Principle	MA Response
		worst case PMF event without exceeding evacuation route capacities or impacting the evacuation of others in the floodplain. d. Variability and uncertainty of flood risks have been addressed by locating all urban uses at an elevation of 7.6 mAHD, which is 1.6 m above the FPL and above the 1 in 5,000 year flood level, and all residential uses above the PMF level.
8	*Maintain natural flood functions*	(8) Refer to Section 2.3.4. Hydraulic modelling shows the proposed development has an insignificant effect on local flood function and behaviour.
9	*Manage flood risk effectively*	(9) As discussed in Sections 2.3.4 and 3, flood risk on the site can be effectively managed through an evacuation response and a SIP backup strategy. (10) Hydraulic modelling shows the development will not result in flood impacts offsite and flood risks offsite will not be materially affected, and evacuation modelling shows that site can be effectively evacuated without impacting the efficient evacuation or safe occupation of other people within the floodplain or exceeding the capacity of existing evacuation routes.
10	*Continually improve the management of flood risk*	(11) As discussed in Section 3, site flood risks can be effectively managed through an evacuation response and a SIP backup strategy. (12) The PP site would be strata managed by a body corporate that would implement in perpetuity a flood emergency management plan (FEMP) to provide measures required to prepare for (e.g. training, flood wardens, education, signage), respond to and recover from flood emergency situations including monitoring of flood warnings and evacuation of the site. (13) The FEMP would be regularly updated as result of lessons learnt in floods or changes to flood regulations. (14) The FEMP would require regular training of relevant staff and can be upgraded if this training identifies better procedures for flood evacuations or when new technologies become available. Flood warning systems may improve over time which provide more relevant information to make flood evacuations more efficient and these improvements could be incorporated in the FEMP as required.

4.5 2022 Emergency Management Planning Guideline

Section A2.7 of the DPE (2022) *Support for Emergency Management Planning: Flood Risk Management Guide EM01* (FRM guide EM01) outlines 7 principles for emergency management (**EM**) primarily applicable for Councils with technical assistance from the NSW SES, when considering redevelopment in existing evacuation constrained areas.

Responses to these principles are summarised in Table 23 which demonstrates that the 7 principles have been considered for the proposed development and that the additional permitted use can be approved for the site.

Table 23 Assessment of PP against FRM guide EM01 (2022) emergency management principles.

#	Principle	MA Response
1	*Any proposed EM strategy should be compatible with any existing community EM strategy*	(1) The applicable flooding EM strategy is provided in the SES Sub Plan and identifies evacuation 'as the primary response strategy for people impacted by flooding'. (2) As detailed in Section 3, site flood risks can be effectively managed through an evacuation strategy up to and including the PMF event which is consistent with the SES Sub Plan. Further, sheltering-in-place above the PMF is available as a measure of last resort.
2	*Decisions should be informed by understanding the full range of flood EM risks to the community*	(3) As discussed in Sections 2.3.4 and 3.4.7, modelling has considered the full range of flood events up to the worst case PMF event. Modelling has demonstrated that the proposed development will not result in offsite impacts on the floodplain environment in all floods and will not impact existing flood emergency response or pose an increased risk to the community.
3	*Development of the floodplain does not impact on the ability of the existing community to safely and effectively respond to a flood*	(4) As discussed at principle 2, hydraulic modelling shows that the proposed development will not result in offsite impacts or increased risks to the surrounding community including impacts to safe occupation and efficient evacuation. (5) Evacuation modelling (refer to Section 3.4.7) demonstrates that the entire site can evacuate successfully in proposed conditions without impacting the efficient evacuation or safe occupation of other people within the floodplain or exceeding the capacity of existing evacuation routes.
4	*Decisions on redevelopment within the floodplain are supported by an EM strategy that does not increase risk to life from flooding*	(6) As discussed at principle 1 and Section 3.4.7. The available evacuation and backup SIP strategy will ensure no increased risk to life from flooding.
5	*Risks faced by the itinerant population need to be managed*	(7) The site management would implement in perpetuity a flood emergency management plan (FEMP) to provide measures required to prepare for (e.g. training, flood wardens, education, signage), respond to and recover from flood emergency situations including monitoring of flood warnings and evacuation of the site ensuring any visitors will be evacuated in the event of a flood.
6	*Recognise the need for effective flood warning and associated limitations*	(8) Site isolation occurs on average approximately once every 500 years, which is equivalent to the 1% AEP climate change scenario and is caused by large scale storm events that will be widely anticipated days in advance. In all flood events site flood risks can be managed via an evacuation strategy with a minimum of 18.0 hours warning time available in the worst case PMF event. (9) The site operator will implement in perpetuity a flood emergency management plan (FEMP) to provide measures required to prepare for (e.g. training, flood wardens, education, signage), respond to and recover from flood emergency situations including monitoring of flood warnings and evacuation of the site ensuring all site occupants are evacuated in the event of a flood.

#	Principle	MA Response
7	*Ongoing community awareness of flooding is critical to assist effective emergency response*	(10) The site operator will implement in perpetuity a FEMP which will be regularly updated as required as result of lessons learnt in floods or when there are changes to flood regulations, flood plans, etc. As part of the FEMP procedures, flood wardens will be regularly trained, and site occupants will be educated on site flood risks and emergency procedures.

5 Summary and Recommendations

5.1 Summary

This report provides a consolidated review of flood risks as they relate to a planning proposal (**PP**) to amend the Liverpool Local Environmental Plan 2008 (**LEP**) and include an additional permitted use clause to enable construction of a mixed-use development at Lot 3 DP1246745, 146 Newbridge Road, Mooorebank, NSW (the **Site**).

The report provides:

1. A review of the flood risk related work completed to date.
2. Evaluates likely flood characteristics and potential impacts arising from the PP based on the latest BMT 2020 flood model for the Georges River, finding that a future development would not likely lead to off-site flood impacts.
3. Evaluates flood evacuation constraints on the Georges River floodplain and how these impact on the PP by application of the Life Safety Model (**LSM**) evacuation assessment documented in the Molino 2022 report, that being the most recent and up to date assessment of evacuation for the floodplain. The modelling demonstrates that a future development could be successfully evacuated without impacting on others seeking shelter from floods.
4. Assesses the PP against relevant planning controls, specifically Section 9.1 Local Planning Directions 4.1 and the Planning Circular PS24-001, finding that the PP satisfies the Local Planning Directions and the requirements of the Planning Circular because: a future development would be capable of ensuring that the risk of floods to structures is managed by setting appropriate floor levels and conventions structural design and building methods; and that the risk of floods to persons is managed through the implementation of an overarching flood emergency response plan that would be centrally managed by a funded body corporate operating in perpetuity over the entire site that is capable of liaising with the SES to ensure timely evacuation and control over the site during any flood.

5.2 Recommendations

On the basis of our review, we provide the following recommendations:

Recommendation 1 – Flood Impacts

Detailed updated flood modelling has been completed using the most recent 2020 flood models developed and documented by BMT. Modelling compared the existing approved site conditions with conditions that would likely be present under a future development scenario. Modelling was undertaken for a full range of events including the 20%, 10%, 5%, 2%, 1%, 0.5%, 0.2%, 0.05%, 0.02% AEP and PMF (EFE) events. Modelling indicated that off-site flood impacts or impacts to the local environment are not likely. On this basis we recommend:

- *The site is capable of supporting the proposed residential land use and that there is sufficient flexibility available to accommodate a range of design solutions to ensure no adverse off-site flood impacts.*

Recommendation 2 – Flood Resilience

The updated flood modelling was undertaken on the basis that future residential floors would be located at or above the PMF and that the carpark and ground floor retail spaces would be protected from flooding up to the 0.006% AEP or 1 in 17,500 year ARI flood event. On this basis, we recommend that:

- *The site is capable of supporting a future residential development that provides for adequate flood resilience measures incorporated into the urban design. In particular, a future development would be capable of ensuring that all residential floors would be above the PMF to protect private property and that basements could be protected to the 0.006% AEP flood. It is conceivable that a basement design could be produced that provides flood immunity to the PMF.*

Recommendation 3 – Structural Risks

The updated flood modelling was completed on the basis that the urban use will be located on structural piers above water within the marina. On this basis, the urban footprint would not be located within a floodway or in a high hazard flood zone. In Australia it is not uncommon to find structures which are successfully supported over piers within harbours, the ocean or over rivers. In Sydney Harbour there are numerous examples where urban development has successfully occurred suspended on piers over deep water. Importantly for this site, flooding conditions below the future urban footprint arise artificially because of historical extraction activities at the site which has created a large pool of open water where velocities are very low and do not present any difficulty for future structural design and construction. On this basis, we recommend that:

- *The site is capable of delivering a future urban development footprint supported by piers over open water, this being consistent with other similar developments found in Sydney Harbour, and that the design details are matters capable of being addressed at a future development application stage.*

Recommendation 4 – Evacuation Route Capacity

Detailed flood evacuation modelling was undertaken based on the LSM model documented in the Molino 2022 Georges River Evacuation Modelling report, which documents floodplain evacuation during a critical duration PMF event. The model was reviewed and updated to reflect approvals, gateway determinations (with the exception of Site F which will require road upgrades presently unknown), and road upgrade works that had occurred since the Molino modelling.

It was identified that there was an opportunity to refine the model by adjusting the evacuation timing so that the PP site within sub-sector R7, which includes the site, could be evacuated shortly after sub-sector R25, which is the first sub-sector to be evacuated and is adjacent to the site and located in the very eastern most part of the floodplain

evacuation area. This would be either by SES control or by a self-evacuation trigger actioned by the body corporate through implementation of a flood emergency management plan. Modelling demonstrated that the entire site would be capable of evacuating without impacting other persons on the floodplain also evacuating. On this basis, we recommend that:

- *A future development of the site, if managed and controlled by a body corporate, is capable of being fully evacuated during a flood emergency without detrimentally impacting on the evacuation capable of other persons on the floodplain or on public resources such as the SES.*

Recommendation 5 – Flood Emergency Response

The PP would see a future development managed by a body corporate which would function to ensure that any continuing flood risks and flood emergency response would be centrally managed, ensuring that risk management measures such as signage, warning systems, flood alarms, evacuation procedures and flood wardens, would be funded and operational in perpetuity. The body corporate would provide a key single point of contact with the SES, ensuring that SES resources would not be burdened and would be most efficiently utilised.

This approach would be consistent with best practice development on flood constrained land. For example, the June 2022 Penrith Lakes Stage 1 Development Control Plan requires that all new development must be either strata or community title, and that the managing body must implement a flood emergency management plan to ensure evacuation requirements. On this basis, we recommend that:

- *A future development should be managed by a body corporate able to remain informed of any changes in flood information and risk and adapt continuing risk management processes and procedures for the entire community it serves. The body corporate would provide a single point of contact for the SES and other emergency response agencies.*

Recommendation 6 – s9.1 Local Planning Directions

A detailed analysis of the PP against the Section 9.1 Local Planning Directions 4.1 Flooding has been completed and shows that all Directions are complied with on the basis that a future urban development can be designed so that it would not result in any adverse off-site impacts, that it would not be located be located in a floodway or in high hazard floodwater, and was consistent with flood planning policies such as the NSW flood prone land policy, the principles of the 2023 NSW flood risk management manual, the Department of Planning, Housing and Infrastructure Planning Circular PS 24-001 and the 2004 Georges River floodplain risk management study. On this basis, we recommend that:

- *The PP is consistent with all relevant terms of the Section 9.1 Local Planning Directions 4.1 Flooding, and a future development of the site consistent with the PP would be capable of being designed to meet flood planning controls in respect of risk to life and property.*

Recommendation 7 – Shelter-in-place Guideline for Flash Flooding

Based on the updated flood modelling contained in this report, the PP site or the evacuation route to the M5 are not affected by flash flooding, that being because flooding occurs significantly after the 6 hour period following a precipitation event (as defined in the Guideline). At this site, the detailed evacuation modelling using the updated Molino LSM model demonstrates that there is sufficient warning period available to evacuate to land above the PMF via the M5 before evacuation routes become affected by flood water. The primary evacuation strategy for the PP is therefore to evacuate off-site in accordance with SES requirements.

The PP proposal will not need to rely on a shelter-in-place (SIP) strategy which is defined as requiring a building's occupants to move to an area within the building above the PMF level before their property becomes inundated by flood waters. This option is however available as a measure of last resort because all residential units would have floor levels above the PMF. On this basis, we recommend that:

- *The PP site and evacuation route to the M5 are not affected by flash flooding and the PP will therefore not need to rely on sheltering in place. A future urban development will be able to implement off-site evacuation as the primary evacuation strategy, and as a measure of last resort, will be able to provide on-site shelter above the PMF to all persons.*

References

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Molino Stewart (2022), *Georges River Evacuation Modelling Flood Evacuation Analysis Final.*

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NSW Government (2022), *2022 Flood Inquiry Volume 1: Summary Report.*

NSW Government (2022), *2022 Flood Inquiry Volume 2: Full Report.*

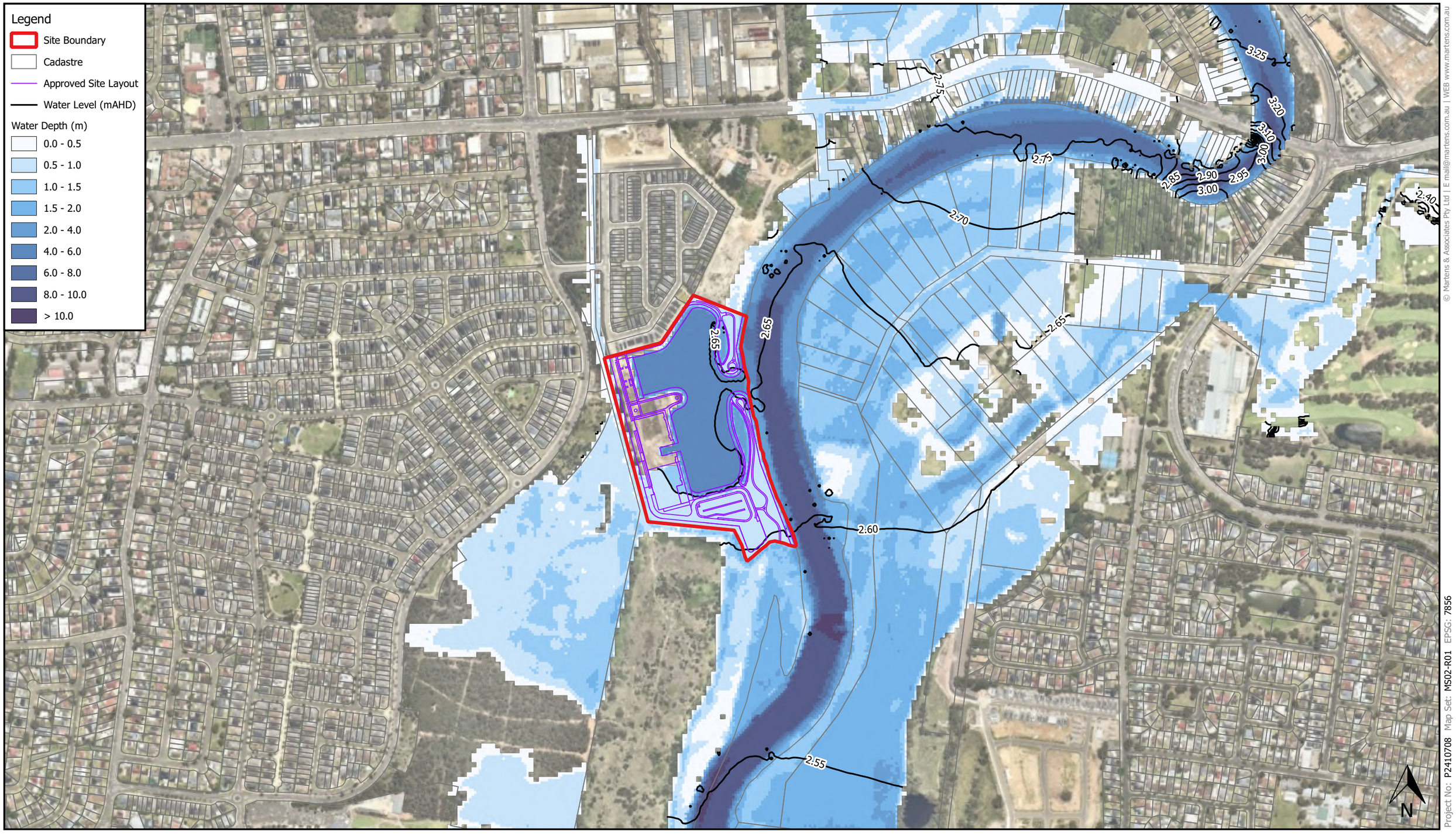
NSW State Emergency Service (2023), *Liverpool City Local Flood Emergency Sub Plan Volume 1.*

NSW State Emergency Service (2023), *Georges & Woronora Valley Volume 1 Flood Emergency Sub Plan.*

Appendices

Appendix A

Approved Conditions Flood Maps



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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

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Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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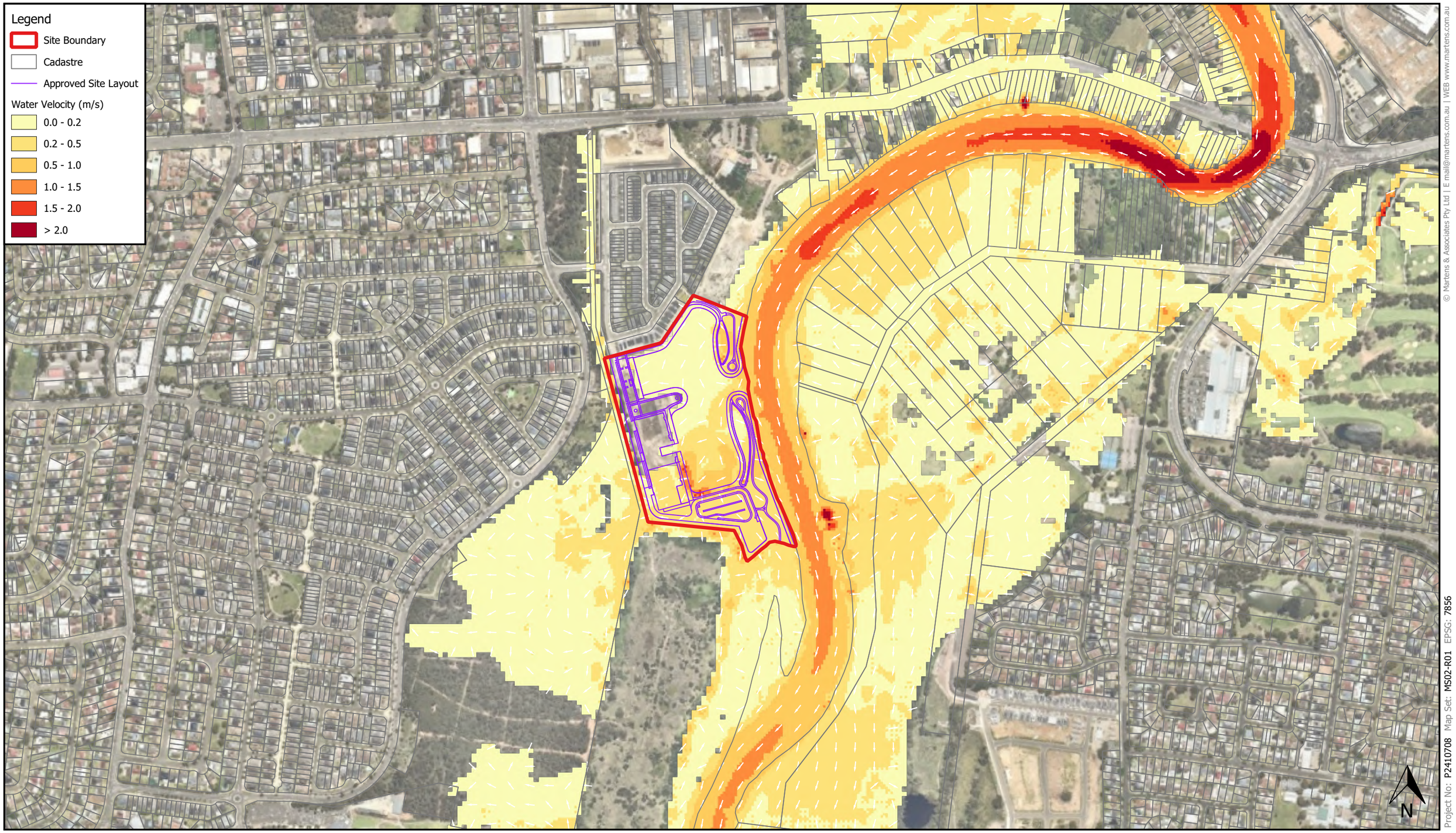
Map Title / Figure:

20% AEP Existing Approved Conditions Water Level & Water Depth

Map E1	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date



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Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

20% AEP Existing Approved Conditions Water Velocity

Map E2	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Approved Site Layout

ARR Flood Hazard Categories

- H1
- H2
- H3
- H4
- H5
- H6

N

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Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

20% AEP Existing Approved Conditions ARR Flood Hazard

Map E3	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Approved Site Layout
- Water Level (mAHD)

Water Depth (m)

- 0.0 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 4.0
- 4.0 - 6.0
- 6.0 - 8.0
- 8.0 - 10.0
- > 10.0

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Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

10% AEP Existing Approved Conditions Water Level & Water Depth

Map E4	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Legend

- Site Boundary
- Cadastre
- Approved Site Layout

Water Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

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N

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Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

10% AEP Existing Approved Conditions Water Velocity

Map E5	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Site Boundary
- Cadastre
- Approved Site Layout

ARR Flood Hazard Categories

- H1
- H2
- H3
- H4
- H5
- H6

N

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Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

10% AEP Existing Approved Conditions ARR Flood Hazard

Map E6	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

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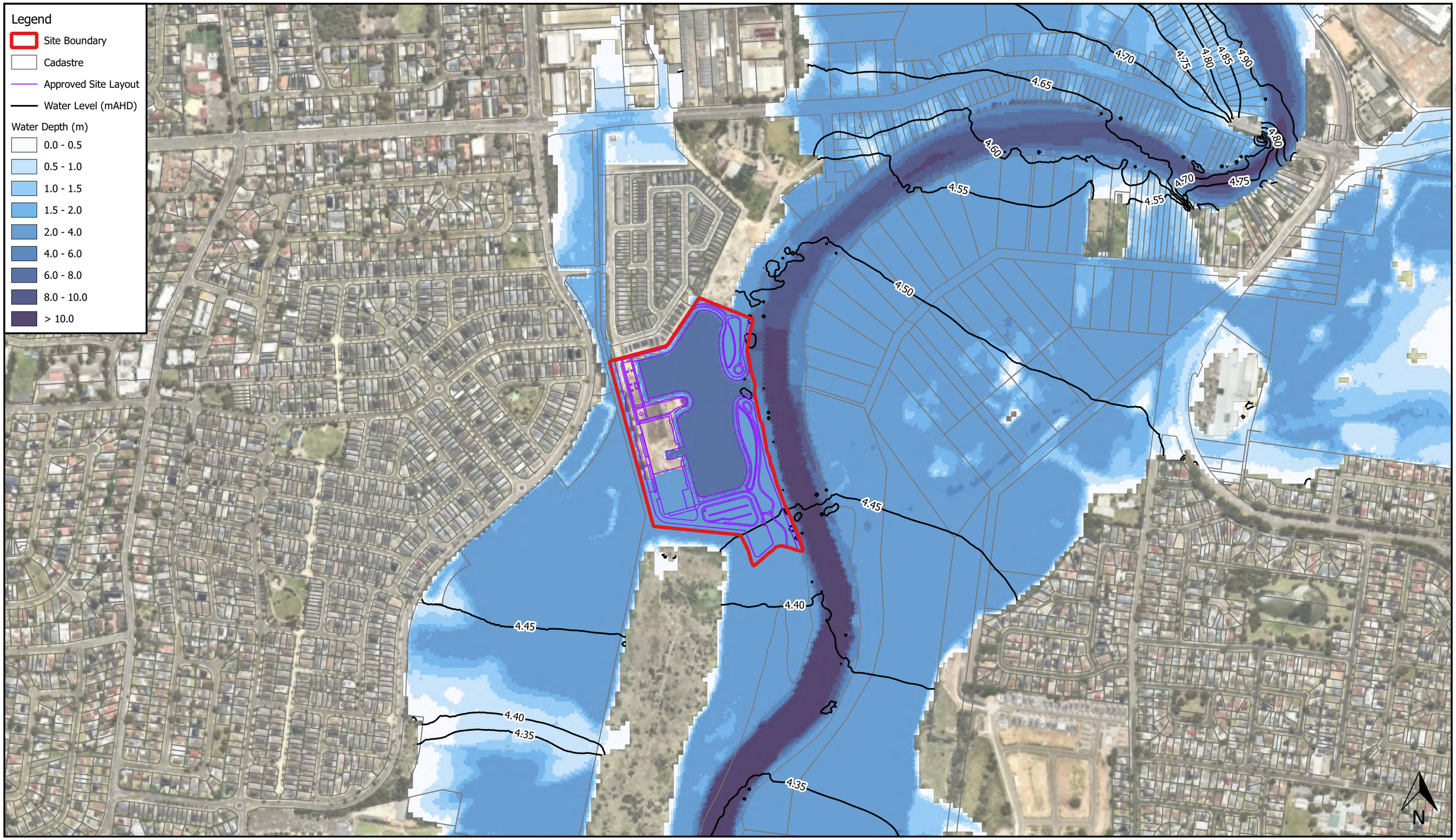

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

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Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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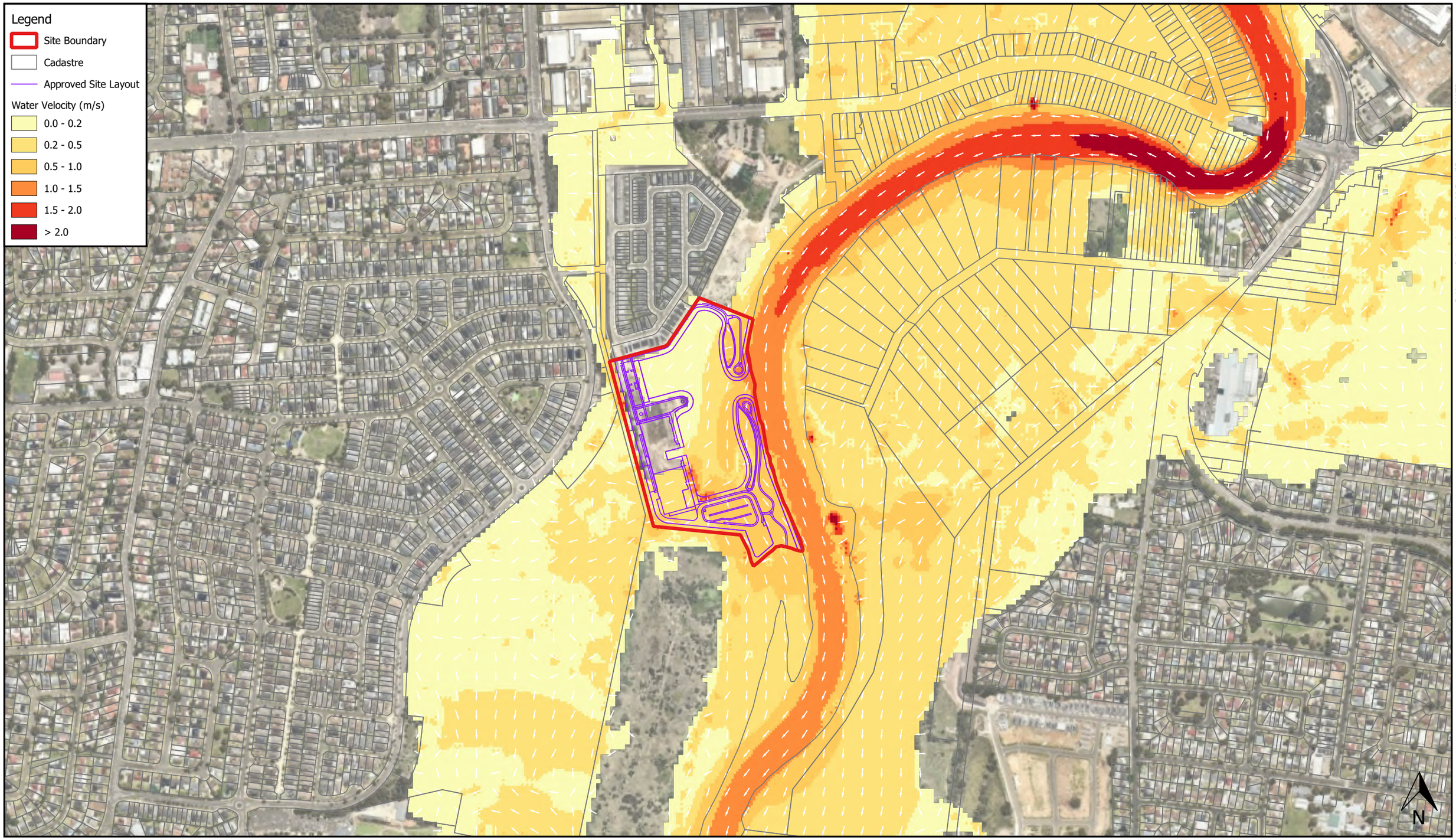
Map Title / Figure:

5% AEP Existing Approved Conditions Water Level & Water Depth

Map E7	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date



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Notes:
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- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

5% AEP Existing Approved Conditions Water Velocity

Map E8	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Approved Site Layout

ARR Flood Hazard Categories

- H1
- H2
- H3
- H4
- H5
- H6

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

5% AEP Existing Approved Conditions ARR Flood Hazard

Map E9	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

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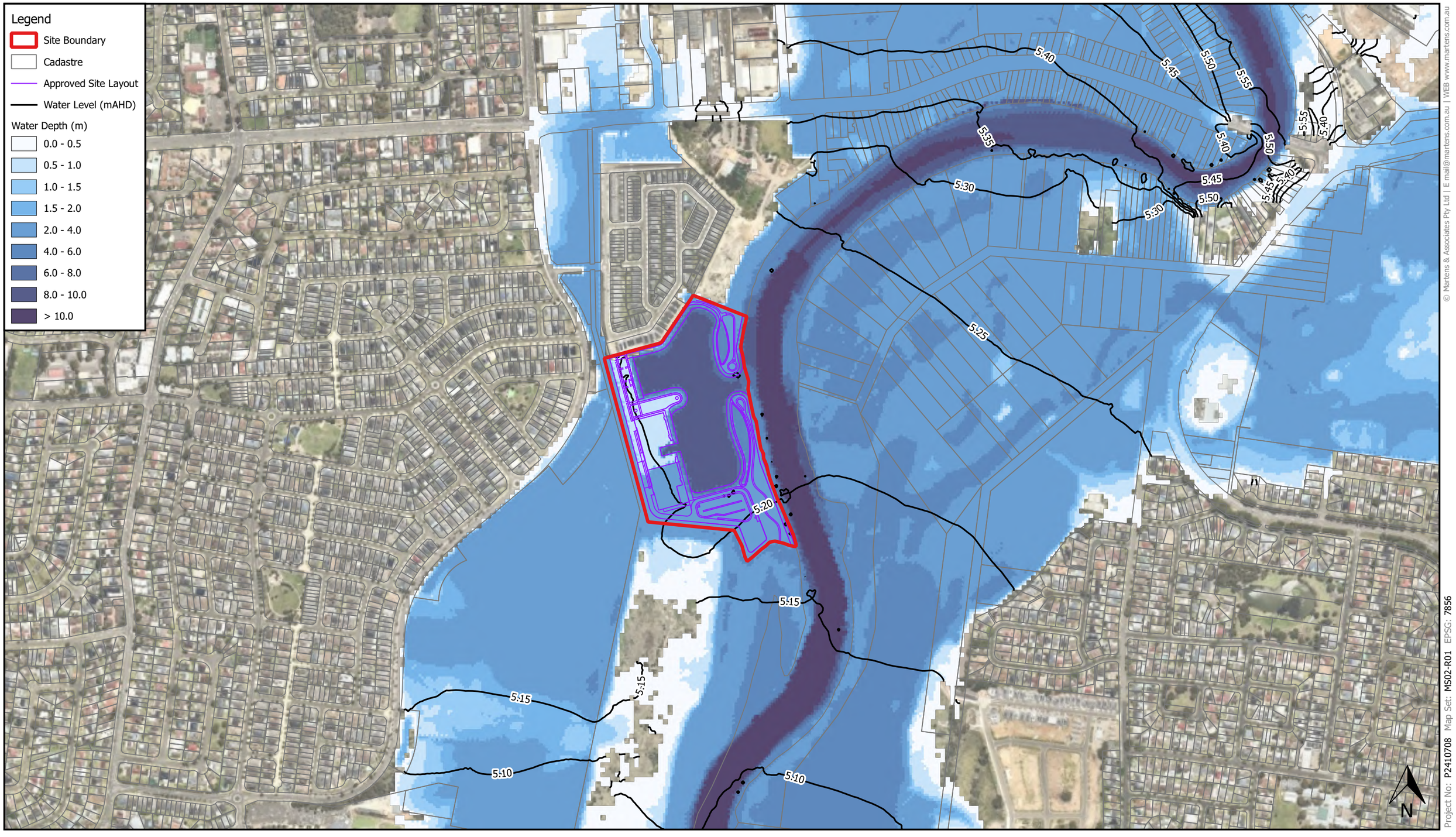
Legend

- Site Boundary
- Cadastre
- Approved Site Layout
- Water Level (mAHD)

Water Depth (m)

- 0.0 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 4.0
- 4.0 - 6.0
- 6.0 - 8.0
- 8.0 - 10.0
- > 10.0



