Kingborough

COUNCIL MEETING AGENDA

NOTICE is hereby given that an Ordinary meeting of the Kingborough Council will be held in the Kingborough Civic Centre, 15 Channel Highway, Kingston on

Monday, 4 October 2021 at 5.30pm

Kingborough Councillors 2018 - 2022

Mayor
Councillor Paula Wriedt

Deputy Mayor
Councillor Jo Westwood

Councillor Sue Bastone

Councillor Gideon Cordover

Councillor Flora Fox

Councillor Clare Glade-Wright

Councillor David Grace

Councillor Amanda Midgley

Councillor Christian Street

Councillor Steve Wass

QUALIFIED PERSONS

In accordance with Section 65 of the *Local Government Act 1993*, I confirm that the reports contained in Council Meeting Agenda No. 20 to be held on Monday, 4 October 2021 contain advice, information and recommendations given by a person who has the qualifications or experience necessary to give such advice, information or recommendations.

Gary Arnold
GENERAL MANAGER

Tuesday, 28 September 2021

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Appendix

GUIDELINES FOR PUBLIC QUESTIONS

Section 31 of the *Local Government (Meeting Procedures) Regulations 2015*

Questions from the public may either be submitted to the General Manager in writing or asked verbally at an Ordinary Council meeting. Any question asked must only relate to the activities of Council [Section 31(2)(b)].

This guideline is provided to assist the public with the requirements of Public Question Time as set out in the *Local Government (Meeting Procedures) Regulations 2015* as well as determinations made by Council. You are reminded that the public question forum is designed to accommodate questions only and neither the questions nor answers will be debated.

Questions on Notice

Written questions on notice must be received at least seven (7) days before an Ordinary Council meeting [Section 31(1)] and must be clearly headed 'Question/s on Notice'. The period of 7 days includes Saturdays, Sundays and statutory holidays but does not include the day on which notice is given or the day of the Ordinary Council meeting [Section 31(8)].

Questions Without Notice

The Chairperson of an Ordinary Council meeting must ensure that, if required, at least 15 minutes is made available for public questions without notice [Section 31(3)]. A question without notice must not relate to any matter that is listed on the agenda for that meeting.

A question by any member of the public and an answer to that question is not to be debated at the meeting [Section 31(4)]. If a response to a question cannot be provided at the meeting, the question will be taken on notice and will be included in the following Ordinary Council meeting agenda, or as soon as practicable, together with the response to that question.

There is to be no discussion, preamble or embellishment of any question asked without notice, and the Chairperson may require that a member of the public immediately put the question.

The Chairperson can determine whether a question without notice will not be accepted but must provide reasons for refusing to accept the said question [Section 31 (6)]. The Chairperson may require a question without notice to be put on notice and in writing.

The Chairperson may rule a question inappropriate, and thus inadmissible if in his or her opinion it has already been asked, is unclear, irrelevant, offensive or relates to any matter which would normally be considered in Closed Session. The Chairperson may require that a member of the public immediately put the question.

AGENDA of an Ordinary Meeting of Council
Kingborough Civic Centre, 15 Channel Highway, Kingston
Monday, 4 October 2021 at 5.30pm

1 AUDIO RECORDING

The Chairperson will declare the meeting open, welcome all in attendance and advise that Council meetings are recorded and made publicly available on its website. In accordance with Council's policy the Chairperson will request confirmation that the audio recording has commenced.

2 ACKNOWLEDGEMENT OF TRADITIONAL CUSTODIANS

The Chairperson will acknowledge the traditional custodians of this land, pay respects to elders past and present, and acknowledge today's Tasmanian Aboriginal community.

3 ATTENDEES

Councillors:

Mayor Councillor P Wriedt
Deputy Mayor Councillor J Westwood
Councillor S Bastone
Councillor G Cordover
Councillor F Fox
Councillor C Glade-Wright
Councillor C Street
Councillor S Wass

4 APOLOGIES

Councillor D Grace
Councillor A Midgley

5 CONFIRMATION OF MINUTES

RECOMMENDATION

That the Minutes of the open session of the Council Meeting No. 19 held on 20 September 2021 be confirmed as a true record.

6 WORKSHOPS HELD SINCE LAST COUNCIL MEETING

27 September - Kingston CBD Structure Plan

7 DECLARATIONS OF INTEREST

In accordance with Regulation 8 of the *Local Government (Meeting Procedures) Regulations 2015* and Council's adopted Code of Conduct, the Mayor requests Councillors to indicate whether they have, or are likely to have, a pecuniary interest (any pecuniary benefits or pecuniary detriment) or conflict of interest in any item on the Agenda.

8 TRANSFER OF AGENDA ITEMS

Are there any items, which the meeting believes, should be transferred from this agenda to the closed agenda or from the closed agenda to the open agenda, in accordance with the procedures allowed under Section 15 of the *Local Government (Meeting Procedures) Regulations 2015*.

9 QUESTIONS WITHOUT NOTICE FROM THE PUBLIC

10 QUESTIONS ON NOTICE FROM THE PUBLIC

10.1 SPRING FARM WALKING TRACK

Mr David Bain submitted the following question on notice:

In January 2020, against Council Officers' advice, Council accepted the Spring Farm Estate developers offer to construct a walking track through Spring Farm, in lieu of making their public open space contribution of approximately $353,000.

On Monday 6th September 2021 (20 months later), the developer (Josef Chromy's JAC Group) advised Council that they were no longer prepared to undertake the construction works of the walking track. Essentially, walking away from the original agreement without even lodging an acceptable development application, let alone making an actual start on the track.

Can the Council advise:

1) *Will the Council be penalising the developer for reneging on the original agreement and/or charging interest for the 20 months the JAC Group has held funds that would have otherwise been paid to Council?*

2) *Is the Council now committed to undertaking these track works and if so, what are the amount of funds set aside for the works; what are the next steps; and approximate timeframes?*

Officer's Response:

Council has been provided with a full set of design plans for the track by the JAC Group and does not intend to take any action in relation to the changes to the original agreement. The JAC Group has paid $207,000 in public open space funds associated with the development to date, with future payments dependent upon further subdivisions proceeding. It is Council's intention to put the $207,000 towards the development of the Spring Farm Walking track. However, this amount will not be sufficient to complete the track and it is intended to apply for grant funding to cover the shortfall. The outcome of this grant funding will not be known until early in 2022.

Daniel Smee, Director Governance, Recreation & Property Services

10.2 TASMANIAN STATE SERVICE

Ms Monika Kuppelwieser submitted the following question on notice:

An Independent Review of the State Service has been released and includes a recommendation (Recommendation 64, page 214) that identifies Kingston as a possible location for consideration of decentralised office hub for the Tasmanian State Service.

This sounds like a promising idea which could keep people working closer to where they live, reduce congestion on roads and public transport and improve work life balance.

Is this something that the Kingborough Council would consider supporting?

http://www.dpac.tas.gov.au/__data/assets/pdf_file/0004/587515/TSSR_Final_Report.pdf)

Officer's Response:

Council does not have a formal policy position in relation to this matter but is broadly supportive of measures to reduce congestion on roads. Subject to the provision of a more detailed proposal, it is something that Council would consider supporting.

Daniel Smee, Director Governance, Recreation & Property Services

10.3 MANAGEMENT WAGE FREEZES

At the Council meeting on 20 September 2021, **Ms Karen Tantari** of the **Australian Services Union** asked the following question without notice to the General Manager, with a response that the question would be taken on notice:

On 27 May 2020 the General Manager advised that on 25 May 2020, Council adopted a Notice of Motion from the Deputy Mayor "that Council directs the General Manager to implement a 2.8% Covid-19 efficiency dividend across the organisation for all non-salary expenditure in 2020/21". The General Manager advised that as a result of this outcome that Council was unable to pay a wage increase to employees in 2020, in effect a wage freeze for everyone, himself included. Could Council please advise how many managers, senior employees on contract have received a wage increase during the period in which employees have endured a wage freeze?

Officer's Response:

Between 1 July 2020 and 30 June 2021 two members of the management team received a wage increase due to changes to their position descriptions/requirements and one due to a condition of contract. The General Manager did not receive a pay increase during this period.

Gary Arnold, General Manager

11 QUESTIONS WITHOUT NOTICE FROM COUNCILLORS

12 QUESTIONS ON NOTICE FROM COUNCILLORS

12.1 RETAINING STRUCTURE NEAR THE BRUNY ISLAND BOAT CLUB

At the Council meeting on 20 September 2021, **Cr Grace** asked the following question without notice to the General Manager, with a response that the question would be taken on notice:

As you are aware with the erosion that occurred down there, the government put $80,000 towards the reinstatement of the erosion and Council undertook the planning and management of that project. I understand that the rock size is too small and the whole thing is starting to collapse again. Could Council give us a report on the process of what took place there?

Officer's Response:

The retaining structure has been designed by experts in coastal sea walls and constructed in accordance with the design. The wall is designed to have a mixture of rock sizes and is structurally sound.

David Reeve, Director Engineering Services

12.2 VACANT LAND, BRUNY ISLAND

At the Council meeting on 20 September 2021, **Cr Grace** asked the following question without notice to the General Manager, with a response that the question would be taken on notice:

Council own a block of land at Bruny Island which we tried to sell some time ago and it was voted unanimously that we would not sell that block of land because it belongs to the ratepayers of Bruny Island. They are in a position where they are trying to develop this block of land. The sewerage that is coming from the hotel onto that block is a major problem that they have inherited. Can Council look at that problem and advise the hotel owner to remove the sewerage off that block of land?

Officer's Response:

This issue is currently being investigated with consideration to off-site impacts and determination of the origin of any seepage.

Abyilene McGuire, Senior Environmental Health Officer

OPEN SESSION ADJOURNS

PLANNING AUTHORITY IN SESSION

13 OFFICERS REPORTS TO PLANNING AUTHORITY

13.1 DEVELOPMENT APPLICATION FOR FOUR (4) MULTIPLE DWELLINGS AT 31 LEWAN AVENUE, KINGSTON

File Number: **DA-2021-196**

Author: **Sarah Silva, Senior Planning Officer**

Authoriser: **Tasha Tyler-Moore, Manager Development Services**

Applicant:	Mr R Smeekes
Owner:	Denison Central Pty Ltd
Subject Site:	31 Lewan Avenue, Kingston (CT 72788/28)
Proposal:	4 multiple dwellings
Planning Scheme:	Kingborough Interim Planning Scheme 2015 *Assessment is based on KIPS2015 and provisions of IPD4 (which commenced 22 Feb 2021)*
Zoning:	Inner Residential
Codes:	E6.0 Parking and Access E7.0 Stormwater Management
Use Class/Category:	Residential (multiple dwelling)
Discretions:	- Clause 11.4.2 – Setbacks and building envelope for all dwellings (A1) - Clause 11.4.3 - Site coverage and private open space for all dwellings (A2) - Clause 11.4.6 - Privacy for all dwellings (A3) - Clause E6.7.7 – Lighting of parking areas (A1)
Public Notification:	Public advertising was undertaken between 26 May 2021 and 8 June 2021 in accordance with section 57 of the *Land Use Planning and Approvals Act 1993*
Representations:	A total of four (4) representations were received. Issues raised include: - Proposed units out of character with area. Non-compliant setbacks. - Traffic impacts particularly upon local residents and the Channel Highway. - Underground watercourse and potential for flooding. - Overshadowing of neighbouring properties. - Privacy impacts. - Sewerage line impacts.
Recommendation:	Approval with conditions

1. BACKGROUND

The application lodged in April 2021 proposed five (5) double-storey, multiple dwellings, with a minimum front setback of 3m to Lewan Avenue. This proposed design commenced advertising in May 2021 and received four (4) representations opposing the development; these representations are discussed further in section 2.5 of this report.

During the assessment period, it became evident that there was an issue with the development due to the particular wording of Acceptable Solution A1 of Clause 11.4.2 *Setbacks and building envelope for all dwellings*, Kingborough Interim Planning Scheme 2015 (Planning Scheme).

Acceptable Solution A1 requires:

> Unless within a building area on a sealed plan, a dwelling, excluding garages, carports and protrusions that extend not more than 0.9m into the frontage setback, must have a setback from a frontage that is:
>
> (a) if the frontage is a primary frontage, not less than 3m, or, if the setback from the primary frontage is less than 3m, not less than the setback, from the primary frontage, of any existing dwelling on the site;
>
> (b) if the frontage is not a primary frontage, not less than 2m, or, if the setback from the frontage is less than 2m, not less than the setback, from a frontage that is not a primary frontage, of any existing dwelling on the site;
>
> ***(c) if for a vacant site and there are existing dwellings on adjoining properties on the same street, not more than the greater, or less than the lesser, setback for the equivalent frontage of the dwellings on the adjoining sites on the same street; or***
>
> (d) if located above a non-residential use at ground floor level, not less than the setback from the frontage of the ground floor level.

Given the subject site was vacant, in order to meet the setback stipulated by A1(c), the front setback needed to be ***not more than the greater, or less than the lesser, setback for the equivalent frontage of the dwellings on the adjoining sites on the same street.*** Given the 3m setback originally proposed and the larger existing setbacks on adjoining sites (approximately 5.5m at 29 Lewan Avenue to the north-west and 12m at 33 Lewan Avenue to the south-east), the proposed setback was ***less than the lesser*** and subsequently could not meet the Acceptable Solution A1. It is noted that the smaller setback of the dwelling at 29 Lewan Avenue is due to a tapered front boundary, to accommodate a speed hump and associated deviation in the pedestrian footway and is an anomaly in the street.

Accordingly, the corresponding Performance Criteria P1 needed to be satisfied to enable the 3m front setback to be approved by the Planning Authority.

The Performance Criteria P1 requires:

> A dwelling must have a setback from a frontage that is compatible with the streetscape having regard to any topographical constraints.

The proposal was unable to satisfy the Performance Criteria as the building setbacks in the streetscape (the streetscape being defined as the area within 100m of the site) were all greater than that proposed (refer to Figure 1 below for context).

Figure 1 - General existing building line (shown in blue). Approximate location of proposed front set back (shown in red)

The reason that the existing Clause 11.4.2 *Setbacks and building envelope for all dwellings* is discussed in the background of this report is because, due to the existing character of the streetscape, it was considered that it was not possible for the proposal for five (5) units to meet the Acceptable Solution nor the Performance Criteria. It is understood that the purpose of the subject clause is to protect the existing character of established streets within the Inner Residential Zone, although the zone provisions allow for lots that are not vacant (ie. have an existing dwelling, even if it is to be demolished), to have a front building setback as close as 3m. Further advice was sought from the Planning Policy Unit and, although this was acknowledged as an issue, no direction was provided.

In response to the problems identified, the applicant amended the plans to reduce the number of dwellings to four and thereby increasing the setback to comply with the Acceptable Solution.

Amended plans, demonstrating the omission of the front dwelling were lodged on 14 August 2021. These plans were not readvertised, given that the change did not change the proposed use nor substantially change the overall development. Amended plans were lodged again on 14 September 2021 to include a privacy screen on the upper level balcony of Unit 4. These are the plans that are the subject of the revised planning assessment and this report.

2. PROPOSAL

2.1 Description of Proposal

The proposal is to construct four (4) detached, double-storey multiple dwellings.

Each dwelling has the same floor layouts including a double car garage, a bedroom, and small casual living area at ground floor level. The upper floor level will contain the main living areas and two additional bedrooms.

The primary private open space area is located to the rear of the dwelling, accessed from the smaller living area on the lower level. In addition, each dwelling will have a small balcony that leading from main living areas, which will overlook the rear garden area. The upper level of each dwelling cantilevers over the lower level on the driveway side of the dwellings.

In addition to the private parking there are two uncovered visitor parking spaces provided.

No high conservation trees exist on the allotment. A landscaping plan has been submitted with the application which includes landscaping along the frontage, private open space areas, and along the shared driveway, where practical.

The application was referred to TasWater and there are no objections to the proposed development subject to conditions of any approval.

2.2 Description of Site

The subject site is 1115m^2 in area and is currently void of any buildings however there is vegetation around the perimeter of the site. There is an existing crossover onto Lewan Avenue.

A TasWater sewer easement and a defunct Council stormwater drainage easement traverse the site (this easement is discussed further in the 'other matters' section of this report).

Figure 2 - aerial image of the subject site

The subject site is located approximately 300m from the Channel Highway and within easy walking distance to the Kingston Town Shopping Centre.

The character of the surrounding area is residential (both single and multiple dwellings). Most existing dwellings generally have generous street setbacks from Lewan Avenue with well establised front gardens.

3. ASSESSMENT

3.1 State Policies and Act Objectives

The proposal complies with the State Policies including the Coastal Policy.

The proposal is consistent with the objectives of Schedule 1 of the *Land Use Planning and Approvals Act 1993.*

3.2 Strategic Planning

The relevant strategies associated with the Scheme are as follows:

Zone Purpose Statements of the Inner Residential zone

The relevant zone purpose statements of the Inner Residential zone are to:

11.1.1.1 To provide for a variety of residential uses and dwelling types close to services and facilities in inner urban and historically established areas, which uses and types respect the existing variation and pattern in lot sizes, set back, and height.

11.1.1.3 To encourage residential development at higher densities in locations within walkable distance of services, facilities, employment and high frequency public transport corridors.

11.1.1.4 To encourage residential development at higher densities in locations that offer good access to services and employment including activity centres and public open spaces.

The proposal will provide additional dwellings within close proximity to public transport corridors. The site is within walking distance to Kingston Town Shopping Centre and the Kingston Central Business zone. For these reasons to proposal would be consistent with the above purpose statements.

Clause 11.1.2 and 11.1.3 – Local Area Objectives and Desired Future Character Statements for Kingston.

The Scheme details separate Local Area Objectives and Desired Future Character Statements for the main towns in the municipal area. The following Local Area Objectives and Desired Future Character Statements for Kingston are relevant to the assessment of this application.

Local Area Objectives		**Implementation Strategy**	
(a)	Land will be utilised for residential purposes to the maximum extent and in a manner that optimises high quality design and amenity outcomes.	(a)	Infill opportunities will be taken up with larger lots being developed at higher residential densities.

Desired Future Character Statements		Implementation Strategy	
(a)	Increased inner urban residential living opportunities will be provided that enable residents to have improved access to local services and public facilities.	(a)	Further subdivision and/or strata development will be encouraged within this zone in a manner that encourages high quality design outcomes in both the private and public realms.

The proposal complies with the Local Area Objectives and Desired Future Character Statements as the additional dwellings will provide infill development within an established residential area, access to local services and public facilities.

3.3 Statutory Planning

The use is categorised as Residential (Multiple Dwelling) under the Scheme, which is a use that requires Permitted assessment in the Inner Residential Zone. Whilst the application is classified as a Permitted use, it relies on Performance Criteria to comply with the Scheme provisions and is therefore discretionary.

Council's assessment of this proposal should also consider the issues raised in the representations, the outcomes of any relevant State Policies and the objectives of Schedule 1 of the *Land Use Planning and Approvals Act 1993*.

3.4 Use and Development Standards

The proposal satisfies the relevant Acceptable Solutions of the Scheme (see checklist in Attachment 1), with the exception of the following:

Inner Residential ZoneClause 11.4.2
Setbacks and building envelope for all dwellings

Acceptable Solution
A1 Unless within a building area on a sealed plan, a dwelling, excluding garages, carports and protrusions that extend not more than 0.9m into the frontage setback, must have a setback from a frontage that is: (a) if the frontage is a primary frontage, not less than 3m, or, if the setback from the primary frontage is less than 3m, not less than the setback, from the primary frontage, of any existing dwelling on the site; (b) if the frontage is not a primary frontage, not less than 2m, or, if the setback from the frontage is less than 2m, not less than the setback, from a frontage that is not a primary frontage, of any existing dwelling on the site; (c) if for a vacant site and there are existing dwellings on adjoining properties on the same street, not more than the greater, or less than the lesser, setback for the equivalent frontage of the dwellings on the adjoining sites on the same street; or (d) if located above a non-residential use at ground floor level, not less than the setback from the frontage of the ground floor level.
Performance Criteria
P1 A dwelling must have a setback from a frontage that is compatible with the streetscape having regard to any topographical constraints.
Proposal
The proposed setback is 13.4m. The street setback of the dwelling to the south of the site is approximately 11.8m; the street setback of the dwelling to the north of the site is approximately 5.8m. To meet the acceptable solution the proposal would need to be 11.8m.