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

2% AEP Existing Approved Conditions Water Level & Water Depth

Map E10	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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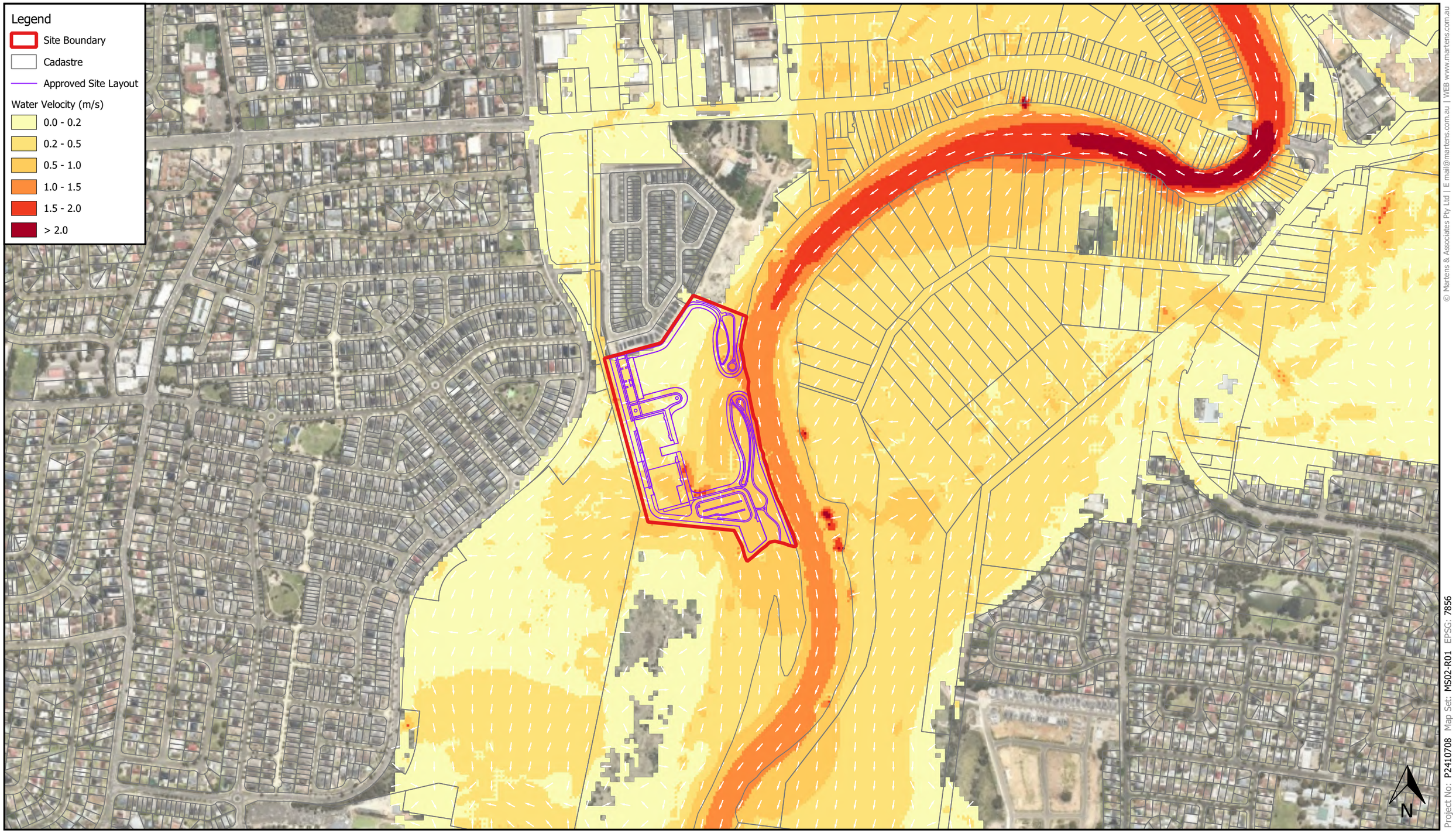
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

2% AEP Existing Approved Conditions Water Velocity

Map E11	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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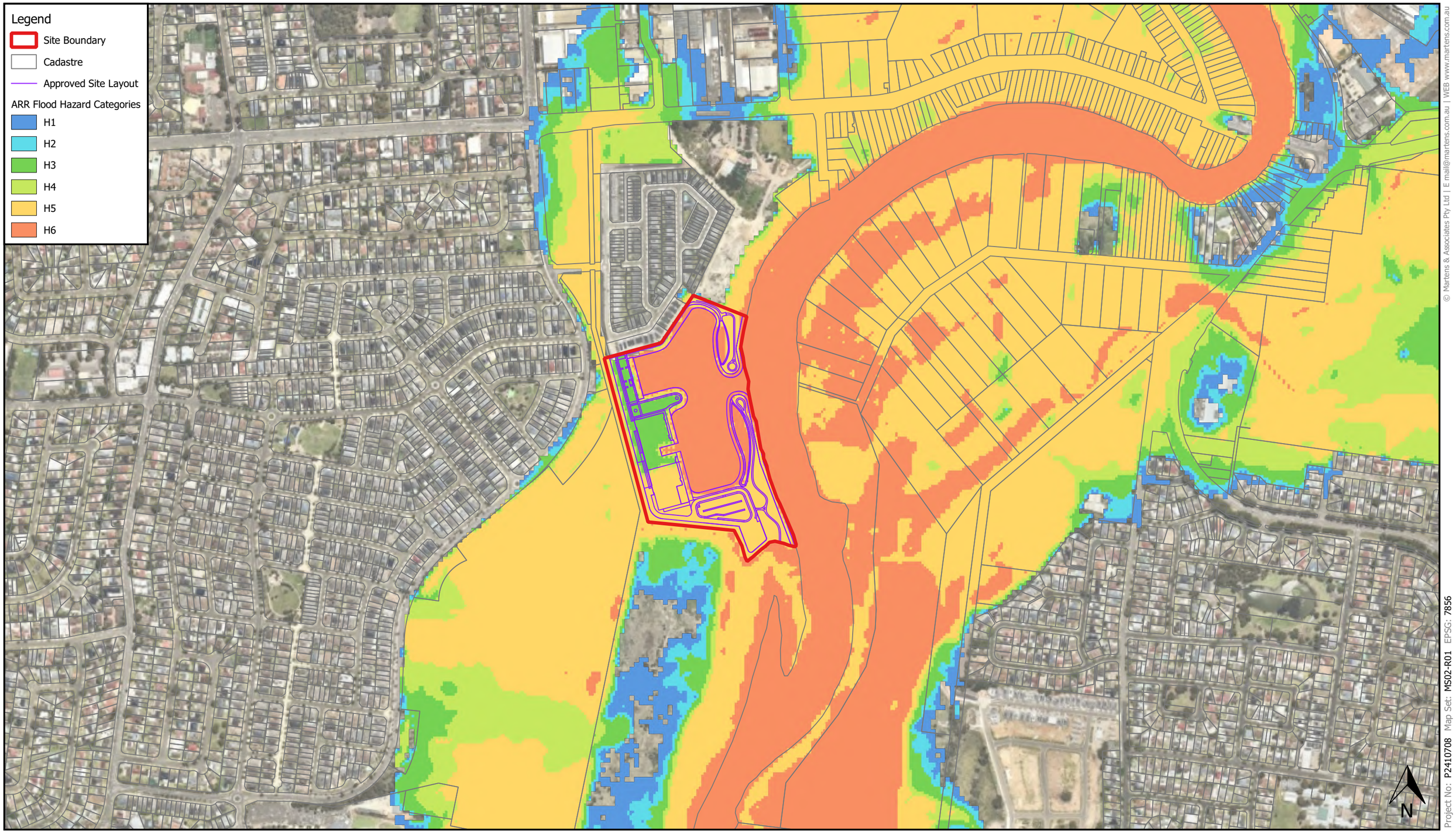
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

2% AEP Existing Approved Conditions ARR Flood Hazard

Map E12	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Approved Site Layout
- Water Level (mAHD)

Water Depth (m)

- 0.0 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 4.0
- 4.0 - 6.0
- 6.0 - 8.0
- 8.0 - 10.0
- > 10.0

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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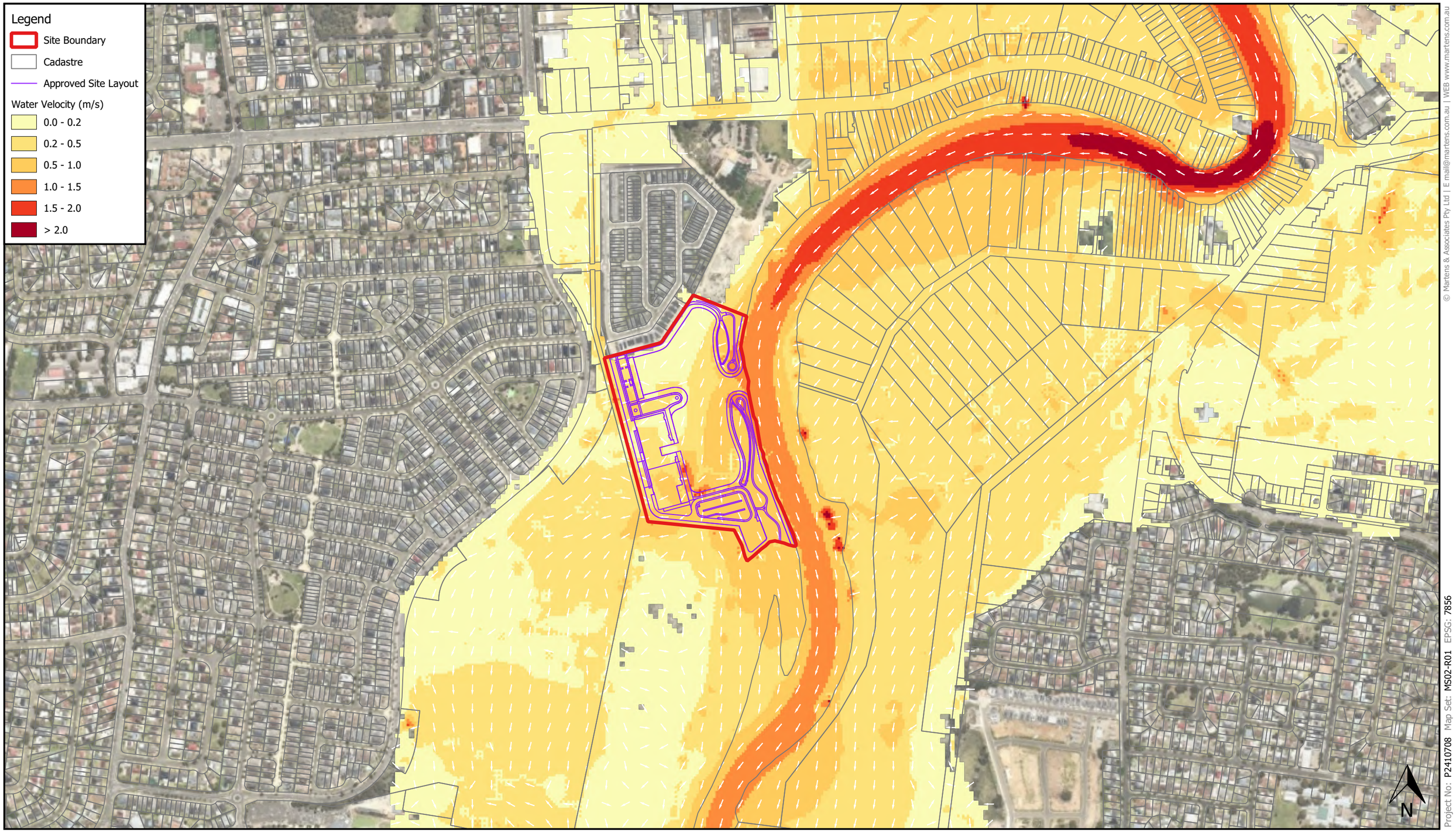
Map Title / Figure:

1% AEP Existing Approved Conditions Water Level & Water Depth

Map E13	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

1% AEP Existing Approved Conditions Water Velocity

Map E14	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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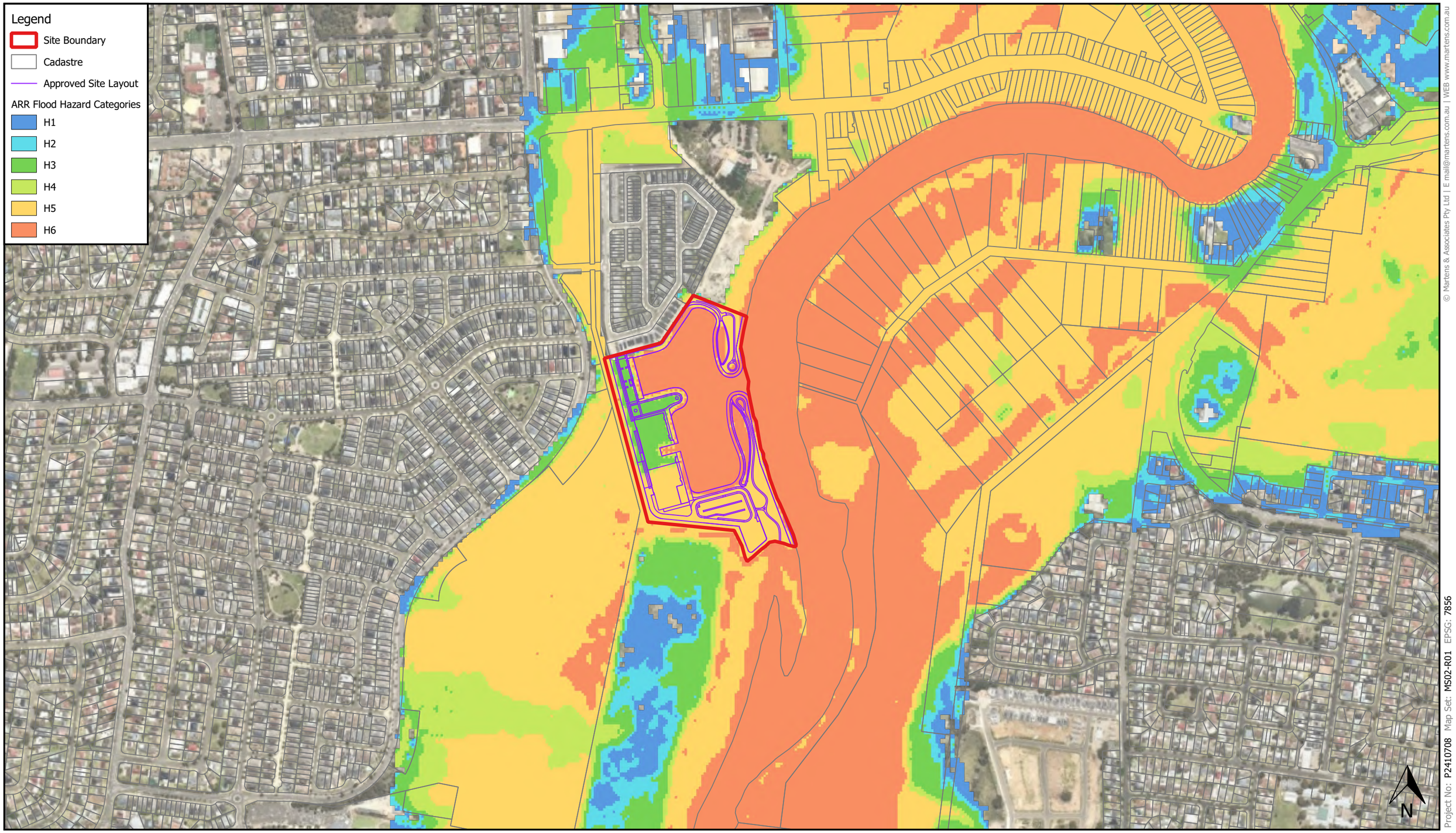
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

1% AEP Existing Approved Conditions ARR Flood Hazard

Map E15	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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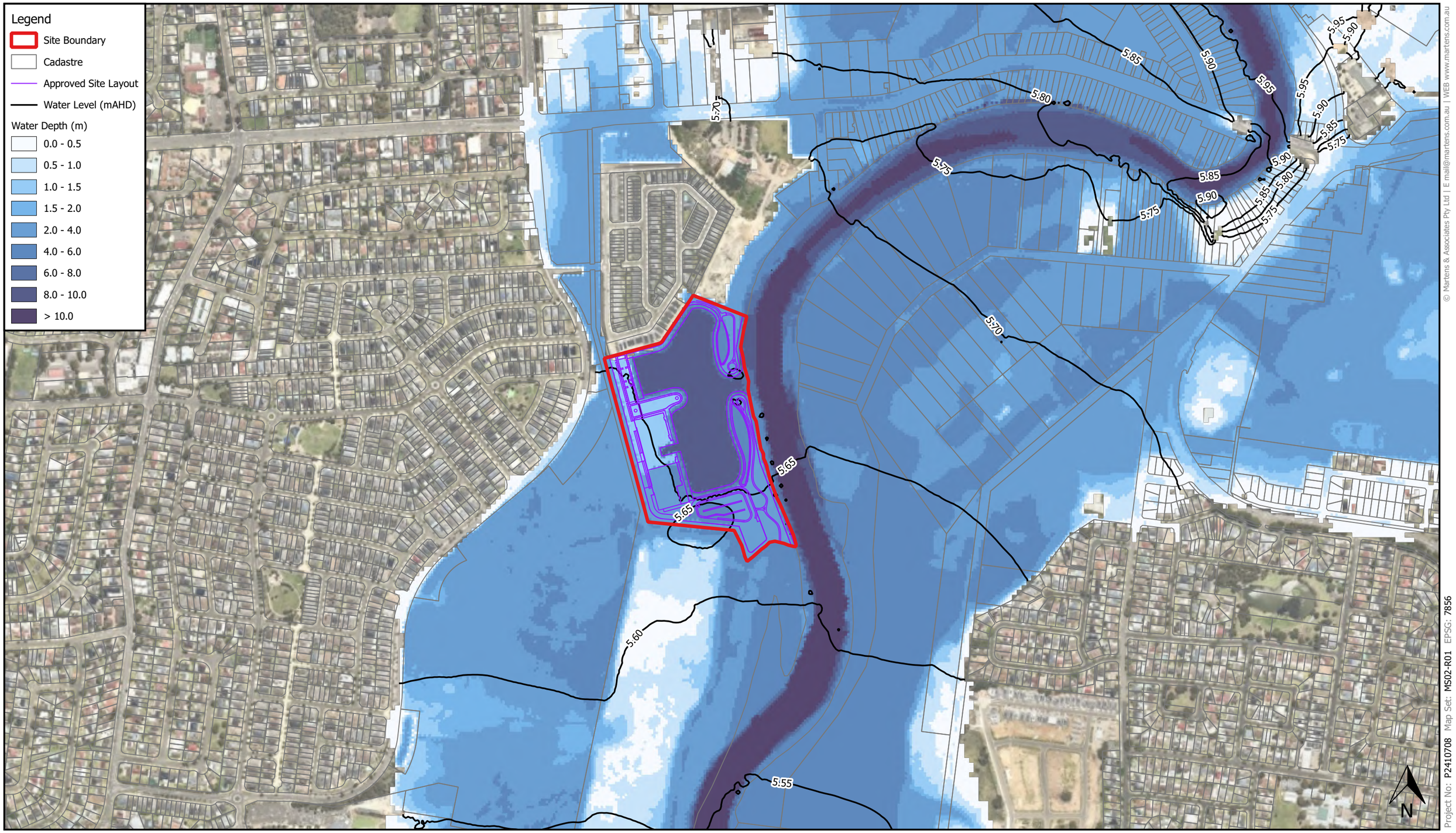
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

0.5% AEP Existing Approved Conditions Water Level & Water Depth

Map E16	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Site Boundary
- Cadastre
- Approved Site Layout

Water Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

0.5% AEP Existing Approved Conditions Water Velocity

Map E17	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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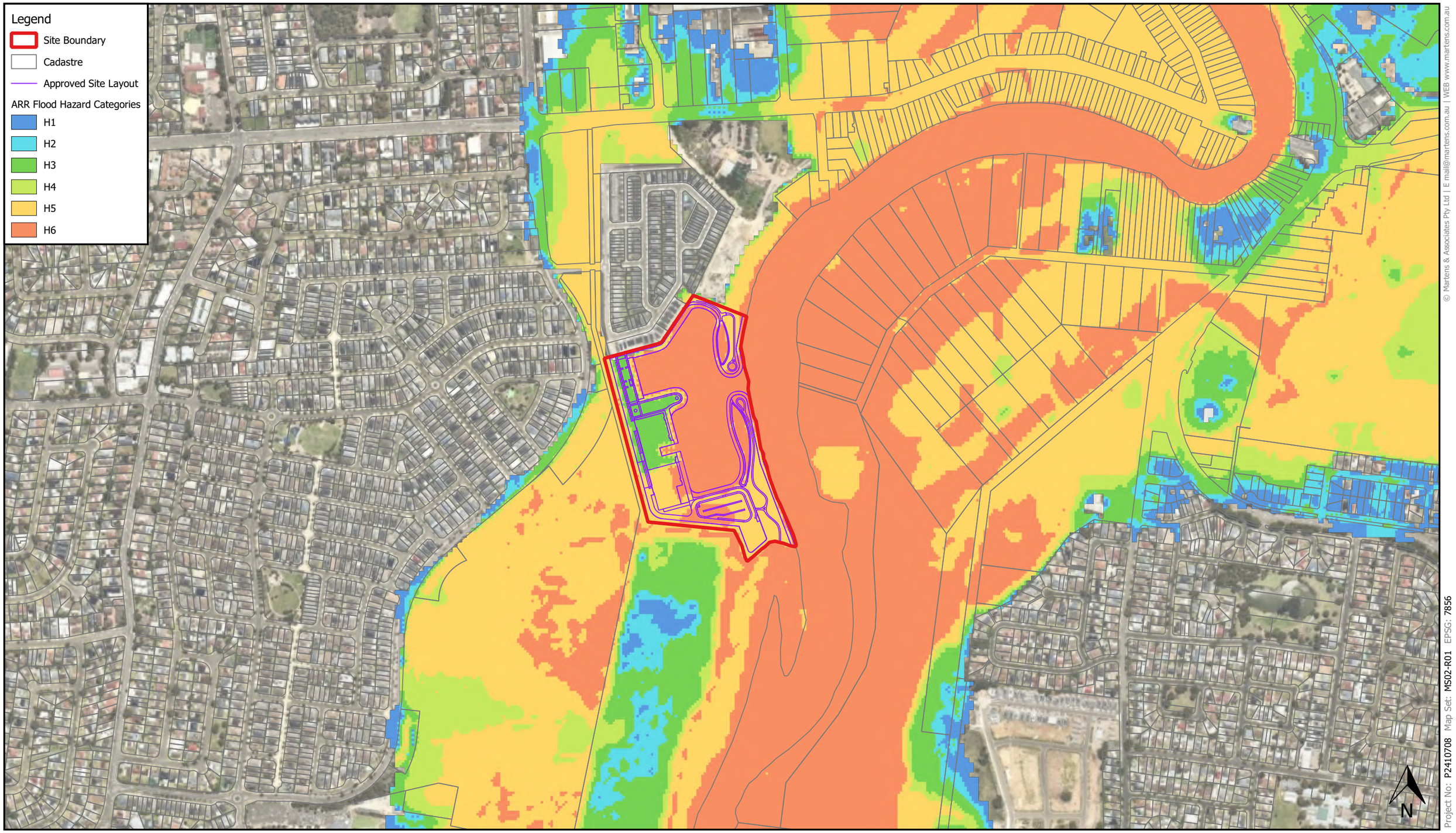
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

0.5% AEP Existing Approved Conditions ARR Flood Hazard

Map E18	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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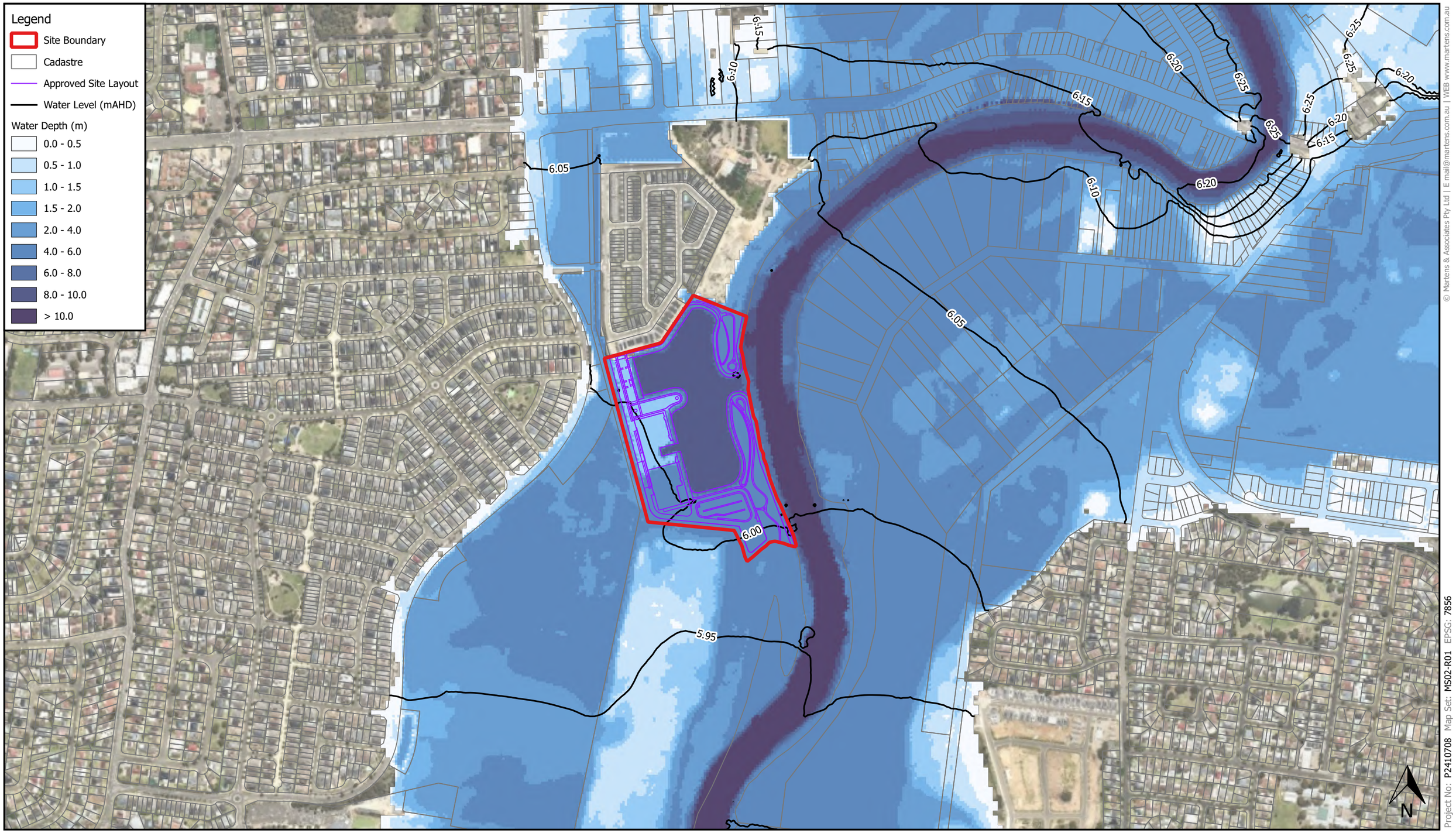
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

0.2% AEP Existing Approved Conditions Water Level & Water Depth

Map E19	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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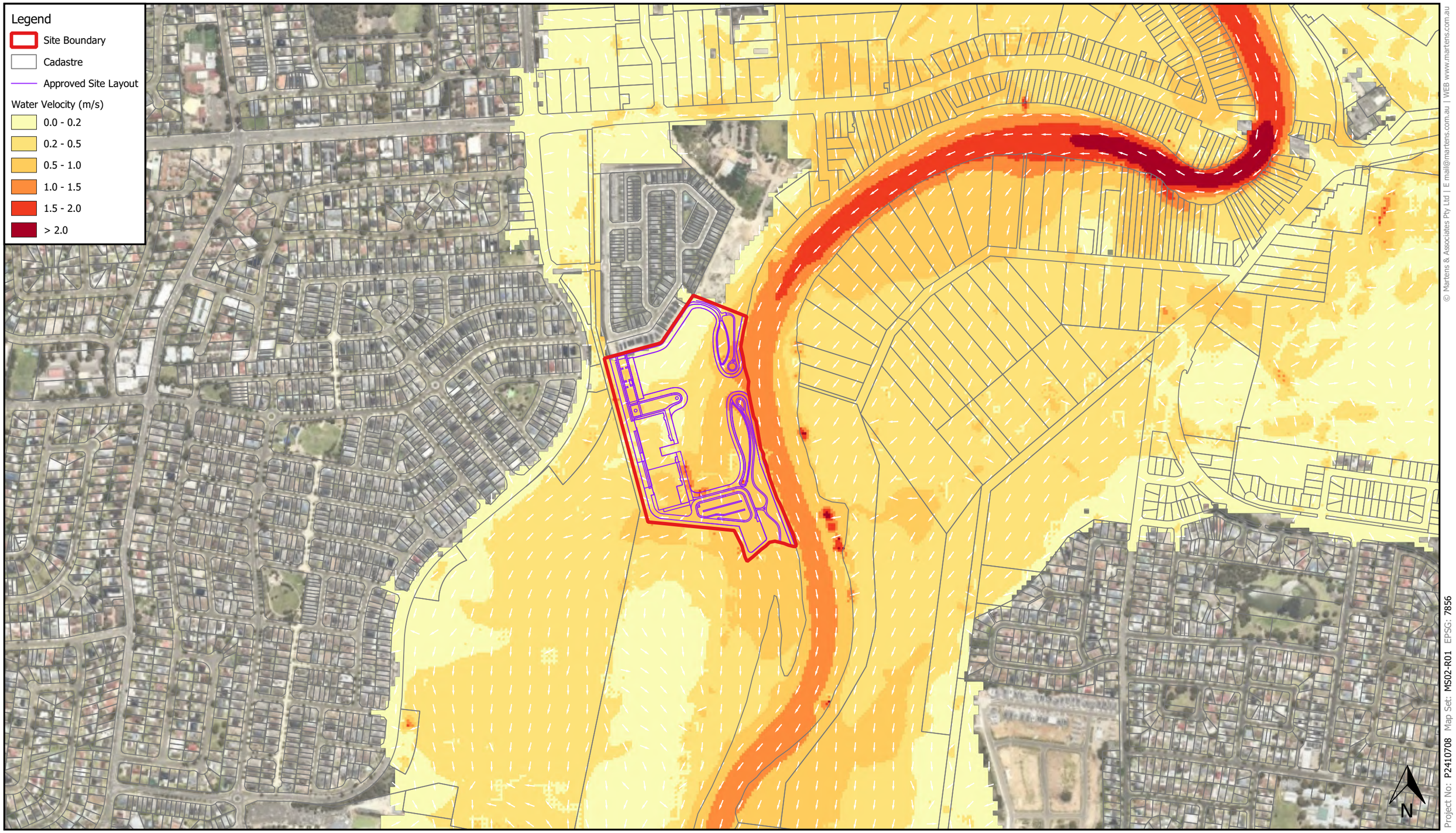
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

0.2% AEP Existing Approved Conditions Water Velocity

Map E20	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Approved Site Layout

ARR Flood Hazard Categories

- H1
- H2
- H3
- H4
- H5
- H6

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

0.2% AEP Existing Approved Conditions ARR Flood Hazard

Map E21	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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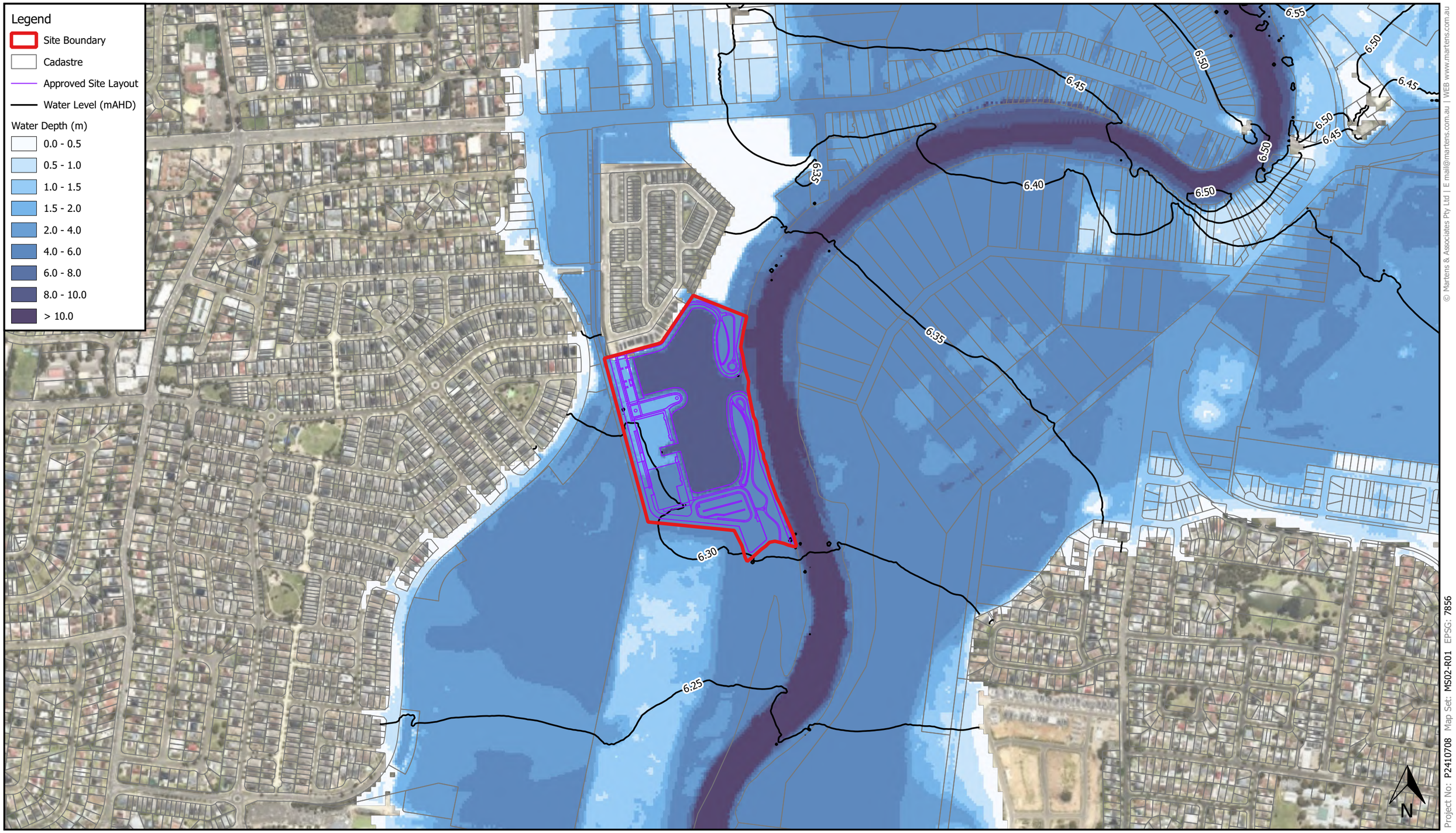
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

0.05% AEP Existing Approved Conditions Water Level & Water Depth

Map E22	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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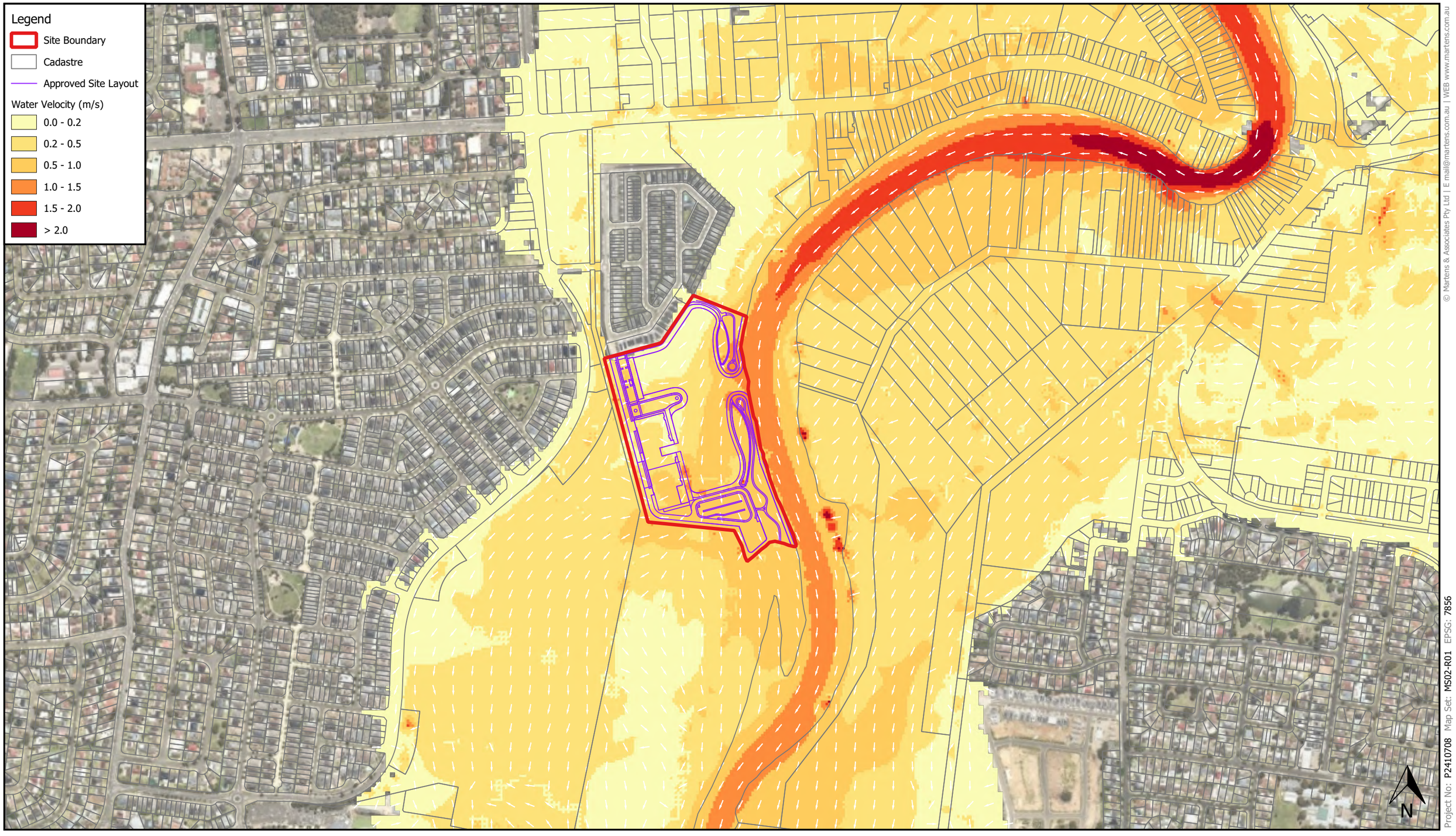
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

0.05% AEP Existing Approved Conditions Water Velocity

Map E23	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Approved Site Layout

ARR Flood Hazard Categories

- H1
- H2
- H3
- H4
- H5
- H6

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

0.05% AEP Existing Approved Conditions ARR Flood Hazard

Map E24	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

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Legend

- Site Boundary
- Cadastre
- Approved Site Layout
- Water Level (mAHD)

Water Depth (m)

- 0.0 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 4.0
- 4.0 - 6.0
- 6.0 - 8.0
- 8.0 - 10.0
- > 10.0

6.75
6.70
6.65
6.70
6.75
6.70
6.65
6.60
6.55
6.55
6.50

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

0.02% AEP Existing Approved Conditions Water Level & Water Depth

Map E25	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Site Boundary
- Cadastre
- Approved Site Layout

Water Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

0.02% AEP Existing Approved Conditions Water Velocity

Map E26	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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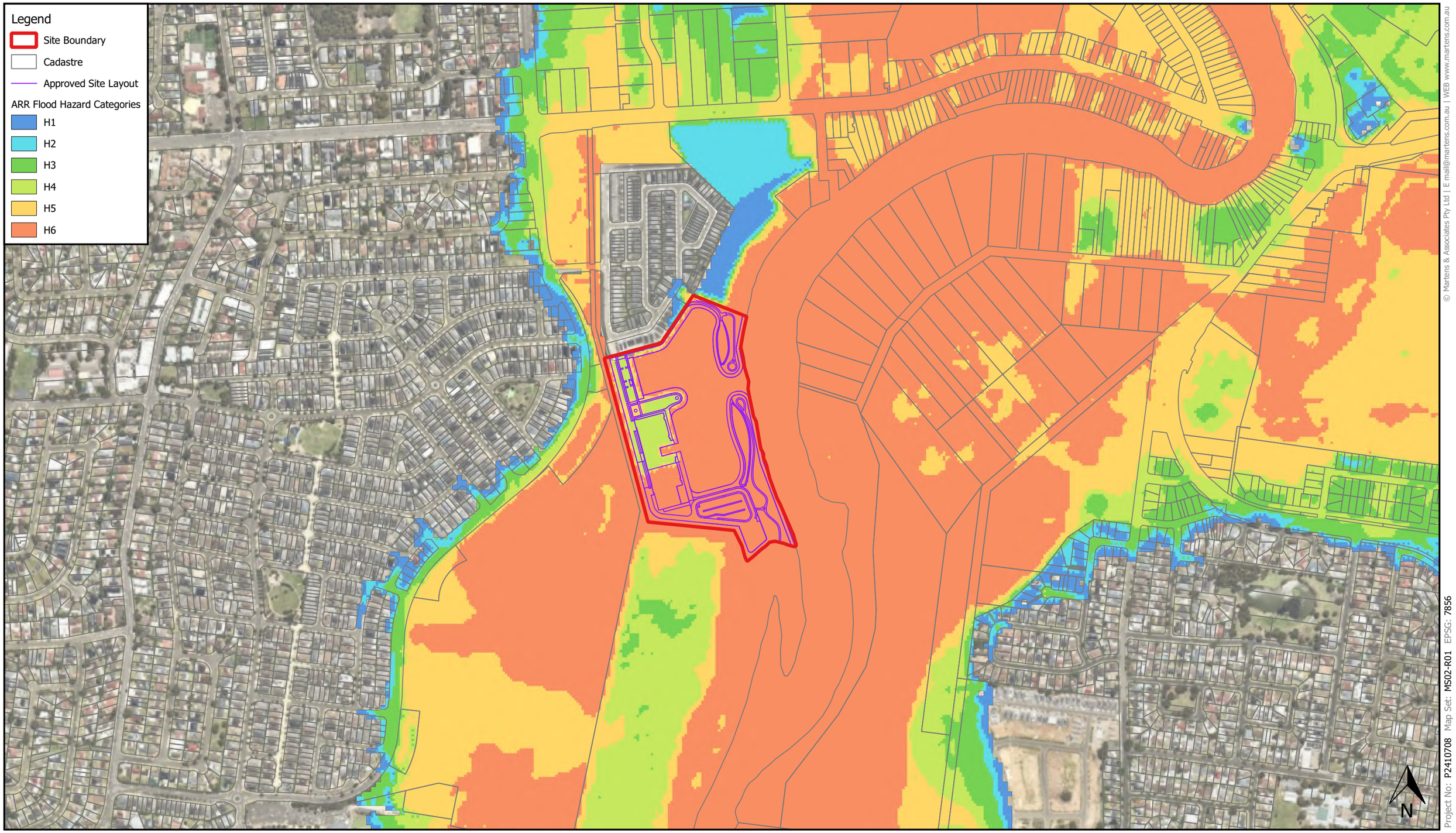

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

0.02% AEP Existing Approved Conditions ARR Flood Hazard

Map E27	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Approved Site Layout
- Water Level (mAHD)

Water Depth (m)

- 0.0 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 4.0
- 4.0 - 6.0
- 6.0 - 8.0
- 8.0 - 10.0
- > 10.0

11.80

11.80

11.75

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

PMF (EFE) Existing Approved Conditions Water Level & Water Depth

Map E28	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

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Legend

- Site Boundary
- Cadastre
- Approved Site Layout

Water Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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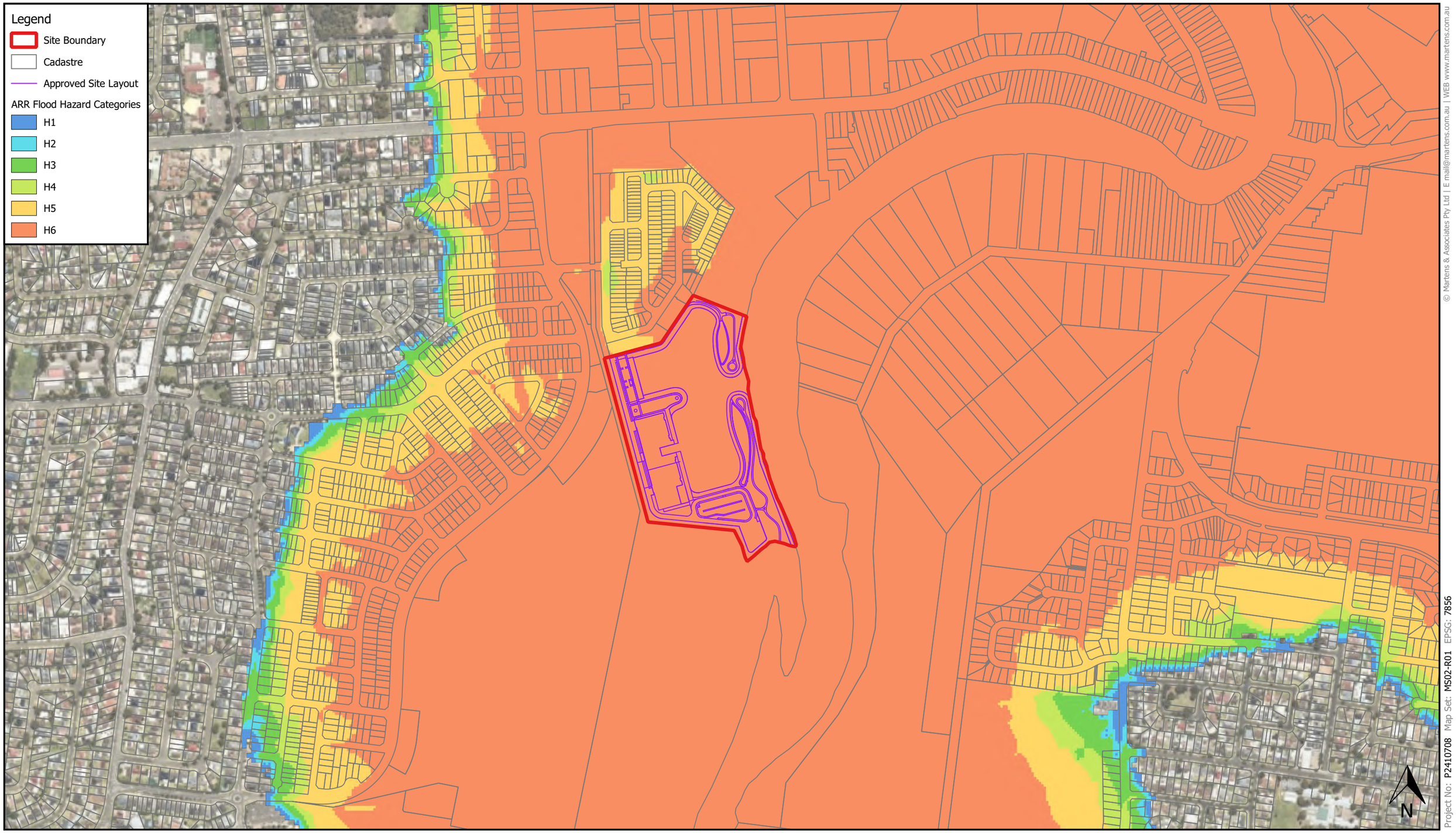
Map Title / Figure:

PMF (EFE) Existing Approved Conditions Water Velocity

Map E29	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

PMF (EFE) Existing Approved Conditions ARR Flood Hazard

Map E30	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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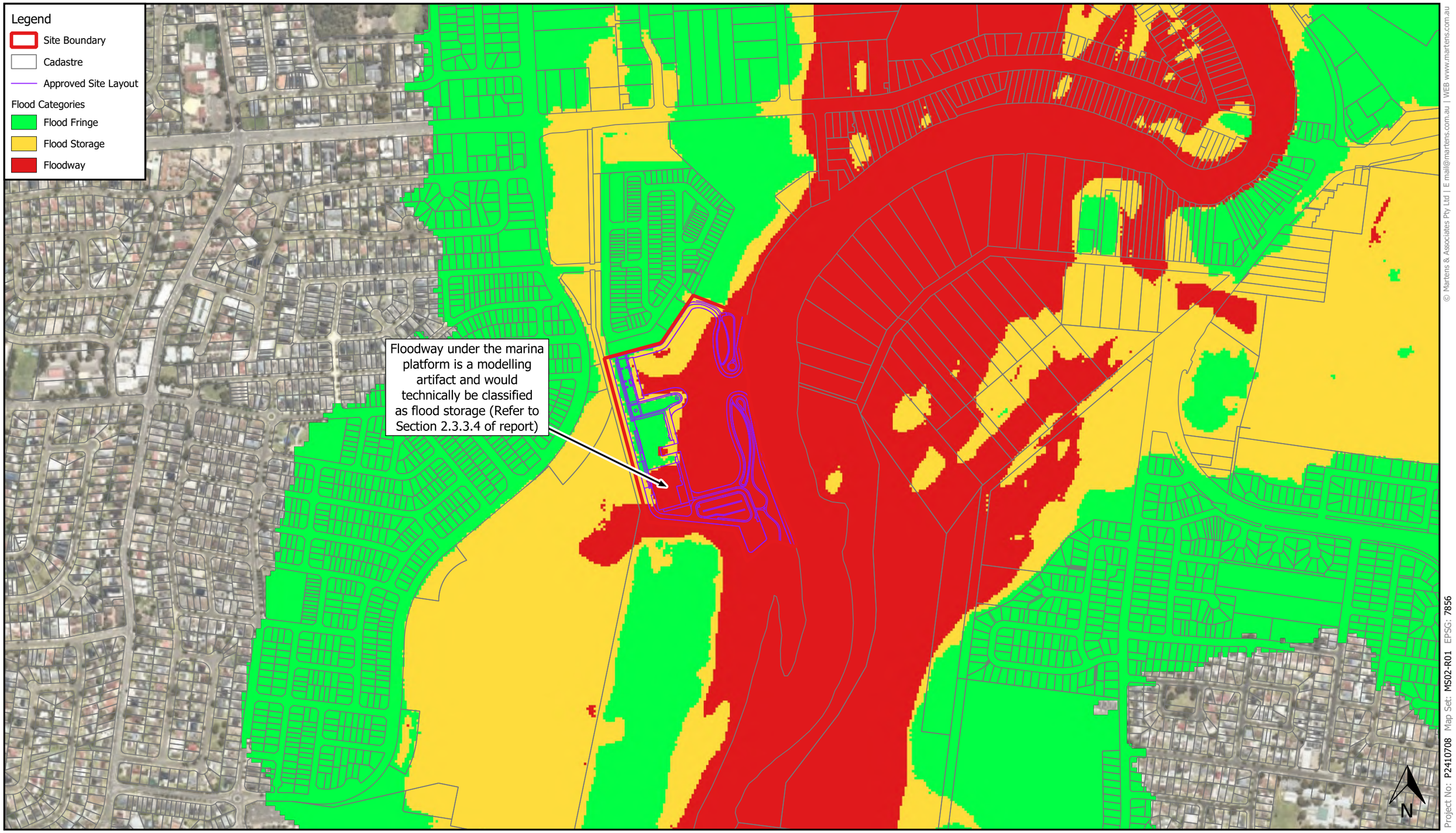

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Floodway is defined as areas where the velocity depth product > 1.0 m²/s in the 1% AEP flood event.
- Flood storage is defined as areas where the velocity depth product < 1.0 m²/s and depths are > 1.0 m in the 1% AEP flood event.
- Flood fringe is defined as areas within the extreme flood event (PMF) extent outside of areas classed as floodway or flood storage.

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Map Title / Figure:

Existing Approved Conditions Flood Categories

Map E31	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

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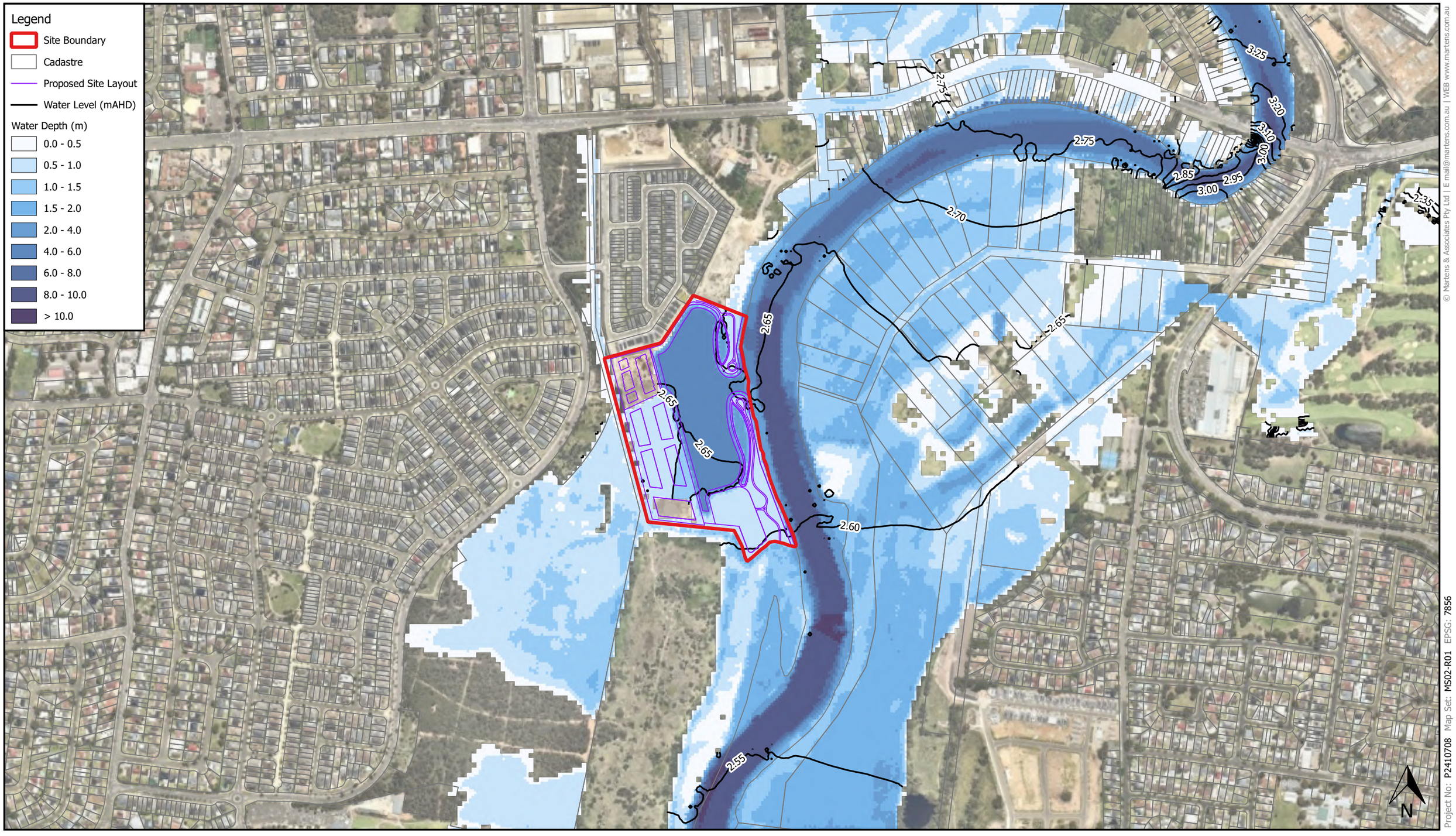
Appendix B

Proposed Conditions Flood Maps



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Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

20% AEP Proposed Conditions Water Level & Water Depth

Map P1	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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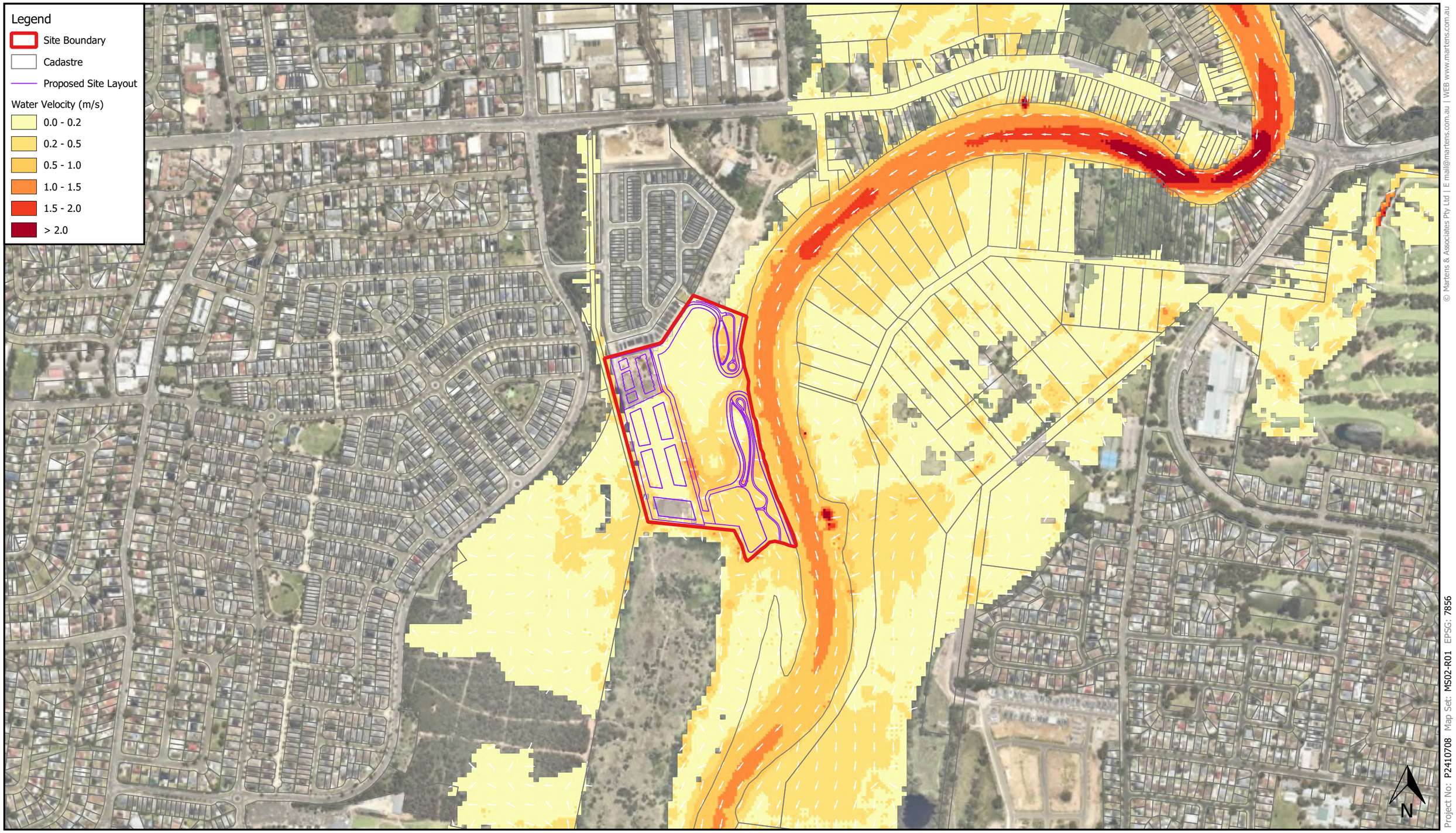
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



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Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

20% AEP Proposed Conditions Water Velocity

Map P2	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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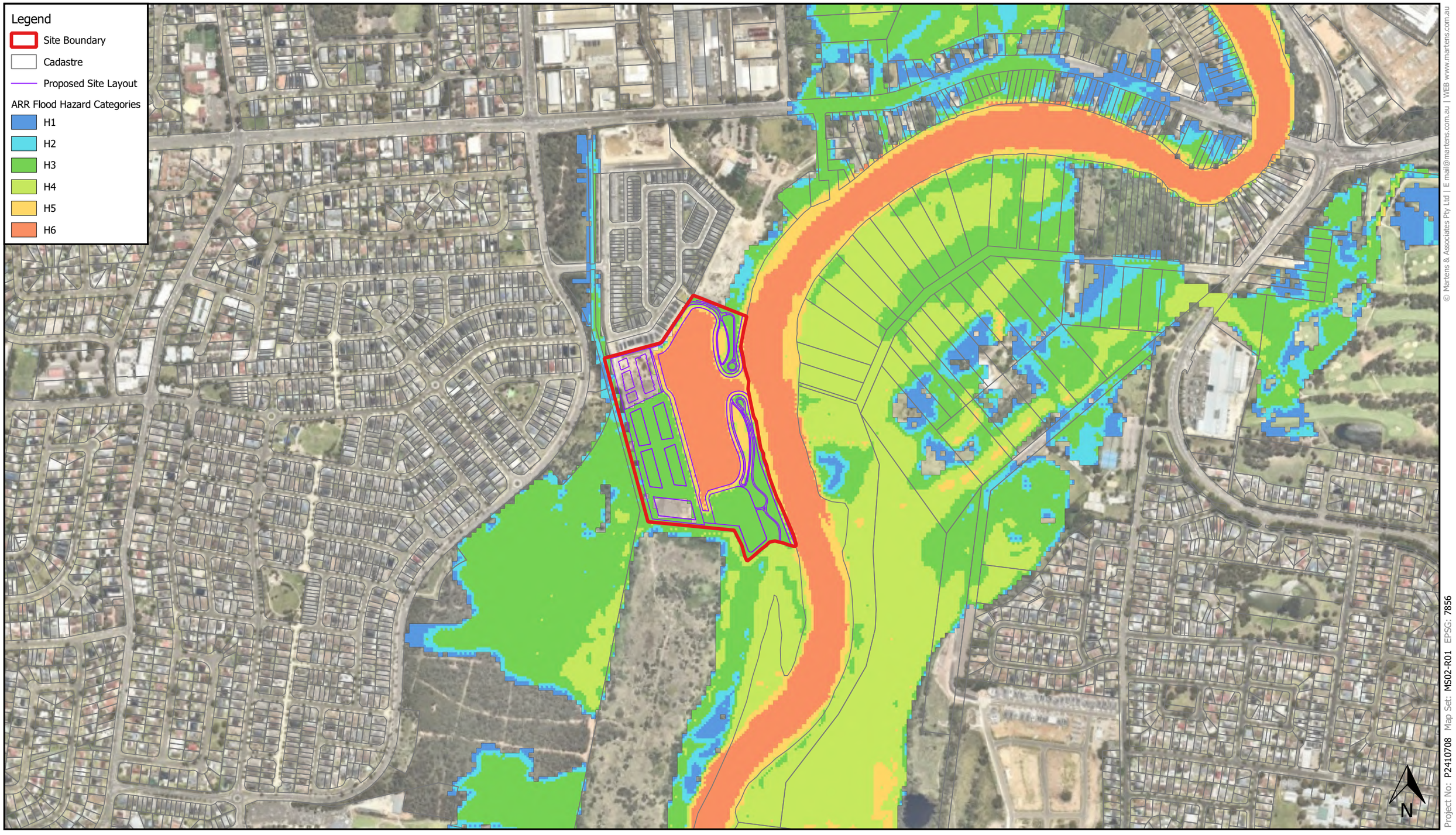
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



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1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

20% AEP Proposed Conditions ARR Flood Hazard

Map P3	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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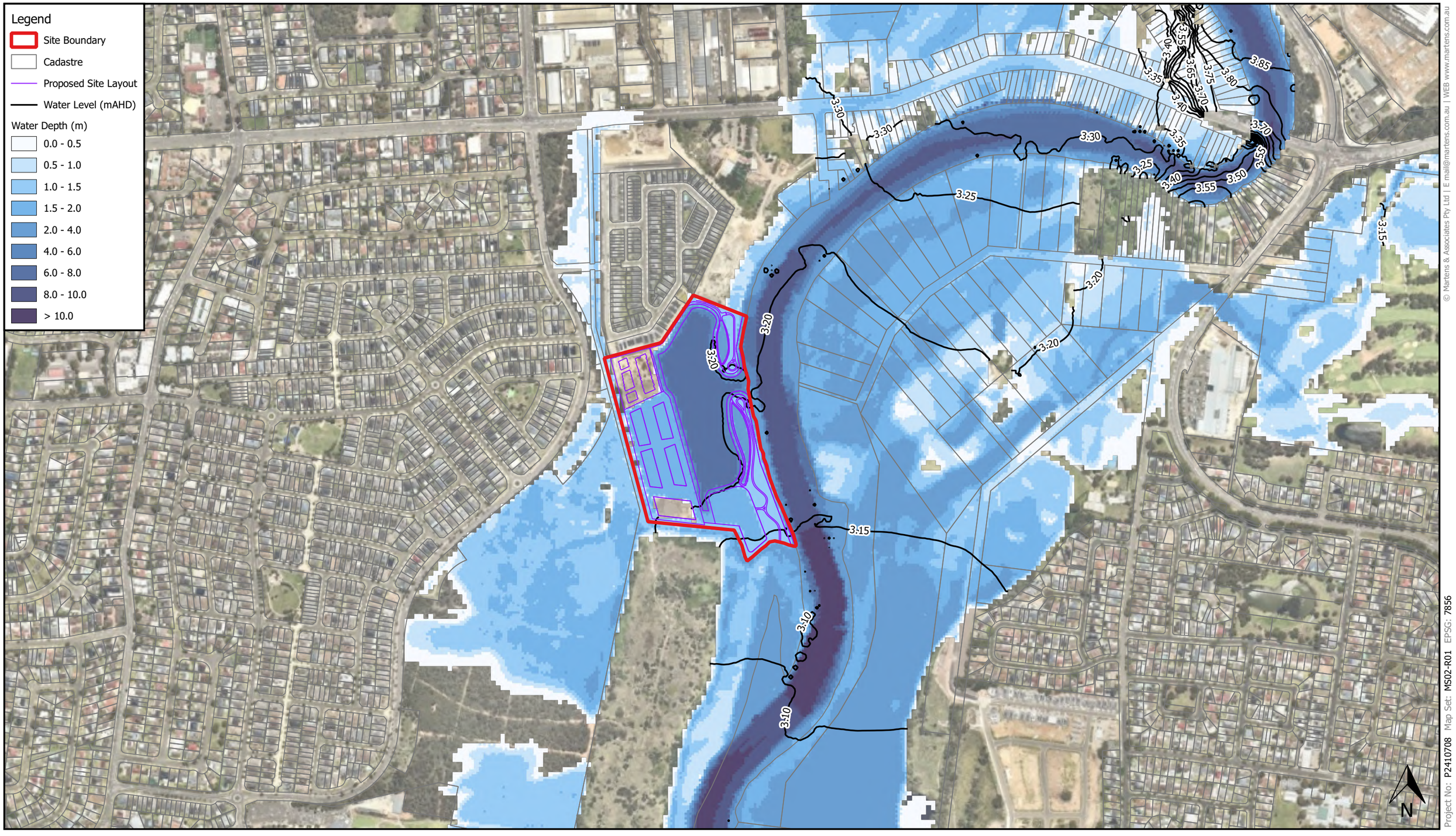
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout
- Water Level (mAHD)