The proposed variation can be supported pursuant to this Performance Criteria of the Zone for the following reasons:

- Lewan Street is characterised by large street setbacks, typically in excess of 10metres. There are some anomalies to street setbacks, such as the dwelling to the north of the site, due to the unusual boundary alignment around the adjoining speed hump.

- The proposed setback is considered compatible with the street setback, as the difference is less than 2 metres and is unlikely to be noticeable as one looks down Lewan Avenue (as the dwelling is set back, rather than forward of the prevailing building line), particularly given that the site is currently vacant.

Inner Residential ZoneClause 11.4.3
Site coverage and private open space for all dwellings

Acceptable Solution
A2 - A dwelling must have private open space that: (a) is in one location and is not less than: (i) $24m^2$; or (ii) $12m^2$, if the dwelling is a multiple dwelling with a finished floor level that is entirely more than 1.8m above the finished ground level (excluding a garage, carport or entry foyer); (b) has a minimum horizontal dimension of not less than: (i) 4m; or (ii) 2m, if the dwelling is a multiple dwelling with a finished floor level that is entirely more than 1.8m above the finished ground level (excluding a garage, carport or entry foyer); (c) is located between the dwelling and the frontage only if the frontage is orientated between 30 degrees west of true north and 30 degrees east of true north; and (d) has a gradient not steeper than 1 in 10.
Performance Criteria
P2 - A dwelling must have private open space that includes an area capable of serving as an extension of the dwelling for outdoor relaxation, dining, entertaining and children's play and is: (a) conveniently located in relation to a living area of the dwelling; and (b) orientated to take advantage of sunlight.
Proposal
Each dwelling has been provided the required $24m^2$ with 4m dimension with almost no fall. The designated private open space area for Unit 1 extends approximately 1.7m into the frontage and the front boundary is orientated approximately 43.3 degrees east of north. All other units have the designated POS area to the rear of the dwelling.

The proposed variation can be supported pursuant to this Performance Criteria of the Zone for the following reasons:

- Only a small area of the designated private open space extends in front of the building line of Unit 1 (approximately 9.9m2). The remainder of the private open space is sited behind the building line and is directly accessed via the ground

level living area. As the setback for the dwelling is so significant it is considered that the amenity of the residents using the open space will not be affected.

- With a north-western orientation, the private open space is orientated to take advantage of sunlight.

Inner Residential ZoneClause 11.4.6
Privacy for all dwellings

Acceptable Solution
A3 - A shared driveway or parking space (excluding a parking space allocated to that dwelling) must be separated from a window, or glazed door, to a habitable room of a multiple dwelling by a horizontal distance of not less than: (a) 2.5m; or (b) 1m if: (i) it is separated by a screen of not less than 1.7m in height; or (ii) the window, or glazed door, to a habitable room has a sill height of not less than 1.7m above the shared driveway or parking space, or has fixed obscure glazing extending to a height of not less than 1.7m above the floor level.
Performance Criteria
P3 - A shared driveway or parking space (excluding a parking space allocated to that dwelling), must be screened, or otherwise located or designed, to minimise unreasonable impact of vehicle noise or vehicle light intrusion to a habitable room of a multiple dwelling.
Proposal
The upper-level bedroom windows cantilever over the shared drive and for this reason the setback to the window is less than 1m. Units 1, 2 and 3 are affected.

The proposed variation can be supported pursuant to this Performance Criteria of the Zone because the upper-level bedroom windows have a sill height of approximately 3.6m above the shared drive, located and designed, to minimise unreasonable impact of vehicle noise or vehicle light intrusion to these bedrooms.

Parking and Access Code
Clause E6.7.7 - Lighting of Parking Areas

Acceptable Solution
A1 - Parking and vehicle circulation roadways and pedestrian paths serving 5 or more car parking spaces, used outside daylight hours, must be provided with lighting in accordance with clause 3.1 “Basis of Design” and clause 3.6 “Car Parks” in AS/NZS 1158.3.1:2005 Lighting for roads and public spaces Part 3.1: Pedestrian area (Category P) lighting.
Performance Criteria
P1 - Parking and vehicle circulation roadways and pedestrian paths used outside daylight hours must be provided with lighting to a standard which satisfies all of the following: (a) enables easy and efficient use of the area; (b) minimises potential for conflicts involving pedestrians, cyclists and vehicles;

(c) reduces opportunities for crime or anti-social behaviour by supporting passive surveillance and clear sight lines and treating the risk from concealment or entrapment points; (d) prevents unreasonable impact on the amenity of adjoining users through light overspill; (e) is appropriate to the hours of operation of the use.
Proposal
No lighting plan has been included with the application.

Council's Development Engineering Officer has advised the proposed variation is not supported and a condition is included in the recommendation to require lighting in the parking area.

3.5 Public Consultation and Representations

The application was advertised in accordance with the requirements of s.57 of the *Land Use Planning and Approvals Act 1993* (from 26 May 2021 to 8 June 2021). Four (4) representations were received during the public exhibition period and the following issues were raised by the representors:

3.5.1 Traffic impacts particularly upon local residents and the Channel Highway.

The development provides two (2) parking spaces per dwelling, plus two (2) visitor parking spaces. The existing access is to be utilised and no additional accesses are proposed. The development therefore complies with the requirements of the Parking and Access Code.

3.5.2 Proposed units out of character with area. Non-compliant setbacks.

It is agreed that the original proposal (April 2021) was out of character with the surrounding area. Amended plans have since been submitted (subject of this assessment) that omit the front unit thereby increasing the front setback. There are no planning controls in relation to the actual building design in the Inner Residential Zone beyond building height, setbacks and privacy; the proposed four (4) units can meet the Acceptable Solutions of the Planning Scheme for these.

3.5.3 Underground watercourse and potential for flooding.

Council's Stormwater Engineer has reviewed the application and has raised no concerns in relation to the potential for flooding on the site. The Kingborough Flood Awareness Map does not indicate the site is subject to flooding.

3.5.4 Overshadowing of neighbouring properties.

The proposed dwellings area all fully contained within the required building envelope and subsequently comply with Clause 11.4.2 - *Setbacks and building envelope for all dwellings* of the Planning Scheme.

3.5.5 Privacy impacts.

The proposed dwellings all either meet the required setbacks or demonstrate the provision of privacy screens and for this reason comply with the Acceptable Solutions A1 and A2 of clause 11.4.6 - Privacy for all dwellings. A condition of approval requires that any privacy screens are erected, prior to the occupation of the dwellings.

3.5.6 Sewerage line impacts.

TasWater has reviewed the application and, after initially requesting further information, have since advised that there are no objections to the proposed development subject to conditions of approval.

3.6 Other Matters

Drainage Easement

A drainage easement traverses through the subject site. It is proposed to construct Unit 3 over this easement.

The *Urban Drainage Act 2013* prohibits any structure to be built on/above/below the drainage easement without the General Manager's (GM) consent. Council's stormwater engineers advised that there is no known impediment to the GM giving consent for the construction of a unit over this easement. The advice noted that the easement has not been in use for a very long time and is too narrow to be practical for use at any time in the future. It was recommended that the easement be formally extinguished to limit any future conflict should other properties on the southern side of Lewan Avenue submit a develop application. GM consent was subsequently granted to build over the subject easement.

Figure 3 – Existing drainage easement (subject site highlighted in yellow)

4. CONCLUSION

The proposal is for the construction of four (4) multiple dwellings in the Inner Residential Zone of the Kingborough Interim Planning Scheme 2015. Services are established in the area and the site is close to central Kingston. The proposal can meet the relevant acceptable solutions or adequately satisfy the relevant performance criteria of the Scheme.

5. RECOMMENDATION

That the Planning Authority resolves that the development application for 4 multiple dwellings at 31 Lewan Avenue, Kingston for Mr R Smeekes be approved subject to the following conditions:

1. Except as otherwise required by this Permit, use and development of the land must be substantially in accordance with Development Application No. DA-2021-196 and Council Plan Reference No. P4 submitted on 14/09/2021.

   This Permit relates to the use of land or buildings irrespective of the applicant or subsequent occupants, and whoever acts on it must comply with all conditions in this Permit. Any amendment, variation or extension of this Permit requires further planning consent of Council.

2. Prior to commencement of on-site works, engineering design drawings must be submitted to Council for approval. The engineering plans and specifications must be prepared and certified by a professional Civil Engineer. Plans must be to satisfaction of the Director Engineering Services and comply with:

   - Tasmanian Standard Drawings
   - Austroads Standards and Australian Standards
   - Australian Rainfall and Runoff Guidelines

   The Plans must include, but are not limited to:

   (a) Detailed internal vehicular and pedestrian access, carparking and manoeuvring areas including:

      (i) Longitudinal and cross sections of the driveway/access road

      (ii) Contours, finish levels and gradients of the driveway/access road

      (iii) Provision of vehicle access (crossovers) with notation to be constructed in standard grey concrete with a broomed non-slip finish

      (iv) Provision of passing bays

      (v) Pavement construction

      (vi) Signage for visitor spaces or residential/commercial spaces if allocated

      (vii) No parking/keep clear signage for turning bay areas

      (viii) Wheel stops for open parking bays (as appropriate)

      (ix) Lighting for parking and vehicle circulation roadways and pedestrian paths

      (x) Surface treatment and stormwater drainage

   (b) Design (including supporting documentation and hydraulic calculations) of the proposed stormwater infrastructure including:

      (i) Layout details

(ii) A stormwater detention system to limit the stormwater discharge rate to the pre-development discharge rate.

(iii) A new 150mm diameter PVC stormwater lot connection to the stormwater main in Lewan Avenue.

(iv) Upgrade the existing stormwater lot connection at the rear of the lot to 150mm diameter PVC.

Once endorsed the plans will form part of the permit.

3 A "start works" notice must be lodged with Council fourteen (14) days prior to the commencement of any on-site works and works must not commence until this notice has been approved by the Manager Development Services.

4. The double width (5.5m wide) vehicular access must be constructed in accordance with the Tasmanian Standard Drawings (TSD-R09) in standard grey concrete with a broomed non-slip finish from the kerb crossing layback to the lot boundary.

Prior to the commencement of the use, all redundant crossovers must be removed and replaced with new kerb and channel with footpaths (where applicable) to match with the existing in a smooth and continuous fashion to the satisfaction of Director Engineering Services.

Advice: A 'Road Works Permit' is required for any works within Council road reservations prior to works commencing. An application can be made on Council's website.

5. The construction works must be undertaken in accordance with the approved engineering design drawings to the satisfaction and approval of the Director Engineering Services.

The works must be supervised by a professional Civil Engineer in accordance with Council's inspections schedule.

6. Prior to the commencement of site works a soil and water management plan must be submitted to Council for approval. The plan must be in accordance with NRM South Soil and Water Management of Construction Sites – Guidelines and Tasmanian Standard Drawings (TSD-SW28). A site inspection of the implemented plan by the Council's Development Inspector must be satisfactorily undertaken with the principal contractor prior to the commencement of any work on site.

7. All waste material generated by the development or from other sources must be contained in appropriate building waste containers for periodic removal to a licensed disposal site. The receptacle must be of a size to adequately contain the amount of waste generated and must be appropriately located on the subject site and must not impede residential traffic or parking at any time.

8. Prior to the occupation of any of the new dwellings the following works must be completed in accordance with the endorsed plans to the satisfaction of the Council:

i. The parking areas (including signage and access);

ii. The garden and landscape areas;

iii. Drainage works undertaken and completed;

iv. Letterboxes installed

v. The privacy screens to all upper level balconies are to be installed.

9. Unless otherwise agreed in writing by the Responsible Authority, the landscaping areas shown on the endorsed plans must be used for landscaping and no other purpose to the satisfaction of the Responsible Authority.

10. At least two (2) visitor parking spaces must be provided for the proposed development. These visitor parking spaces must be appropriately signposted and kept available for visitor parking at all times.

    Any future application for strata title in respect of the property must ensure that the visitor parking spaces are included within the common property on the strata plan.

11. The conditions as determined by TasWater, and set out in the attached Appendix A, form part of this permit.

ADVICE

A. In accordance with section 53(5) of the Land Use Planning and Approvals Act 1993 this permit lapses after a period of two years from the date on which it is granted if the use or development in respect of which it is granted is not substantially commenced within that period.

B. The approval in this permit is under the Land Use Planning and Approvals Act 1993 and does not provide any approvals under other Acts including, but not limited to Building Act 2016, Urban Drainage Act 2013, Food Act 2003 or Council by-laws.

    If your development involves demolition, new buildings or alterations to buildings (including plumbing works or onsite wastewater treatment) it is likely that you will be required to get approvals under the Building Act 2016. Change of use, including visitor accommodation, may also require approval under the Building Act 2016. Advice should be sought from Council's Building Department or an independent building surveyor to establish any requirements.

C. The Developer should not allocate any property address numbers for the proposed units.

    New property addresses have been allocated as follows:

Unit No.	Allocated Property Address
1	1/31 Lewan Avenue, Kingston
2	2/31 Lewan Avenue, Kingston
3	3/31 Lewan Avenue, Kingston
4	4/31 Lewan Avenue, Kingston

    These numbers must then be referenced on design and As-Constructed drawings as well as any Strata Plans lodged for sealing.

D. An application for Notifiable Plumbing Work must be lodged with Council before commencing any work.

E. A drainage design plan at a scale of 1:200, designed by a qualified Hydraulic Designer, showing the location of the proposed sewer and stormwater house connection drains; including the pipe sizes, pits and driveway drainage, must be submitted with the application for Plumbing Permit.

ATTACHMENTS

1. **Locality Plan**
2. **Assessment Checklist**
3. **Proposed Plans**
4. **TasWater Submission**

Locality Plan

Assessment Checklist for Development Applications forMultiple Dwellings within the Inner Residential Zone

Clause	Compliance/Comments
11.4.1 - Residential density for multiple dwellings **A1** - Multiple dwellings must have a site area perdwelling of not less than 200m^2.	**A1** – complies – the lot size is 1115m^2 and four (4) dwellings areproposed = 278.75m^2 per dwelling.
11.4.2 - Setbacks and building envelope for alldwellings **A1** - Unless within a building area on a sealed plan,a dwelling, excluding garages, carports and protrusions that extend not more than 0.9m into thefrontage setback, must have a setback from a frontage that is: (a) if the frontage is a primary frontage, not less than 3m, or, if the setback from the primary frontage is less than 3m, not less than thesetback, from the primary frontage, of any existing dwelling on the site; (b) if the frontage is not a primary frontage, not less than 2m, or, if the setback from the frontage is less than 2m, not less than thesetback, from a frontage that is not a primary frontage, of any existing dwelling on the site; (c) if for a vacant site and there are existing dwellings on adjoining properties on the same street, not more than the greater, or less than the lesser, setback for the equivalent frontage of the dwellings on the adjoining sites on the same street; or (d) if located above a non-residential use at ground floor level, not less than the setback from the frontage of the ground floor level.	**A1(a-d)** – (a) n/a – no existing dwellingon the site. (b) n/a – only one (1) frontage. (c) Does not comply – as the street setback is greater than the neighbouring properties. Therefore requires assessment against the performance criteria. (d) n/a.
A2 - A garage or carport for a dwelling must have asetback from a primary frontage of not less than: (a) 4m, or alternatively 1m behind the building line; (b) the same as the building line, if a portion of the dwelling gross floor area is located above the garage or carport; or (c) 1m, if the existing ground level slopes up or down at a gradient steeper than 1 in 5 for a distance of 10m from the frontage.	**A2(a-c)** – complies with (b). The garage to Unit 1 is the same as the building line; a portion of the dwellinggross floor area is located above the garage.
A3 - A dwelling, excluding outbuildings with a building height of not more than 2.4m and protrusions that extend not more than 0.9m horizontally beyond the building envelope, must: (a) be contained within a building envelope (refer to Figures 11.1, 11.2 and 11.3) determined by: (i) a distance equal to the frontage setback or, for an internal lot, a distance of 3m from the rear boundary of a property with an adjoining frontage; and (ii) projecting a line at an angle of 45 degrees from the horizontal at a height of 3m above existing ground	**A3(a)** – complies – the plans demonstrates that the dwellings are contained within the building envelope (with only a minor eave protrusions of approximately 300mmalong the north-western elevations). **A3(b)** – n/a – the dwellings are not within 1.5m of any boundary (the minimum setback is 3m).

Clause	Compliance/Comments
level at the side and rear boundaries to a building height of not more than 9.5m above existing ground level; and (b) only have a setback within 1.5m of a side or rear boundary if the dwelling: (i) does not extend beyond an existing building built on or within 0.2m of theboundary of the adjoining property; or (ii) does not exceed a total length of 9m or one-third the length of the side boundary (whichever is the lesser) **A4** - No trees of high conservation value will beimpacted.	**A4** – complies – there are no high conservation trees located on the site.
11.4.3 - Site coverage and private open spacefor all dwellings **A1 -** Dwellings must have: (a) a site coverage of not more than 65% (excluding eaves up to 0.6m wide); and (b) for multiple dwellings, a total area of private open space of not less than 40m2 associated with each dwelling, unless the dwelling has a finished floor level that is entirely more than 1.8m above the finished ground level (excluding a garage, carport or entry foyer).	**A1(a)** – complies - the site coverage is 35.12%. **A1(b)** – complies – each dwellingwill have a POS area ranging from 60m^2 to 86m^2.
A2 - A dwelling must have private open space that: (a) is in one location and is not less than: (i) 24m2; or (ii) 12m2, if the dwelling is a multiple dwelling with a finished floor level that is entirely more than 1.8m above the finished ground level (excluding a garage, carport or entry foyer); (b) has a minimum horizontal dimension of not less than: (i) 4m; or (ii) 2m, if the dwelling is a multiple dwelling with a finished floor level that is entirely more than 1.8m above the finished ground level (excluding a garage, carport or entry foyer); (c) is located between the dwelling and the frontage only if the frontage is orientated between 30 degrees west of true north and 30 degrees east of true north; and (d) has a gradient not steeper than 1 in 10.	**A2(a)** – complies – each POS areais in one location with area of 24m^2. **A2(b)** – complies – each POS area has minimum dimensions of 4m x6m. **A2(c)** – **does not comply** - the designated POS area for Unit 1 extends approximately 1.7m into the frontage and the front boundary is orientated approximately 43.3 degrees east of north. All other units have the designated POS area tothe rear of the dwelling. **Assessment against the Performance Criteria required.** **A2(d)** – complies – the site isgenerally flat.
11.4.4 - Sunlight to private open space ofmultiple dwellings **A1** - A multiple dwelling, that is to the north of the private open space of another dwelling on the same site, required to satisfy A2 or P2 of clause 11.4.3, must satisfy (a) or (b), unless excluded by (c):	**A1(a)** – n/a – the POS areas arelocated to the north-west of each dwelling and, due to the layout of thebuildings on-site, no dwellings are located to the north of another's POS on the same site. **A1(b)** – n/a as above.

Clause	Compliance/Comments
(a) the multiple dwelling is contained within a line projecting (see Figure 11.4): (i) at a distance of 3m from the northern edge of the private open space; and (ii) vertically to a height of 3m above existing ground level and then at an angle of 45 degrees from the horizontal; (b) the multiple dwelling does not cause 50% of the private open space to receive less than 3 hours of sunlight between 9.00am and 3.00pm on 21st June; and (c) this Acceptable Solution excludes that part of a multiple dwelling consisting of: (i) an outbuilding with a building height not more than 2.4m; or (ii) protrusions that extend not more than 0.9m horizontally from the multiple dwelling.	**A1(c)** – n/a as above.
11.4.5 - Width of openings for garages and carports for all dwellings **A1** - A garage or carport for a dwelling within 12mof a primary frontage, whether the garage or carport is free-standing or part of the dwelling, musthave a total width of openings facing the primary frontage of not more than 6m or half the width of the frontage (whichever is the lesser).	**A1** – n/a – no garage or carport within 12m of the frontage.
11.4.6 - Privacy for all dwellings **A1** - A balcony, deck, roof terrace, parking space,or carport for a dwelling (whether freestanding or part of the dwelling), that has a finished surface or floor level more than 1m above existing groundlevel must have a permanently fixed screen to a height of not less than 1.7m above the finished surface or floor level, with a uniform transparency of not more than 25%, along the sides facing a: (a) side boundary, unless the balcony, deck, roof terrace, parking space, or carport has a setback of not less than 3m from the side boundary; (b) rear boundary, unless the balcony, deck, roof terrace, parking space, or carport has a setback of not less than 4m from the rear boundary; and (c) dwelling on the same site, unless the balcony, deck, roof terrace, parking space, or carport is not less than 6m: (i) from a window or glazed door, to a habitable room of the other dwelling on the same site; or (ii) from a balcony, deck, roof terrace or the private open space of the other dwelling on the same site.	**A1(a)** – n/a – all dwellings are setback a minimum of 3m from any side boundary. **A1(b)** – complies – the upper level balcony of Unit 4 is located within4m of the rear boundary althoughplans indicate the provision of a 1.8m privacy screen (with 20% transparency) along this side of the balcony. **A1(c)** – complies – the upper level rear decks to each dwelling, are setback less than 6m from another dwellings' POS area, although theplans indicate that a 1.8m privacyscreens (with 20% transparency) areto be installed to the northern corner of all balconies to minimise any potential for overlooking.

Clause	Compliance/Comments
A2 - A window or glazed door to a habitable roomof a dwelling, that has a floor level more than 1m above existing ground level, must satisfy (a), unless it satisfies (b): (a) the window or glazed door: (i) is to have a setback of not less than 3m from a side boundary; (ii) is to have a setback of not less than 4m from a rear boundary; (iii) if the dwelling is a multiple dwelling, is to be not less than 6m from a window or glazed door, to a habitable room, of another dwelling on the same site; and (iv) if the dwelling is a multiple dwelling, is to be not less than 6m from the private (v) open space of another dwelling on the same site. (b) the window or glazed door: (i) is to be offset, in the horizontal plane, not less than 1.5m from the edge of a window or glazed door, to a habitable room of another dwelling; (ii) is to have a sill height of not less than 1.7m above the floor level or have fixed obscure glazing extending to a height of not less than 1.7m above the floor level; or (iii) is to have a permanently fixed external screen for the full length of the window or glazed door, to a height of not less than 1.7m above floor level, with a uniform transparency of not more than 25%.	**A2(a)(i) -** complies – all proposed windows have a minimum setback of3m from any side boundary. **A2(a)(ii)** – complies – the living roomand bedroom windows of Unit 4 are within 4m of the rear boundaryhowever these both have a sillheight of 1.7m above FFL. **A2(a)(iii)** – complies – the proposed dwellings have a separation ranging from 3.35 to 2.1m, with habitable windows facing each other on theupper level, however all of these windows have a sill height of 1.7m above FFL and therefore comply with **A2(b)(ii)** as required. **A2(a)(iv)** – complies – no habitable windows at upper level overlook the POS of another dwelling on the same site.
A3 - A shared driveway or parking space (excluding a parking space allocated to that dwelling) must be separated from a window, orglazed door, to a habitable room of a multiple dwelling by a horizontal distance of not less than: (a) 2.5m; or (b) 1m if: (i) it is separated by a screen of not less than 1.7m in height; or (ii) the window, or glazed door, to a habitable room has a sill height of not less than 1.7m above the shared driveway or parking space, or has fixed obscure glazing extending to a height of not less than 1.7m above the floor level.	**A3(a) and (b)** – does not comply – the upper level bedroom windows counter lever over the shared drive and for this reason the setback tothe window is less than 1m. **Subsequently an assessment against the Performance Criteria is required.**
11.4.7 - Frontage fences for all dwellings **A1** - No Acceptable solution (when not exempt)	**A1** – n/a – as exemption 5.6.2 would apply (front fences)
11.4.8 - Waste storage for multiple dwellings **A1** - A multiple dwelling must have a storage area, for waste and recycling bins, that is not less than 1.5m^2 per dwelling and is within one of the following locations: (a) an area for the exclusive use of each dwelling, excluding the area in front of the dwelling; or	**A1(a)** – complies - each dwellingwill have individual waste bins. **A1(b)** – n/a

Clause	Compliance/Comments
(b) a common storage area with an impervious surface that: (i) has a setback of not less than 4.5m from a frontage; (ii) is not less than 5.5m from any dwelling; and (iii) is screened from the frontage and any dwelling by a wall to a height not less than 1.2m above the finished surface level of the storage area.	

Code Provisions

E6.0 Parking and Access Code	
Use standards – number of car parking spaces (Cl.E6.6.1) • A1 - Number of on-site car parking spaces complies with table	A1 – complies – each dwelling requires two (2) parking bays. One (1) visitor bay is required; a total of 9 required. The application proposes 10 parking bays; two (2) for each dwelling and two (2) visitor bays.
Number of vehicular accesses (Cl.E6.7.1) • A1 – Number of vehicle access points complies	A1 – complies - One double width vehicle access is proposed.
Design of vehicular accesses (Cl.E6.7.2) • A1 – Design of vehicle access points complies	A1 – complies – complies with Australian Standard.
Vehicular passing areas along an access (Cl.E6.7.3) • A1 – Vehicular passing areas comply	A1 – complies - Driveway width 5.5m allows passing.
On-site turning (Cl.E6.7.4) • A1 – on-site turning provides for vehicles to exit property in forward direction	A1 – complies – adequate area for on-site turning.
Layout of parking areas (Cl.E6.7.5) • A1 – Layout and compliance with Australian Standard	A1 – complies with Australian Standard
Surface treatment of parking areas (Cl.E6.7.6) • A1 – Parking spaces and vehicular circulation surfaces provided	A1 – complies – concrete and drained.
Lighting of parking areas (Cl.E6.7.7) • A1 – Parking and vehicle circulation roadways are provided with lighting	A1 – **does not comply** – no lighting indicated. **Assessment against the Performance Criteria is required.**
Landscaping of parking areas (Cl.E6.7.8) • A1 – Landscaping of parking and circulation areas complies	A1 – complies – a Landscaping Plan has been provided.
Siting of carparking (Cl.6.7.12) • A1 – Location of carparking	A1 – complies – parking areas (including garages) located behind the building line.
Access to a road (Cl.6.7.14) • A1 – Access to road complies with road authority requirements	A1 – complies

E7.0 Stormwater Management Code	
Stormwater drainage and disposal (Cl.E7.7.1) • A1 – Disposal of stormwater to public infrastructure • A2 – Sensitive design of stormwater system incorporates water sensitive urban design principles • A3 – Design of minor stormwater drainage system • A4 – Design of major stormwater drainage system	A1 – complies - Stormwater from new impervious surfaces to be disposed of by gravity to public stormwater infrastructure. A2 – complies - stormwater system incorporates water sensitive urban design principles. A3 – complies A4 – n/a

Note: Codes not listed in this Checklist have been assessed as not being relevant to theassessment of this application.

Development Application:
DA-2021-196
Plan Reference: P4
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31 LEWAN AVENUE PROPOSED UNITS
SHEET SCHEDULE

COVER PAGE	000-31LEWAN
EXIST. SITE PLAN	001E-31LEWAN
PROP. SITE PLAN	001-31LEWAN
HYDRAULICS + DRAINAGE	001H-31LEWAN
IMPERVIOUS SURFACE AREA	001P-31LEWAN
SUMMER SHADOW DIAGRAM	001SS-31LEWAN
WINTER SHADOW DIAGRAM	001SW-31LEWAN
VEHICULAR SWEEP PATHS	001V-31LEWAN
SECTIONAL ELEVATIONS	001Z-31LEWAN
CUT & FILL + WASTEWATER MGMT	002-31LEWAN
FLOOR PLANS	003-31LEWAN
ELEVATIONS	004-31LEWAN
RENDERS 1 OF 3	005-31LEWAN
RENDERS 2 OF 3	006-31LEWAN
RENDERS 3 OF 3	007-31LEWAN

MAY REQUIRE MIN. 1700H, MAX. 20% TRANSPARENCY PRIVACY SCREEN

REV.	DESCRIPTION
0	ISSUED FOR DEVELOPMENT APPROVAL. 19-04-2021
1	SEWER MAIN RE-ALIGNED. 14-05-2021
2	REISSUED FOR DEVELOPMENT APPROVAL. 09-09-2021
3	REISSUED FOR DEVELOPMENT APPROVAL. 14-09-2021

REFERENCE
REFER TO SHEET SCHEDULE DRG. 31-LEWAN-000

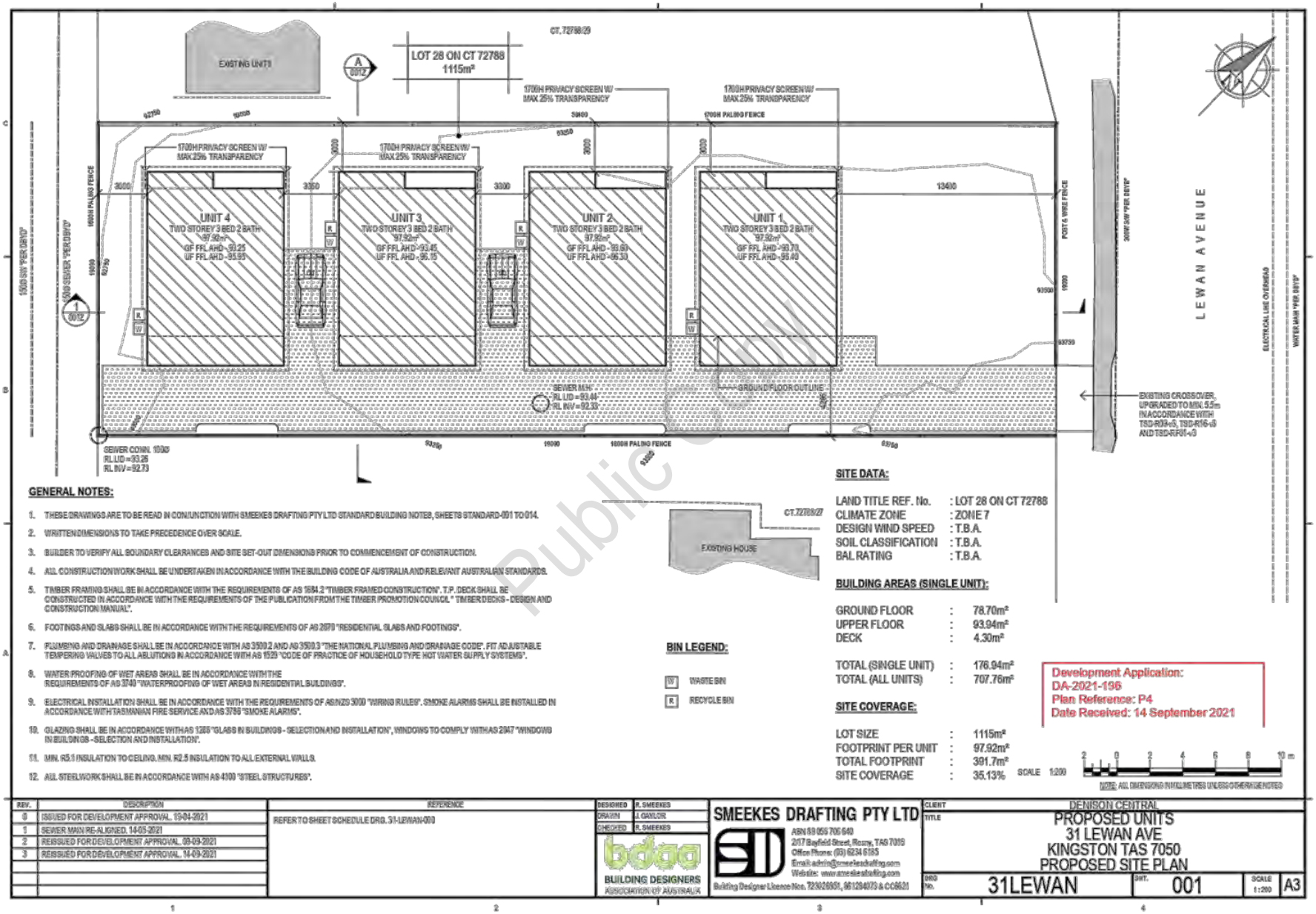
DESIGNED R. SMEEKES
DRAWN J. GAYLOR
CHECKED R. SMEEKES

BUILDING DESIGNERS ASSOCIATION OF AUSTRALIA

SMEEKES DRAFTING PTY LTD
ABN 89 056 706 640
2/17 Bayfield Street, Rosny, TAS 7018
Office Phone: (03) 6234 6155
Email: admin@smeekesdrafting.com
Website: www.smeekesdrafting.com
Building Designer Licence Nos. 723026951, 661284073 & CC6521

CLIENT DENISON CENTRAL
TITLE PROPOSED UNITS
31 LEWAN AVE
KINGSTON TAS 7050
COVER PAGE

DRG No. 31LEWAN | SHT. 000 | SCALE 1:100 | A3



GENERAL NOTES:

1. THESE DRAWINGS ARE TO BE READ IN CONJUNCTION WITH SMEEKES DRAFTING PTY LTD STANDARD BUILDING NOTES, SHEETS STANDARD-001 TO 014.
2. WRITTEN DIMENSIONS TO TAKE PRECEDENCE OVER SCALE.
3. BUILDER TO VERIFY ALL BOUNDARY CLEARANCES AND SITE SET-OUT DIMENSIONS PRIOR TO COMMENCEMENT OF CONSTRUCTION.
4. ALL CONSTRUCTION WORK SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE BUILDING CODE OF AUSTRALIA AND RELEVANT AUSTRALIAN STANDARDS.
5. TIMBER FRAMING SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF AS 1684.2 "TIMBER FRAMED CONSTRUCTION". T.P. DECK SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS OF THE PUBLICATION FROM THE TIMBER PROMOTION COUNCIL " TIMBER DECKS - DESIGN AND CONSTRUCTION MANUAL".
6. FOOTINGS AND SLABS SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF AS 2870 "RESIDENTIAL SLABS AND FOOTINGS".
7. PLUMBING AND DRAINAGE SHALL BE IN ACCORDANCE WITH AS 3500.2 AND AS 3500.3 "THE NATIONAL PLUMBING AND DRAINAGE CODE". FIT AD JUSTABLE TEMPERING VALVES TO ALL ABLUTIONS IN ACCORDANCE WITH AS 1529 "CODE OF PRACTICE OF HOUSEHOLD TYPE HOT WATER SUPPLY SYSTEMS".
8. WATER PROOFING OF WET AREAS SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF AS 3740 "WATERPROOFING OF WET AREAS IN RESIDENTIAL BUILDINGS".
9. ELECTRICAL INSTALLATION SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF AS/NZS 3000 "WIRING RULES". SMOKE ALARMS SHALL BE INSTALLED IN ACCORDANCE WITH TASMANIAN FIRE SERVICE AND AS 3786 "SMOKE ALARMS".
10. GLAZING SHALL BE IN ACCORDANCE WITH AS 1288 "GLASS IN BUILDINGS - SELECTION AND INSTALLATION", WINDOWS TO COMPLY WITH AS 2047 "WINDOWS IN BUILDINGS - SELECTION AND INSTALLATION".
11. MIN. R5.1 INSULATION TO CEILING. MIN. R2.5 INSULATION TO ALL EXTERNAL WALLS.
12. ALL STEELWORK SHALL BE IN ACCORDANCE WITH AS 4100 "STEEL STRUCTURES".

BIN LEGEND:

W WASTE BIN
R RECYCLE BIN

SITE DATA:

LAND TITLE REF. No.	: LOT 28 ON CT 72788
CLIMATE ZONE	: ZONE 7
DESIGN WIND SPEED	: T.B.A.
SOIL CLASSIFICATION	: T.B.A.
BAL RATING	: T.B.A.