Water Depth (m)

- 0.0 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 4.0
- 4.0 - 6.0
- 6.0 - 8.0
- 8.0 - 10.0
- > 10.0



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

10% AEP Proposed Conditions Water Level & Water Depth

Map P4	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Water Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

10% AEP Proposed Conditions Water Velocity

Map P5	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

ARR Flood Hazard Categories

- H1
- H2
- H3
- H4
- H5
- H6

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

10% AEP Proposed Conditions ARR Flood Hazard

Map P6	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout
- Water Level (mAHD)

Water Depth (m)

- 0.0 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 4.0
- 4.0 - 6.0
- 6.0 - 8.0
- 8.0 - 10.0
- > 10.0

4.70 4.75 4.80 4.85 4.90 4.65 4.60 4.55 4.50 4.45 4.40 4.35

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

5% AEP Proposed Conditions Water Level & Water Depth

Map P7	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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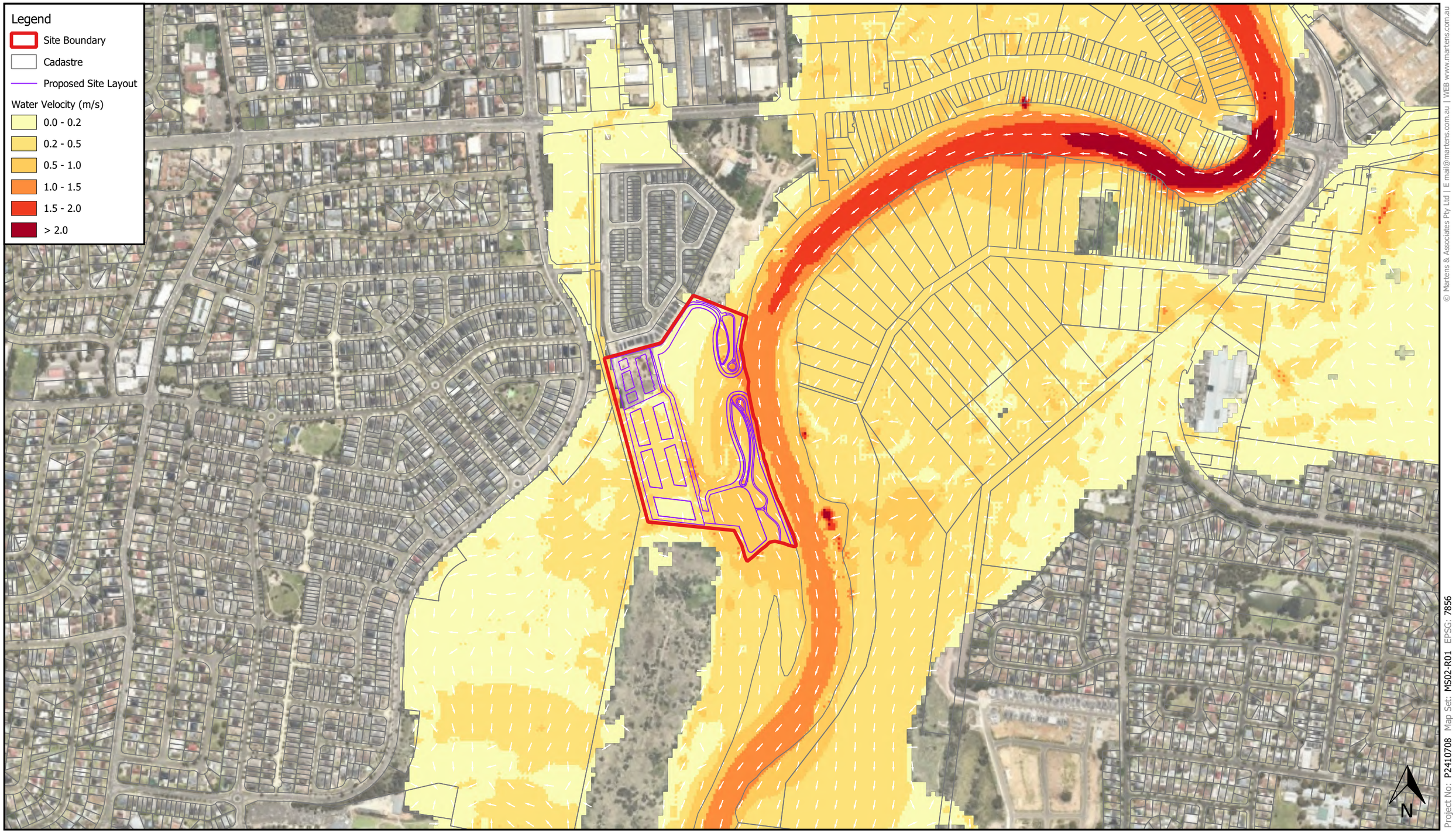
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

5% AEP Proposed Conditions Water Velocity

Map P8	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

ARR Flood Hazard Categories

- H1
- H2
- H3
- H4
- H5
- H6

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

5% AEP Proposed Conditions ARR Flood Hazard

Map P9	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout
- Water Level (mAHD)

Water Depth (m)

- 0.0 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 4.0
- 4.0 - 6.0
- 6.0 - 8.0
- 8.0 - 10.0
- > 10.0

5:40 5:45 5:50 5:55 5:35 5:30 5:25 5:20 5:15 5:10

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

2% AEP Proposed Conditions Water Level & Water Depth

Map P10	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Water Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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N

Map Title / Figure:

2% AEP Proposed Conditions Water Velocity

Map P11	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

ARR Flood Hazard Categories

- H1
- H2
- H3
- H4
- H5
- H6

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

2% AEP Proposed Conditions ARR Flood Hazard

Map P12	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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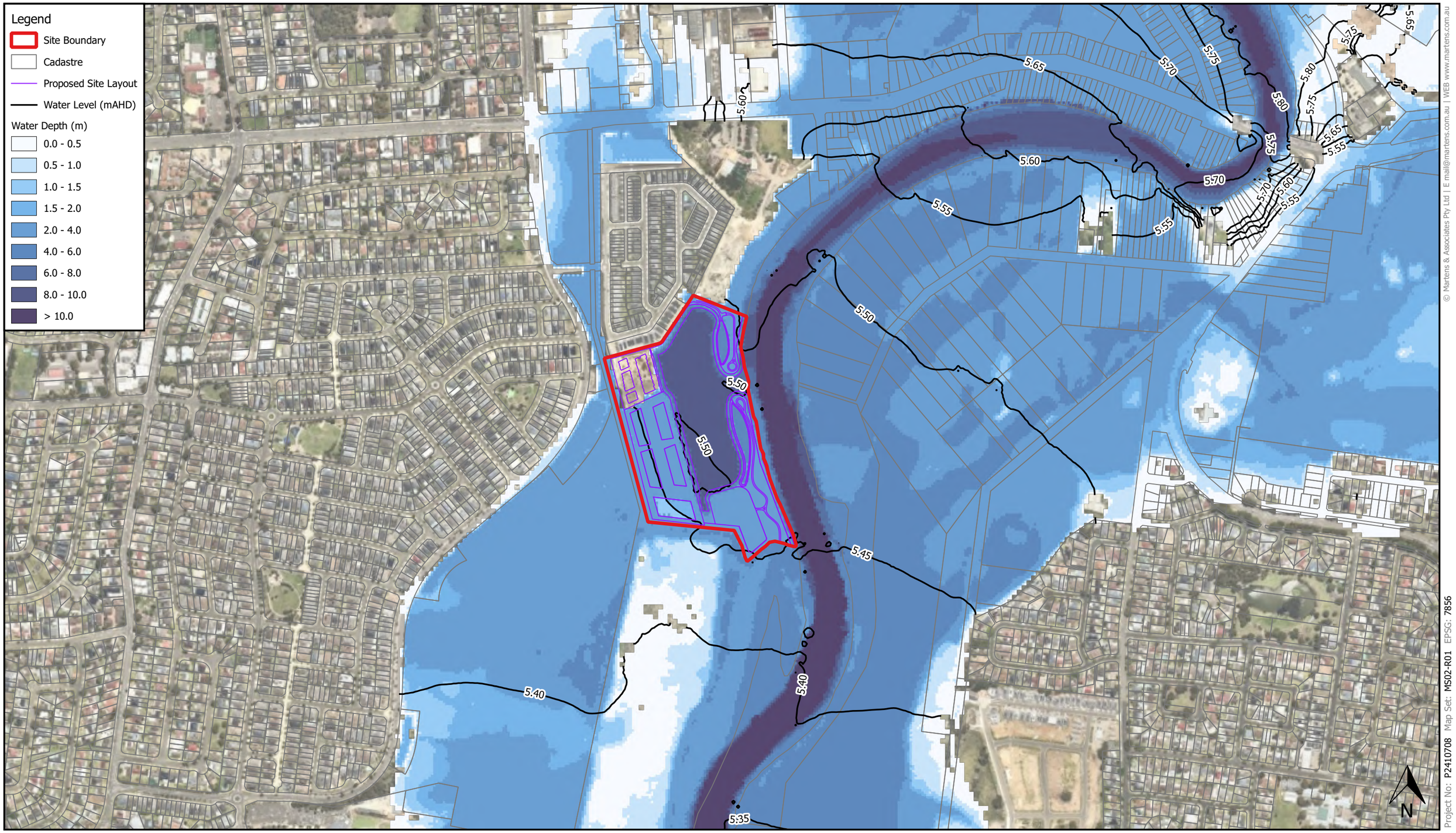
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

1% AEP Proposed Conditions Water Level & Water Depth

Map P13	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Water Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

1% AEP Proposed Conditions Water Velocity

Map P14	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

ARR Flood Hazard Categories

- H1
- H2
- H3
- H4
- H5
- H6

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

1% AEP Proposed Conditions ARR Flood Hazard

Map P15	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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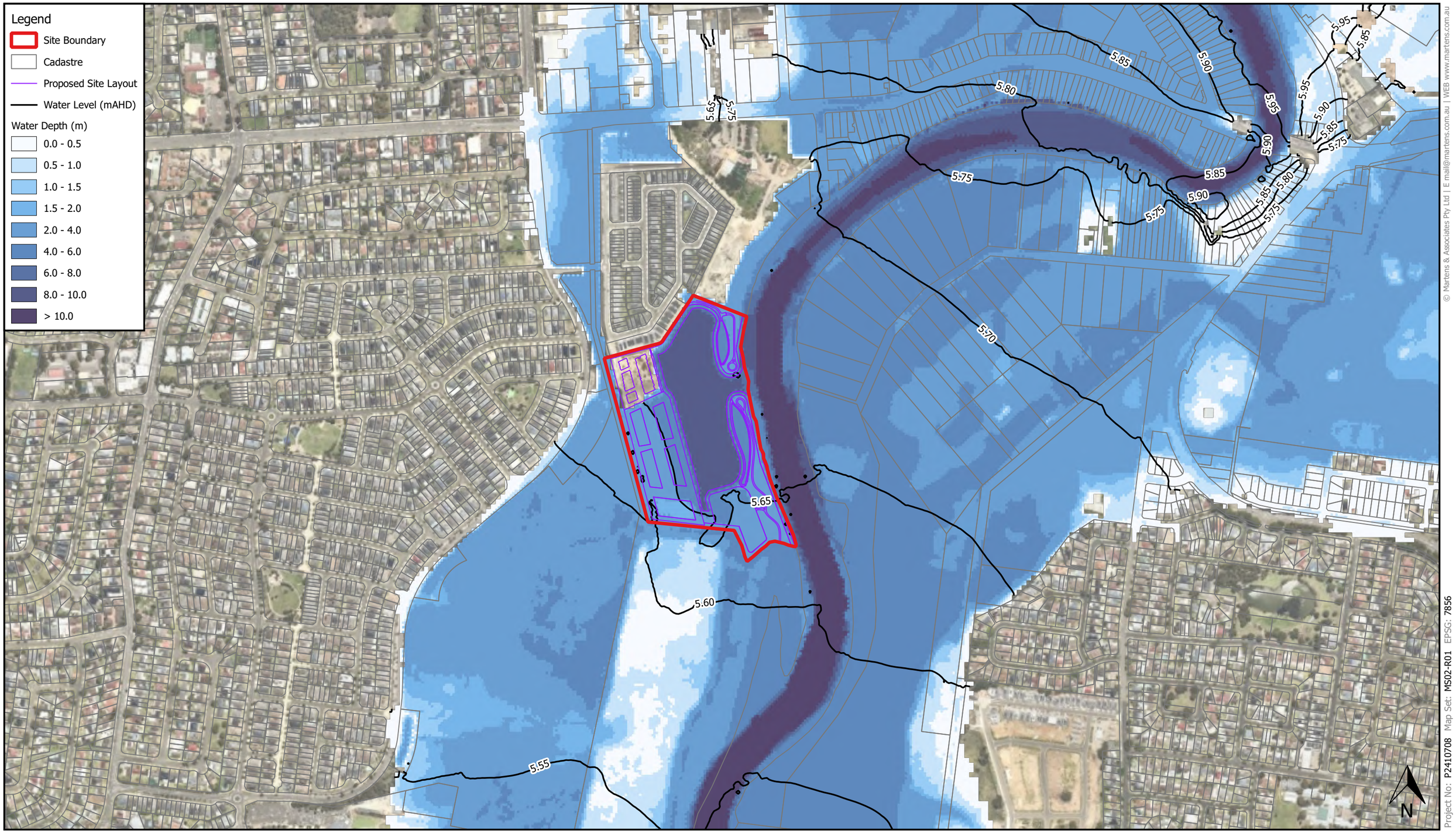
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

0.5% AEP Proposed Conditions Water Level & Water Depth

Map P16	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Water Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

0.5% AEP Proposed Conditions Water Velocity

Map P17	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

ARR Flood Hazard Categories

- H1
- H2
- H3
- H4
- H5
- H6

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

0.5% AEP Proposed Conditions ARR Flood Hazard

Map P18	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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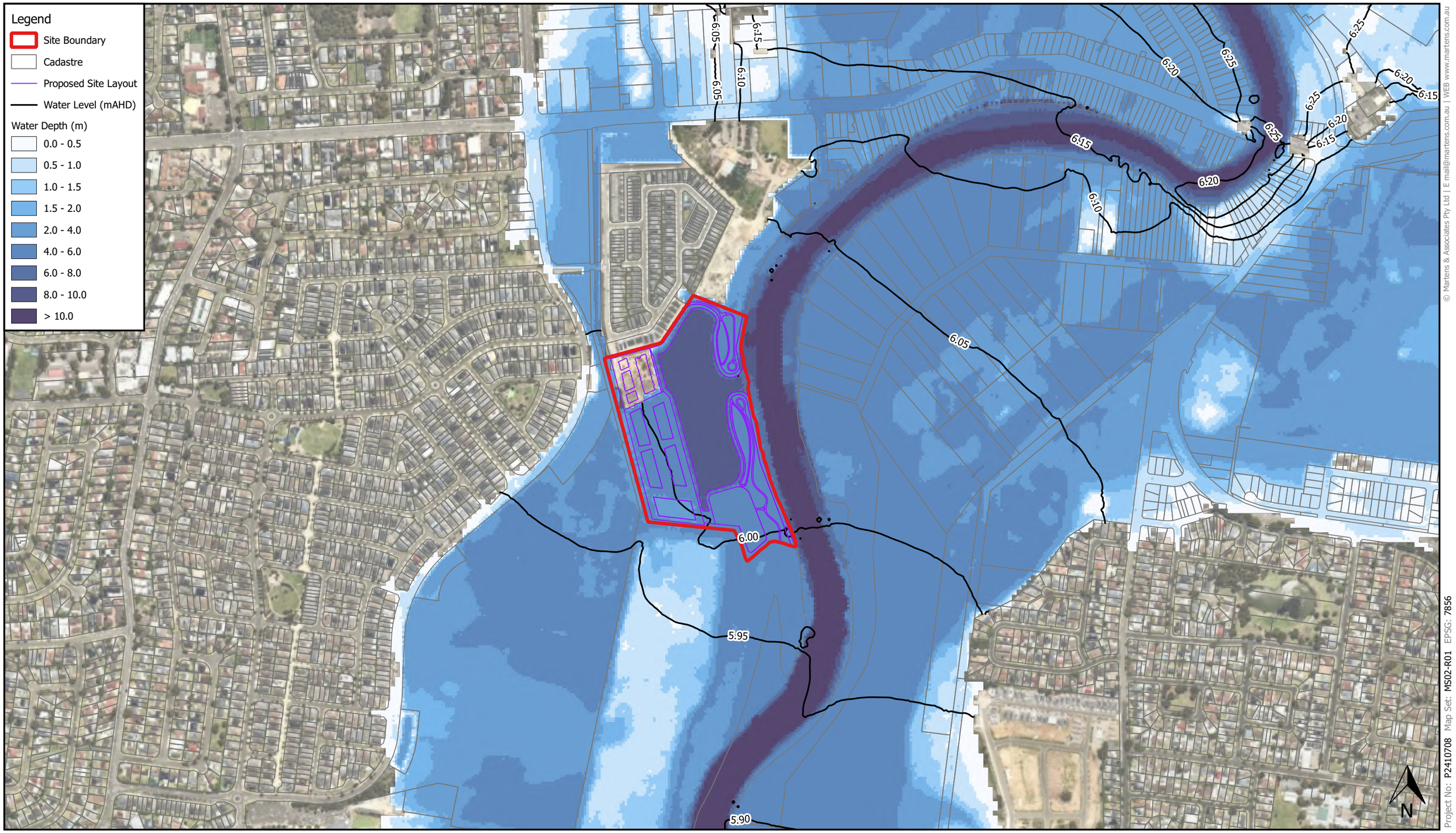
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

0.2% AEP Proposed Conditions Water Level & Water Depth

Map P19	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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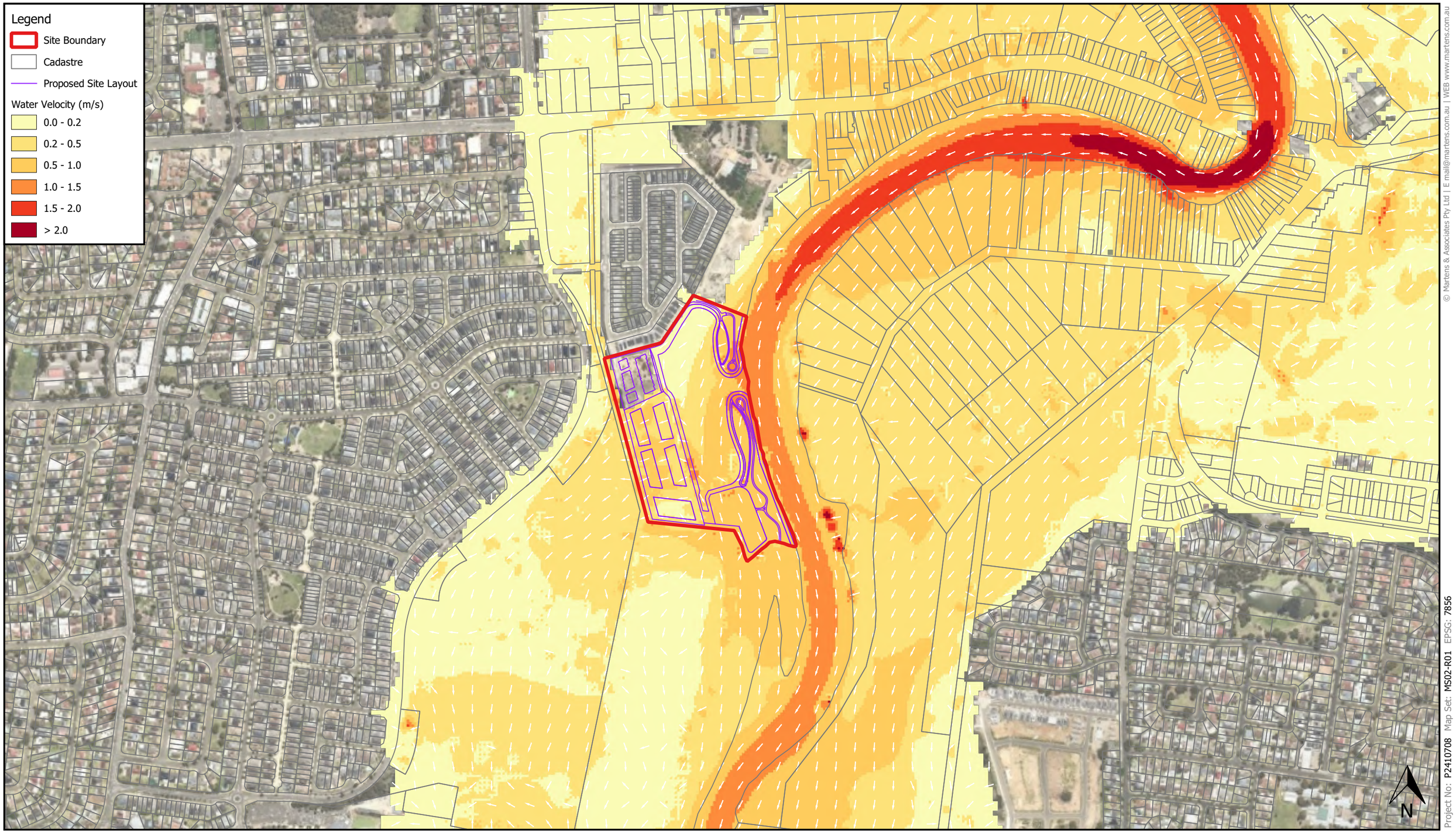
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

0.2% AEP Proposed Conditions Water Velocity

Map P20	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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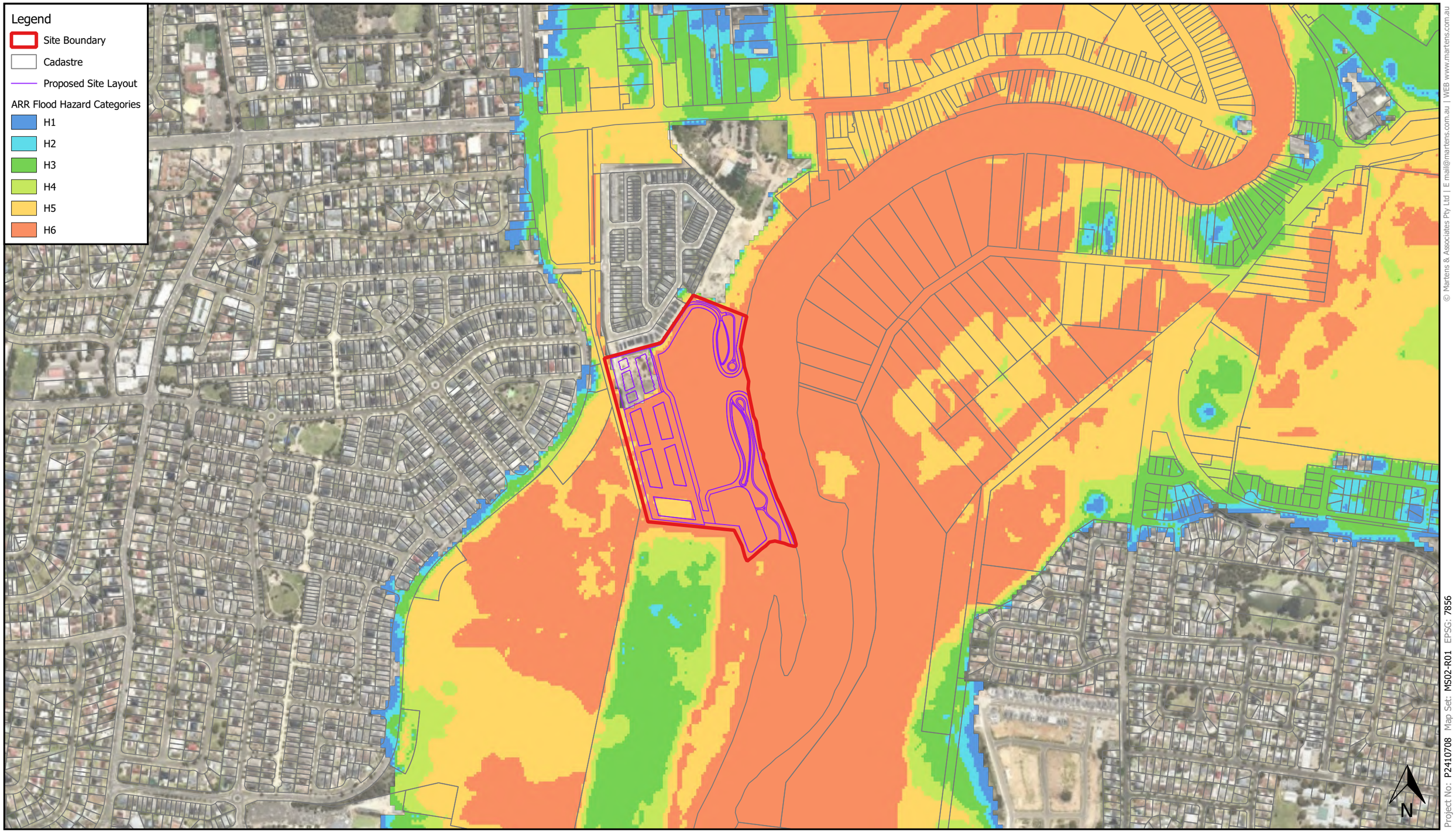
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

0.2% AEP Proposed Conditions ARR Flood Hazard

Map P21	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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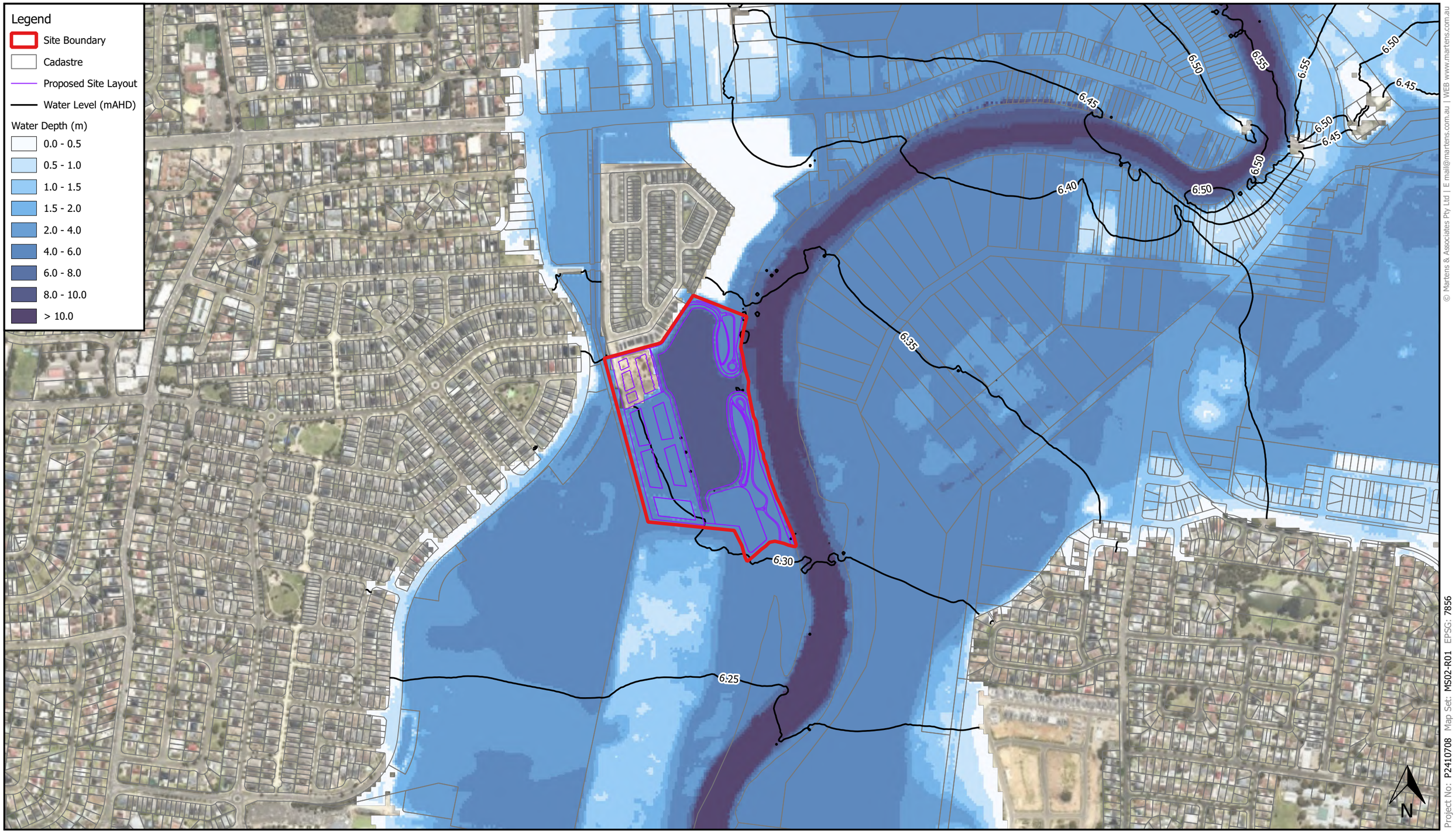
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout
- Water Level (mAHD)

Water Depth (m)

- 0.0 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 4.0
- 4.0 - 6.0
- 6.0 - 8.0
- 8.0 - 10.0
- > 10.0



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

0.05% AEP Proposed Conditions Water Level & Water Depth

Map P22	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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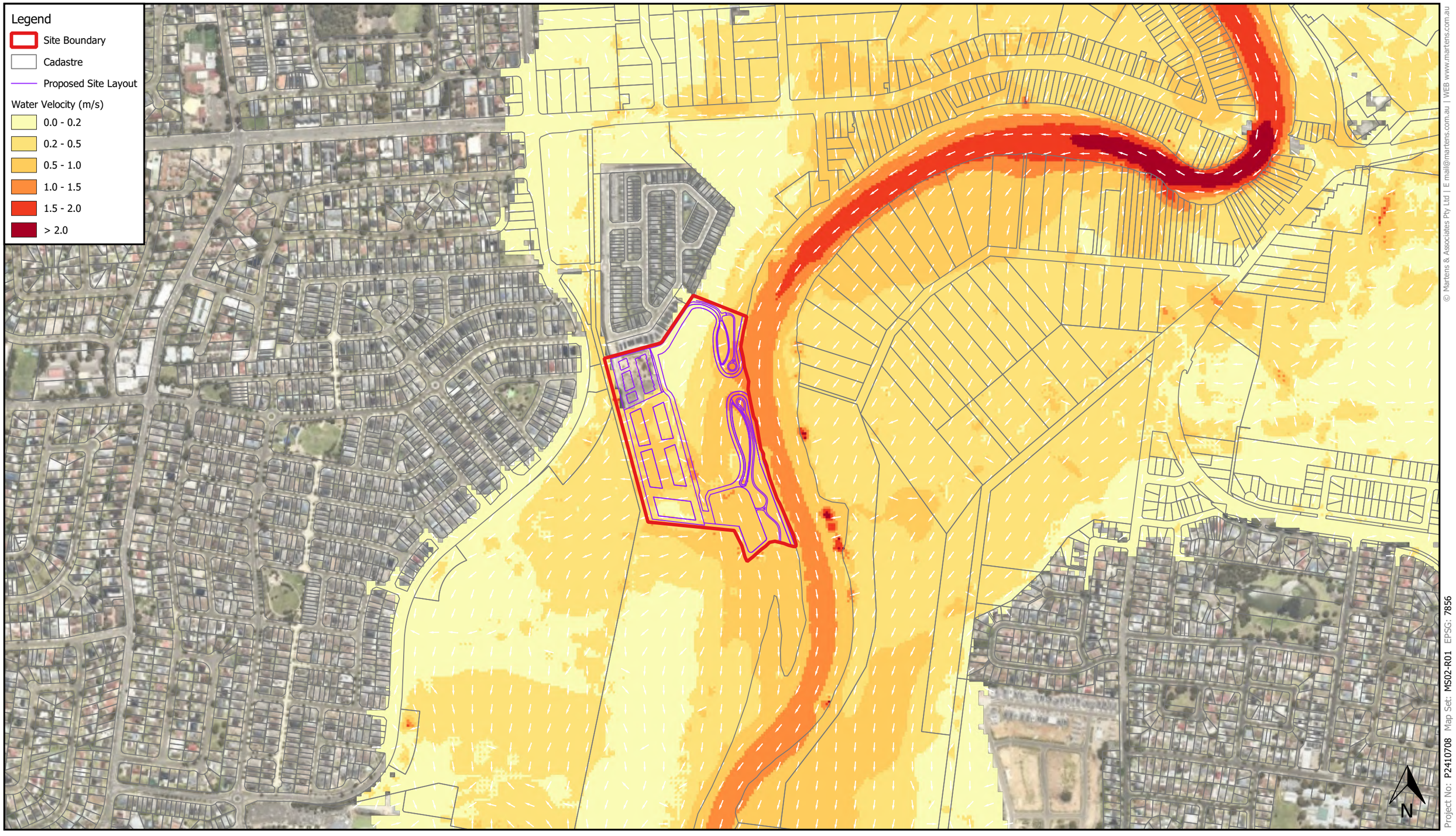
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