BUILDING AREAS (SINGLE UNIT):

GROUND FLOOR	:	78.70m²
UPPER FLOOR	:	93.94m²
DECK	:	4.30m²
TOTAL (SINGLE UNIT)	:	176.94m²
TOTAL (ALL UNITS)	:	707.76m²

SITE COVERAGE:

LOT SIZE	:	1115m²
FOOTPRINT PER UNIT	:	97.92m²
TOTAL FOOTPRINT	:	391.7m²
SITE COVERAGE	:	35.13%

SCALE 1:200

NOTE: ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

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3	REISSUED FOR DEVELOPMENT APPROVAL. 14-09-2021

REFERENCE: REFER TO SHEET SCHEDULE DRG. 31-LEWAN-000

DESIGNED R. SMEEKES
DRAWN J. GAYLOR
CHECKED R. SMEEKES

BUILDING DESIGNERS ASSOCIATION OF AUSTRALIA

SMEEKES DRAFTING PTY LTD
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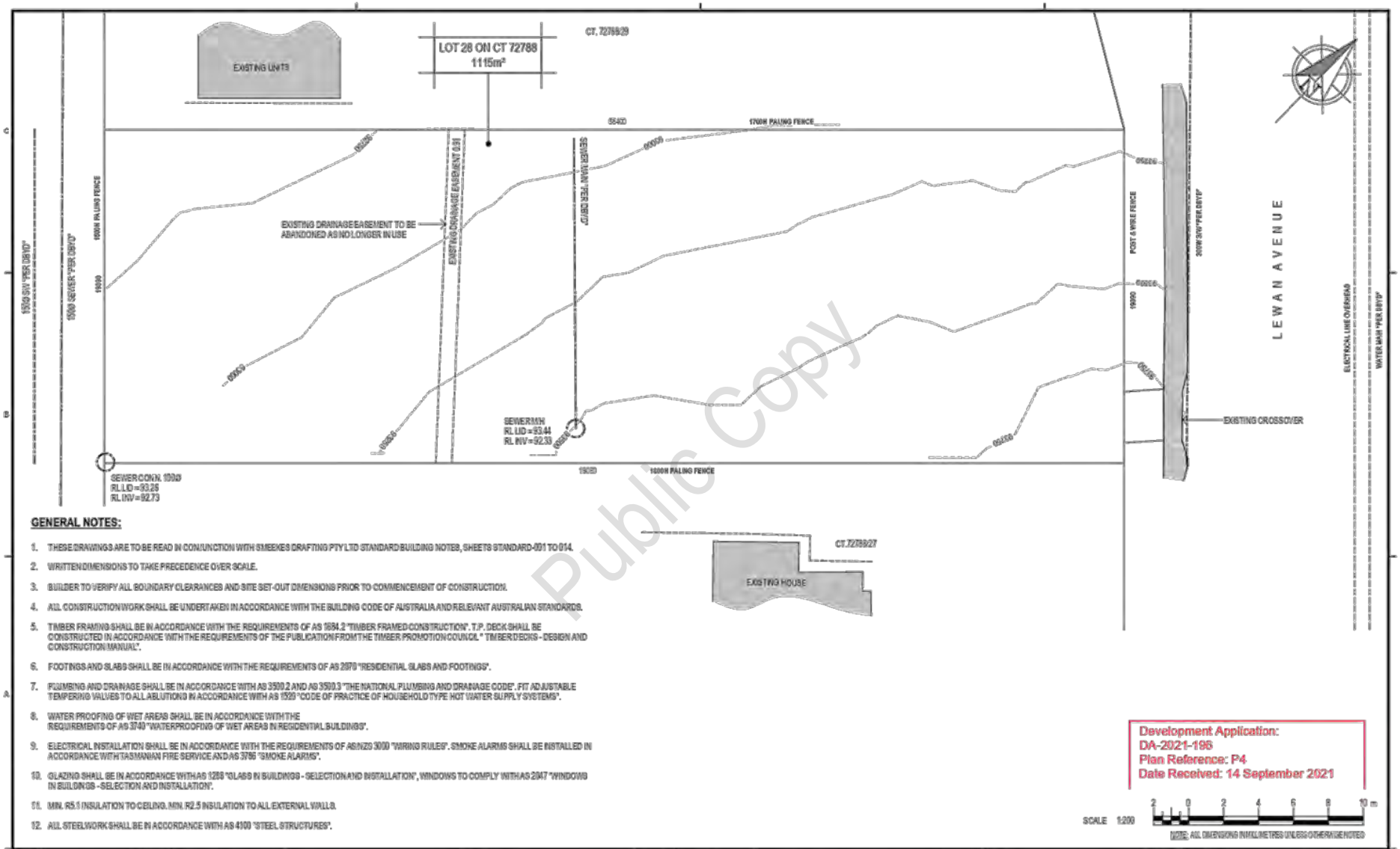
2/17 Bayfield Street, Rosny, TAS 7018
Office Phone: (03) 6234 6185
Email: admin@smeekesdrafting.com
Website: www.smeekesdrafting.com
Building Designer Licence Nos. 7230269SI, 961284073 & CC862I

CLIENT: DENISON CENTRAL
TITLE: PROPOSED UNITS
31 LEWAN AVE
KINGSTON TAS 7050
PROPOSED SITE PLAN

DRG No. 31LEWAN | SHT. 001 | SCALE 1:200 | A3



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SCALE 1:200 — 2 0 2 4 6 8 10 m

NOTE: ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

REV.	DESCRIPTION
0	ISSUED FOR DEVELOPMENT APPROVAL, 19-04-2021
1	SEWER MAIN RE-ALIGNED, 14-05-2021
2	REISSUED FOR DEVELOPMENT APPROVAL, 09-09-2021
3	REISSUED FOR DEVELOPMENT APPROVAL, 14-09-2021

REFERENCE: REFER TO SHEET SCHEDULE DRG. 31-LEWAN-000

DESIGNED: R. SMEEKES
DRAWN: J. GAYLOR
CHECKED: R. SMEEKES

BUILDING DESIGNERS ASSOCIATION OF AUSTRALIA

SMEEKES DRAFTING PTY LTD
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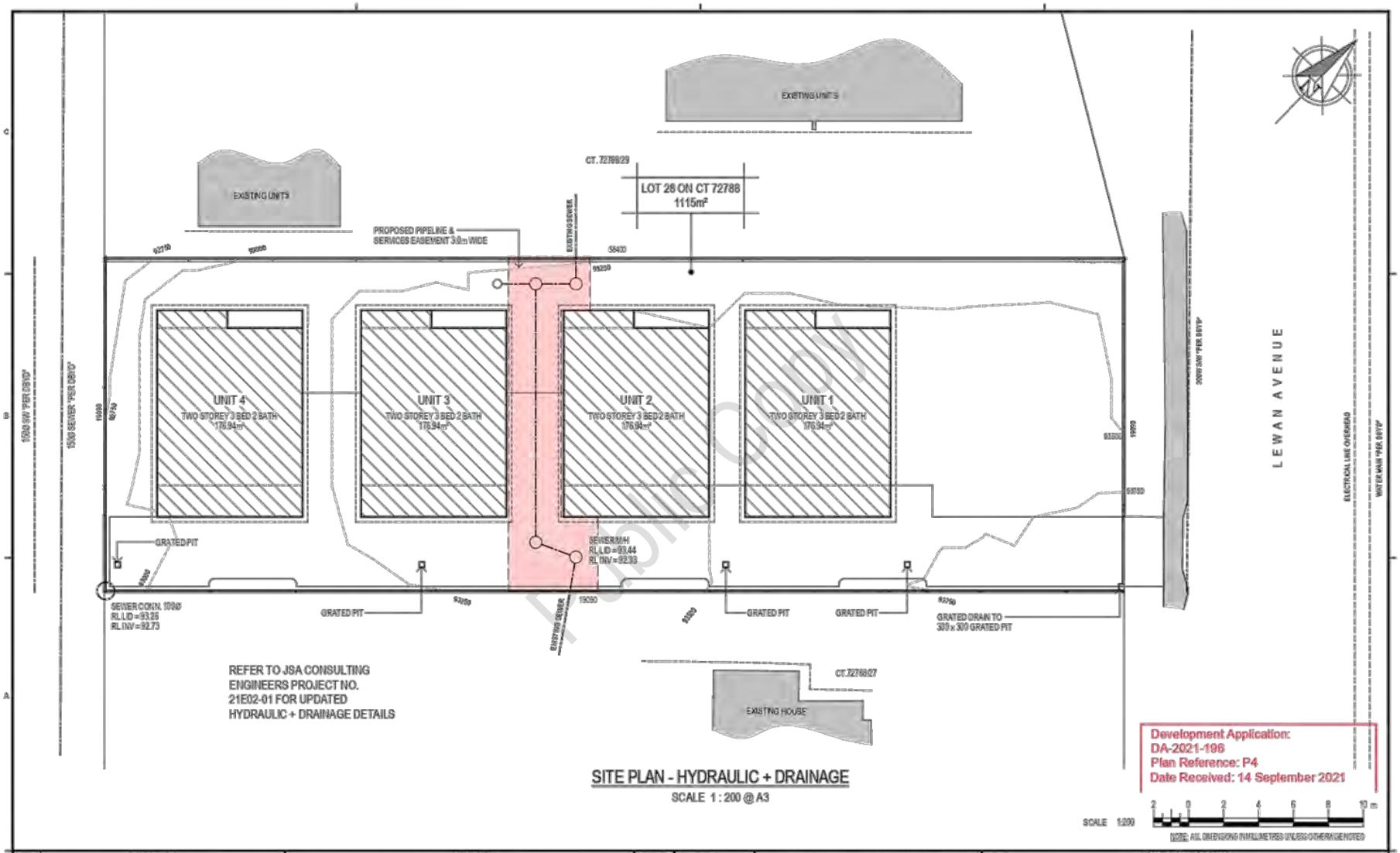
Office Phone: (03) 6234 6185
Email: admin@smeekesdrafting.com
Website: www.smeekesdrafting.com
Building Designer Licence Nos. 723026951, 961284073 & CC6521

CLIENT: DENISON CENTRAL
TITLE: PROPOSED UNITS
31 LEWAN AVE
KINGSTON TAS 7050
EXISTING SITE PLAN

DRG No. 31LEWAN | SHT. 001E | SCALE 1:200 | A3


EXISTING UNITS
CT. 72788/29
LOT 28 ON CT 72788
1115m²
EXISTING UNITS
PROPOSED PIPELINE & SERVICES EASEMENT 3.0m WIDE
EXISTING SEWER
UNIT 4
TWO STOREY 3 BED 2 BATH
176.94m²
UNIT 3
TWO STOREY 3 BED 2 BATH
176.94m²
UNIT 2
TWO STOREY 3 BED 2 BATH
176.94m²
UNIT 1
TWO STOREY 3 BED 2 BATH
176.94m²
LEWAN AVENUE
GRATED PIT
SEWER MH
RL I.D = 93.44
RL INV = 92.33
SEWER CONN. 100Ø
RL I.D = 93.26
RL INV = 92.73
GRATED PIT
GRATED PIT
GRATED PIT
GRATED DRAIN TO
300 x 300 GRATED PIT
EXISTING SEWER
REFER TO JSA CONSULTING
ENGINEERS PROJECT NO.
21E02-01 FOR UPDATED
HYDRAULIC + DRAINAGE DETAILS
CT. 72768/27
EXISTING HOUSE
SITE PLAN - HYDRAULIC + DRAINAGE
SCALE 1 : 200 @ A3
Development Application:
DA-2021-196
Plan Reference: P4
Date Received: 14 September 2021
SCALE 1:200
NOTE: ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED
REV. DESCRIPTION
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REFERENCE
REFER TO SHEET SCHEDULE DRG. 31-LEWAN-000
DESIGNED R. SMEEKES
DRAWN J. GAYLOR
CHECKED R. SMEEKES
BUILDING DESIGNERS ASSOCIATION OF AUSTRALIA
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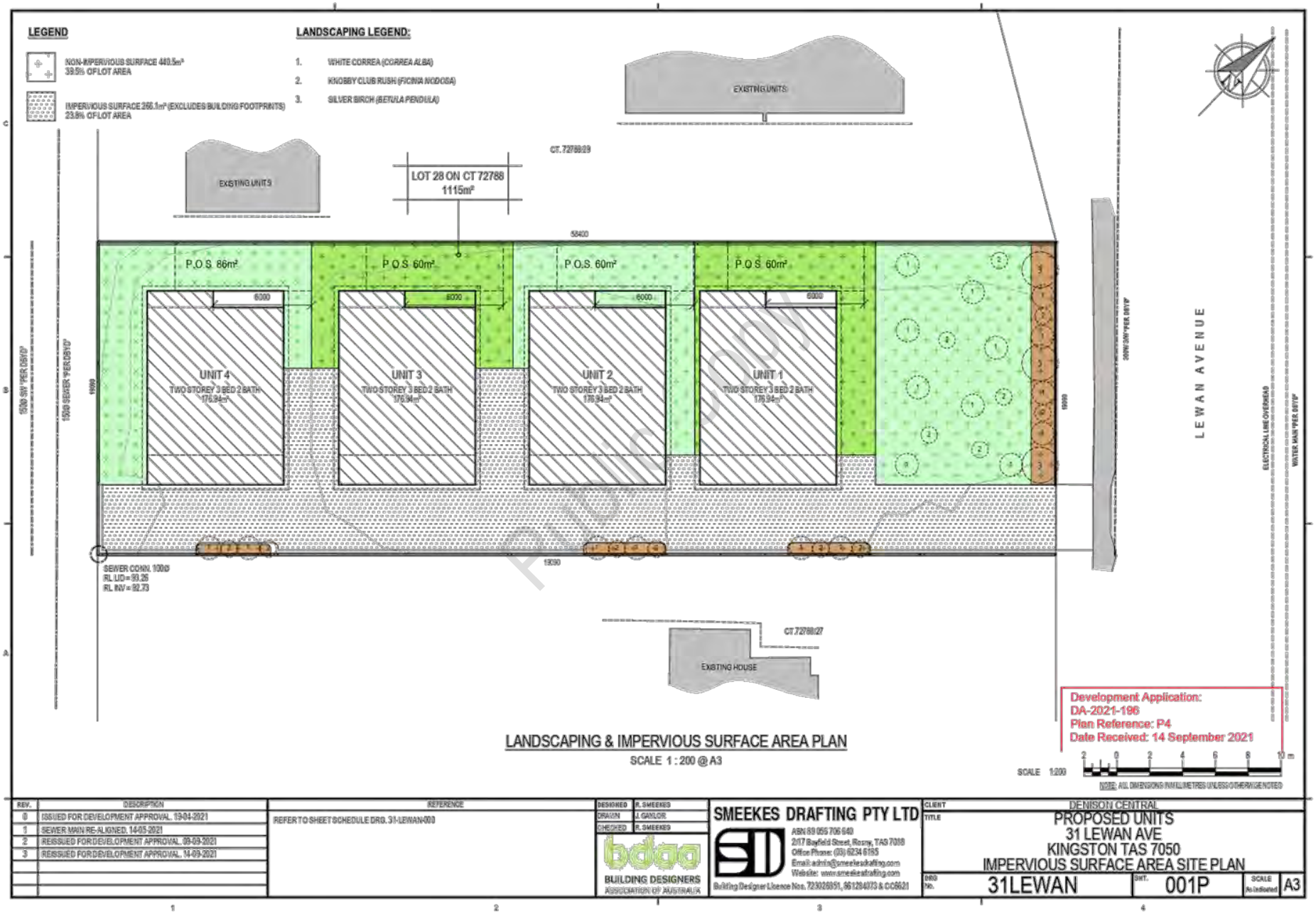
Website: www.smeekesdrafting.com
Building Designer Licence Nos. 723026951, 951284073 & CC6521
CLIENT DENISON CENTRAL
TITLE PROPOSED UNITS
31 LEWAN AVE
KINGSTON TAS 7050
SITE PLAN - HYDRAULICS + DRAINAGE
DRG No. 31LEWAN
SHT. 001H
SCALE 1:200
A3



LANDSCAPING & IMPERVIOUS SURFACE AREA PLAN

SCALE 1 : 200 @ A3

REV.	DESCRIPTION
0	ISSUED FOR DEVELOPMENT APPROVAL, 19-04-2021
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REFERENCE: REFER TO SHEET SCHEDULE DRG. 31-LEWAN-000

DESIGNED: R. SMEEKES
DRAWN: J. GAYLOR
CHECKED: R. SMEEKES

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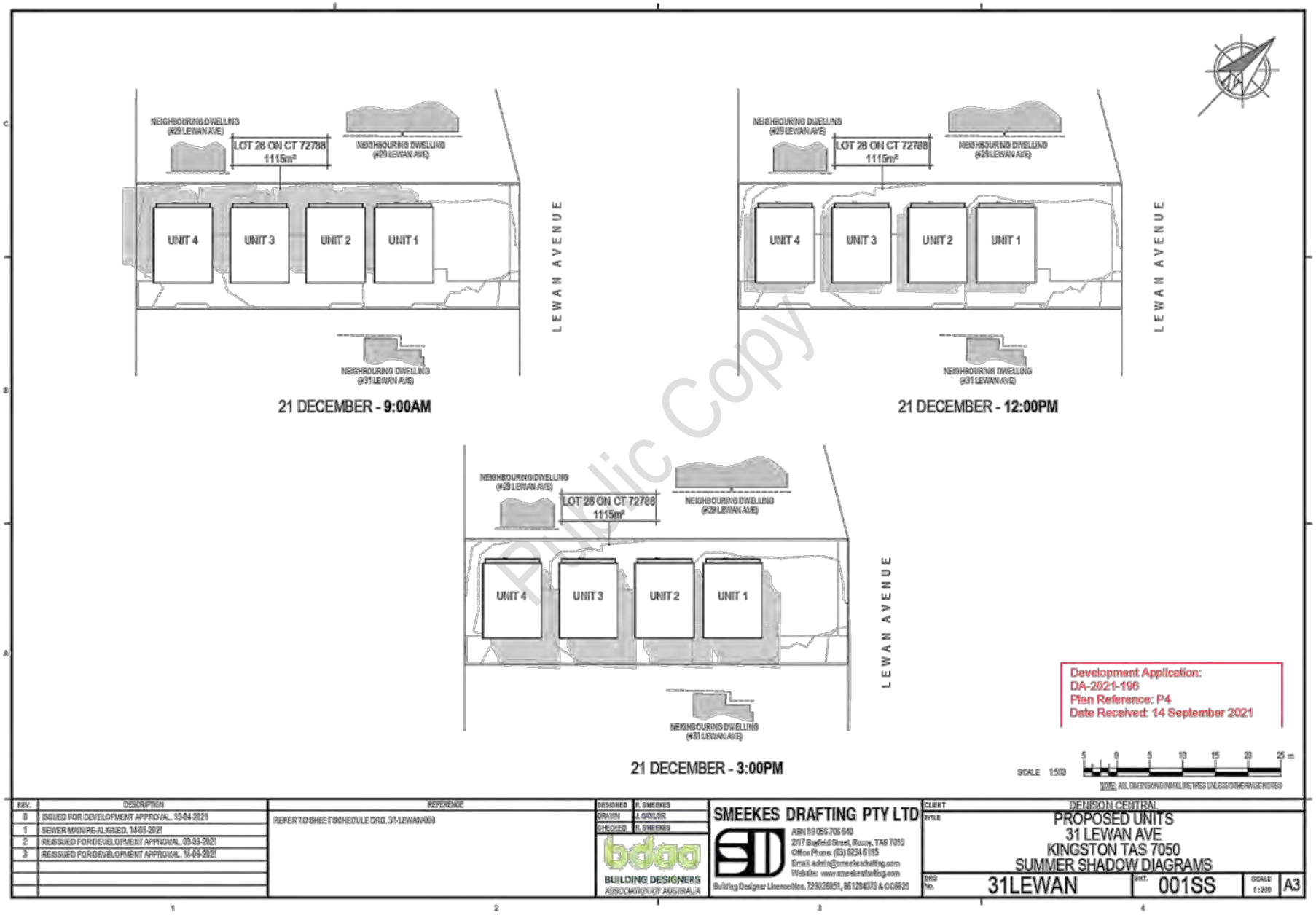
Website: www.smeekesdrafting.com
Building Designer Licence Nos. 723026951, 861294073 & CC6621

CLIENT: DENISON CENTRAL
TITLE: PROPOSED UNITS
31 LEWAN AVE
KINGSTON TAS 7050
IMPERVIOUS SURFACE AREA SITE PLAN

DRG No. 31LEWAN | SHT. 001P | SCALE As indicated | A3


NEIGHBOURING DWELLING (#29 LEWAN AVE)
LOT 28 ON CT 72788 1115m²
NEIGHBOURING DWELLING (#29 LEWAN AVE)
UNIT 4
UNIT 3
UNIT 2
UNIT 1
LEWAN AVENUE
NEIGHBOURING DWELLING (#31 LEWAN AVE)
21 DECEMBER - 9:00AM
21 DECEMBER - 12:00PM
21 DECEMBER - 3:00PM
Public Copy
Development Application:
DA-2021-196
Plan Reference: P4
Date Received: 14 September 2021
SCALE 1:500
NOTE: ALL DIMENSIONS IN KILOMETRES UNLESS OTHERWISE NOTED
REV. DESCRIPTION
0 ISSUED FOR DEVELOPMENT APPROVAL. 19-04-2021
1 SEWER MAIN RE-ALIGNED. 14-05-2021
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3 REISSUED FOR DEVELOPMENT APPROVAL. 14-09-2021
REFERENCE
REFER TO SHEET SCHEDULE DRG. 31-LEWAN-000
DESIGNED R. SMEEKES
DRAWN J. GAYLOR
CHECKED R. SMEEKES
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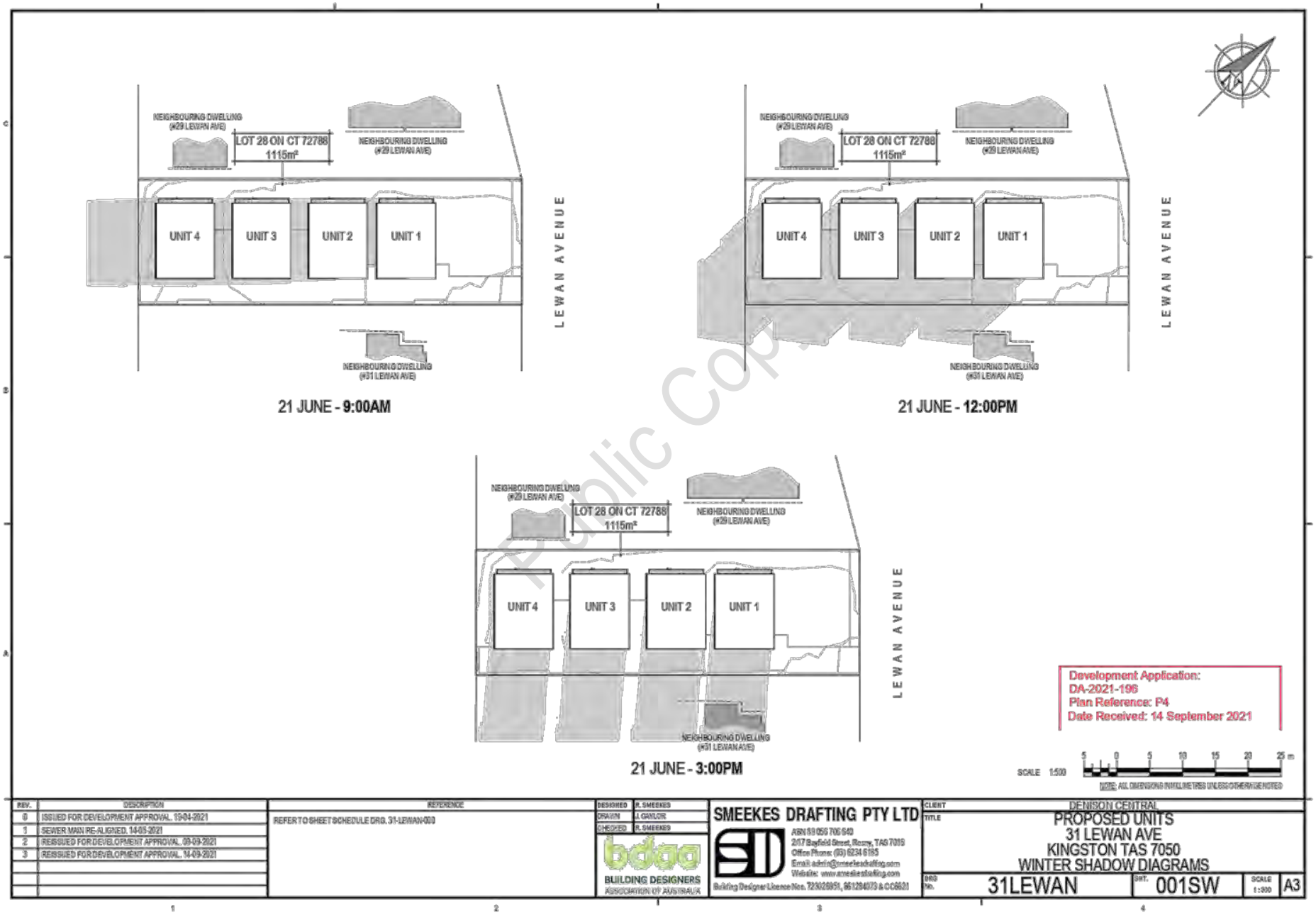
Website: www.smeekesdrafting.com
Building Designer Licence Nos. 723026951, 661284073 & CC6521
CLIENT DENISON CENTRAL
TITLE PROPOSED UNITS
31 LEWAN AVE
KINGSTON TAS 7050
SUMMER SHADOW DIAGRAMS
DRG No. 31LEWAN
SHT. 001SS
SCALE 1:500
A3


NEIGHBOURING DWELLING (#29 LEWAN AVE)
LOT 28 ON CT 72788 1115m²
NEIGHBOURING DWELLING (#29 LEWAN AVE)
UNIT 4
UNIT 3
UNIT 2
UNIT 1
LEWAN AVENUE
NEIGHBOURING DWELLING (#31 LEWAN AVE)
21 JUNE - 9:00AM
21 JUNE - 12:00PM
21 JUNE - 3:00PM
Development Application:
DA-2021-196
Plan Reference: P4
Date Received: 14 September 2021
SCALE 1:500
5 0 5 10 15 20 25 m
NOTE: ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED
REV. DESCRIPTION
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CHECKED R. SMEEKES
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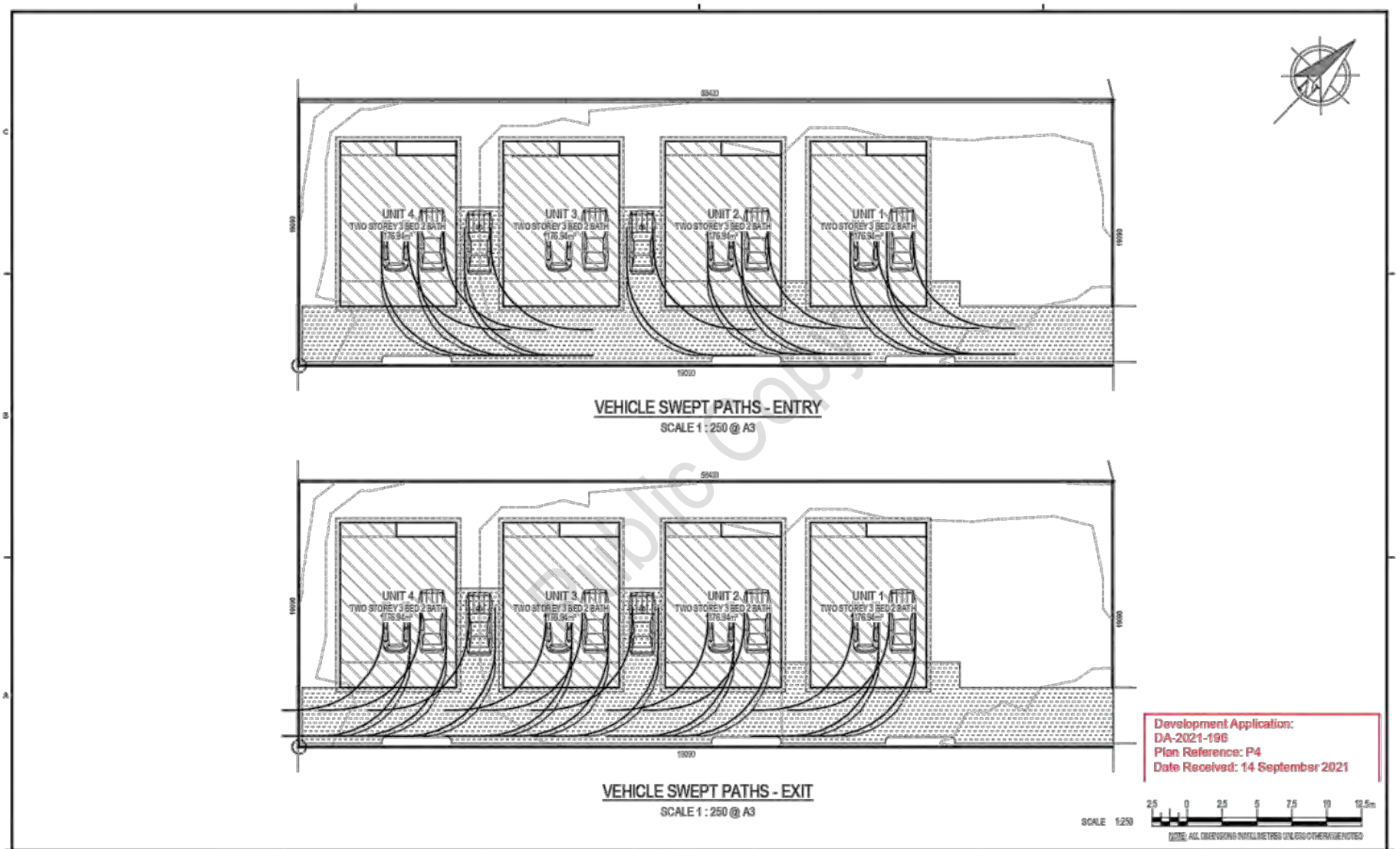
Website: www.smeekesdrafting.com
Building Designer Licence Nos. 723026951, 961294073 & CC8621
CLIENT DENISON CENTRAL
TITLE PROPOSED UNITS
31 LEWAN AVE
KINGSTON TAS 7050
WINTER SHADOW DIAGRAMS
DRG No. 31LEWAN
SHT. 001SW
SCALE 1:500
A3


UNIT 4
TWO STOREY 3 BED 2 BATH
176.94m²
UNIT 3
TWO STOREY 3 BED 2 BATH
176.94m²
UNIT 2
TWO STOREY 3 BED 2 BATH
176.94m²
UNIT 1
TWO STOREY 3 BED 2 BATH
176.94m²
VEHICLE SWEPT PATHS - ENTRY
SCALE 1 : 250 @ A3
VEHICLE SWEPT PATHS - EXIT
SCALE 1 : 250 @ A3
Development Application:
DA-2021-196
Plan Reference: P4
Date Received: 14 September 2021
SCALE 1:250
2.5 0 2.5 5 7.5 10 12.5m
NOTE: ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED
REV. DESCRIPTION
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REFERENCE
REFER TO SHEET SCHEDULE DRG. 31-LEWAN-000
DESIGNED R. SMEEKES
DRAWN J. GAYLOR
CHECKED R. SMEEKES
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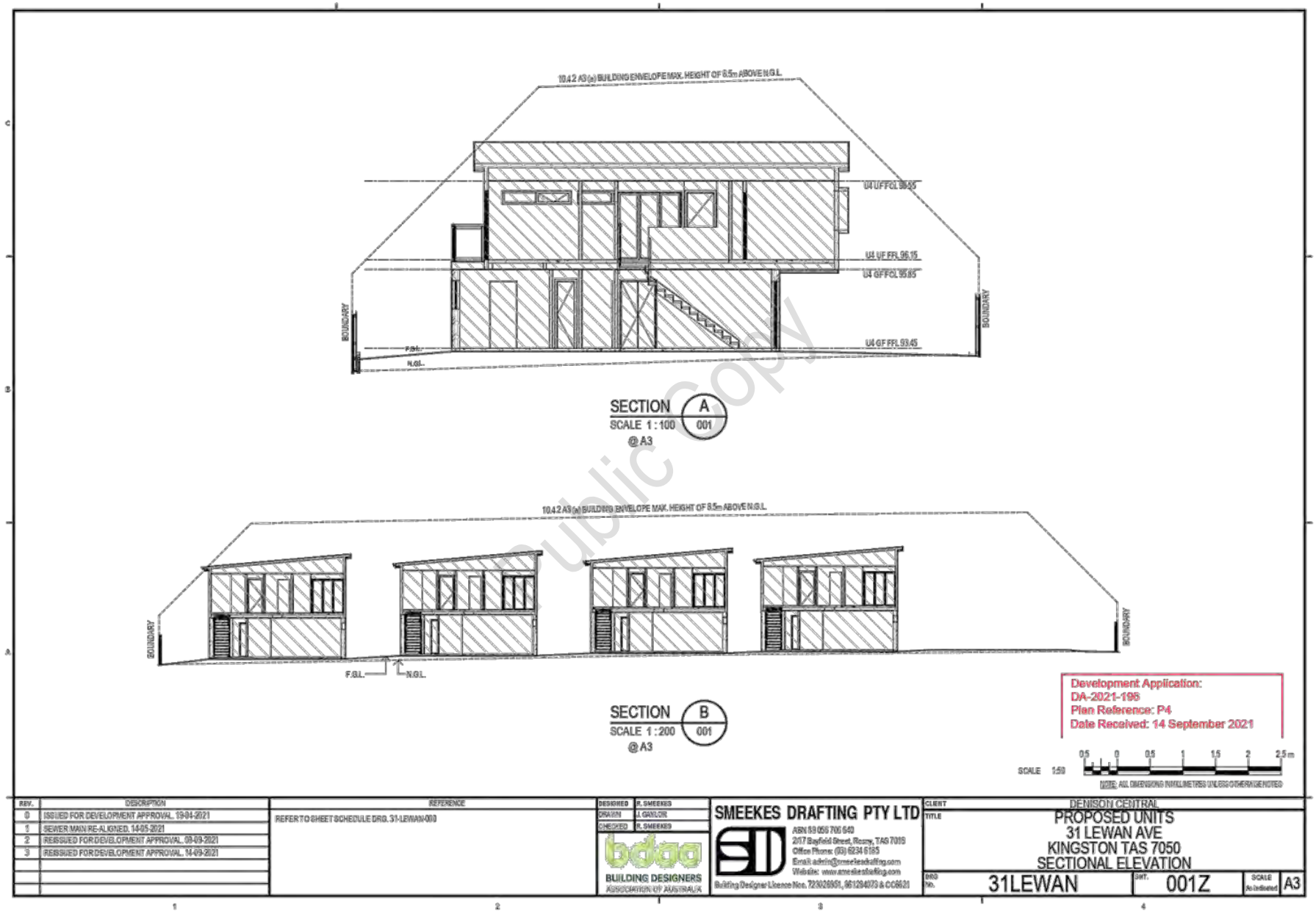
Website: www.smeekesdrafting.com
Building Designer Licence Nos. 723020851, 561284073 & CC6521
CLIENT DENISON CENTRAL
TITLE PROPOSED UNITS
31 LEWAN AVE
KINGSTON TAS 7050
SITE PLAN - VEHICULAR SWEEP PATHS
DRG No. 31LEWAN
SHT. 001V
SCALE 1:250
A3


10.4.2 A3 (a) BUILDING ENVELOPE MAX. HEIGHT OF 8.5m ABOVE N.G.L.
U4 U/F FFL 98.65
U4 UF FFL 96.15
U4 GF FFL 95.65
U4 GF FFL 93.45
BOUNDARY
BOUNDARY
F.G.L.
N.G.L.
SECTION A
SCALE 1 : 100 @ A3
001
10.4.2 A3 (a) BUILDING ENVELOPE MAX. HEIGHT OF 8.5m ABOVE N.G.L.
BOUNDARY
BOUNDARY
F.G.L.
N.G.L.
SECTION B
SCALE 1 : 200 @ A3
001
Development Application:
DA-2021-195
Plan Reference: P4
Date Received: 14 September 2021
SCALE 1:50
0.5 0 0.5 1 1.5 2 2.5 m
NOTE: ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED
REV. DESCRIPTION
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REFERENCE
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DESIGNED R. SMEEKES
DRAWN J. GAYLOR
CHECKED R. SMEEKES
BUILDING DESIGNERS ASSOCIATION OF AUSTRALIA
SMEEKES DRAFTING PTY LTD
ABN 59 056 706 640
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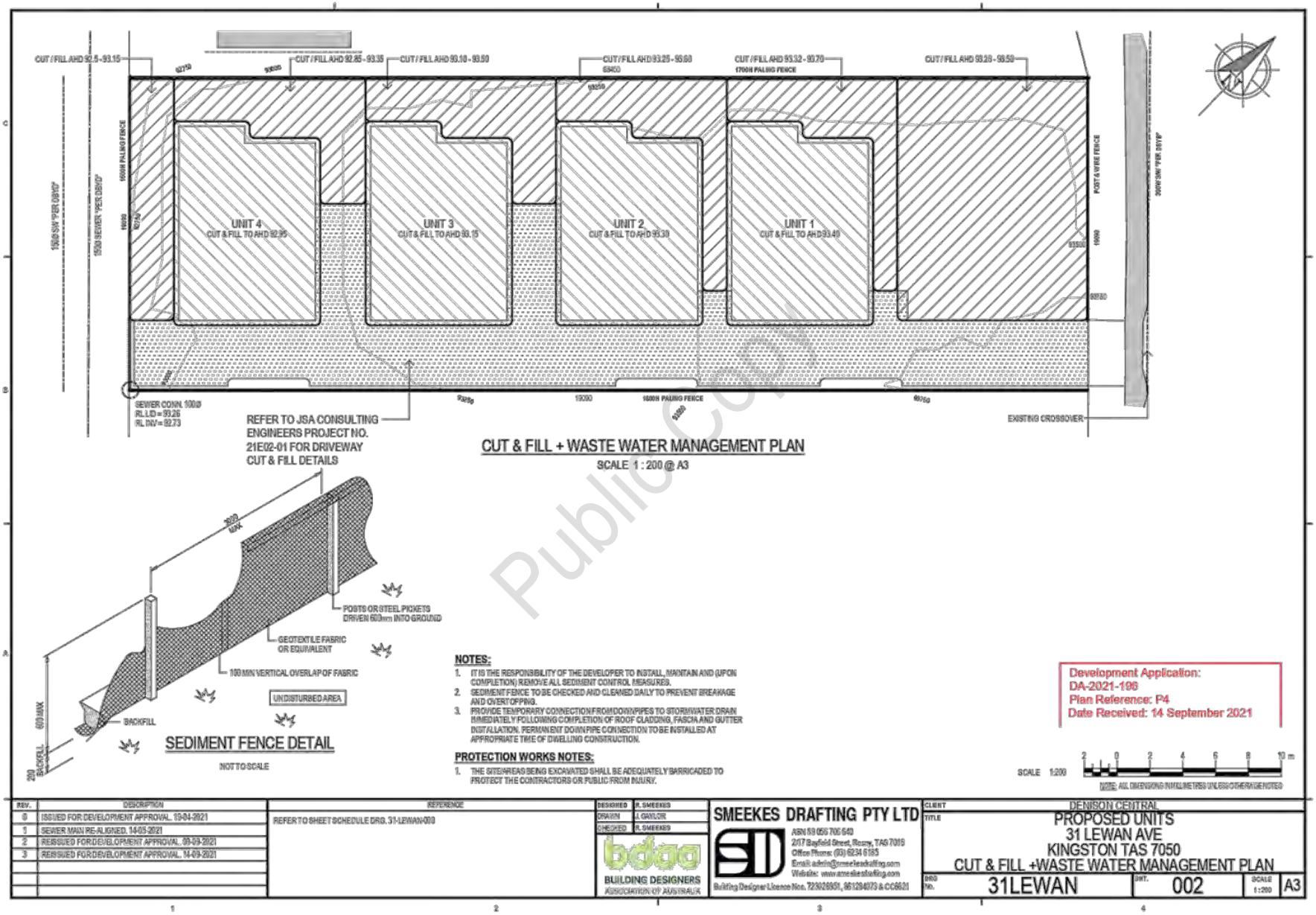
Office Phone: (03) 6234 6185
Email: admin@smeekesdrafting.com
Website: www.smeekesdrafting.com
Building Designer Licence Nos. 723026951, 961294073 & CC8621
CLIENT DENISON CENTRAL
TITLE PROPOSED UNITS
31 LEWAN AVE
KINGSTON TAS 7050
SECTIONAL ELEVATION
DRG No. 31LEWAN
DWT. 001Z
SCALE As Indicated
A3