0.05% AEP Proposed Conditions Water Velocity

Map P23	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

ARR Flood Hazard Categories

- H1
- H2
- H3
- H4
- H5
- H6

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

0.05% AEP Proposed Conditions ARR Flood Hazard

Map P24	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

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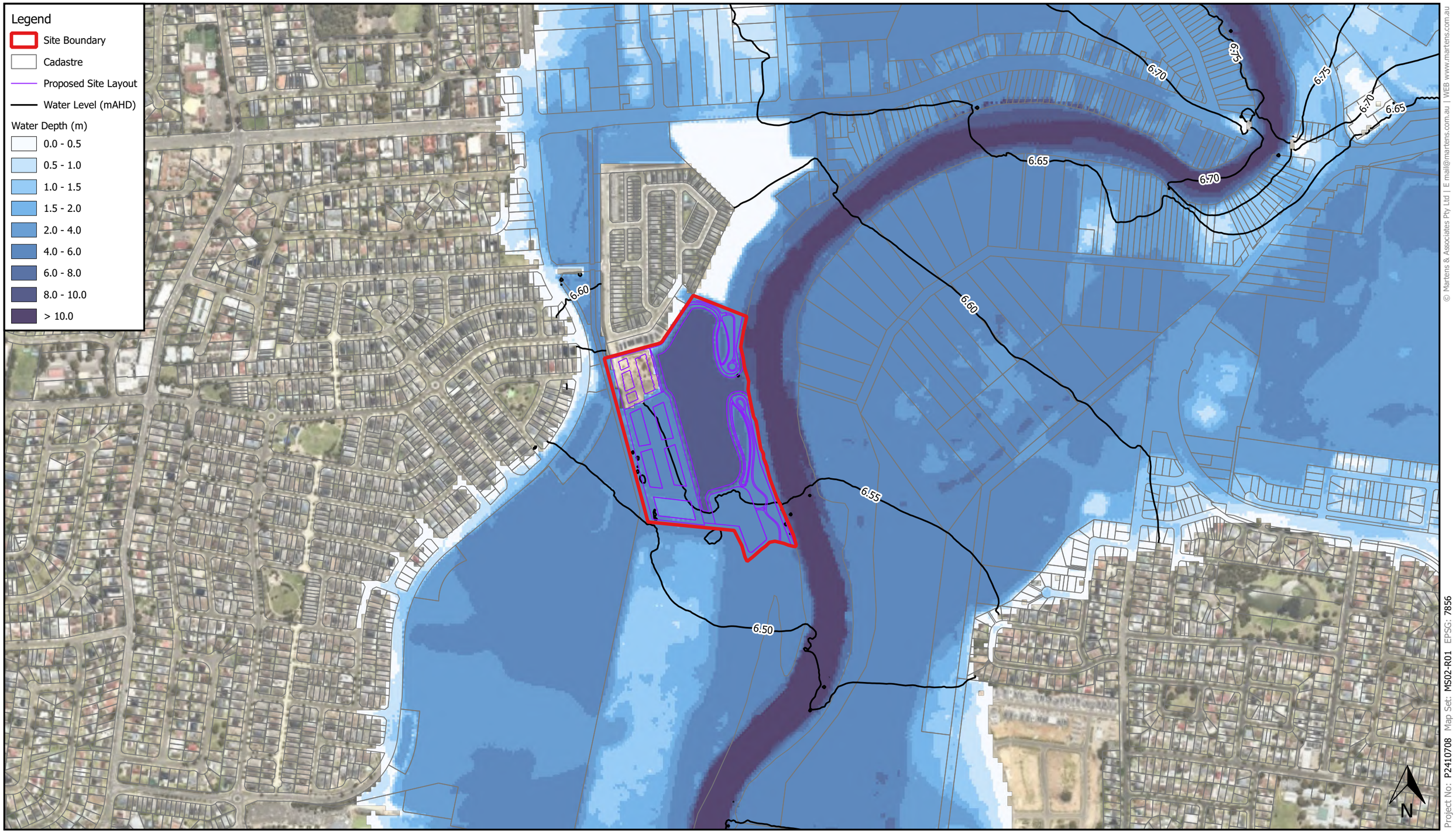

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

0.02% AEP Proposed Conditions Water Level & Water Depth

Map P25	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Water Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

0.02% AEP Proposed Conditions Water Velocity

Map P26	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

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Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

ARR Flood Hazard Categories

- H1
- H2
- H3
- H4
- H5
- H6

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

0.02% AEP Proposed Conditions ARR Flood Hazard

Map P27	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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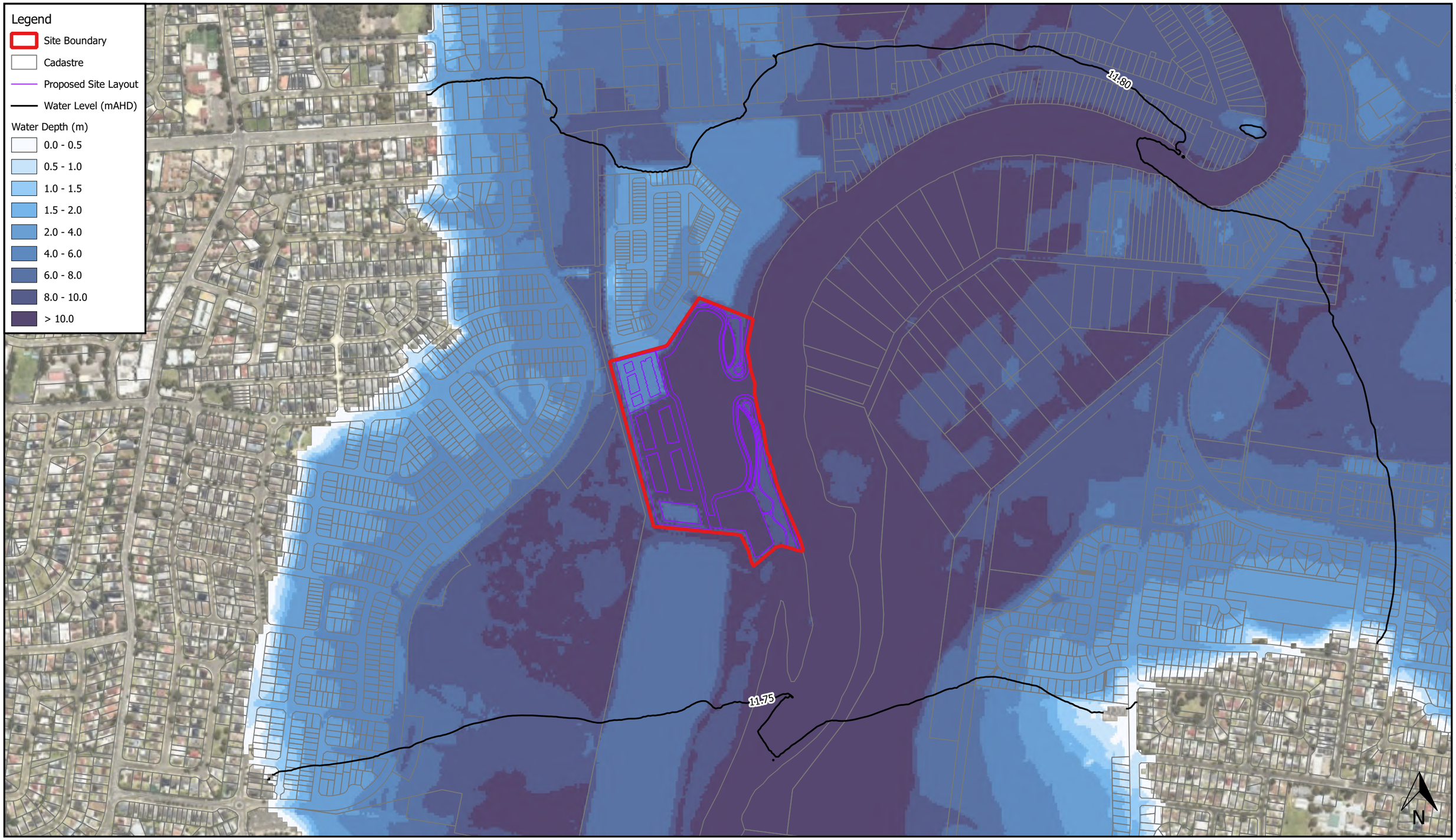
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

PMF (EFE) Proposed Conditions Water Level & Water Depth

Map P28	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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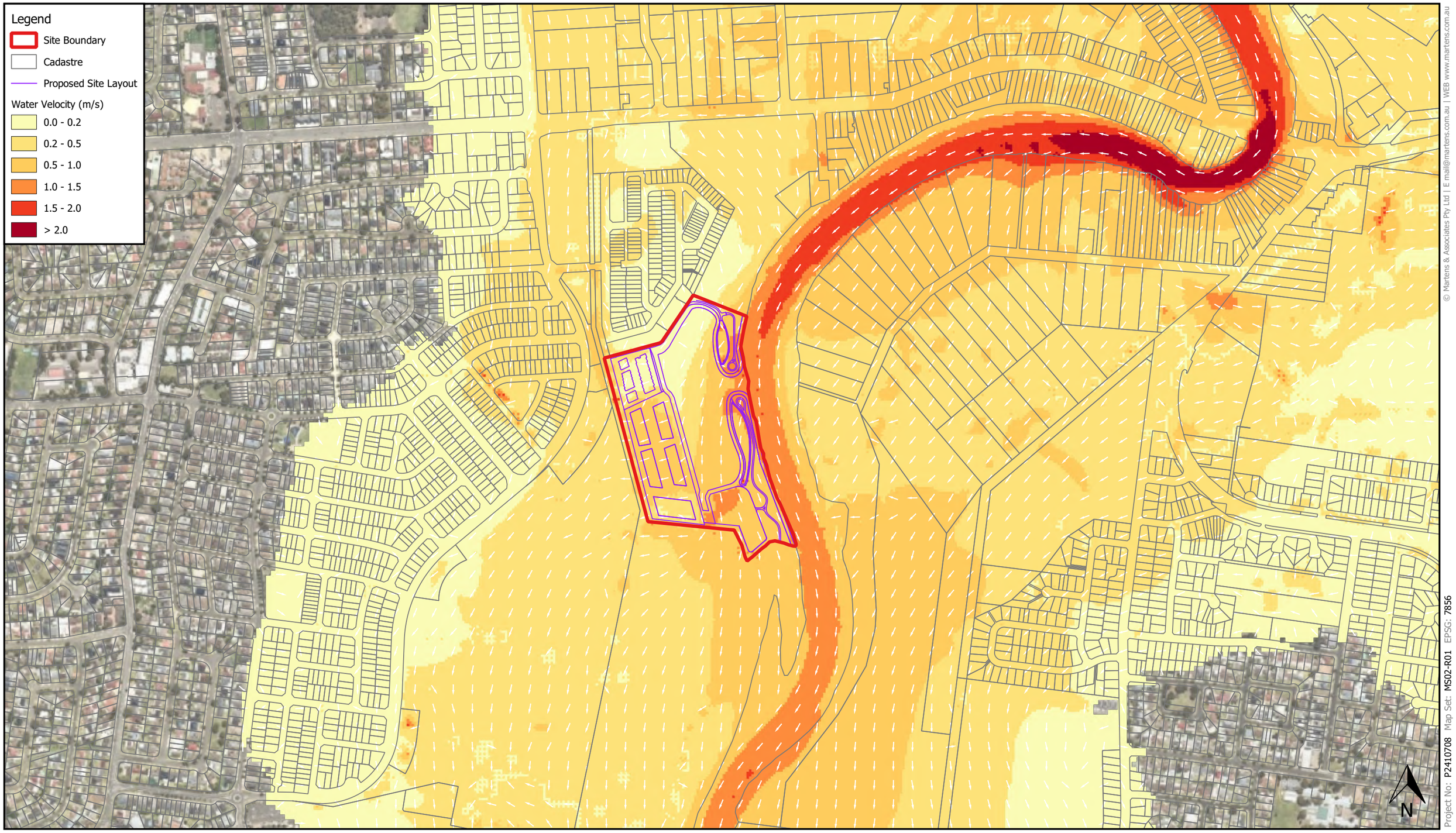
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

PMF (EFE) Proposed Conditions Water Velocity

Map P29	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

ARR Flood Hazard Categories

- H1
- H2
- H3
- H4
- H5
- H6

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Flood hazard based on Australian Rainfall and Runoff (ARR 2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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Map Title / Figure:

PMF (EFE) Proposed Conditions ARR Flood Hazard

Map P30	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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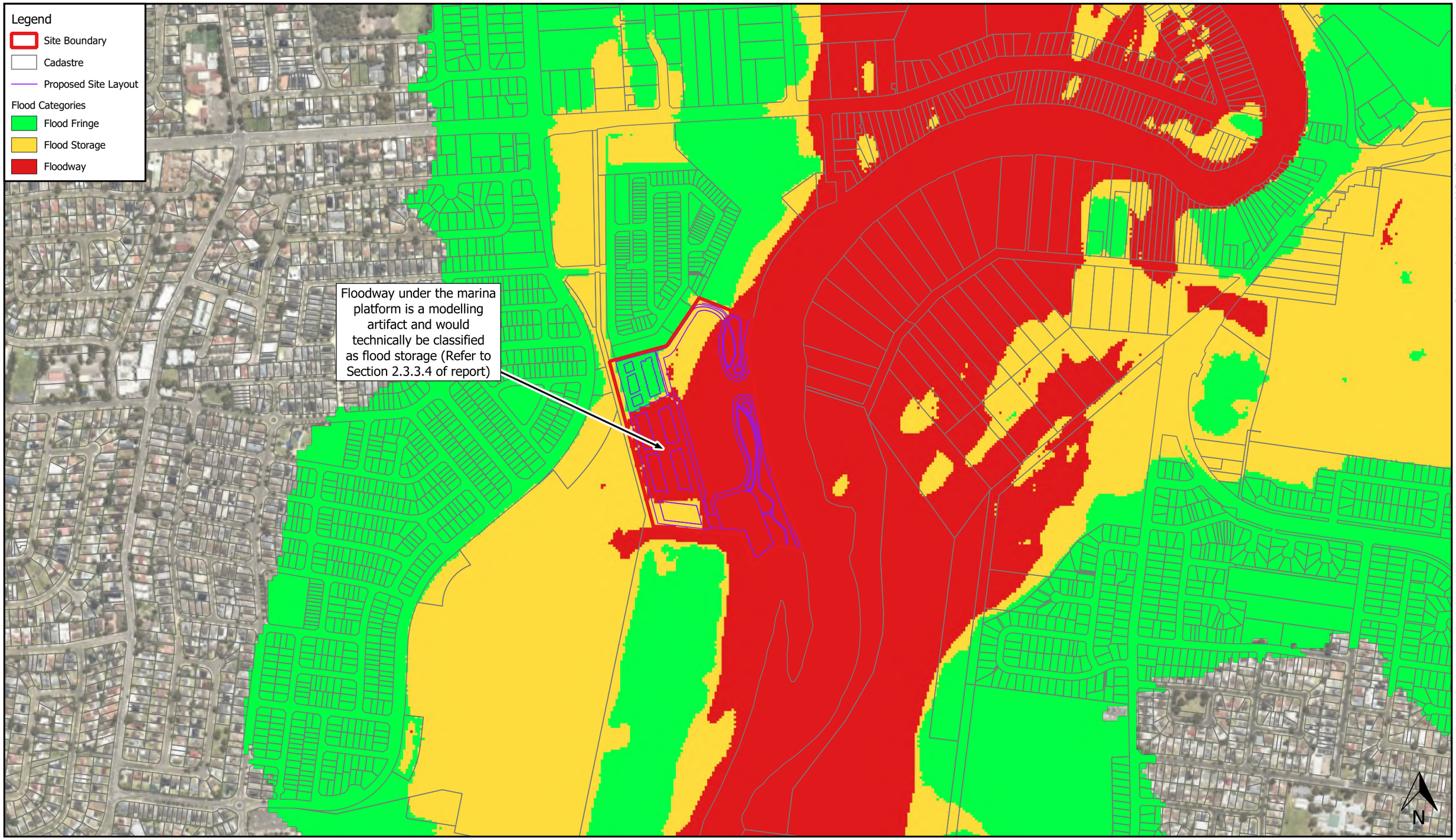
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Floodway is defined as areas where the velocity depth product > 1.0 m²/s in the 1% AEP flood event.
- Flood storage is defined as areas where the velocity depth product < 1.0 m²/s and depths are > 1.0 m in the 1% AEP flood event.
- Flood fringe is defined as areas within the extreme flood event (PMF) extent outside of areas classed as floodway or flood storage.

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Map Title / Figure:

Proposed Conditions Flood Categories

Map P31	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

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Appendix C

Flood Impact Maps

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Water Level Afflux (m)

- < -1.00
- -1.00 - -0.50
- -0.50 - -0.20
- -0.20 - -0.10
- -0.10 - -0.05
- -0.05 - -0.02
- -0.02 - 0.02
- 0.02 - 0.05
- 0.05 - 0.10
- 0.10 - 0.20
- 0.20 - 0.50
- 0.50 - 1.00
- > 1.00

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0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water level decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water level increase.

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Map Title / Figure:

20% AEP Proposed Conditions Water Level Impacts

Map I1	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Water Velocity Afflux (m/s)

- < -1.0
- -1.0 - -0.5
- -0.5 - -0.3
- -0.3 - -0.2
- -0.2 - -0.1
- -0.1 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- > 1.0

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water velocity decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water velocity increase.

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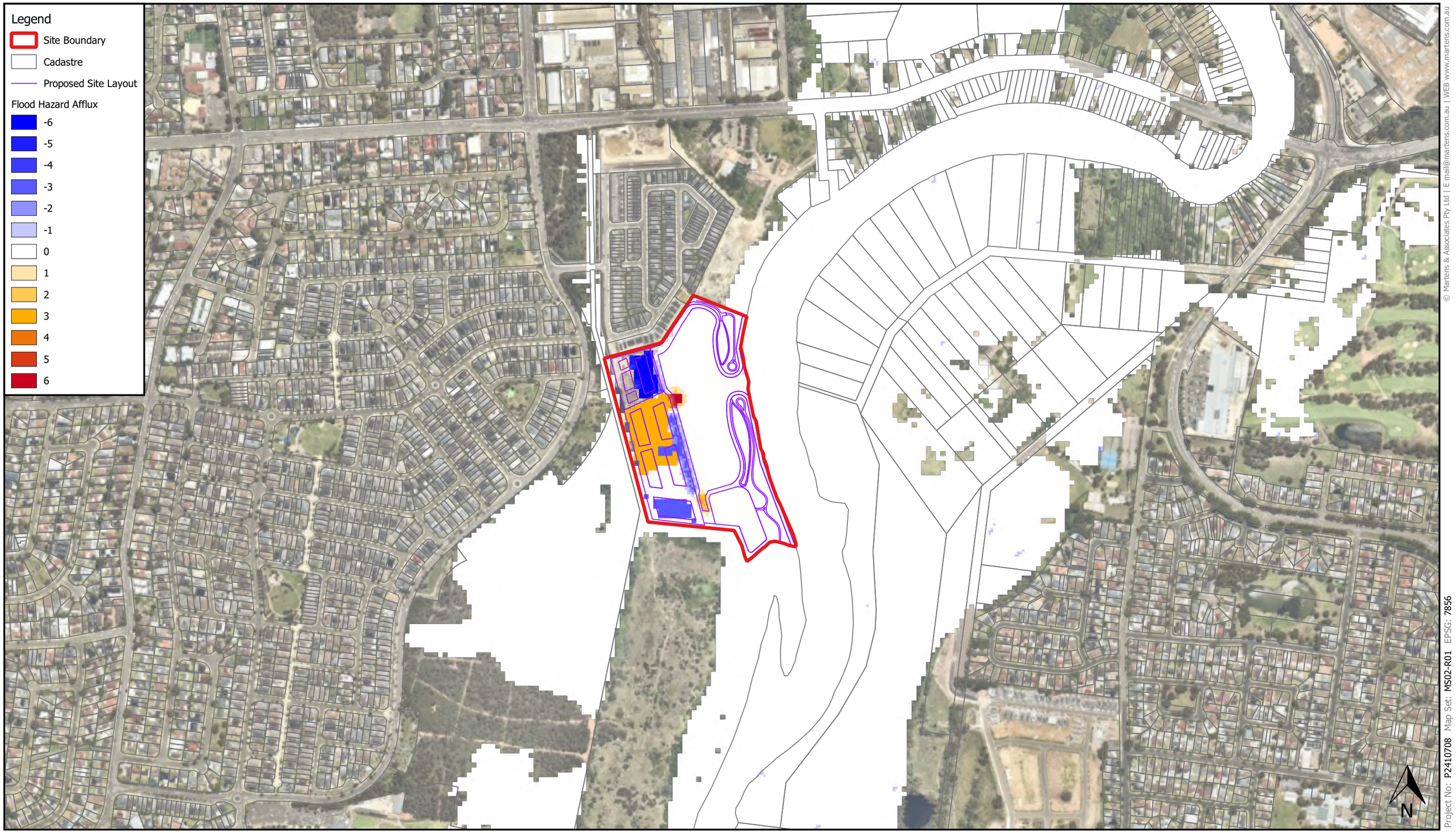
Map Title / Figure:

20% AEP Proposed Conditions Water Velocity Impacts

Map I2	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent a decrease in flood hazard category (e.g. was H2, now H1). Areas coloured white represent negligible change (e.g. remains H2). Areas coloured yellow / red represent an increase in flood hazard category (e.g. was H1, now H2).

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Map Title / Figure:

20% AEP Proposed Conditions Hazard Impacts

Map I3	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Water Level Afflux (m)

- < -1.00
- -1.00 - -0.50
- -0.50 - -0.20
- -0.20 - -0.10
- -0.10 - -0.05
- -0.05 - -0.02
- -0.02 - 0.02
- 0.02 - 0.05
- 0.05 - 0.10
- 0.10 - 0.20
- 0.20 - 0.50
- 0.50 - 1.00
- > 1.00

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water level decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water level increase.

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Map Title / Figure:

10% AEP Proposed Conditions Water Level Impacts

Map I4	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Water Velocity Afflux (m/s)

- < -1.0
- -1.0 - -0.5
- -0.5 - -0.3
- -0.3 - -0.2
- -0.2 - -0.1
- -0.1 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- > 1.0

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water velocity decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water velocity increase.

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Map Title / Figure:

10% AEP Proposed Conditions Water Velocity Impacts

Map I5	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

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Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Flood Hazard Afflux

- -6
- -5
- -4
- -3
- -2
- -1
- 0
- 1
- 2
- 3
- 4
- 5
- 6

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent a decrease in flood hazard category (e.g. was H2, now H1). Areas coloured white represent negligible change (e.g. remains H2). Areas coloured yellow / red represent an increase in flood hazard category (e.g. was H1, now H2).

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Map Title / Figure:

10% AEP Proposed Conditions Hazard Impacts

Map I6	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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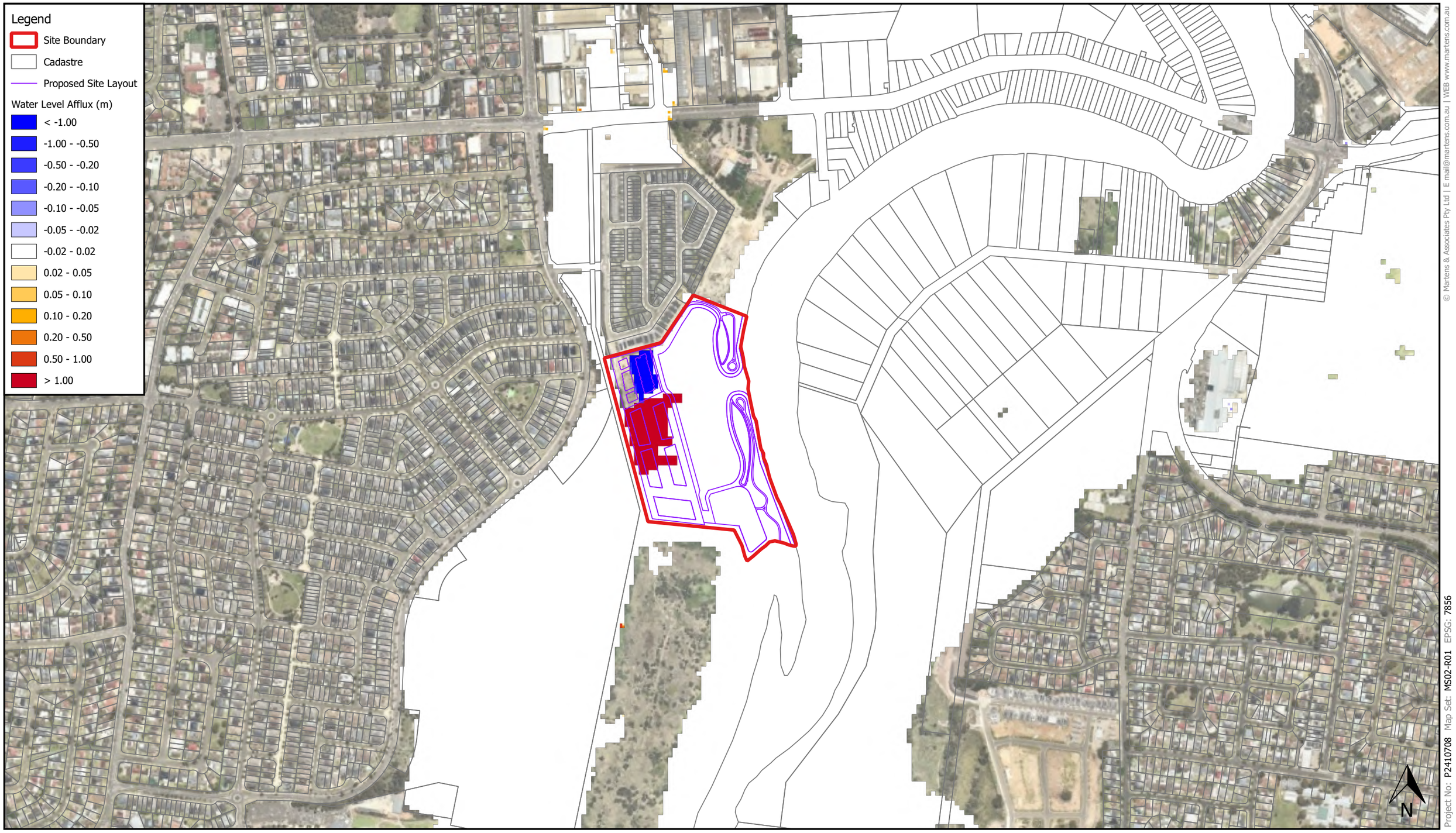
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water level decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water level increase.

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Map Title / Figure:

5% AEP Proposed Conditions Water Level Impacts

Map I7	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Water Velocity Afflux (m/s)

- < -1.0
- -1.0 - -0.5
- -0.5 - -0.3
- -0.3 - -0.2
- -0.2 - -0.1
- -0.1 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- > 1.0

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water velocity decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water velocity increase.

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Map Title / Figure:

5% AEP Proposed Conditions Water Velocity Impacts

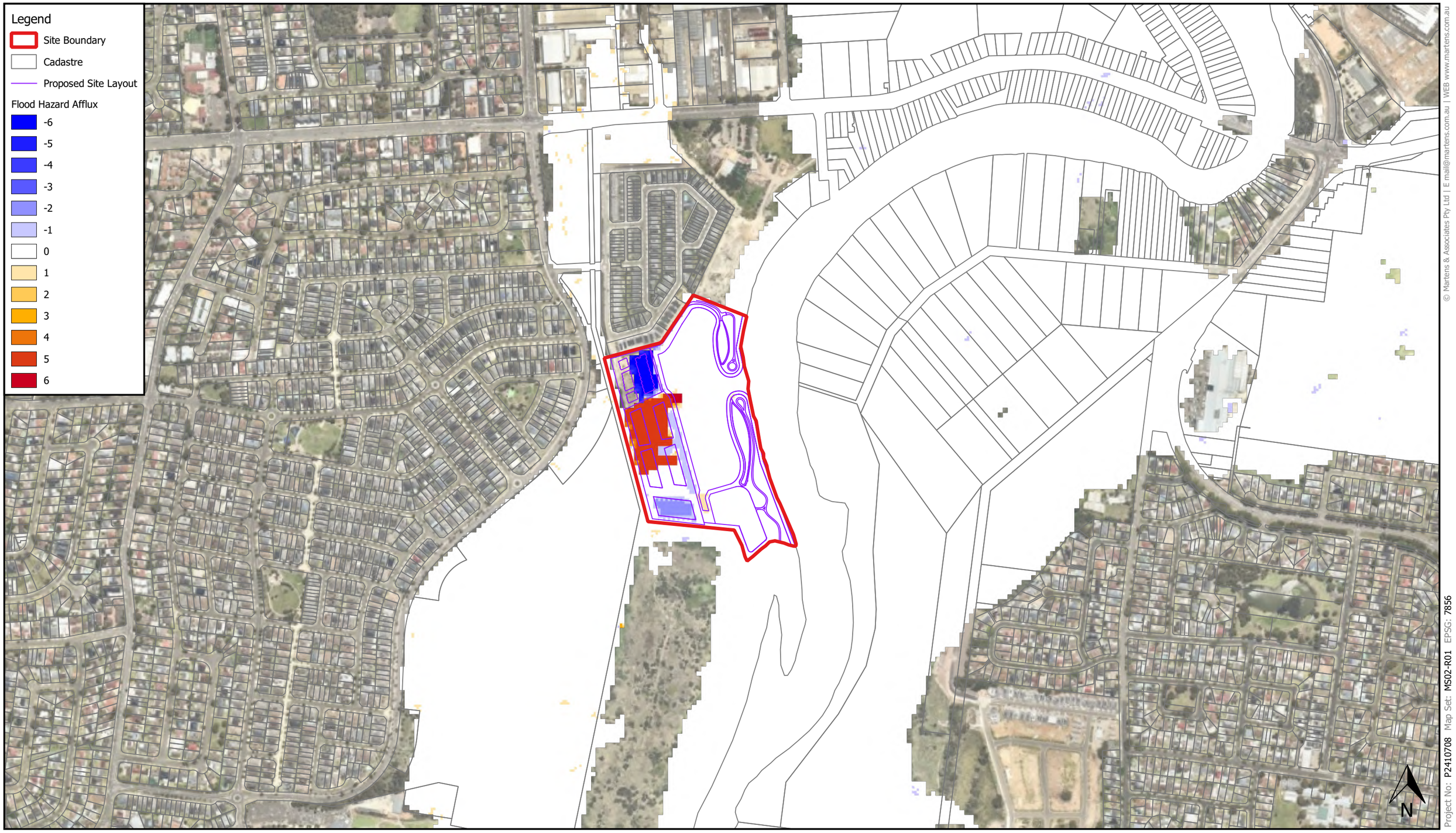
Map I8	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Flood Hazard Afflux

- -6
- -5
- -4
- -3
- -2
- -1
- 0
- 1
- 2
- 3
- 4
- 5
- 6



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent a decrease in flood hazard category (e.g. was H2, now H1). Areas coloured white represent negligible change (e.g. remains H2). Areas coloured yellow / red represent an increase in flood hazard category (e.g. was H1, now H2).

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Map Title / Figure:

5% AEP Proposed Conditions Hazard Impacts

Map I9	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Water Level Afflux (m)

- < -1.00
- -1.00 - -0.50
- -0.50 - -0.20
- -0.20 - -0.10
- -0.10 - -0.05
- -0.05 - -0.02
- -0.02 - 0.02
- 0.02 - 0.05
- 0.05 - 0.10
- 0.10 - 0.20
- 0.20 - 0.50
- 0.50 - 1.00
- > 1.00

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water level decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water level increase.

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Map Title / Figure:

2% AEP Proposed Conditions Water Level Impacts

Map I10	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Water Velocity Afflux (m/s)

- < -1.0
- -1.0 - -0.5
- -0.5 - -0.3
- -0.3 - -0.2
- -0.2 - -0.1
- -0.1 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- > 1.0

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water velocity decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water velocity increase.

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Map Title / Figure:

2% AEP Proposed Conditions Water Velocity Impacts

Map I11	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Flood Hazard Afflux

- -6
- -5
- -4
- -3
- -2
- -1
- 0
- 1
- 2
- 3
- 4
- 5
- 6

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent a decrease in flood hazard category (e.g. was H2, now H1). Areas coloured white represent negligible change (e.g. remains H2). Areas coloured yellow / red represent an increase in flood hazard category (e.g. was H1, now H2).