CUT / FILL AHD 92.5 - 93.15
CUT / FILL AHD 92.85 - 93.35
CUT / FILL AHD 93.10 - 93.50
CUT / FILL AHD 93.25 - 93.60
CUT / FILL AHD 93.32 - 93.70
CUT / FILL AHD 93.28 - 93.50
1700H PALING FENCE
POST & WIRE FENCE
UNIT 4
CUT & FILL TO AHD 92.95
UNIT 3
CUT & FILL TO AHD 93.15
UNIT 2
CUT & FILL TO AHD 93.30
UNIT 1
CUT & FILL TO AHD 93.40
SEWER CONN. 100Ø
RL LID = 99.26
RL INV = 92.73
EXISTING CROSSOVER
REFER TO JSA CONSULTING ENGINEERS PROJECT NO. 21E02-01 FOR DRIVEWAY CUT & FILL DETAILS
CUT & FILL + WASTE WATER MANAGEMENT PLAN
SCALE 1 : 200 @ A3
POSTS OR STEEL PICKETS DRIVEN 600mm INTO GROUND
GEOTEXTILE FABRIC OR EQUIVALENT
100 MIN VERTICAL OVERLAP OF FABRIC
UNDISTURBED AREA
BACKFILL
SEDIMENT FENCE DETAIL
NOT TO SCALE
NOTES:
1. IT IS THE RESPONSIBILITY OF THE DEVELOPER TO INSTALL, MAINTAIN AND (UPON COMPLETION) REMOVE ALL SEDIMENT CONTROL MEASURES.
2. SEDIMENT FENCE TO BE CHECKED AND CLEANED DAILY TO PREVENT BREAKAGE AND OVERTOPPING.
3. PROVIDE TEMPORARY CONNECTION FROM DOWNPIPES TO STORMWATER DRAIN IMMEDIATELY FOLLOWING COMPLETION OF ROOF CLADDING, FASCIA AND GUTTER INSTALLATION. PERMANENT DOWNPIPE CONNECTION TO BE INSTALLED AT APPROPRIATE TIME OF DWELLING CONSTRUCTION.
PROTECTION WORKS NOTES:
1. THE SITE/AREAS BEING EXCAVATED SHALL BE ADEQUATELY BARRICADED TO PROTECT THE CONTRACTORS OR PUBLIC FROM INJURY.
Development Application:
DA-2021-196
Plan Reference: P4
Date Received: 14 September 2021
SCALE 1:200
NOTE: ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED
REV. 0 ISSUED FOR DEVELOPMENT APPROVAL. 19-04-2021
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REFERENCE
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DESIGNED R. SMEEKES
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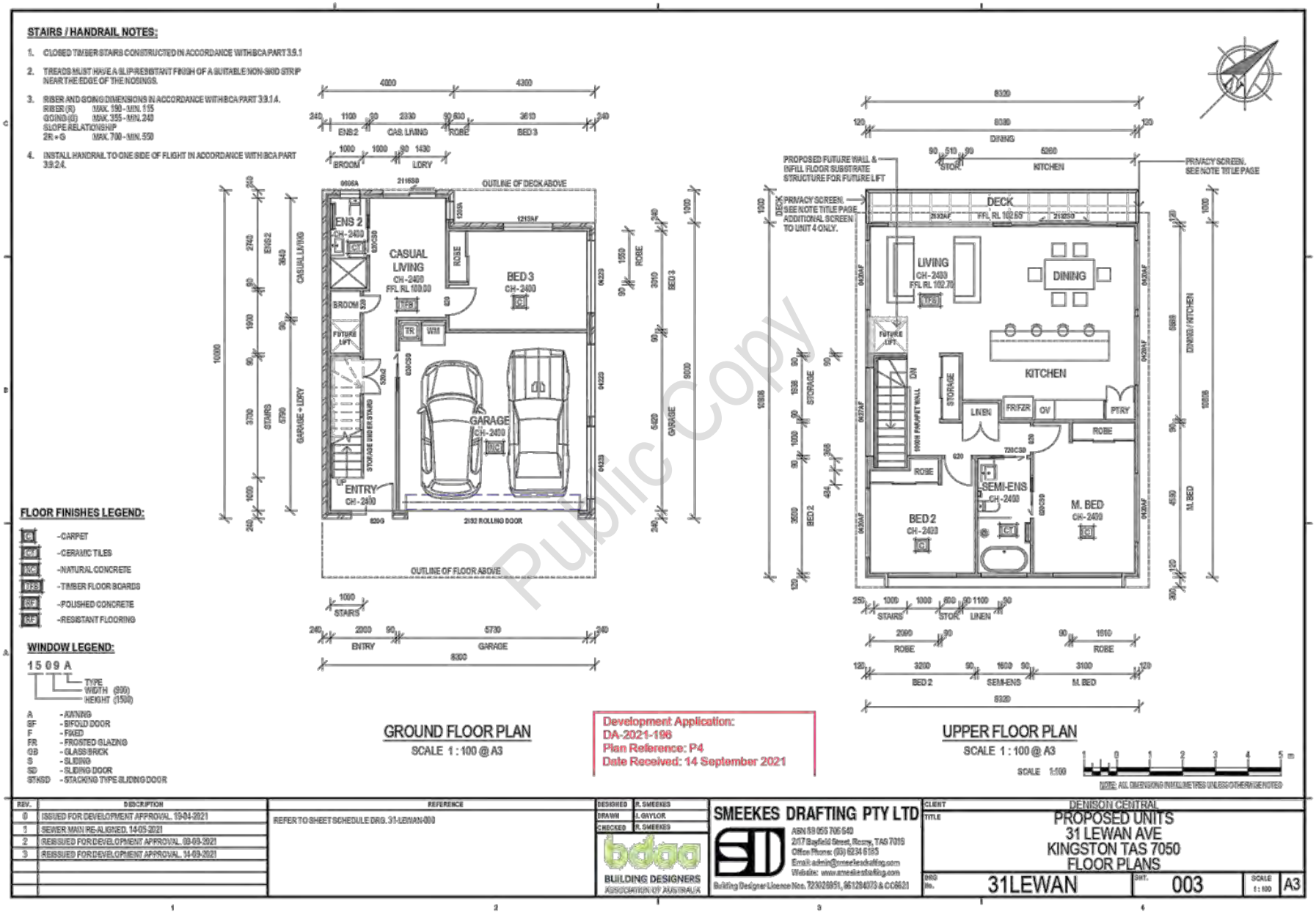
Building Designer Licence Nos. 723026951, 961294073 & CC6521
CLIENT DENISON CENTRAL
TITLE PROPOSED UNITS
31 LEWAN AVE
KINGSTON TAS 7050
CUT & FILL +WASTE WATER MANAGEMENT PLAN
DRG No. 31LEWAN
SHT. 002
SCALE 1:200
A3


STAIRS / HANDRAIL NOTES:
1. CLOSED TIMBER STAIRS CONSTRUCTED IN ACCORDANCE WITH BCA PART 3.9.1
2. TREADS MUST HAVE A SLIP-RESISTANT FINISH OF A SUITABLE NON-SKID STRIP NEAR THE EDGE OF THE NOSINGS.
3. RISER AND GOING DIMENSIONS IN ACCORDANCE WITH BCA PART 3.9.1.4.
RISER (R) MAX. 190 - MIN. 115
GOING (G) MAX. 355 - MIN. 240
SLOPE RELATIONSHIP
2R + G MAX. 700 - MIN. 550
4. INSTALL HANDRAIL TO ONE SIDE OF FLIGHT IN ACCORDANCE WITH BCA PART 3.9.2.4.
FLOOR FINISHES LEGEND:
-CARPET
-CERAMIC TILES
-NATURAL CONCRETE
-TIMBER FLOOR BOARDS
-POLISHED CONCRETE
-RESISTANT FLOORING
WINDOW LEGEND:
1509A
TYPE
WIDTH (900)
HEIGHT (1500)
A - AWNING
BF - BIFOLD DOOR
F - FIXED
FR - FROSTED GLAZING
GB - GLASS BRICK
S - SLIDING
SD - SLIDING DOOR
STKSD - STACKING TYPE SLIDING DOOR
ENS 2
CASUAL LIVING
BED 3
BROOM
LDRY
FUTURE LIFT
STAIRS
STORAGE UNDER STAIRS
GARAGE
ENTRY
2132 ROLLING DOOR
OUTLINE OF DECK ABOVE
OUTLINE OF FLOOR ABOVE
GARAGE + LDRY
GROUND FLOOR PLAN
SCALE 1 : 100 @ A3
PROPOSED FUTURE WALL & INFILL FLOOR SUBSTRATE STRUCTURE FOR FUTURE LIFT
PRIVACY SCREEN. SEE NOTE TITLE PAGE
ADDITIONAL SCREEN TO UNIT 4 ONLY.
PRIVACY SCREEN. SEE NOTE TITLE PAGE
DECK
LIVING
DINING
KITCHEN
STORAGE
LINEN
FRIZR
OV
PTRY
ROBE
SEMI-ENS
BED 2
M. BED
DINING / KITCHEN
UPPER FLOOR PLAN
SCALE 1 : 100 @ A3
SCALE 1:100
NOTE: ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED
Development Application:
DA-2021-196
Plan Reference: P4
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DESIGNED R. SMEEKES
DRAWN I. GAYLOR
CHECKED R. SMEEKES
BUILDING DESIGNERS ASSOCIATION OF AUSTRALIA
SMEEKES DRAFTING PTY LTD
ABN 59 055 706 640
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Office Phone: (03) 6234 6155
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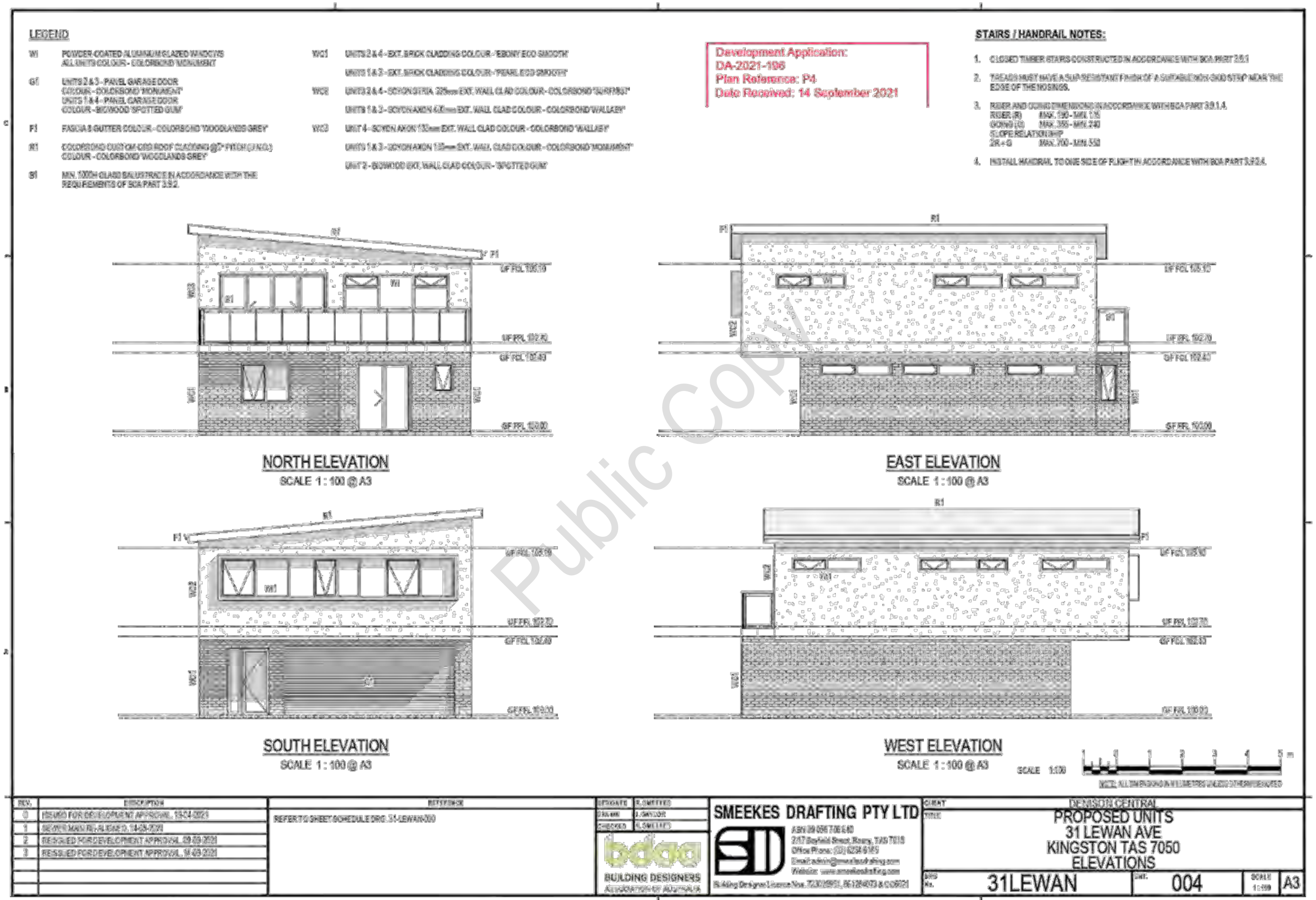
Website: www.smeekesdrafting.com
Building Designer Licence Nos. 723020951, 961284073 & CC6621
CLIENT DENISON CENTRAL
TITLE PROPOSED UNITS
31 LEWAN AVE
KINGSTON TAS 7050
FLOOR PLANS
DRG No. 31LEWAN
SHT. 003
SCALE 1:100
A3


LEGEND
W1 POWDER-COATED ALUMINIUM GLAZED WINDOWS ALL UNITS COLOUR - COLORBOND 'MONUMENT'
G1 UNITS 2 & 3 - PANEL GARAGE DOOR COLOUR - COLORBOND 'MONUMENT' UNITS 1 & 4 - PANEL GARAGE DOOR COLOUR - BIOWOOD 'SPOTTED GUM'
F1 FASCIA & GUTTER COLOUR - COLORBOND 'WOODLANDS GREY'
R1 COLORBOND CUSTOM-ORB ROOF CLADDING COLOUR - COLORBOND 'WOODLANDS GREY'
B1 MIN. 1000H GLASS BALUSTRADE IN ACCORDANCE WITH THE REQUIREMENTS OF BCA PART 3.9.2.
WC1 UNITS 2 & 4 - EXT. BRICK CLADDING COLOUR - 'EBONY ECO SMOOTH'
UNITS 1 & 3 - EXT. BRICK CLADDING COLOUR - 'PEARL ECO SMOOTH'
UNIT 2 - BIOWOOD EXT. WALL CLAD COLOUR - 'SPOTTED GUM'
Development Application:
DA-2021-196
Plan Reference: P4
Date Received: 14 September 2021
STAIRS / HANDRAIL NOTES:
1. CLOSED TIMBER STAIRS CONSTRUCTED IN ACCORDANCE WITH BCA PART 3.9.1
2. TREADS MUST HAVE A SLIP-RESISTANT FINISH OF A SUITABLE NON-SKID STRIP NEAR THE EDGE OF THE NOSINGS.
3. RISER AND GOING DIMENSIONS IN ACCORDANCE WITH BCA PART 3.9.1.4.
SLOPE RELATIONSHIP
4. INSTALL HANDRAIL TO ONE SIDE OF FLIGHT IN ACCORDANCE WITH BCA PART 3.9.2.4.
NORTH ELEVATION
SCALE 1 : 100 @ A3
EAST ELEVATION
SCALE 1 : 100 @ A3
SOUTH ELEVATION
SCALE 1 : 100 @ A3
WEST ELEVATION
SCALE 1 : 100 @ A3
Public Copy
SMEEKES DRAFTING PTY LTD
BUILDING DESIGNERS
DENISON CENTRAL
PROPOSED UNITS
31 LEWAN AVE
KINGSTON TAS 7050
ELEVATIONS
31LEWAN
004
A3

Development Application:
DA-2021-186
Plan Reference: P4
Date Received: 14 September 2021

NOT TO SCALE

REV.	DESCRIPTION
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REFERENCE: REFER TO SHEET SCHEDULE DRG. 31-LEWAN-000

DESIGNED: R. SMEEKES
DRAWN: L. GAYLOR
CHECKED: R. SMEEKES

BUILDING DESIGNERS ASSOCIATION OF AUSTRALIA

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Building Designer Licence Nos. 72302691, 661284078 & CC6921

CLIENT: DENISON CENTRAL
TITLE: PROPOSED UNITS
31 LEWAN AVE
KINGSTON TAS 7050
RENDERS 1 OF 3
DRG No.: 31LEWAN
SHT.: 005
SCALE: A3

Development Application:
DA-2021-196
Plan Reference: P4
Date Received: 14 September 2021

NOT TO SCALE

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DRAWN: J. GAYLOR
CHECKED: R. SMEEKES

BUILDING DESIGNERS ASSOCIATION OF AUSTRALIA

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CLIENT: DENISON CENTRAL
TITLE: PROPOSED UNITS
31 LEWAN AVE
KINGSTON TAS 7050
RENDERS 2 OF 3

DRG No.: 31LEWAN
SHT.: 006
SCALE: A3

Development Application:
DA-2021-196
Plan Reference: P4
Date Received: 14 September 2021

NOT TO SCALE

REV.	DESCRIPTION
0	ISSUED FOR DEVELOPMENT APPROVAL. 13-04-2021
1	SEWER MAIN RE-ALIGNED. 14-05-2021
2	RE-ISSUED FOR DEVELOPMENT APPROVAL. 05-09-2021
3	RE-ISSUED FOR DEVELOPMENT APPROVAL. 14-09-2021

REFERENCE
REFER TO SHEET SCHEDULE DRG. 31 LEWAN 000

DESIGNED R.SWEEKES
DRAWN A.GAYLOR
CHECKED R.SWEEKES

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CLIENT: DENISON CENTRAL
TITLE: PROPOSED UNITS
31 LEWAN AVE
KINGSTON TAS 7050
RENDERS 3 OF 3

DRG NO. 31LEWAN | SHT. 007 | SCALE A3

OPEN SESSION RESUMES

14 NOTICES OF MOTION

14.1 BEACH ROAD, KINGSTON BEACH

The following Notice of Motion was submitted by **Cr Glade-Wright:**

RECOMMENDATION

That Council staff investigate road safety issues involving pedestrians crossing Beach Road, Kingston Beach, and report back to Council with traffic data and recommended solutions.

Background

There is growing community concern for pedestrian safety, and a desire for a pedestrian crossing to allow pedestrian ease and safety when crossing Beach Road.

After parking in the car park, pedestrians are forced to cross Beach Road to attend restaurants, shops and business premises.

At weekends people are drawn to the popular market and/or sport being played on Kingston Beach oval. In summer, beach visitors are attracted to the area, and also need to navigate Beach Road whilst experiencing increased traffic in the area.

It has been stated that pedestrian crossings are not favoured. This being the case, what safety measures can be put in place to protect pedestrians when forced to cross Beach Road?

Can temporary safety measures be put in place in readiness for summer whilst staff fully investigate pedestrian safety in the area?

Officer's Response

A report can be provided.

David Reeve, Director Engineering Services

14.2 COUNCIL CARETAKER PERIOD ARRANGEMENTS

The following Notice of Motion was submitted by **Cr Westwood:**

RECOMMENDATION

That Council officers prepare a report to address the introduction of Caretaker Conventions to guide the actions of Kingborough's elected representatives and Council staff in a 'caretaker role' during the period of a declared local government election, including by-elections.

Background

At both a State and Federal government level, during the period of an election for the House of Assembly or House of Representatives, a period of time known as the 'caretaker period' applies and the Government assumes a 'caretaker role'. Governments follow a set of practices, known as the 'caretaker conventions', which aim to ensure that their actions do not bind an incoming government.

In Tasmania, there are no special arrangements that apply immediately before the period of a local government election.

The intent of the policy should be that, during a caretaker period and until the declaration of the polls, the business of local government including ordinary matters of administration and service delivery should continue. However, no major decisions should be to be made during this period relating to, for example:

- significant appointments;
- major policy decisions that are likely to commit an incoming Council or limit its freedom to act;
- entering into major contracts or agreements; and
- the publication or distribution of election material.

The provision for land use planning decision making requirements, by elected representatives as members in their capacity as members of the Planning Authority, will need to be considered.

The Caretaker Conventions should apply to all elected representatives and Council staff.

Officer's Response

A report can be provided.

Gary Arnold, General Manager

15 PETITIONS STILL BEING ACTIONED

There are no petitions still being actioned.

16 PETITIONS RECEIVED IN LAST PERIOD

At the time the Agenda was compiled no Petitions had been received.