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Map Title / Figure:

2% AEP Proposed Conditions Hazard Impacts

Map I12	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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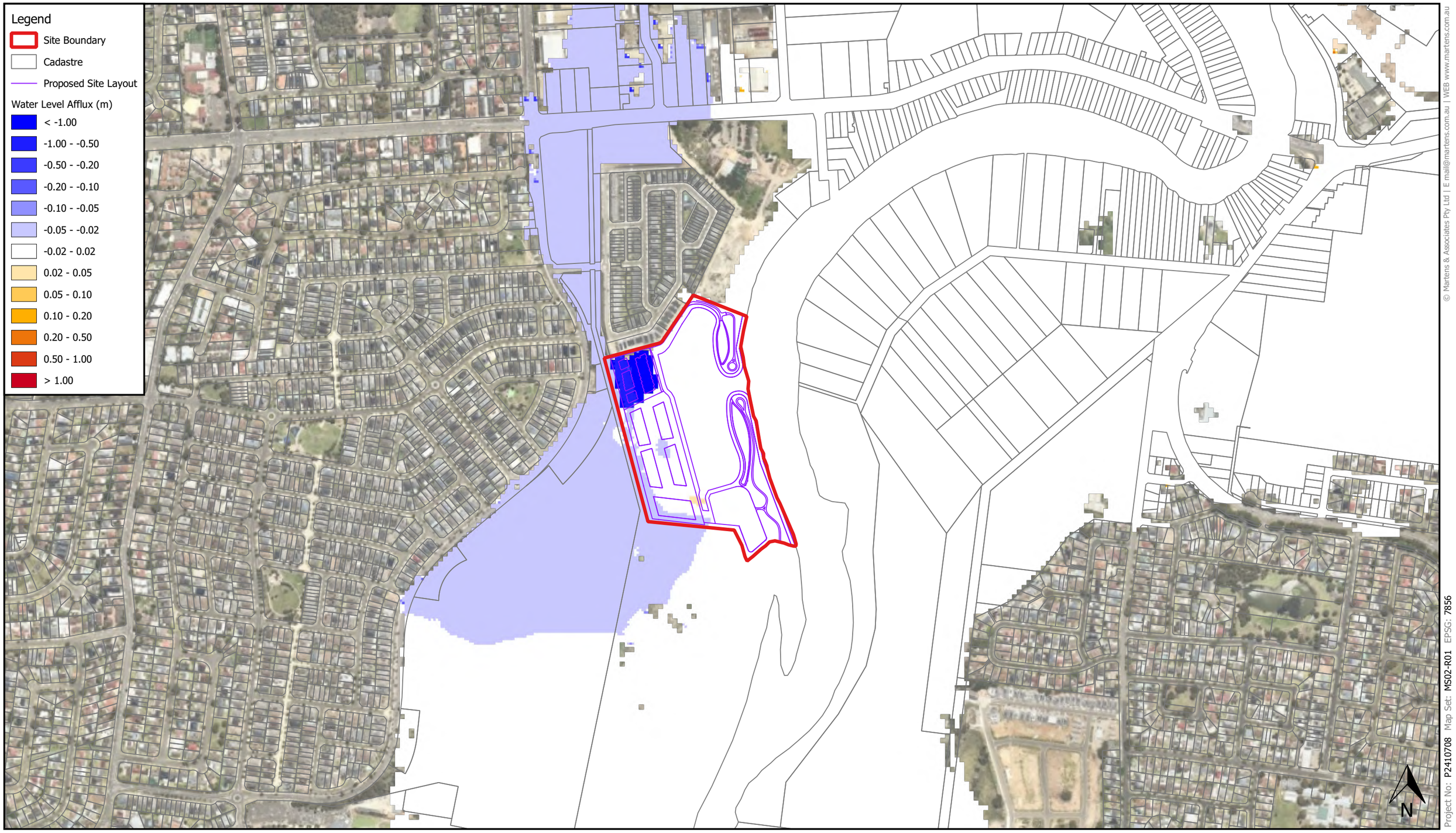
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water level decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water level increase.

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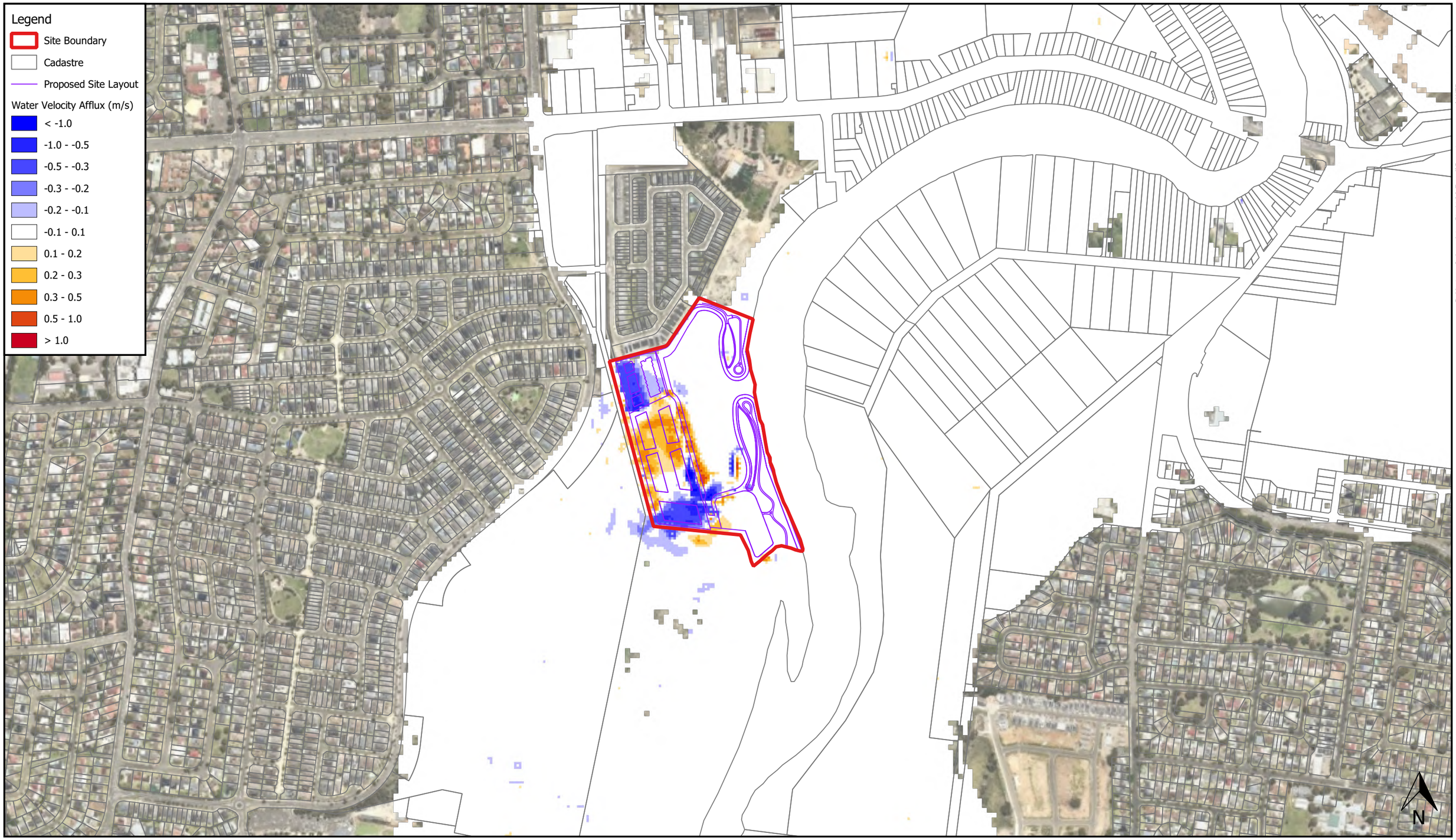
Map Title / Figure:

1% AEP Proposed Conditions Water Level Impacts

Map I13	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water velocity decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water velocity increase.

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Map Title / Figure:

1% AEP Proposed Conditions Water Velocity Impacts

Map I14	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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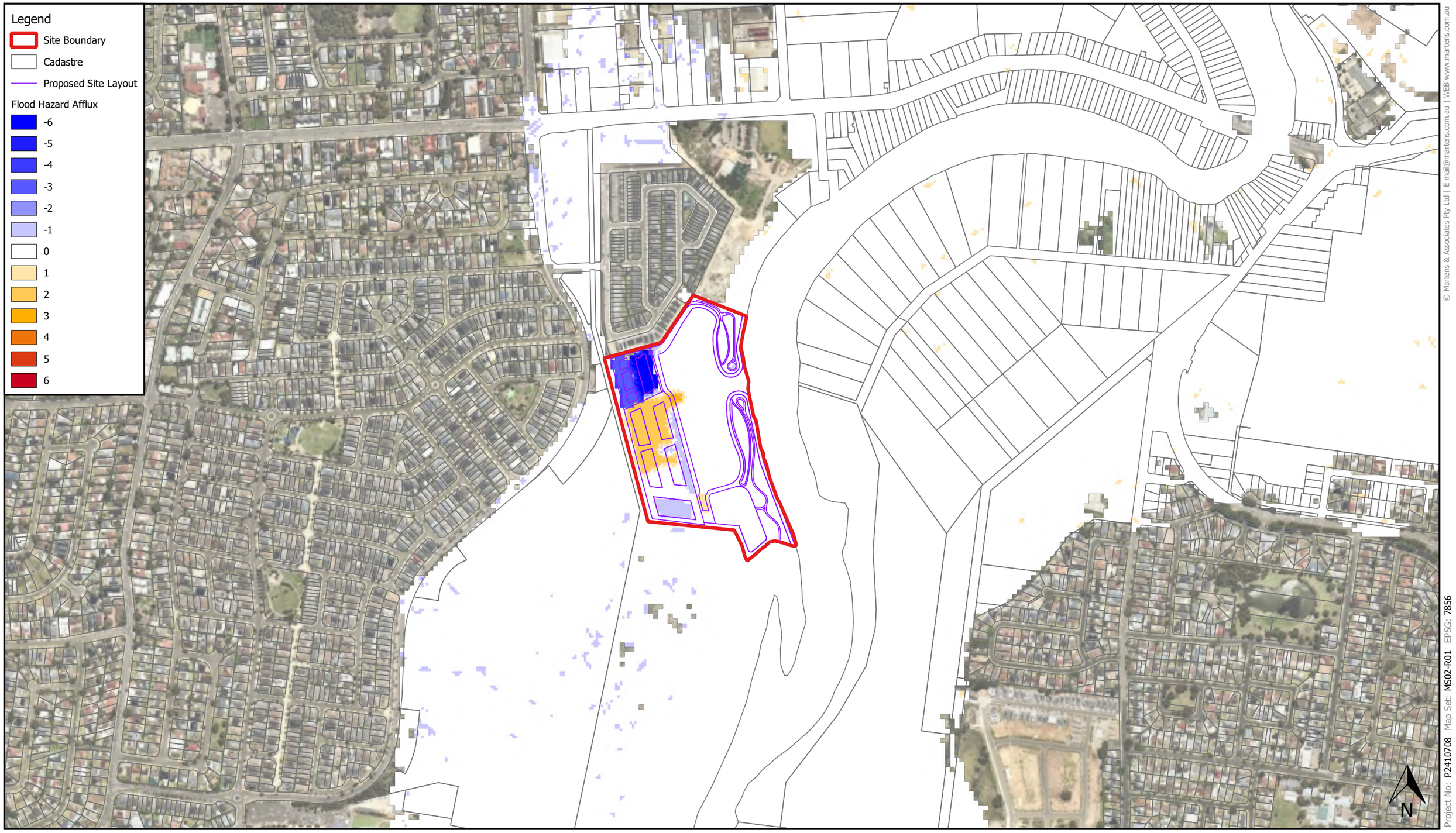
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Flood Hazard Afflux

- -6
- -5
- -4
- -3
- -2
- -1
- 0
- 1
- 2
- 3
- 4
- 5
- 6



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent a decrease in flood hazard category (e.g. was H2, now H1). Areas coloured white represent negligible change (e.g. remains H2). Areas coloured yellow / red represent an increase in flood hazard category (e.g. was H1, now H2).

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Map Title / Figure:

1% AEP Proposed Conditions Hazard Impacts

Map I15	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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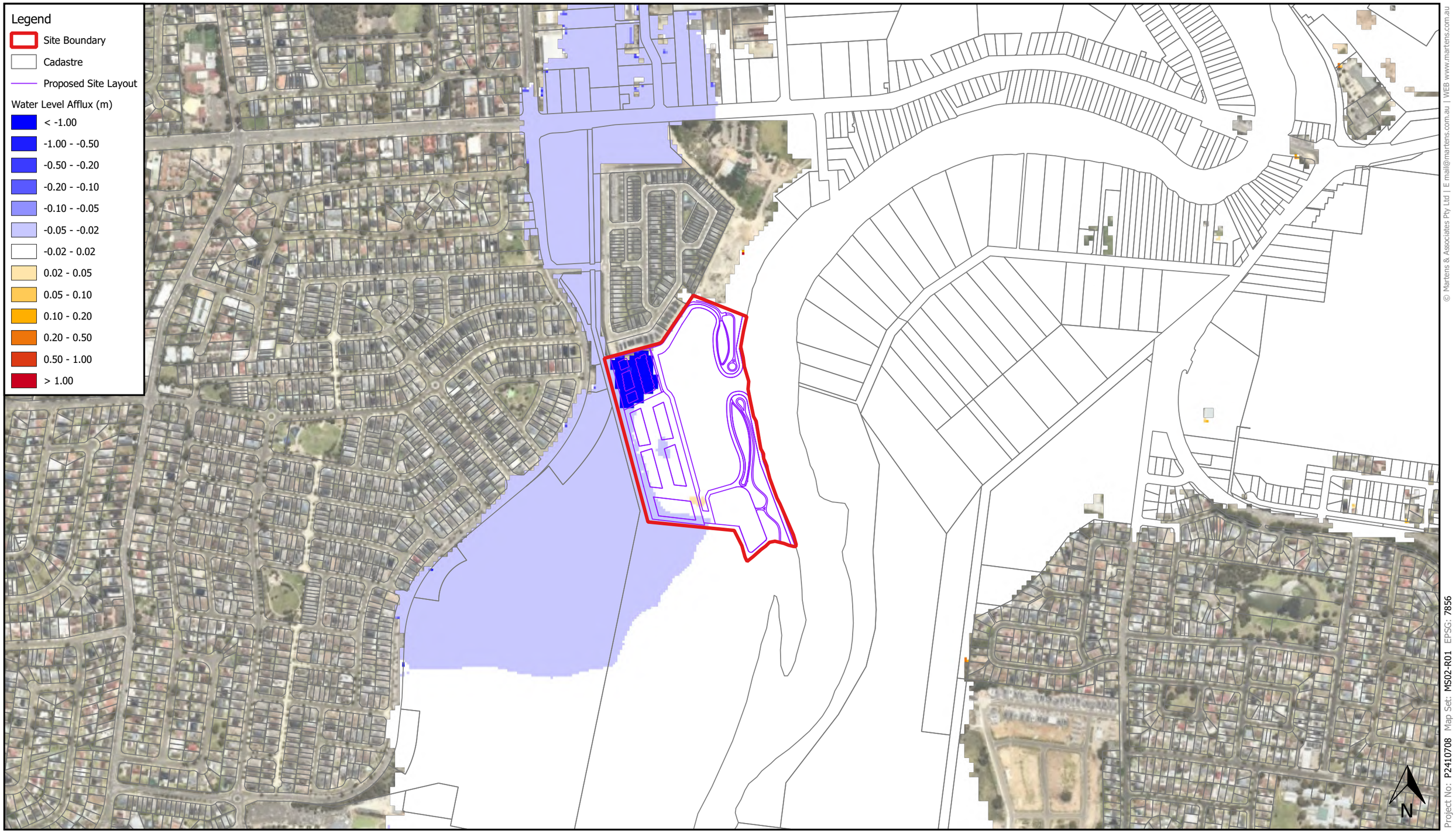
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water level decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water level increase.

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Map Title / Figure:

0.5% AEP Proposed Conditions Water Level Impacts

Map I16	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Water Velocity Afflux (m/s)

- < -1.0
- -1.0 - -0.5
- -0.5 - -0.3
- -0.3 - -0.2
- -0.2 - -0.1
- -0.1 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- > 1.0

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water velocity decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water velocity increase.

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Map Title / Figure:

0.5% AEP Proposed Conditions Water Velocity Impacts

Map I17	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Flood Hazard Afflux

- -6
- -5
- -4
- -3
- -2
- -1
- 0
- 1
- 2
- 3
- 4
- 5
- 6

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent a decrease in flood hazard category (e.g. was H2, now H1). Areas coloured white represent negligible change (e.g. remains H2). Areas coloured yellow / red represent an increase in flood hazard category (e.g. was H1, now H2).

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Map Title / Figure:

0.5% AEP Proposed Conditions Hazard Impacts

Map I18	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Water Level Afflux (m)

- < -1.00
- -1.00 - -0.50
- -0.50 - -0.20
- -0.20 - -0.10
- -0.10 - -0.05
- -0.05 - -0.02
- -0.02 - 0.02
- 0.02 - 0.05
- 0.05 - 0.10
- 0.10 - 0.20
- 0.20 - 0.50
- 0.50 - 1.00
- > 1.00

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water level decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water level increase.

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Map Title / Figure:

0.2% AEP Proposed Conditions Water Level Impacts

Map I19	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Water Velocity Afflux (m/s)

- < -1.0
- -1.0 - -0.5
- -0.5 - -0.3
- -0.3 - -0.2
- -0.2 - -0.1
- -0.1 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- > 1.0

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water velocity decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water velocity increase.

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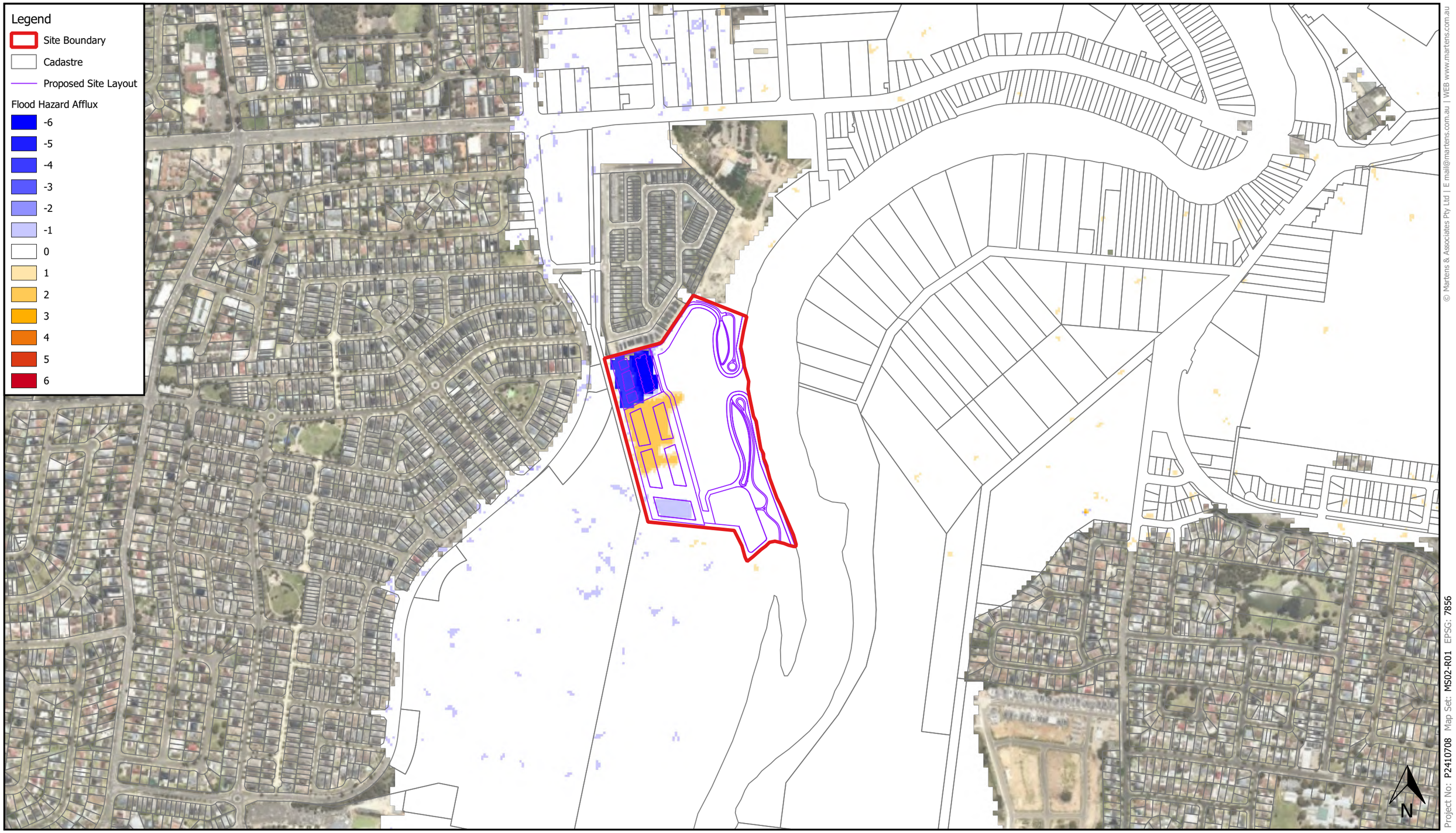
Map Title / Figure:

0.2% AEP Proposed Conditions Water Velocity Impacts

Map I20	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent a decrease in flood hazard category (e.g. was H2, now H1). Areas coloured white represent negligible change (e.g. remains H2). Areas coloured yellow / red represent an increase in flood hazard category (e.g. was H1, now H2).

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Map Title / Figure:

0.2% AEP Proposed Conditions Hazard Impacts

Map I21	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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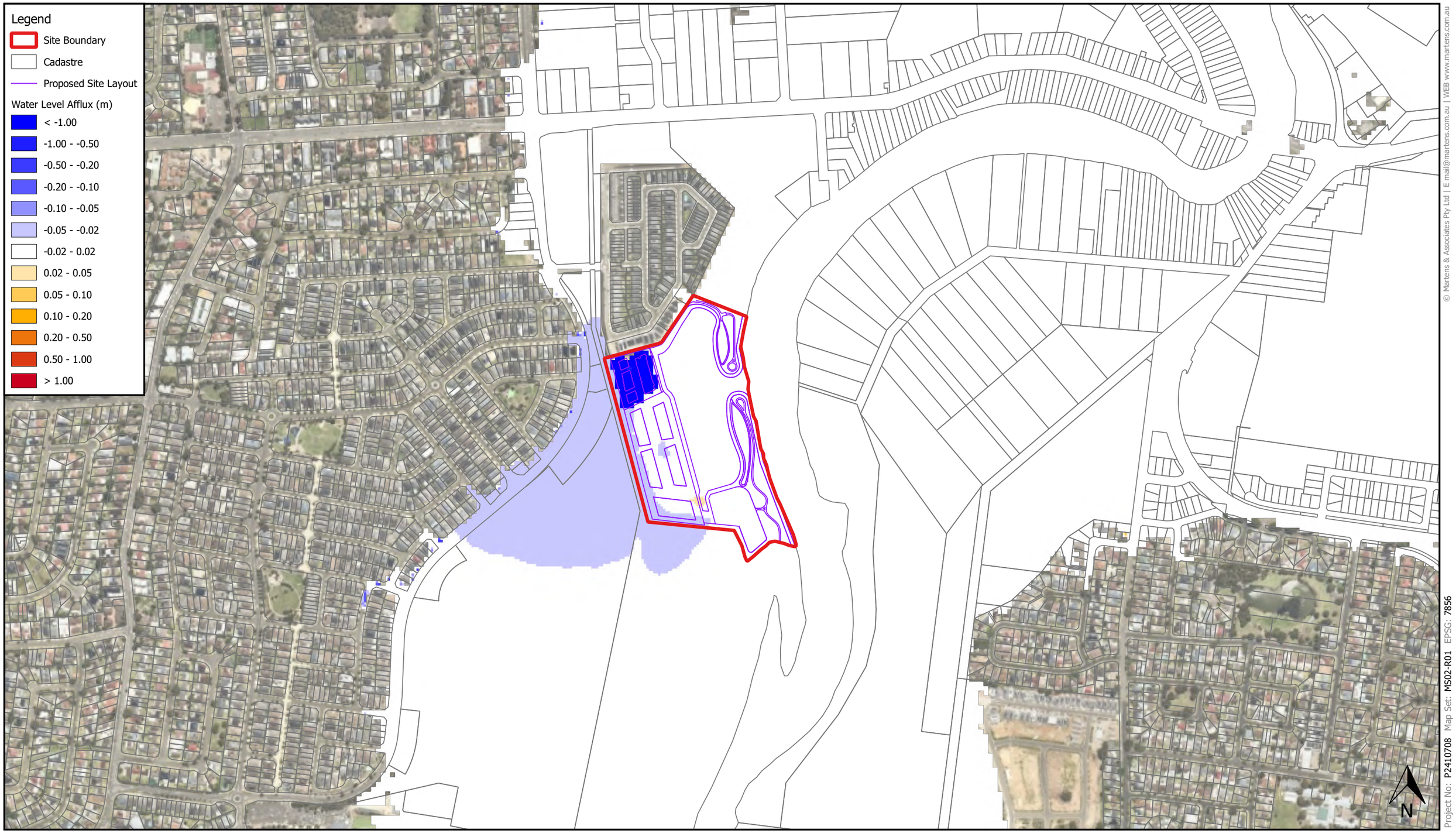
Project No: P2410708 Map Set: MS02-R01 EPSG: 7856



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water level decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water level increase.

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Map Title / Figure:

0.05% AEP Proposed Conditions Water Level Impacts

Map I22	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Water Velocity Afflux (m/s)

- < -1.0
- -1.0 - -0.5
- -0.5 - -0.3
- -0.3 - -0.2
- -0.2 - -0.1
- -0.1 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- > 1.0

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water velocity decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water velocity increase.

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Map Title / Figure:

0.05% AEP Proposed Conditions Water Velocity Impacts

Map I23	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Flood Hazard Afflux

- -6
- -5
- -4
- -3
- -2
- -1
- 0
- 1
- 2
- 3
- 4
- 5
- 6

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent a decrease in flood hazard category (e.g. was H2, now H1). Areas coloured white represent negligible change (e.g. remains H2). Areas coloured yellow / red represent an increase in flood hazard category (e.g. was H1, now H2).

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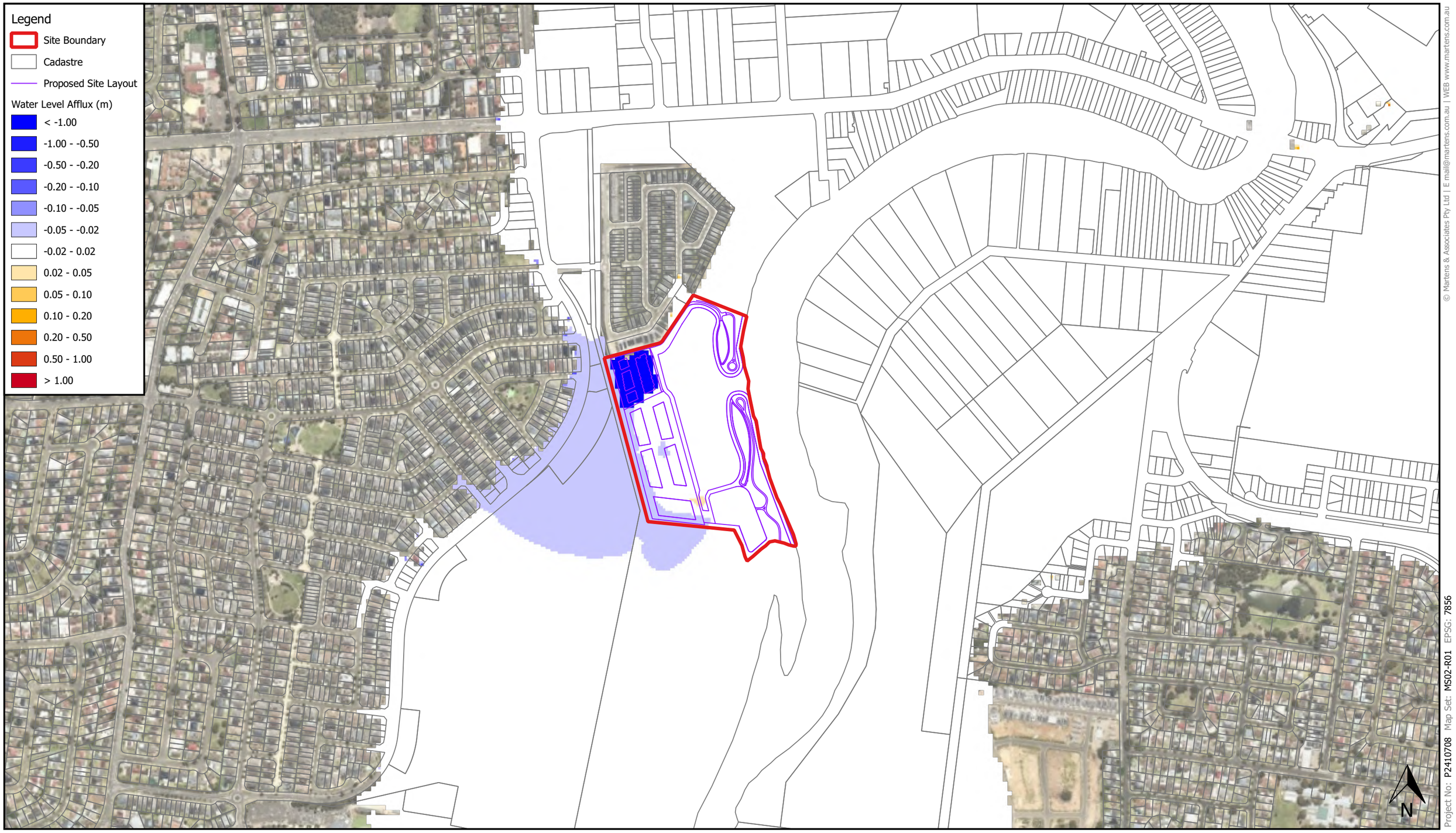
Map Title / Figure:

0.05% AEP Proposed Conditions Hazard Impacts

Map I24	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date



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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water level decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water level increase.

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Map Title / Figure:

0.02% AEP Proposed Conditions Water Level Impacts

Map I25	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Water Velocity Afflux (m/s)

- < -1.0
- -1.0 - -0.5
- -0.5 - -0.3
- -0.3 - -0.2
- -0.2 - -0.1
- -0.1 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- > 1.0

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water velocity decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water velocity increase.

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Map Title / Figure:

0.02% AEP Proposed Conditions Water Velocity Impacts

Map I26	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Flood Hazard Afflux

- -6
- -5
- -4
- -3
- -2
- -1
- 0
- 1
- 2
- 3
- 4
- 5
- 6

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent a decrease in flood hazard category (e.g. was H2, now H1). Areas coloured white represent negligible change (e.g. remains H2). Areas coloured yellow / red represent an increase in flood hazard category (e.g. was H1, now H2).

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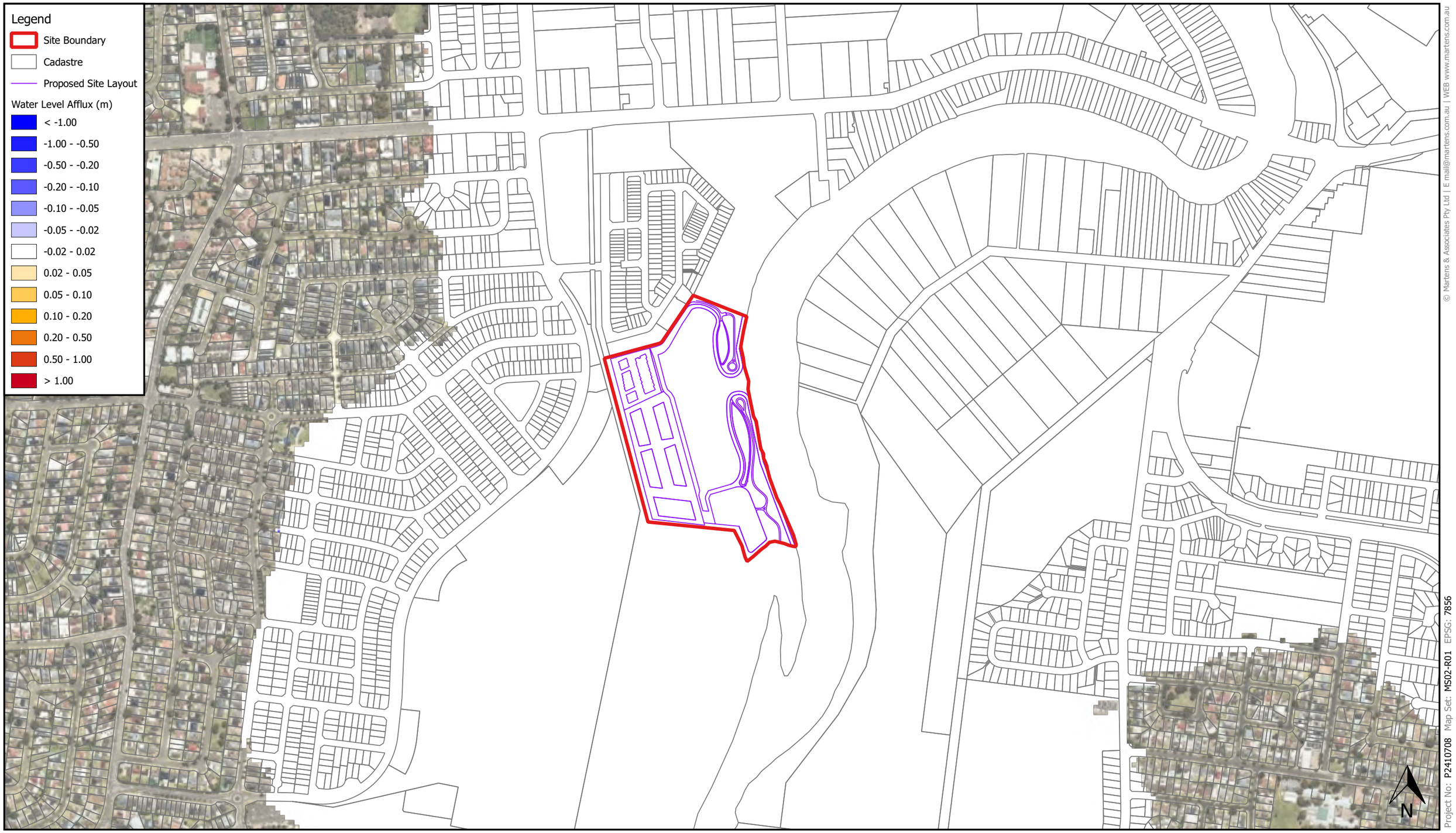
Map Title / Figure:

0.02% AEP Proposed Conditions Hazard Impacts

Map I27	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date



0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water level decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water level increase.