17 OFFICERS REPORTS TO COUNCIL

17.1 MARGATE RIVULET HYDRAULIC ASSESSMENT

File Number: **TS3027**

Author: **Alexander Aronsson, Stormwater Engineer**

Authoriser: **David Reeve, Director Engineering Services**

Strategic Plan Reference

Key Priority Area:	3	Sustaining the natural environment whilst facilitating development for our future.
Strategic Outcome:	3.5	Management of environmental assets is based on professional advice and strategic planning.

1. PURPOSE

1.1 The purpose of this report is to provide a summary of the Margate Rivulet Hydraulic Assessment, undertaken for Kingborough Council, and to seek Council endorsement for recommendations from the study.

2. BACKGROUND

2.1 The Margate Rivulet is the major watercourse in the Margate hinterland, including its primary tributary Nierinna Creek and associated minor waterways, with a catchment covering approximately 22.75 km^2. It drains from hilly bushlands in the west into North West Bay in the east.

2.2 The catchment is largely undeveloped with most of the urban development occurring in the lower part of the catchment in and around the Margate township. There is however an increased risk that future development may encroach into the floodplain and natural waterway areas of the catchment.

2.3 Kingborough Council engaged Cardno Engineering to undertake a Margate Rivulet Hydraulic Assessment to provide flood intelligence for current and future climate conditions. The study sought to identify and provide recommendations for planning controls and stormwater management requirements to ensure that future development will occur sustainably and that any potential adverse impacts on the waterway is mitigated. The study also identified a range of flood mitigation measures with potential to reduce existing flood risk.

3. STATUTORY REQUIREMENTS

3.1 Under the *Land Use & Approvals Act (LUPAA) 1993*, planning and development within the Kingborough Local Government Area is governed by the Kingborough Interim Planning Scheme 2015. Several objectives of the Planning Scheme require responses to flooding, such as: the risk of loss of life and property from flooding is minimised (3.0.6) and that Council must identify areas which are at risk of periodic or permanent inundation from riverine, watercourse and inland flooding (E15.1).

3.2 Under the *Urban Drainage Act 2013* Council is required to identify the level of risk from flooding for each urban stormwater catchment in the public stormwater system, of which Margate Rivulet forms a significant part.

4. DISCUSSION

4.1 The purpose of the Margate Rivulet Hydraulic Assessment is to provide Council with flood intelligence that can be used in preparation of planning controls for development applications, to understand existing and future flood risk and to identify potential mitigation options available to reduce existing flood risk.

4.2 In completing the Margate Rivulet Hydraulic Assessment, the following activities were undertaken:

- Collection and compilation of available historical rainfall, runoff and flood data related to the study area.

- Development of a comprehensive flood model using available data and current best practise, including calibration and validation of the model to the extent possible.

- Production of a range of design flood maps for the Margate Rivulet Catchment for the 5%, 1% and 0.5% AEP event. The produced mapping includes climate change, ultimate development and vegetation management scenarios.

- Identification of flooding hotspots along Margate Rivulet. Please note that the flood mapping was calibrated to target the accuracy of in-stream flooding. Should any future development occur within a mapped overland flow area, localised flood modelling may be required to identify potential impact and mitigation requirements. Any localised studies can build upon the existing Margate Rivulet flood model.

  A high-level vegetation assessment to determine potential impact on flood level from clearance of in-stream dense vegetation such as willows.

- A future development assessment to understand its potential impact on flooding and waterway health.

- A multi criteria analysis, identifying available mitigation measures to reduce existing and future flood risk.

4.3 The results indicate that:

- There are three flood risk hotspots classified as H5 & H6 within the catchment based on Australian Rainfall and Runoff 2019 Hazard categorisation:

  i. The walking track along Margate Rivulet, upstream of Channel Highway;

  ii. Sections of Van Morey Road, and

  iii. The walking track along Nierinna Creek.

- Erosion is likely to be a significant risk throughout the catchment due to the presence of dispersive soils and very steep slopes in the upper reaches.

- The erosion risk could be mitigated by sealing of gravel roads and by increasing the level of vegetation in order to slow velocities and help bind soil together.

- Clearing of Margate Rivulet from dense vegetation (such as willows and other environmental weeds) may reduce the flood depth from the top of the catchment to the outlet in North West Bay. Should any vegetation clearing occur, it is advised

that the process is started at the downstream reaches before moving into the upstream areas to avoid causing any adverse flood effects.

- Intensification of development in the lower regions of the catchment is unlikely to lead to large increase in flood levels within the catchment as flooding within Margate Rivulet is mainly driven by the characteristics of the upper reaches of the catchment. However, future development should still be required to meet best practice guidelines in terms of both controlling runoff volumes from the site/s, meeting water quality targets and addressing potential inundation risks.

4.4 A high-level flood mitigation multi criteria analysis was undertaken to identify suitable mitigation options for the catchment to further reduce existing flood hazard to acceptable levels. The identified measures were:

- Preventative maintenance by Council by keeping existing drains clear of debris ahead of a storm events.
- Utilise planning controls for the inundation prone areas of the catchment through the Kingborough Council's Interim Planning Scheme (and the statewide provisions of the Planning Scheme once it comes into effect).
- Upgrade the Channel Highway bridge to increase capacity (note: this is a State Growth asset and is as such outside of Council's jurisdiction).
- Upgrade culverts under Nierinna Road to improve conveyance capacity and to reduce the likelihood of flows overtop the road in a 1% AEP even.
- Improve drainage through Crimson Drive to reduce the risk of local inundation and overland flooding.
- Improve flood protection to three properties along Tarragon Drive through landscaping and local earthworks on Lot 1 Dayspring Drive.
- Construction of a levee system between Margate Rivulet and 1684 Channel Highway to improve flood protection to units bordering the rivulet.
- Upgrade of minor road culverts in the upper part of the catchment in conjunction with road upgrades to avoid overtopping during the 5% AEP event.

4.5 The multi criteria analysis assessed each option above against Expected Cost, Constructability and Flood reduction and the results are summarised in Table 9-1 of the attached report. Further feasibility assessment and detailing of the structural mitigation options will be required before any plans for implementation are made.

5. FINANCE

5.1 Future works arising from this study will require both capital and operational expenditure. The timing and extent of any such works will be determined on further investigations, available budget and resourcing.

6. ENVIRONMENT

6.1 Natural values potentially at risk from extreme weather events and climate change within the Margate Rivulet catchment have not been addressed specifically as part of this study.

6.2 A high-level erosion assessment has been undertaken as part of the hydraulic modelling. High levels of silt and sediments in waterways can have both an acute and a long-term negative effect on waterway health. However, as the erosion risk in Margate Rivulet is widespread and part of the catchment geography, it is very challenging to manage it.

7. COMMUNICATION AND CONSULTATION

7.1 Community engagement to date has been facilitated via an online flood questionnaire. The purpose of the questionnaire was to gather historic flood information in relation to Margate Rivulet from the local community to be used for validation of the modelling results. Responses received have been incorporated into the report for documentation, without inclusion of specific locations.

8. RISK

8.1 The principal purpose of this study is to classify the existing and future flood risk within the catchment during extreme weather events and, where applicable, develop mitigation strategies to manage those risks.

9. CONCLUSION

9.1 This report has provided a summary of the Margate Rivulet Hydraulic Assessment resulting in several recommendations for Council endorsement.

10. RECOMMENDATION

That Council:

(a) incorporate the 1% AEP storm event (year 2100), as identified in the Margate Rivulet Hydraulic Assessment, into Council's planning process;

(b) engage with the community about the result of this study via Council's website and online interactive map; and

(c) further investigate and consider identified mitigation options presented in this report to reduce the overall flood risk and to control the impact of future development within the catchment.

ATTACHMENTS

1. Margate Rivulet Hydraulic Assessment

Hydraulic Modelling

Margate Rivulet Hydraulic Assessment

NW30106

Prepared for
Kingborough Council

9 September 2021

Cardno

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Document Information

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Approved By:

Rob Guest
Flooding Practice Lead – Senior Engineer

Date Approved	9/09/2021

Document History

Version	Effective Date	Description of Revision	Prepared by	Reviewed by
R001	25/02/2021	Draft Data Review	SS, PW, DVH	RG
R002	27/04/2021	Draft Model Setup & Methodology	DVH	RG
R003	09/07/2021	Draft Report	SI	RG
R004	24/08/2021	Final Report	SI	RG
R005	09/09/2021	Final Delivery	SI	RG

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Appendices

Tables

Figures

1 Introduction

Kingborough Council (council) have engaged Cardno to undertake a hydraulic assessment of the Margate Rivulet catchment located approximately 6km southwest of Kingston, Tasmania. The Rivulet is the major watercourse in the Margate hinterland and outlets to North West Bay with a contributing catchment of approximately 23km^2.

The works completed as part of this Project intends to identify flooding and associated risks across the catchment and inform future planning decisions for the region. Significant urban development which has the potential to occur throughout the catchment, which will have a potential impact on flooding. Council have identified that other aspects currently within the catchment such as the amount of vegetation and erosion may also have an impact on current and future flooding.

Figure 1-1 Mount Wellington - Margate Rivulet Catchment (Cardno, 2021)

1.1 Purpose of this Study

This Project consists of a number of stages including:

- Data Review – assessing the data available and determining the most appropriate information to take forward to the flood modelling;
- Hydrological Modelling – deriving flows which represent flood events so that these can be introduced to the hydraulic model with additional consideration to urban development and climate change;
- Hydraulic Modelling – determining flood risk in the catchment as a result of these flows (for example flood depth, velocity and hazard) with impacts of urban development and climate change assessed;
- Flood Mapping – preparing GIS and mapped outputs to illustrate the hydraulic modelling findings; and
- High-Level Vegetation and Erosion Assessments – undertaking a MCA to determine areas of risk for Council.

1.2 Related Documents

The following documents should be referred to in conjunction to this report:

- Data Review report – dated 26 February 2021 (file reference NW30106_R001_Data_Review_Margate_Rivulet.pdf)
- Model Setup and Methodology Report – dated 27 April 2021 (file reference NW30106_R002_Model_Setup_&_Methodology_Margate_Rivulet.pdf)

1.3 Study Area

The study area for the Project is shown in Figure 1-2 below and includes the following:

- Indicative catchment for Margate Rivulet;
- A refined hydrological model boundary for Margate Rivulet; and
- Council's drainage network.

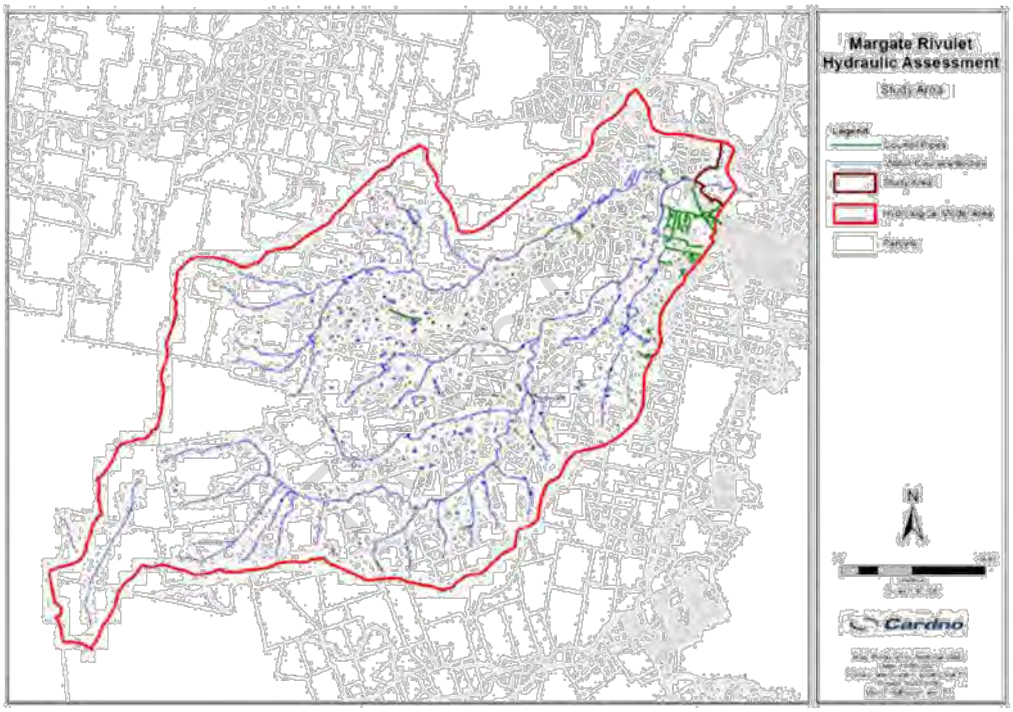


Figure 1-2 Margate Rivulet Study Area

2 Available Information

This section summarises the key information that has been used in this study. A full data review can be found in the Data Review Report (dated 26/02/21) which includes all information provided at Project inception.

2.1 Previous Studies

The following reports have been provided by council for reference in this study:

- Margate Rivulet Flood Plain Study 2006, SKM
- Snug River Flood Study, Kingborough Council 2019

2.2 Topographic Information

LiDAR has been obtained from ELVIS (Elevation Information System) for use in this study. As no single dataset covered the entire study area five separate datasets are required to cover the entire study area, namely:

- Wellington Range 1m LiDAR - Tasmanian Flood Recovery Project from 2019
- Greater Hobart 1m LiDAR - Tas Coastal Project from 2013
- Mt Wellington 1m LiDAR - Forestry Tasmania Project from 2011
- Derwent 1m LiDAR - Climate Futures Project from 2008
- Geoscience Australia 5m LiDAR – National Resampled Project from a collection of datasets

2.3 Aerial Imagery, Parcel and Planning Data

Aerial Imagery of the catchment was obtained from NearMap, while parcel and planning data were obtained from Tasmania's open source public database (The List). This data was used as follows:

- As contextual base map information;
- To ensure the catchment was edge matched to property boundaries where applicable; and
- Estimating the Effective Impervious Area of subareas based on GIS methods provided in Book 5, Chapter 3 of Australian Rainfall and Runoff 2019 Guidelines.

2.4 Pipe and Pit Data

Council have supplied relevant GIS pipe and pit data for the study area. Where pipes were identified to be missing from the supplied dataset, dimensions were captured during the site visit.

2.5 Historical Rainfall Data

Historical Rainfall datasets were provided to Cardno by Kingborough Council for use in validation of the hydraulic model. This included data obtained from the Bureau of Meteorology (BoM) in Pluviograph and Daily formats as well as a hand recorded dataset from a local community member. These are further described in the sections below.

2.5.1 Pluviograph Data

Pluviograph data has been provided for the closest pluviograph station to the catchment, Blackmans Bay Treatment Plant (1998-2018) to derive predicted flow hydrographs for validation/verification of the hydraulic model.

2.5.2 Daily Rainfall Data

Daily rainfall data has been provided for the Sunnyside rainfall gauge (1967-2021), to assist in the validation/verification of the hydraulic model.

2.5.3 Hand Recorded Rainfall Totals

The hand recorded rainfall totals (2008, 2012-2020) have been collected by a local community member in the vicinity of the Sunnyside rainfall gauge.

2.6 Anecdotal Evidence

2.6.1 Historical Events

As part of this study, Council has provided a summary of historical flood event dates, with the key information outline below in Table 2-1. Council have obtained this information from previous flood studies, a community questionnaire, site visits, community engagement as well as news sources and community photos.

Information provided by council indicate that the 1973 event caused the greatest impact across the catchment. However, due the significant time has elapsed since this event occurred and with significant changes to the catchment made since this date, it has been agreed with council that the May 2018 event was to be used for validation of the hydraulic model.

Table 2-1 Historical Flooding Events of the Margate Rivulet catchment

Event	Information	Evidence (if any)
6-7th June 1954*	This event is referenced in the flood questionnaire provided by Council.	
22-23rd April 1960*	This event is referenced in the flood questionnaire provided by Council.	
May 1973	This event was referenced as an event of concern to a particular community member in the 2006 study (SKM). However, it has been reported that that only 55mm of rainfall was recorded within 24 hours. Community engagement was undertaken with the owner of a property on Sandfly Road, who identified that this event was the largest experienced for their property. For flooding that occurred at the property in question, the flooding reached the second row of fruit trees as shown in the first image on the right, with approximately 400mm deep flood waters experienced at the first row of fruit trees as seen in the second image. A significant flow path was experienced through their property with flood waters sheeting down the hill shown in the third image. Debris was washed up approximately halfway up this hill, with the flood waters being approximately half way up the large hill next to the town shown in the fourth image. "In the 1973 flood, the water level reached to where the main limbs branch out from the butt...The 1973 flood did not come down the main Margate Rivulet tributary, but a smaller minor tributary, which roughly runs parallel to the last part of Old Bernies Road..." – Owner of a property on Sandfly Road Upstream at the top of the catchment near Old Bernies Rd "the flood piled logs on the bridge and his property and then continued on scouring trees and vegetation from both sides of the rivulet. (This can be seen in the aerial photo of 1974). Some logs are still there" – Owner of property on Sandfly Road	 Image 1: Flood debris at a property on Sandlfy Road, at the plum fruit trees (Site Visit location 29l)

Image 2: Flood debris a property on Sandify Road, at the apple fruit trees (Site Visit location 29a and 29b)

Image 3: Flood debris at a property on Sandify Road (across between Site Visit location 29b and 29k)

Image 4: Taken from the bank of a property on Sandfly Road looking downstream (between Site Visit location 29b and 29k)

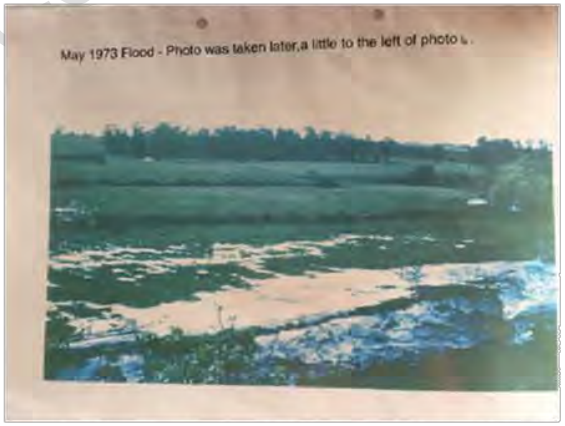


Image 5: Taken from the bank of a property on Sandfly Road looking upstream (between Site Visit location 29b and 29k)

Image 6: Aerial image of 1973 flood event of catchment

		
22-23rd March 1983*	This event is referenced in the flood questionnaire provided by Council.	
18-19th December 1995*	This event is referenced in the flood questionnaire provided by Council. "There were also two floods in the 1990's, which reached a similar level (as 2018 event) about half way between Nierinna creek and old pear trees" – Owner of a property on Sandfly Road	
8-9th February 1996*	This event is referenced in the flood questionnaire provided by Council. "There were also two floods in the 1990's, which reached a similar level (as 2018 event) about half way between Nierinna creek and old pear trees" – Owner of a property on Sandfly Road	
August 2004	A rainfall intensity of 17mm/h, corresponding to a 1-in-20-year event is documented in the 2006 Flood Study Report. Rainfall recorded at the Margate (Sunnyside) rainfall station for this event (likely from the 9th-15th) was 88.2mm.	