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

Map Title / Figure:

PMF (EFE) Proposed Conditions Water Level Impacts

Map I28	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Water Velocity Afflux (m/s)

- < -1.0
- -1.0 - -0.5
- -0.5 - -0.3
- -0.3 - -0.2
- -0.2 - -0.1
- -0.1 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- > 1.0

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent water velocity decrease. Areas coloured white represent negligible change. Areas coloured yellow / red represent water velocity increase.

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Map Title / Figure:

PMF (EFE) Proposed Conditions Water Velocity Impacts

Map I29	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Site Boundary
- Cadastre
- Proposed Site Layout

Flood Hazard Afflux

- -6
- -5
- -4
- -3
- -2
- -1
- 0
- 1
- 2
- 3
- 4
- 5
- 6

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Project No: P2410708 Map Set: MS02-R01 EPSG: 7856

N

0 90 180 270 360 450 m

1:7500 @ A3

Viewport A

Notes:
- Aerial from Nearmap (2025).
- Cadastre and Site Boundary from NSW Spatial Services Clip and Ship (2025).
- Areas coloured blue represent a decrease in flood hazard category (e.g. was H2, now H1). Areas coloured white represent negligible change (e.g. remains H2). Areas coloured yellow / red represent an increase in flood hazard category (e.g. was H1, now H2).

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Map Title / Figure:

PMF (EFE) Proposed Conditions Hazard Impacts

Map I30	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
Flood Risk Review	Sub-Project
Mirvac	Client
28/03/2025	Date

Appendix D

Evacuation Modelling Maps

Legend

- Subsectors
- Subsector R7
- Site Boundary

Vehicle Status

- Parked
- Driving

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Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

N

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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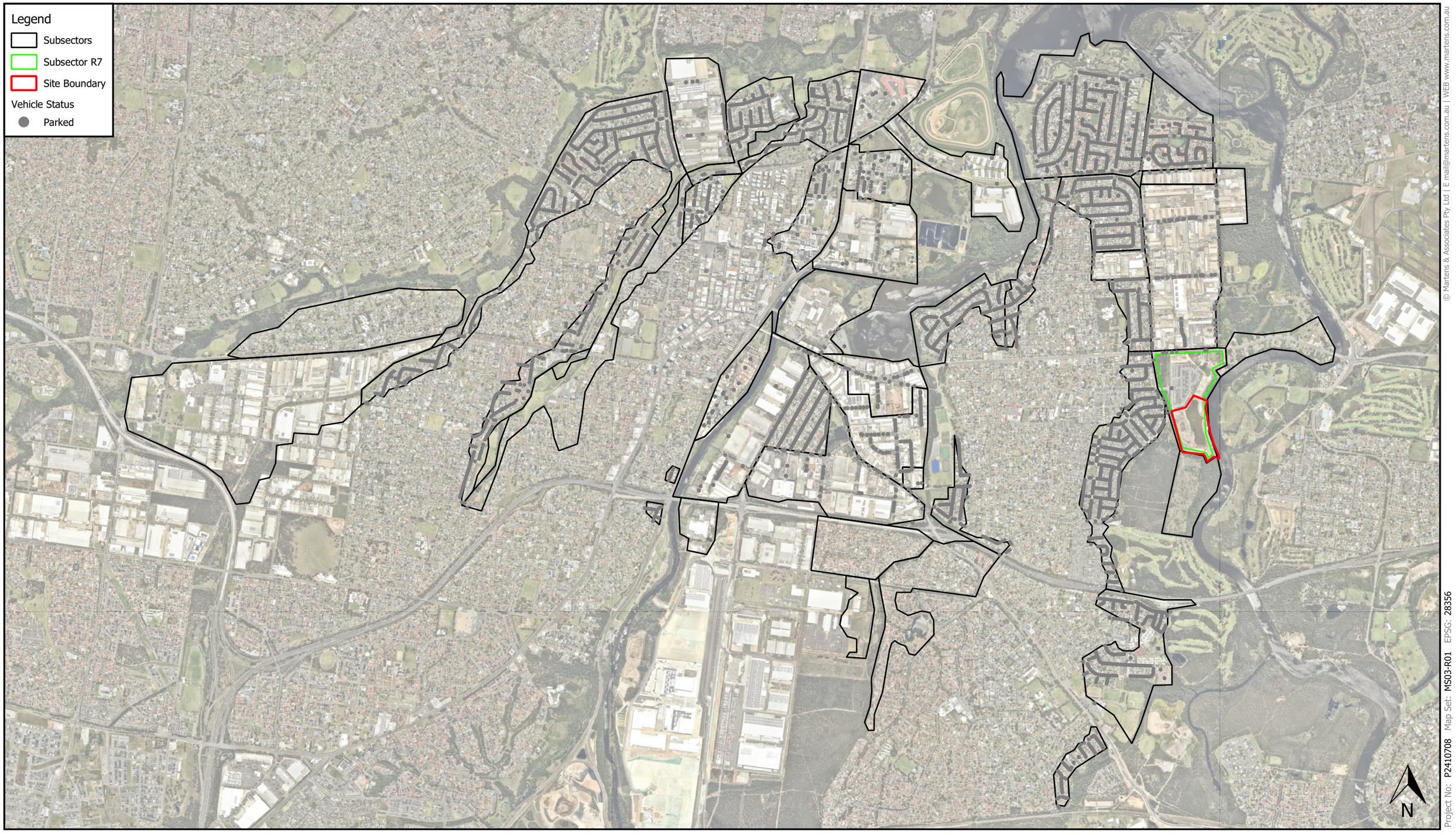
Map Title / Figure:

LSM Approved Condition Timeseries Result at t = -5:25

Map L01	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date



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Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

LSM Approved Condition Timeseries Result at t = -3:30

Map L02	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Subsectors
- Subsector R7
- Site Boundary

Vehicle Status

- Parked
- Driving

N

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

LSM Approved Condition
Timeseries Result at t = -2:55

Map L03	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

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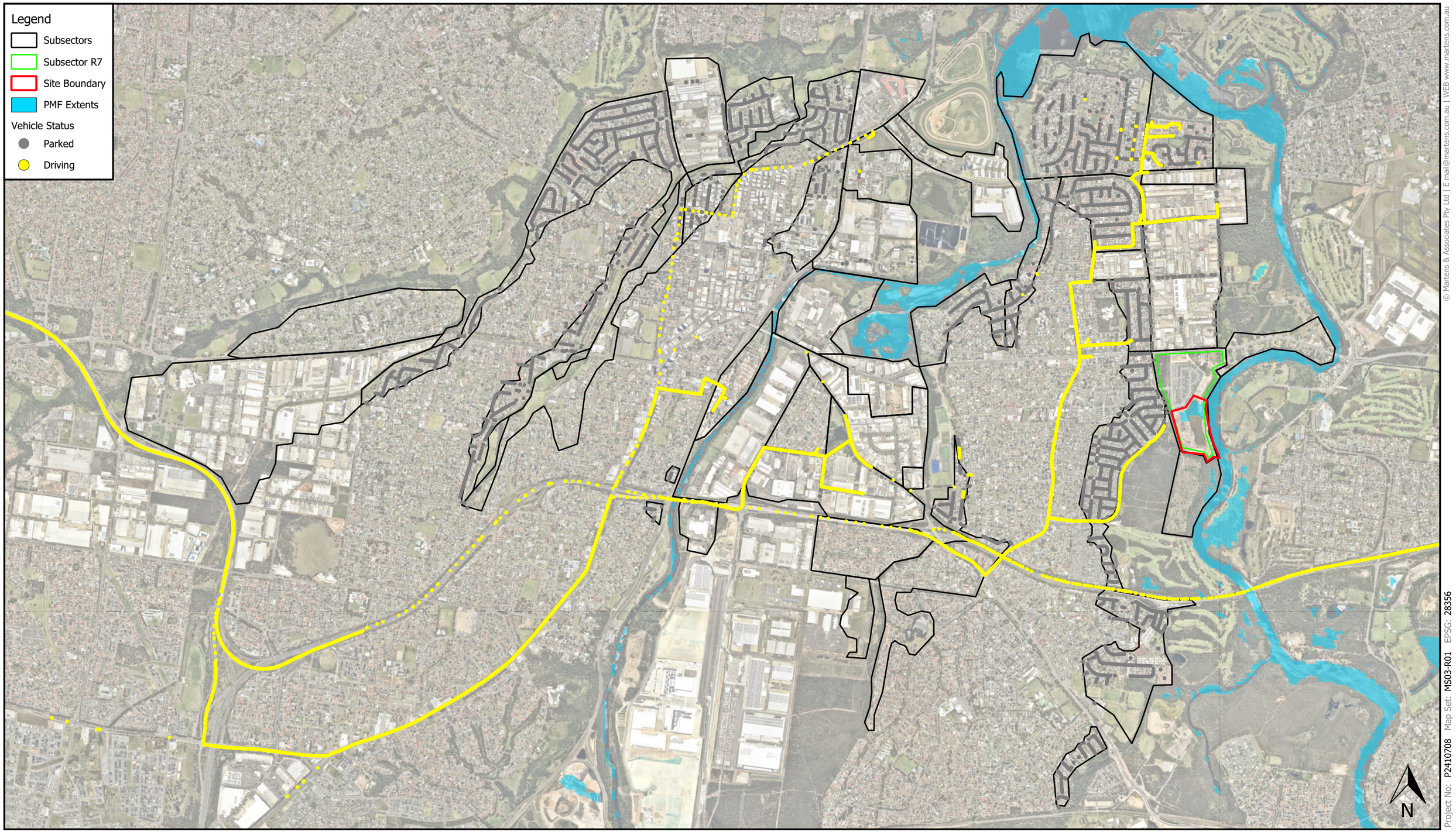

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Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

LSM Approved Condition Timeseries Result at t = 0:00

Map L04	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Subsectors
- Subsector R7
- Site Boundary
- PMF Extents

Vehicle Status

- Parked
- Driving

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

LSM Approved Condition Timeseries Result at t = 5:00

Map L05	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

N

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Legend

- Subsectors
- Subsector R7
- Site Boundary
- PMF Extents

Vehicle Status

- Parked
- Driving
- Caught

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Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

N

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

LSM Approved Condition Timeseries Result at t = 8:35

Map L06	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Subsectors
- Subsector R7
- Site Boundary
- PMF Extents

Vehicle Status

- Parked
- Caught

N

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

LSM Approved Condition Timeseries Result at t = 28:30

Map L07	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

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Legend

- Subsectors
- Subsector R7
- Site Boundary

Vehicle Status

- Parked
- Driving

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Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

N

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

LSM Proposed Condition Timeseries Result at t = -5:25

Map L08	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Subsectors
- Subsector R7
- Site Boundary

Vehicle Status

- Parked
- Driving

N

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

LSM Proposed Condition
Timeseries Result at t = -3:30

Map L09	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

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Legend

- Subsectors
- Subsector R7
- Site Boundary

Vehicle Status

- Parked
- Driving

N

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

LSM Proposed Condition
Timeseries Result at t = -2:55

Map L10	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

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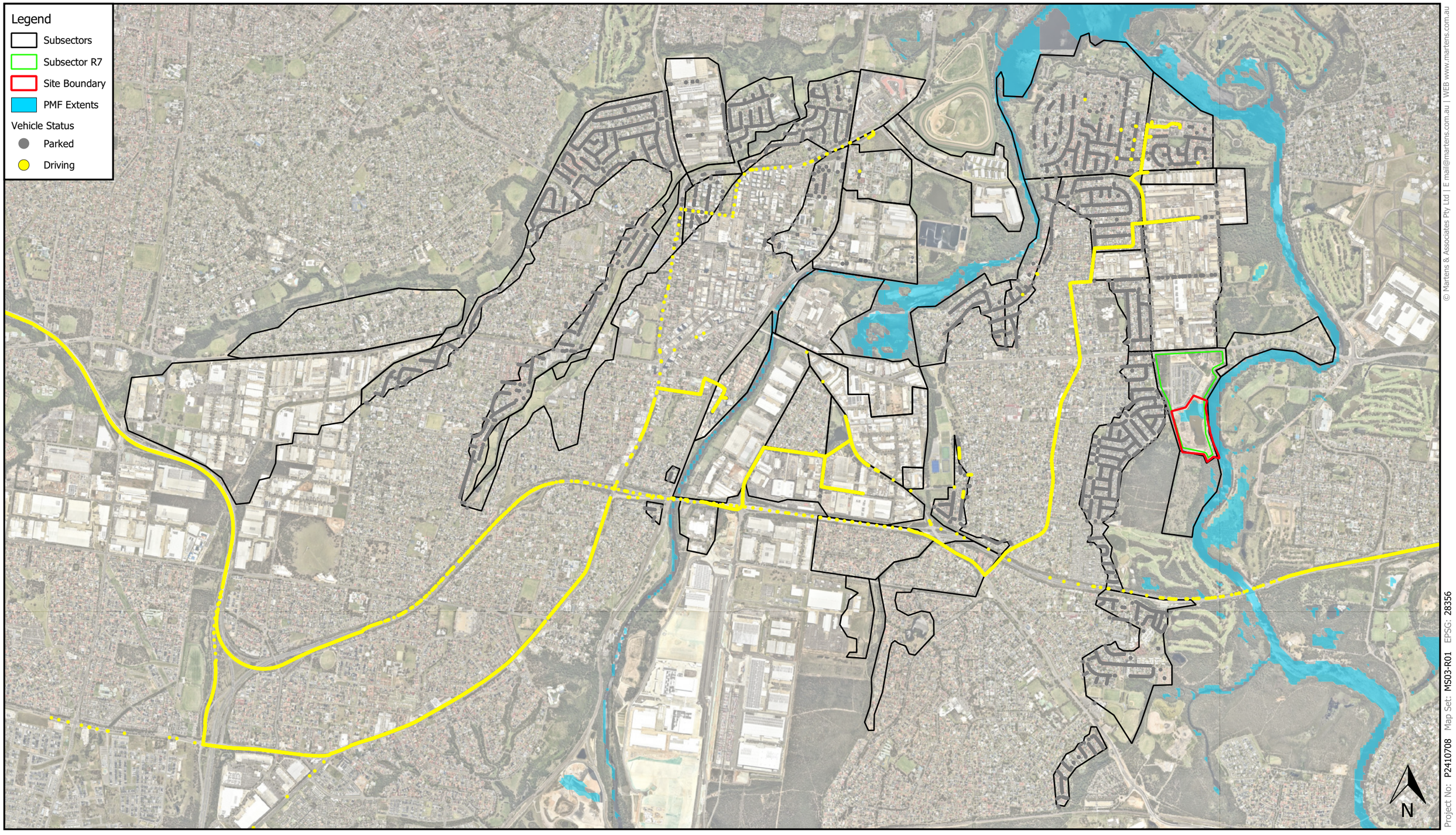
Project No: P2410708 Map Set: MS03-R01 EPSG: 28356



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Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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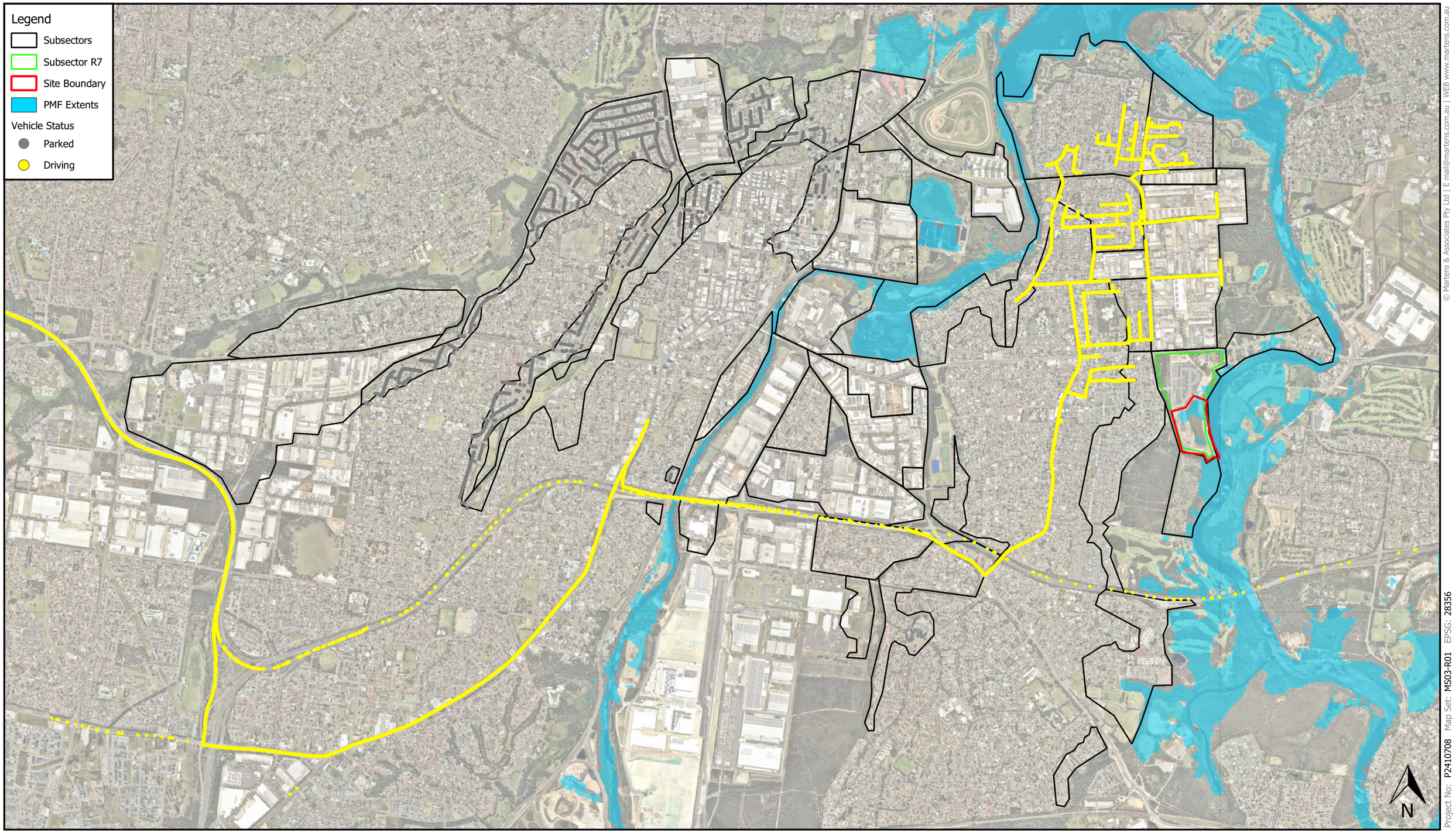
Map Title / Figure:

LSM Proposed Condition Timeseries Result at t = 0:00

Map L11	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date



0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

LSM Proposed Condition Timeseries Result at t = 5:00

Map L12	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

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Legend

- Subsectors
- Subsector R7
- Site Boundary
- PMF Extents

Vehicle Status

- Parked
- Driving
- Caught

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Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

N

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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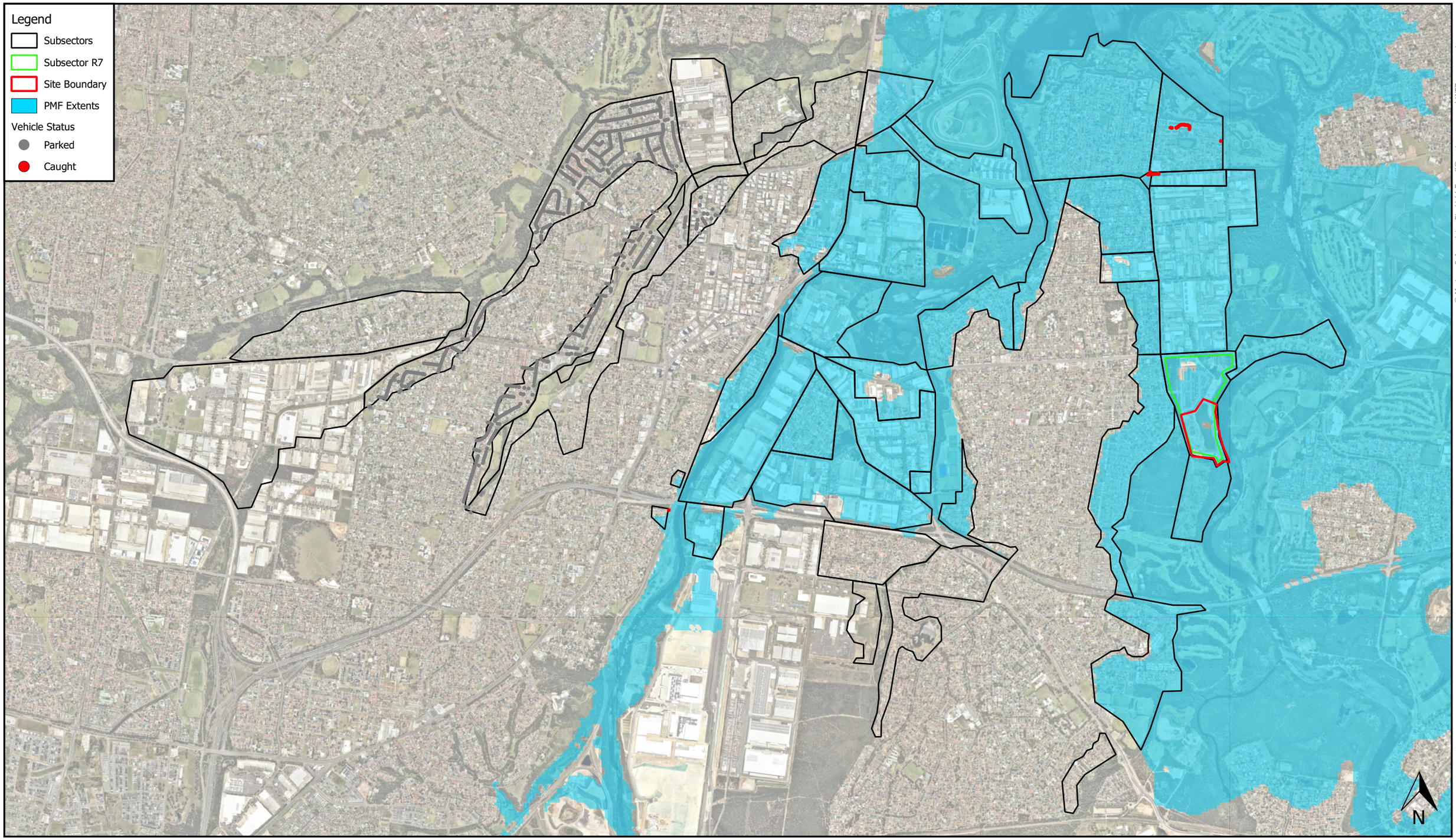
Map Title / Figure:

LSM Proposed Condition Timeseries Result at t = 8:35

Map L13	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date



0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

LSM Proposed Condition Timeseries Result at t = 28:30

Map L14	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

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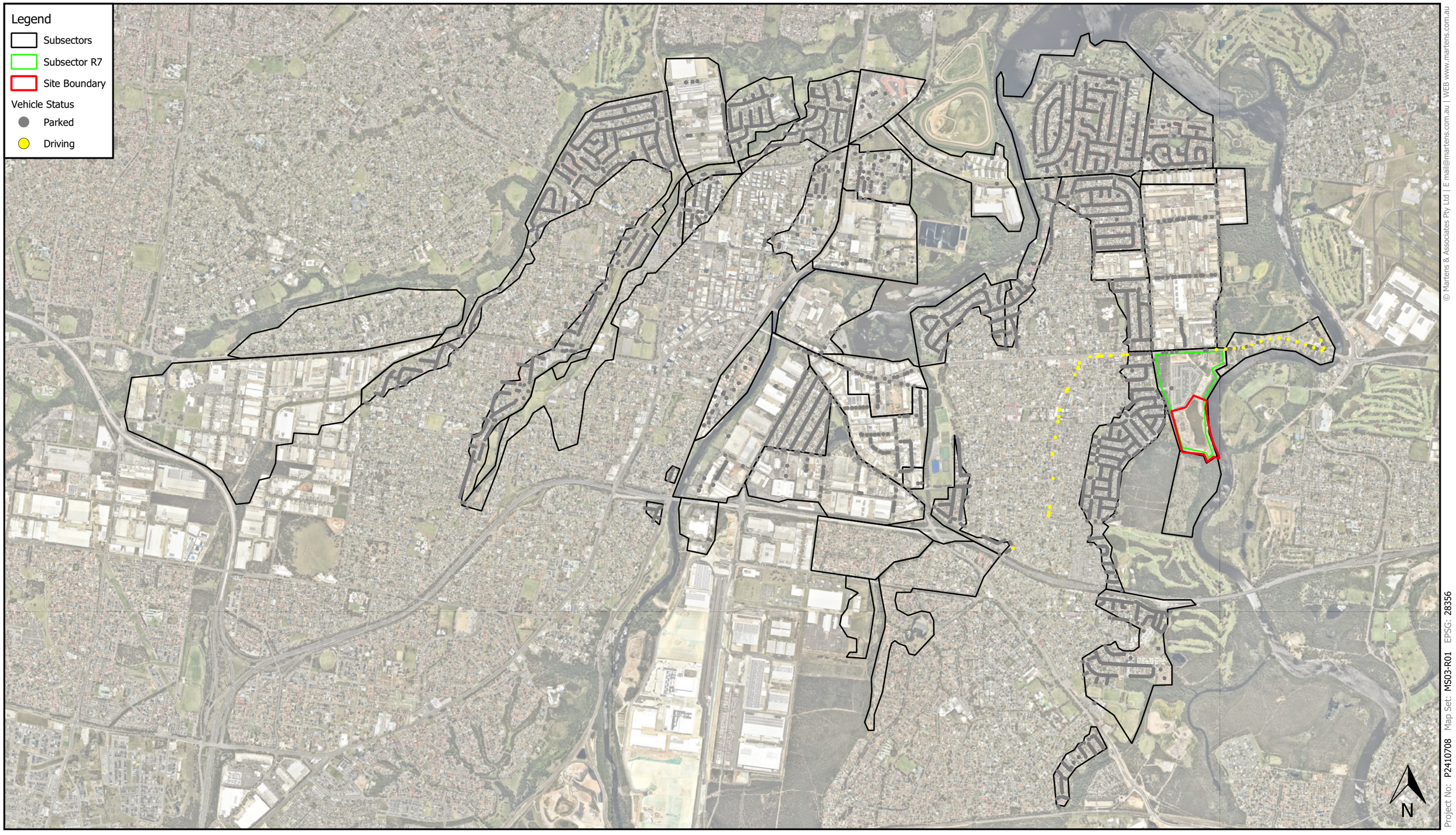
Project No: P2410708 Map Set: MS03-R01 EPSG: 28356



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Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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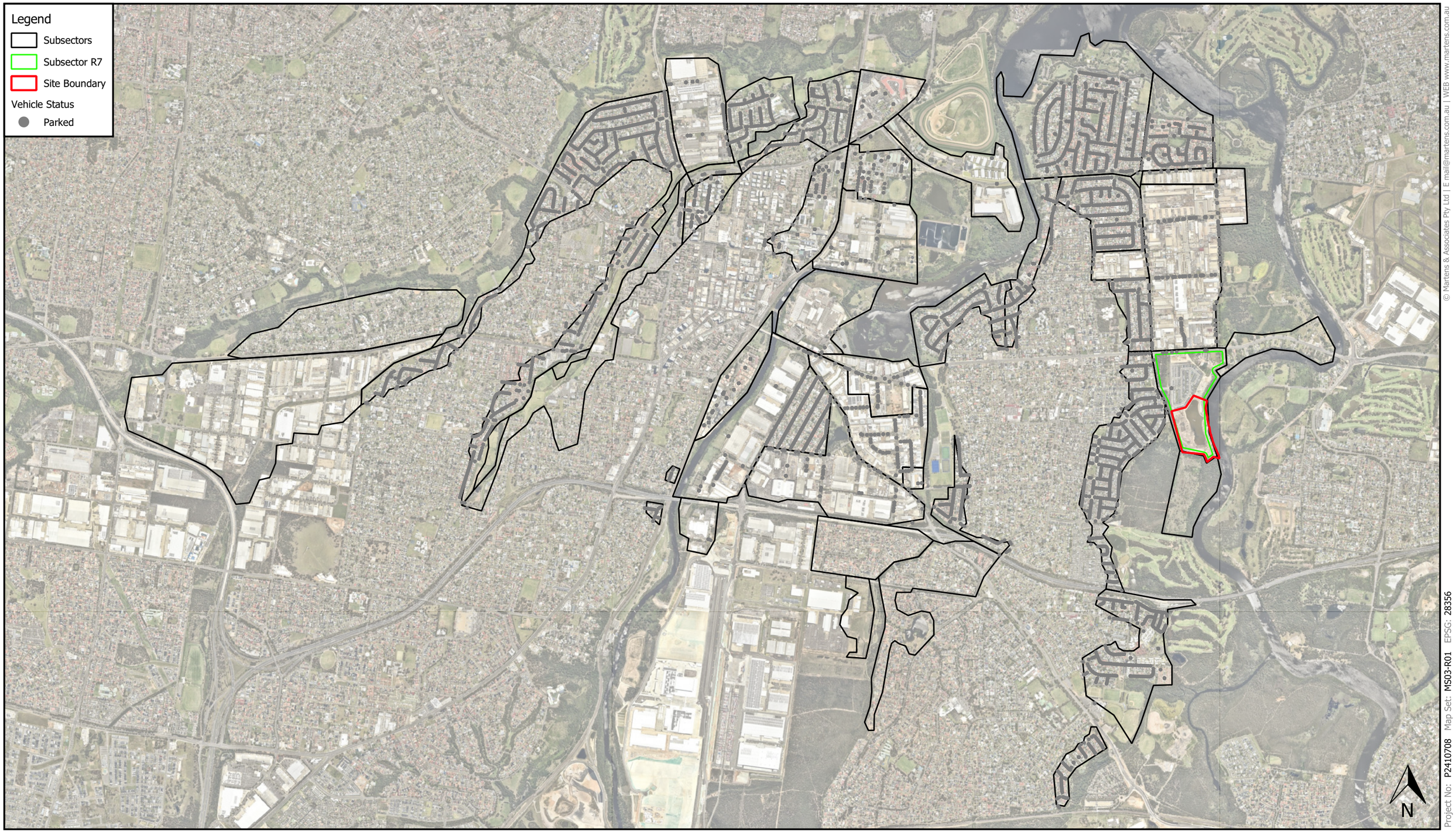
Map Title / Figure:

LSM Approved Condition with M5 Upgrade Timeseries Result at t = -5:25

Map L15	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date



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Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

LSM Approved Condition with M5 Upgrade Timeseries Result at t = -3:30

Map L16	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Subsectors
- Subsector R7
- Site Boundary

Vehicle Status

- Parked
- Driving

N

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

LSM Approved Condition with M5 Upgrade Timeseries Result at t = -2:55

Map L17	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

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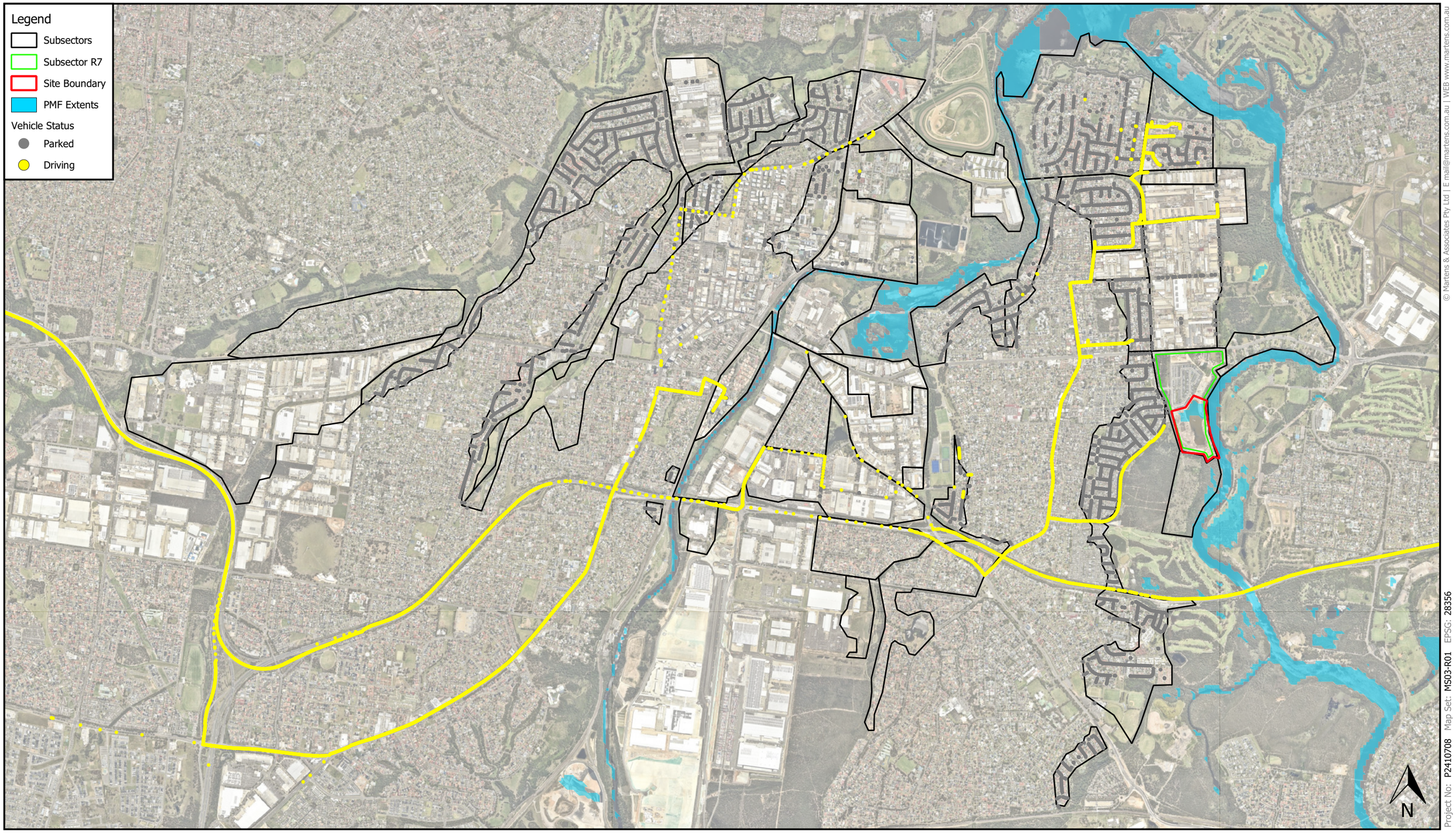

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Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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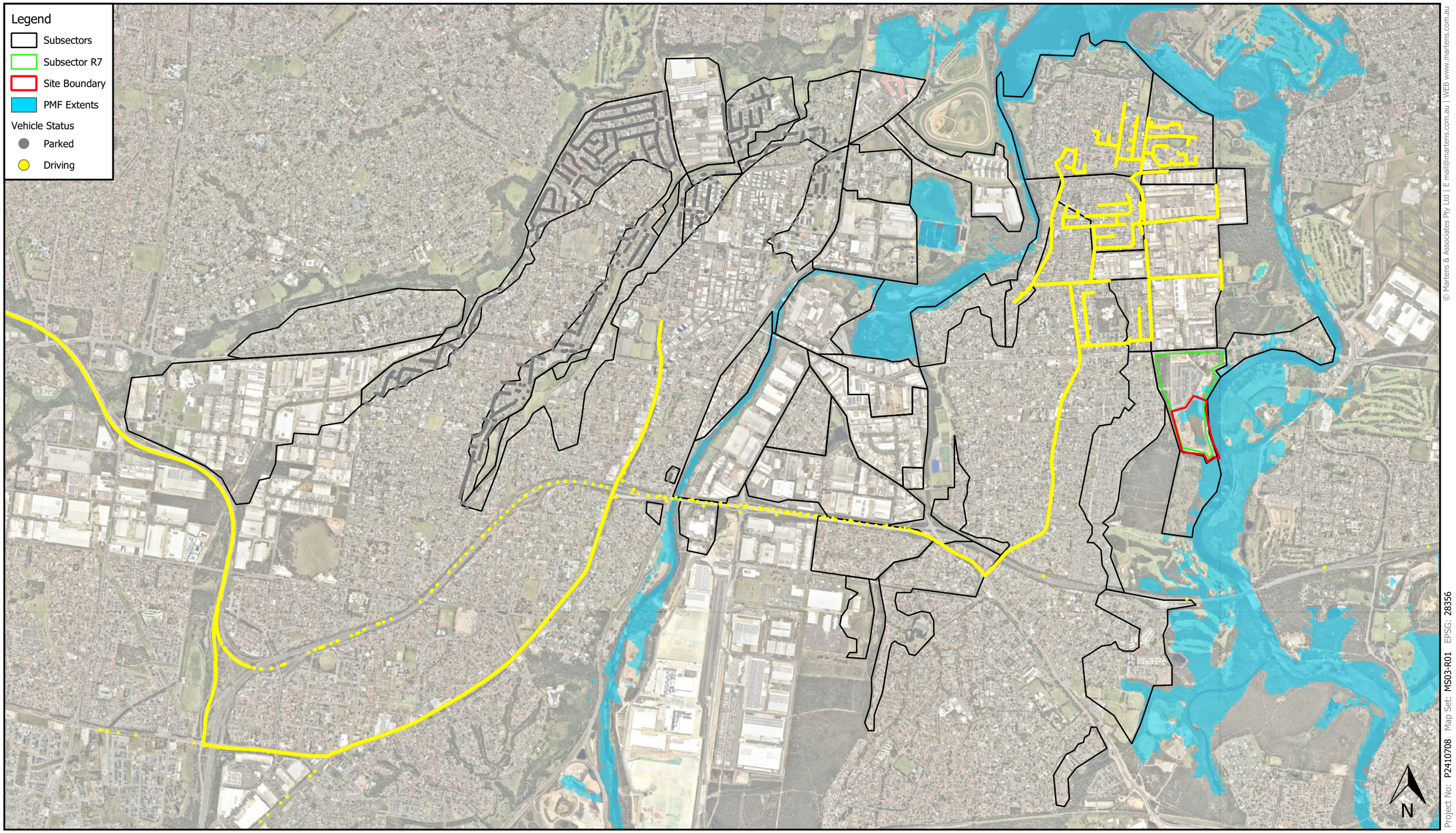
Map Title / Figure:

LSM Approved Condition with M5 Upgrade Timeseries Result at t = 0:00

Map L18	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date



0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

LSM Approved Condition with M5 Upgrade Timeseries Result at t = 5:00

Map L19	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

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Legend

- Subsectors
- Subsector R7
- Site Boundary
- PMF Extents

Vehicle Status

- Parked
- Driving
- Caught

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Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

N

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

LSM Approved Condition with M5 Upgrade Timeseries Result at t = 8:35

Map L20	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Subsectors
- Subsector R7
- Site Boundary
- PMF Extents

Vehicle Status

- Parked
- Caught

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

Map Title / Figure:

LSM Approved Condition with M5 Upgrade Timeseries Result at t = 28:30

Map L21	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Subsectors
- Subsector R7
- Site Boundary

Vehicle Status

- Parked
- Driving

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Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

N

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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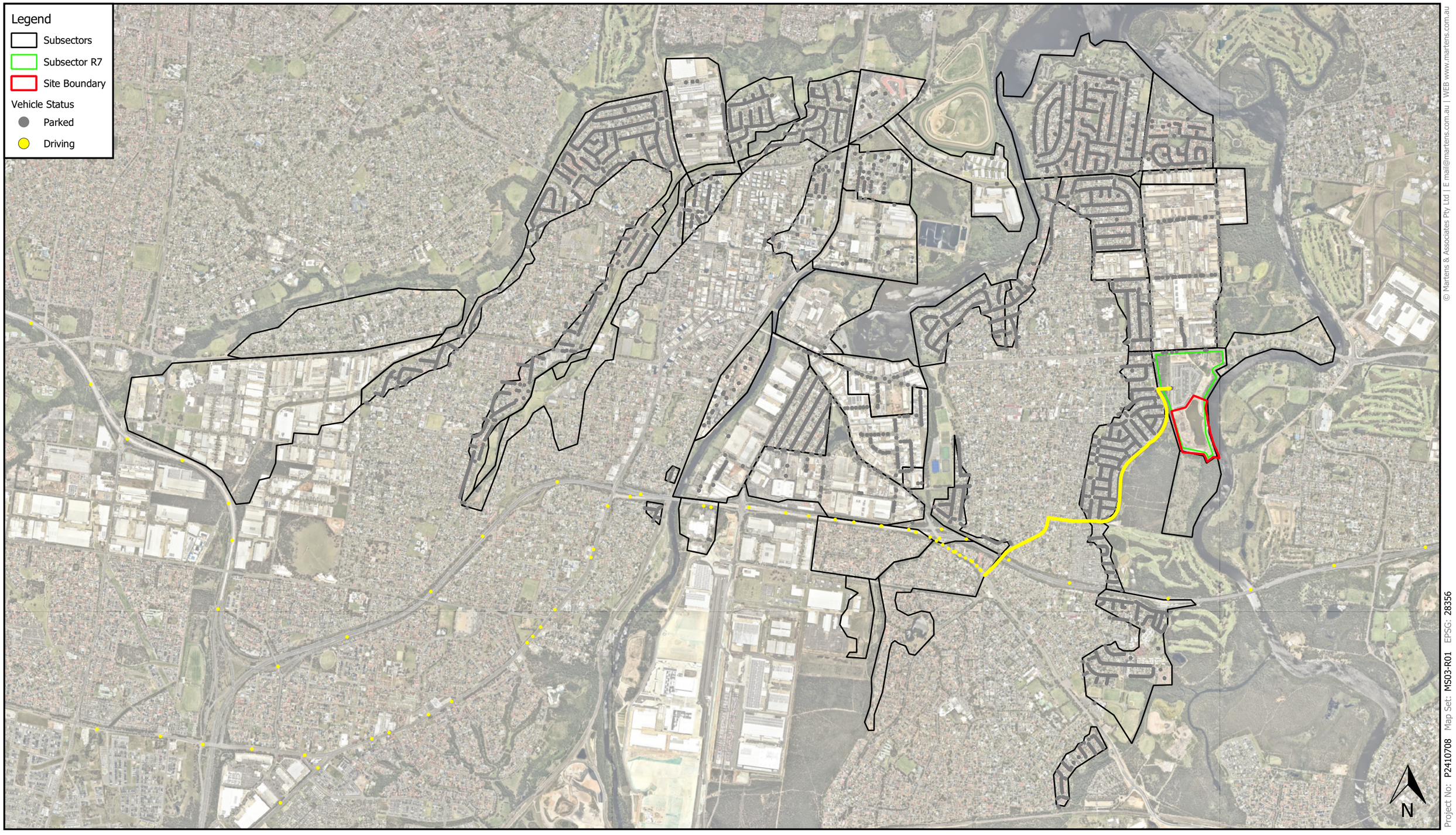
Map Title / Figure:

LSM Proposed Condition with M5 Upgrade Timeseries Result at t = -5:25

Map L22	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date



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Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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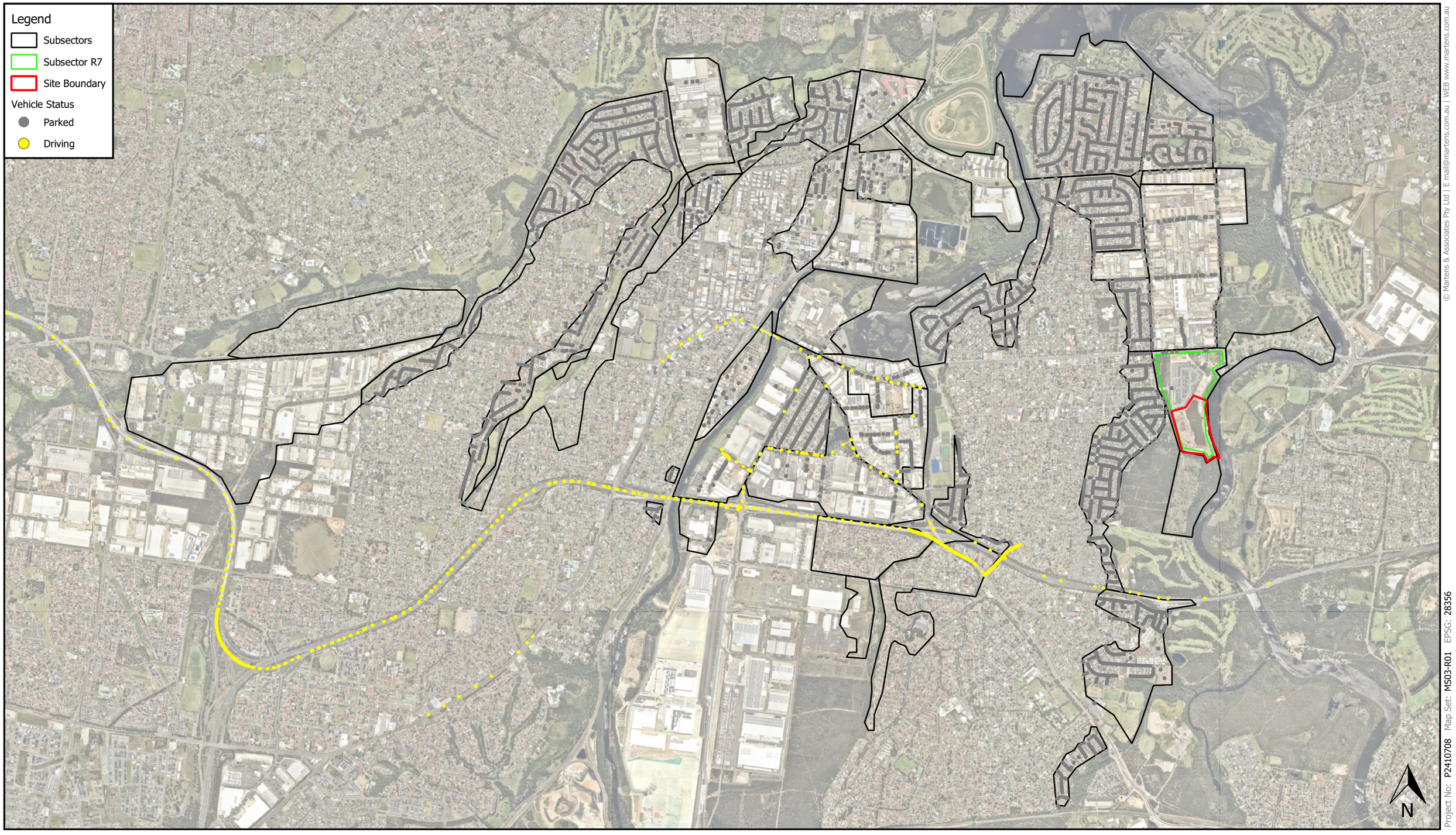
Map Title / Figure:

LSM Proposed Condition with M5 Upgrade Timeseries Result at t = -3:30

Map L23	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date



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Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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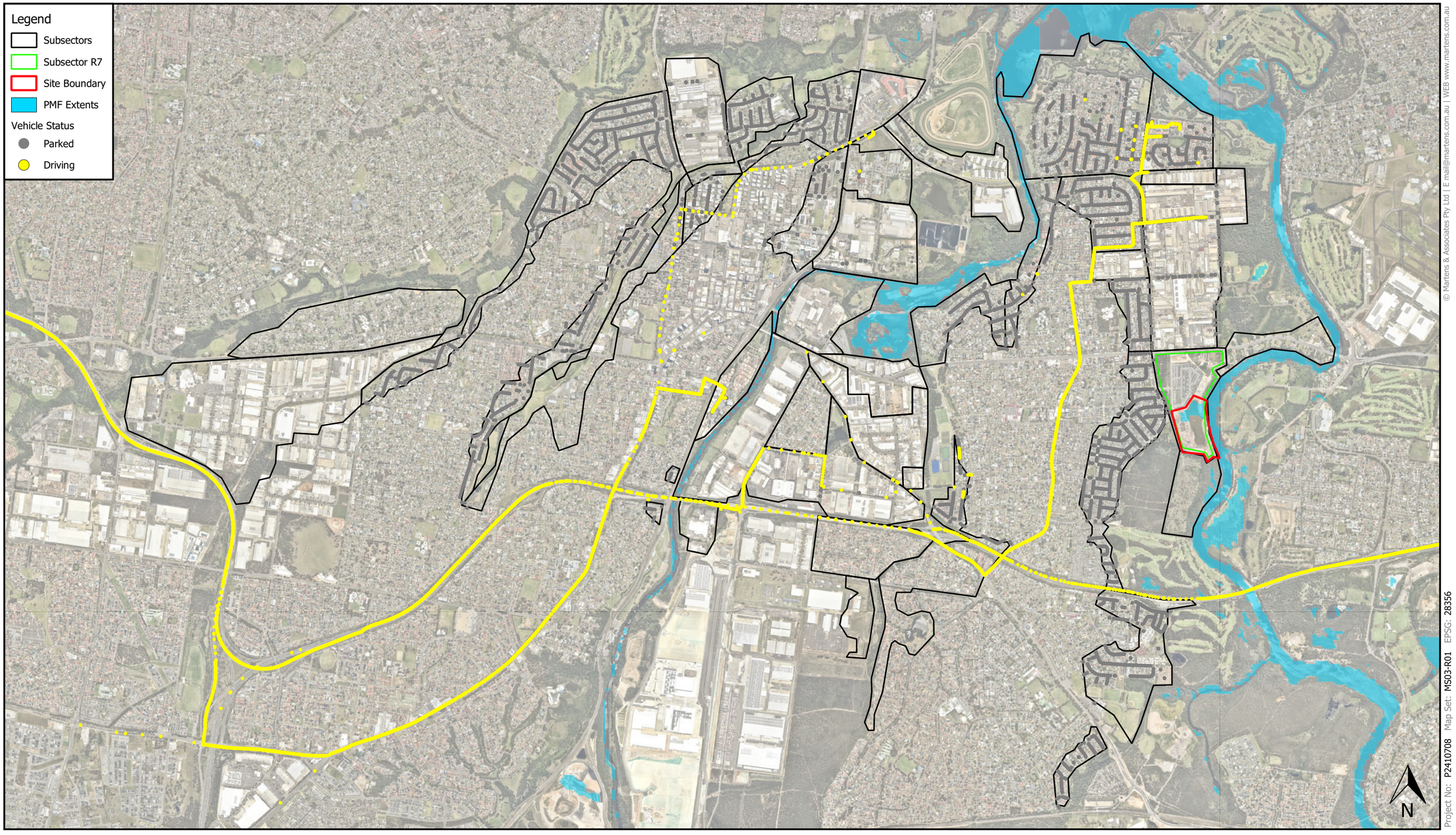
Map Title / Figure:

LSM Proposed Condition with M5 Upgrade Timeseries Result at t = -2:55

Map L24	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date



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Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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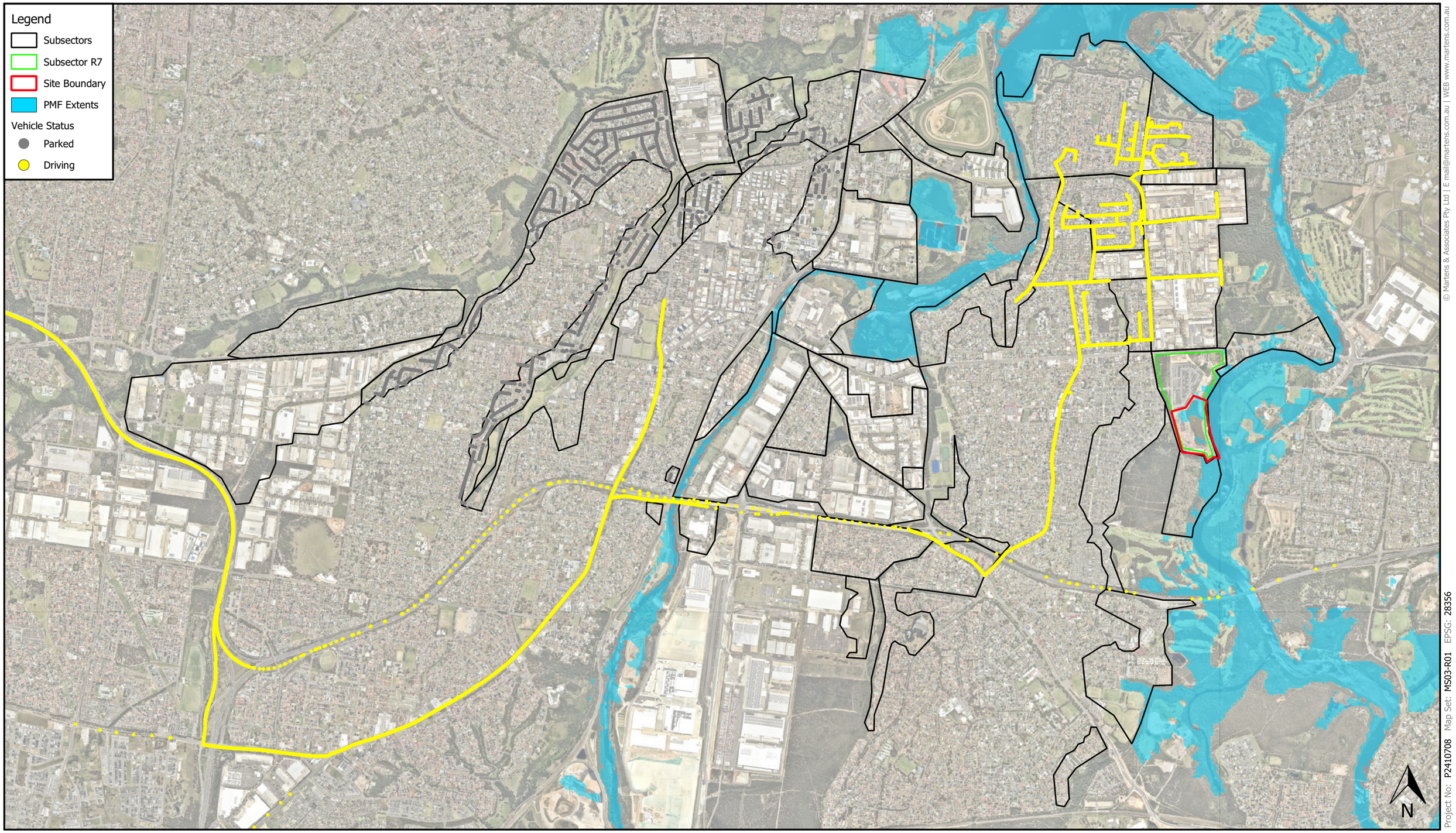
Map Title / Figure:

LSM Proposed Condition with M5 Upgrade Timeseries Result at t = 0:00

Map L25	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date



0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

LSM Proposed Condition with M5 Upgrade Timeseries Result at t = 5:00

Map L26	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

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Legend

- Subsectors
- Subsector R7
- Site Boundary
- PMF Extents

Vehicle Status

- Parked
- Driving
- Caught

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Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

N

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Map Title / Figure:

LSM Proposed Condition with M5 Upgrade Timeseries Result at t = 8:35

Map L27	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

Legend

- Subsectors
- Subsector R7
- Site Boundary
- PMF Extents

Vehicle Status

- Parked
- Caught

0 300 600 900 1,200 1,500 m

1:30000 @ A3

Viewport

Notes:
- Aerial from Nearmap (2025).
- Site Boundary from NSW Spatial Services Clip and Ship (2025).

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Project No: P2410708 Map Set: MS03-R01 EPSG: 28356

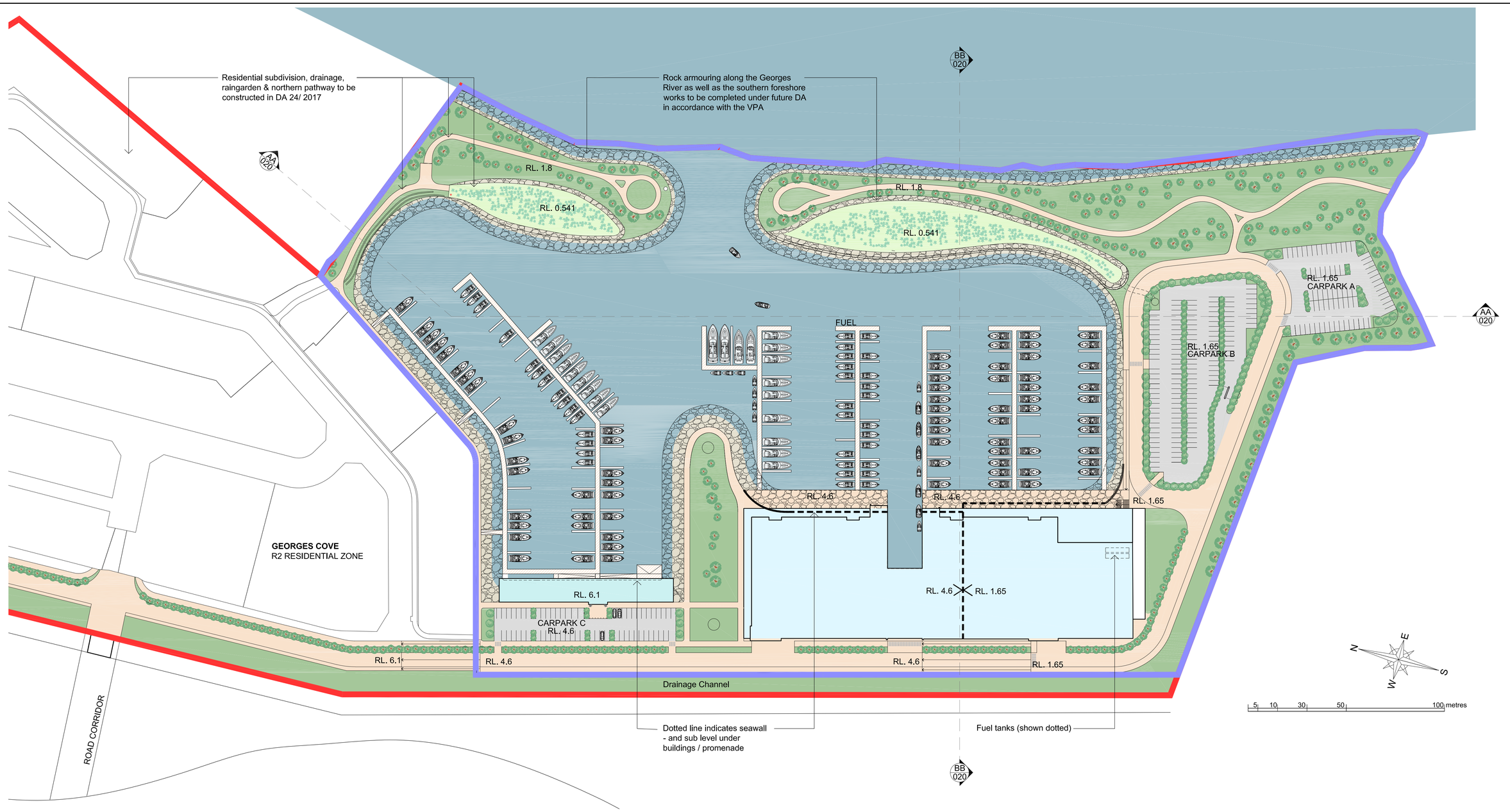
Map Title / Figure:

LSM Proposed Condition with M5 Upgrade Timeseries Result at t = 28:30

Map L28	Map
146 Newbridge Road, Moorebank, NSW	Site
Planning Proposal - Georges Cove Marina	Project
LSM Evacuation Modelling	Sub-Project
Mirvac	Client
28/03/2025	Date

Appendix E

Approved Marina Architectural Plans



01 Site - Plan
1: 1000

Legend

- Water
- Seawall
- Wetlands
- Landscape
- Circulation
- Carparking
- Private Marina Clubhouse
- Maritime Building
- Lot 70 Boundary
- Marina Proposal Boundary

MFA
MICHEAL FOUNTAIN ARCHITECTS PTY. LTD.
2/ 5 NARABANG WAY BELROSE NSW 2085
TEL (02) 9450 2070 FAX (02) 94502757

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ISSUE	REV	AMENDMENTS	DATE
A		Issue for Development Application	16.11.10
B		Amendments following Liverpool Council design review panel meeting	29.06.12
C		Issue for Development Application	26.10.12
D		Re-issue for Development Application	26.03.15
E		Re-issue for Development Application	01.04.15
	1	Bridge deleted	
F		Re-Issue for Development Application	06.05.19
G		Issued to Client	27.09.19

ISSUE	REV	AMENDMENTS	DATE
H		Issued to Client	30.09.19
i		Issued to Client - DRAFT	02.10.19
		Other boundaries added	02.10.19
J		Issued to Client	11.10.19
K		Issue for Development Application	17.10.19
L		Issue for Development Application	15.04.20

CLIENT: Benedict Industries Pty. Ltd.

PROJECT: George's Cove Marina
Newbridge Road
Moorebank NSW 2170

PRINTED: Apr 15, 2020 - 6:31pm
P:\MOOREBANK MARINA\Cadwork\Drawings\028_Amended DA_September 2019 - NEW\DA-001- Site Plan.dwg

DRAWING: Site - Plan
General Layout

DRAWN	CHKD	APPROVED
MF		

SCALE	DATE	CAD FILE No
1 : 1000 @ A1 1: 2000 @ A3	01/04/15	

JOB NO	DRAWING NO	ISSUE
0914	DA- 001	L

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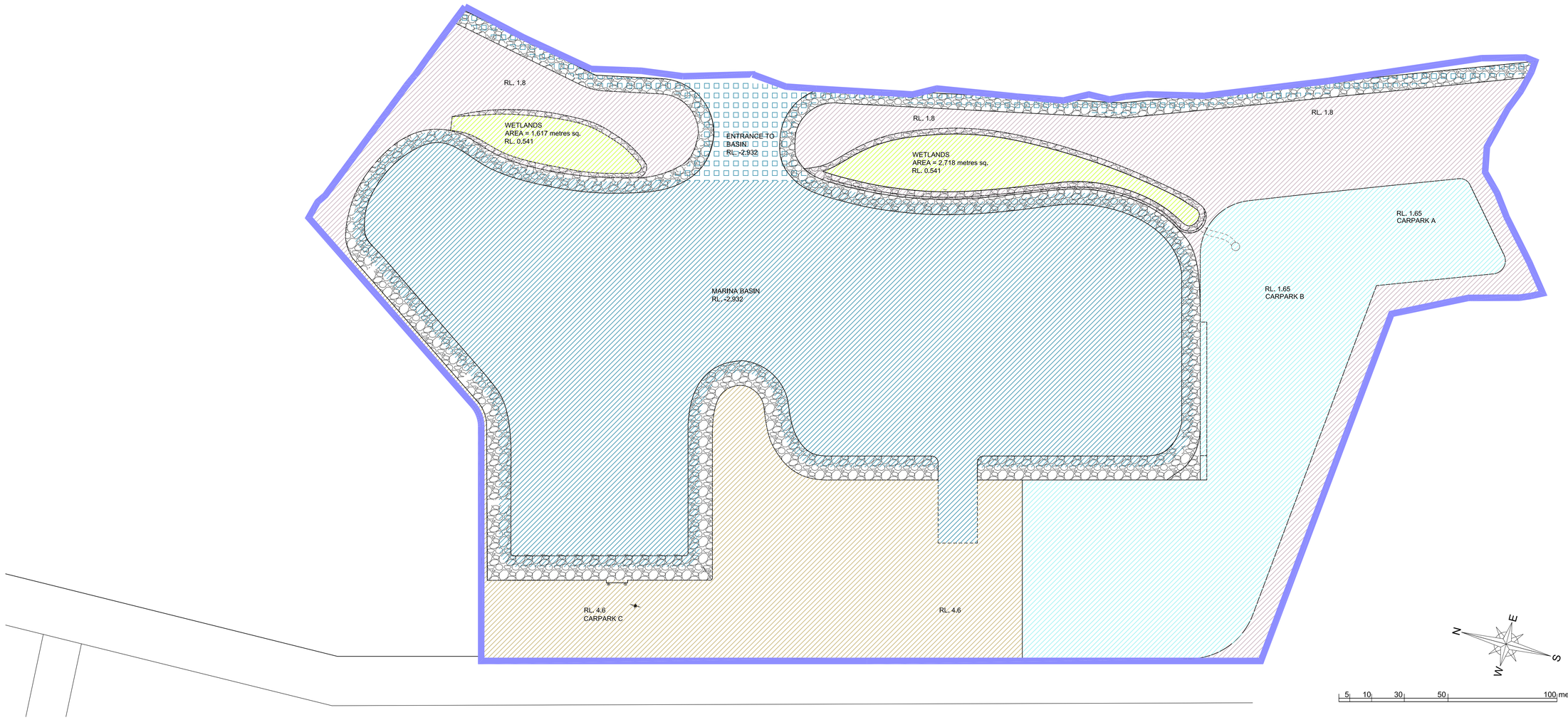

01 Site - Plan
1: 2000

Legend

		Level	Area
	Northern Carpark & Surrounds	RL. 4.6	3,737 m sq
	Maritime Buildings & Surrounds	RL. 4.6	17,192 m sq
	Southern Carparks & Roads	RL. 1.65	20,578 m sq
	Wetlands	RL. 0.541	4,335 m sq
	Marina Basin	RL. -2.932	48,955 m sq
	Entrance to Basin	RL. -2.932	4,550 m sq
	Pedestrian/ Cycle Path & Open Space	RL. 1.8	15,616 m sq
	Marina Proposal Boundary		

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ISSUE	REV	AMENDMENTS	DATE
A		Issue for Development Application	16.11.10
B		Re-issue for Development Application	01.04.15
C		Re-issue for Development Application	26.03.15
D		Re-issue for Development Application	07.05.19
E		Issued to Client	27.09.19
F		Issued to Client	30.09.19
G		Issued to Client	11.10.19
H		Issue for Development Application	17.10.19
i		Issue for Development Application	15.04.20

ISSUE	REV	AMENDMENTS	DATE

CLIENT
Benedict Industries Pty. Ltd.

PROJECT
George's Cove Marina
Newbridge Road
Moorebank NSW 2170

PRINTED: Apr 15, 2020 - 6:33pm
P:\MOOREBANK MARINA\Cadwork\Drawings\028_Amended DA_September 2019 - NEW\DA-001- Site Plan.dwg

DRAWING
Site - Plan
Diagram - Levels & Contours

DRAWN	CHKD	APPROVED
MF		
SCALE	DATE	CAD FILE No
1 : 2000 @ A3	15- 03- 110	

JOB NO	DRAWING NO	ISSUE
0914	DA- 002	i

MICHEAL FOUNTAIN ARCHITECTS PTY. LTD.
2/ 5 NARABANG WAY BELROSE NSW 2085
TEL (02) 9450 2070 FAX (02) 94502757

Appendix F

Planning Proposal Modification 2 Plans

Modification 2