3rd February 2005	This event is referenced in the flood questionnaire provided by Council. This flood event is documented in the 2006 Flood Study Report, stating that the 1-in-100-year rate was exceeded for between 2 to 6 hours (at the Cades Drive Gauge). The report states that the observed flood levels are approximate to the 1-in-100-year levels produced by the study. The report further states that the event did not overtop the Rivulet which contradicts a community member statement at Sandfly Road: "the maximum depth of flooding above ground was observed as being approximately 4 metres, over the top bank of the Rivulet on the southern side". Based on the rainfall recorded at the Margate (Sunnyside) station, it is likely the event occurred between the 2nd to the 4th of February 2005 with a total rainfall of 118.4mm. Photos taken along Sandfly Road have been provided for the event looking both upstream and downstream in Images 1 and 2 respectively. According to the flood questionnaire, community members along Van Morey Road and Day Spring Drive identified the February 2005 flood event as greater in magnitude than the May 2018 event.	 Image 1: Taken from the bank of a property along Sandfly Road looking downstream (between Site Visit location 29b and 29k)  Image 2: Taken from the bank of a property along Sandfly Road looking upstream (between Site Visit location 29b and 29k)
11-12th August 2010*	This event is referenced in the flood questionnaire provided by Council. Two residents along Day Spring Drive indicated that the event in August 2010 exceeded the May 2018 event.	

13th April 2011	This event likely occurred between the 10th to the 16th of April 2011 with a total rainfall of 127.8mm at Margate (Sunnyside) rainfall station. Residents at along Day Spring Drive indicated that the event in April 2011 exceeded the May 2018 event. Photos taken from a resident of Morey Road have been provided for the event as per Image 1.	 Image 1: Taken from the bank of a property along Van Morey Road looking upstream
13-14th January 2015	This event is referenced in the flood questionnaire provided by Council. There was a significant rainfall event on 13th and 14th January 2015 resulting from a complex low-pressure system bringing tropical moisture to Tasmania. The highest daily rainfall was 153.4mm at Mount Wellington on the 14th January. Residents along Nierinna Road indicated the January 2015 flood exceeded the May 2018 event.	

9-12th May 2018	This event is referenced in the flood questionnaire provided by Council. According to ABC news sources (2018), an extreme rainfall event likely occurred within the study area between the 9th to the 12th of May 2018 with a total rainfall of 210.4mm. It was reported that chest-deep water flowed through the downstairs level of a Margate restaurant, located at on the Channel Highway. This is shown in Image 1 which was uploaded to ABC Hobart social media on the 10th of May 2018. It must be noted that the restaurant is located within the area likely to be influenced by flooding from the North West Bay River. As the North West Bay River is not within this scope of works, this location may not be fully verified. Images 2, 3 and 4 provided by the owner of properties along Sandfly Road and Nierinna Road. Flood extents are typically demarked by debris.	 Image 1: Flood waters in the restaurant with levels seen approximately ¾ up the wall (ABC, 2018).  Image 2: Flood Debris at Channel Highway Culvert May 2018

Image 3: Flood Extent (Debris) at a property along Sandfly Road near Nierinna Creek

Image 3: Flood Extent (Debris) at a property along Nierinna Road at Margate Rivulet

5th November 2018*	This event is referenced in the flood questionnaire provided by Council. A community member has recorded a maximum flood depth of 1.65m at a shed on a property along the Channel Highway. Aerial imagery shows a vast number of sheds on the property no photo evidence was provided. Additionally, this is located within the area likely to be influenced by flooding from the North West Bay River. As the North West Bay River is not within this scope of works, this location may not be fully verified.	

* While the respondent identified the event as the 5th of November 2018, no rainfall was recoded as occurring on this date, and therefore is it highly likely that this corresponds to a different event (likely the May 2018 event)

2.6.2 Community Engagement

Council has previously undertaken community engagement as part of their internal investigations into flooding of the Margate Rivulet catchment and have provide responses to Cardno for inclusion in this study. The engagement was carried out as a questionnaire and asked local community members to provide comments on the impacts of the most recent 2018 event in the Margate Rivulet catchment. The survey also asked for information on the relative comparisons to other historical events. The outputs of this questionnaire are summarised in Table 2-2.

Table 2-2 Community Engagement Responses from the Kingborough Council's questionnaire of the 2018 event

Location*	Flooding Observations	Requested Action by Community Member
Dayspring Drive	Flooding 20cm depth, 1m within house and directly in front of property at intersections for less than 1 hour. Flooding less than 50mm in centre of street. The open drain that traverses the property, servicing Van Morey and Merediths Road overflows (sometimes) with sudden downpours onto downstream property.	Open council drain unable to cope with stormwater deluge (this has occurred prior). Drain upgrade.
Dayspring Drive	Less than 50mm flooding at centre of the road. Flooding from street into driveway, within separate unit and surrounding house (not within) (2-4hrs). Suspect the flooding was due to blocked drain at the end of our Driveway.	Drainage maintenance
Dayspring Drive	Flooding up to house highest at slab (2-4hrs). The water didn't run away as the drainage system was not effectively cleaned out and was unable to cope with amount of stormwater.	Drainage maintenance
Van Morey Road	Overflowing culverts (4-8hrs) eroding road away (100-200mm in centre of road) and between 50-100m down the street (inaccessible 2-4hrs)	A bigger drain which runs off and under the bend above the property Inadequate and ineffective road/drainage works along Van Morey Road [to be resolved.]
Van Morey Road	13th April 2011: It was reported that the top of the driveway to the standing water level = 2m change in flood level in photo for this date in Table 2-1. Flooding was caused by the ephemeral stream. A metal 'agi drain' style culvert runs beneath the road.	
Van Morey Road	Road was flooded and river was building up across the road, so it was unsafe to drive and residents had to stay home. Gutters were blocked with leaves as they are not maintained by Council (meant to be but it only occurs ~once a year).	Gutter maintenance and cleaning.
Crimson Drive	Flooding directly in front of the house but not in the road (1-2hrs) and ponding surrounding the house (4-8hrs). Outside of the house the door of the under-floor storage door had a mark about 80cm high.	
Nierinna Road	Water flowed down driveways of properties opposite and overflowed Nierinna Road drains cascading into the property at three points**	
Sandfly Road	3rd February 2005: The maximum depth of flooding above ground was observed as being approximately 4 metres, over the top bank of the Rivulet on the southern side.	
Worsley Drive	Less than 50mm flooding (24hrs) in interior of the house by overflowing gutters.	

*Full address details have been withheld to maintain privacy of residents comments

**No events were selected from the questionnaire events so cannot assign to a specific date

2.6.3 Site Visit Community Engagement

During the site visit for this project, a local community member who owns a property on Meredith's Road at Site 6a (See 2.7) discussed flooding behaviour around their property. It was stated that the open channel that runs alongside the rural properties does not fully contain flood waters when it has been raining for more than a day and flood extents are typically 1.5m beyond the centreline of the channel.

Additionally, an owner of a property on Sandfly Road (also the owner of a property at the top of the catchment on Old Bernies Road) guided Cardno on a walkthrough of their property. This provided additional context for evidence supplied for this study and has been used in the model result verification process. It should also be noted that the owner also provided Cardno with information relating to the flows experienced in the Margate Rivulet on the day of the site visit (24/03/2021). No significant flows were experienced down the Margate Rivulet after 2mm rain was observed at the Sunnyside gauge.

Figure 2-1 Upstream Margate Rivulet Crossing on Old Bernies Road (Cardno, 2021)

2.7 Margate Rivulet Site Visit

On Wednesday the 24th of March 2021, Cardno undertook a site visit to the Margate Rivulet catchment as part of this stage of the Project works. This site visit was undertaken to:

- Determine expected flooding behaviour throughout the catchment;
- Understand catchment characteristics such as vegetation, erosion and development;
- Assess regions of flooding identified based on preliminary model results; and
- Collect data on 'Missing Pipe and Pits' throughout the catchment.

The locations at which data was collected is shown in Figure 2-2 and summarised in Table 2-3. Photographs obtained during the Site Visit have been provided to Council electronically. The site observations have been summarised below:

- The catchment is predominantly cleared rural open space with several structures such as farm houses, sheds and animal shelters.
- The urban township of Margate is located at a localised highpoint and there is minimal urban development elsewhere.
- The forested regions are heavily vegetated with dense eucalypt trees, abundant mid-story cover and heavy grass ground cover.
- The topography of the catchment features a high degree of slope with private dams (storages) being typically located in the areas where slopes decline, and flow paths generally being steep (approximately greater than 5%).
- Private dams (storages) are the only systems which currently retain flows in the catchment with other formalised/constructed stormwater assets observed to treat and maintain waterways. A single outlet was observed directly outletting into the Margate Rivulet while it is assumed that several other assets discharge into the main channels at various points along the reach.
- There are areas within the forested regions that feature exposed and degraded soil due to erosion and sedimentation. This is predominantly along flow paths surrounding unsealed roads and in areas where the forest has been cleared.
- Both Margate Rivulet and Nierinna Creek have varying degrees of vegetation within the channel, with a large proportion of the main reach incised within natural bedrock.
- Both Margate Rivulet and Nierinna Creek typically feature undulating topographies such that there are shallow pools followed by an incised section, which is then again followed by more shallow pools.
- Dispersive clay soils were observed throughout the catchment which leads to sedimentation and erosion likely to be a significant risk for the catchment.
- There are notable signs of erosion on the upper side of banks in the main channel, however, this is likely due to the dispersivity of soils in the region and will only arise as a potential issue in significantly large flood events (approximately greater than 2% AEP).
- Several sites featured assets that were blocked by either vegetation or sediment, and large proportion of the assets were determined to be old with capacities likely to be inadequate to deal with moderate flows (10% AEP through to 20% AEP events).
- Several sites featured recently upgraded assets that were determined to be appropriate to deal with moderate flows based on their relative size to the older assets present.

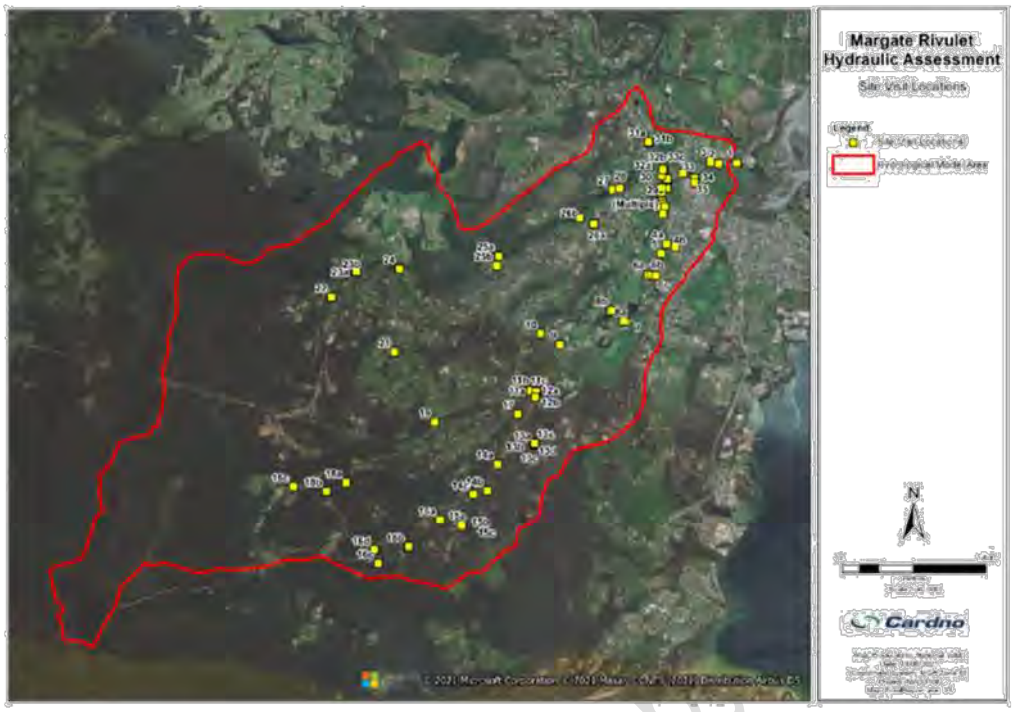


Figure 2-2 Site Visit Locations

Informal community engagement occurred as part of the site visit to understand flooding characteristics of the catchment. This was limited to engagement with two residents within the Margate Rivulet catchment and is further detailed in above Section 2.6.3.

Table 2-3 Site Observations recorded on 24/03/2021 by Cardno of Margate Rivulet catchment characteristics

ID	Description	Type	Data	Comments
1	Bridge	Pier	2 Piers - 12m x 0.8m, Approx 5.8m from bottom of Piers to Deck Bottom (L1)	Anecdotal evidence of flooding up to bottom of deck - Construction workers
2	Crossing	Culvert	2x1200	Right culvert partially covered by vegetation when looking DS (looking southward)
3	Chute, GPT and Crossing	Culvert	600	Roadside drainage 300 links up. Outlet not identified. Can be assumed based on open channel.
4a	Crossing	Culvert	600	1200 measured on upstream, 600 estimated on downstream. Potential chokepoint. 300 pipe from road outlets to upstream - 4b.
4b	Roadside	Culvert	450	Under driveway and then turns alongside property boundary and outlets at 1200 - 4a.
5	Crossing	Culvert	1200	Not accessed as private driveway. 1200 assumed based on Site 4 and 6 culverts.
6a	Crossing	Culvert	1200	Owner of Cat Hotel anecdotally stated that when flooding occurs the culvert can't convey all flow and her neighbour to the east experiences flooding across her front yard.

ID	Description	Type	Data	Comments
				When there is enough rain the extent is approx 1m either side of culvert.
6b	Overland	N/A	N/A	No defined flowpath. Small Channel.
6c	Open Channel	N/A	N/A	No cross or road drainage. No defined flow path for water to be conveyed across road. Likely overland
7	Crossing	Culvert	1200	Heavily vegetated on upstream side
8a	Crossing	Culvert	300	N/A
8b	Open Channel	N/A	N/A	No defined flowpath. Small Channel.
9	Crossing	Culvert	300	Half submerged on downstream side. Pooling at outlet. Channel on downstream side.
10	Bridge	Clear span	N/A	No vegetation in channel. Bedrock.
11a	Bridge	Clear span	N/A	Vegetation on downstream side. No vegetation on upstream side. Upstream similar to Site 10.
11b	Crossing	Culvert	450 & 600	600 is closer to Margate Rivulet side and 450 closer to road and other 450. More than half blocked with sediment on downstream side
11c	Roadside	Culvert	450	Outlets at 11b, inlet is approx 5m. Another 450 midway to main road under a driveway.
12a	Crossing	Culvert	450	Sediment present but not blocking culvert.
12b	Crossing	Culvert	2x600	When looking upstream, right culvert is blocked more than half. Left not blocked. Significant sediment downstream of culvert. Soiled channel downstream. Upstream not blocked.
13a	Crossing	Culvert	300	Under Driveway
13b	Crossing	Culvert	300	Under Driveway
13c	Crossing	Culvert	300	Under Driveway
13d	Open Channel	N/A	N/A	Eroded channel
13e	Crossing	Culvert	300	Assumed based on other culverts
14a	Crossing	Culvert	400	Unusual sizing. Size was frequently found in catchment. Upstream rocky channel.
14b	Crossing	Culvert	450	New Upgrade
14c	Crossing	Culvert	300	Smaller than other culverts
15a	Roadside	Culvert	450	Into closed pit.
15b	Pit	SEP	N/A	375 according to GIS, however right side is a 450.
15c	Open Channel	N/A	N/A	Very small open channel. Essentially soil and rocks. No vegetation.
16a	Crossing	Culvert	600	New upgrade. Eroded slightly downstream.

ID	Description	Type	Data	Comments
16b	Crossing	Culvert	400	Upstream old culvert and downstream upgraded with what measured to be a 350 400 assumption is okay. Upstream vegetated flow path.
16c	Crossing	Culvert	600	Sediment present in culvert
16d	Open Channel	N/A	N/A	Heavily Vegetated
17	Bridge	Clear span	N/A	Bedrock channel.
18a	Crossing	Culvert	300	Small black pipe coming into culvert from private property.
18b	Crossing	Culvert	450	New upgrade.
18c	Bridge	Clear span	N/A	Bedrock Upstream with Downstream mainly rocks and vegetation is some parts.
19	Crossing	Culvert	2x1200	Vegetated Upstream. Erosion alongside road. Rock lined drain for roadside drain from either side entering the DS side.
20	Crossing	Culvert	300	Significant erosion and sediment runoff. Minor culvert
21	Crossing	Culvert	3x450	Cleared upstream for rural properties.
22	Bridge	Clear span	N/A	Vegetated Upstream and regular rocky downstream. Roadside was partially eroded but had vegetation.
23a	Crossing	Culvert	900	Half Submerged with vegetation on upstream side.
23b	Crossing	Culvert	900	Heavily vegetated on downstream side
24	Bridge	Clear span	N/A	Vegetated on upstream and downstream side
25a	Crossing	Culvert	1500	Regular channel with minimal vegetation on both upstream and downstream.
25b	Crossing	Culvert	500	Eroded channel alongside driveway down to Nierinna Creek
26a	Pit Chamber	Closed	N/A	300 under road
26b	Bridge	Clear span	N/A	Height only about 300, however this has likely replaced an old crossing. A 300 is blocked at the bottom of the original crossing.
27	Bridge	Clear span	N/A	Rocks on downstream and upstream with minimal vegetation.
28	Bridge	Clear span	N/A	Rocks on downstream and upstream with minimal vegetation.
29a	Anecdotal Evidence	Flood Level	400mm up to base of tree	1973 flood event
29b	Anecdotal Evidence	Flood Level	Extent between second row of trees	1973 flood event
29c	Anecdotal Evidence	Flood Level	Extent at bottom of hill prior to trees along bank.	1990s and 2018 events. A small flow path along side the rivulet comes down and enters at this location.

ID	Description	Type	Data	Comments
29d	Anecdotal Evidence	Flood Extent	Up to just below the bank on northern side	1990s and 2018
29e	Anecdotal Evidence	Flood Extent	Foot path (previously an illegal levee implemented by developers) was covered up to the bushes on the other side	1973 flood event
29f	Anecdotal Evidence	Flood Extent	Bottom of foundations for the pump station shack	1973 flood event
29g	Anecdotal Evidence	Rain Gauge	Sunnyside Station (BoM)	Operational
29h	Anecdotal Evidence	Rain Gauge	Manual Recordings (Hand Records)	Non-Operational
29i	Anecdotal Evidence	Observation	Natural Spring which keeps pools of water full	No flow received from upstream on 24/3/201. Only 2mm of rain in catchment (BoM recorded rainfall checked)
29j	Anecdotal Evidence	Observation	Stormwater Outlet from new development	Flowing into Rivulet.
29k	Anecdotal Evidence	Observation	Dry rivulet	No flow received from upstream on 24/3/201. Only 2mm of rain in catchment (BoM recorded rainfall checked)
29l	Anecdotal Evidence	Flood Extent	Flood waters sheet down this area into the Rivulet	1973 flood event
29m	Anecdotal Evidence	Flood Extent	Flood waters reached bank	1973 flood event
29n	Anecdotal Evidence	Observation	Vegetation clearing in this area after 1973 event	Erosion on banks due to vegetation removal. Significant banks have been displaced.
29o	Rivulet	N/A	N/A	Pools and minimal vegetation. Bedrock.
30	Bridge	Clear span	N/A	Square clear span (i.e width not as large as channel)
31a	Crossing	Culvert	750	Blocked on upstream side.
31b	Crossing	Culvert	500	Half Blocked
32a	Crossing	Culvert	2x450	Brand new for which appears to be specifically for development on site. Rock chute structure upstream alongside road.
32b	Crossing	Culvert	900	Heavily vegetated upstream. Half blocked.
33c	Crossing	Culvert	600	Outlets to behind childcare
33	Crossing	Culvert	N/A	Couldn't measure as area was heavily vegetated and couldn't see the inlet.
34	Bridge	Pier	2 Piers - 25m x 0.5m, 2m height	Actually 3 clear spans with what appears to be a 1.2m box on the northern side (too vegetated to assess box culvert - likely to be high flow). Heavily vegetated.
35	Open Channel	N/A	N/A	Minor flows on 24/3/2021. Runoff into channel through reserve. Pits not containing flows from upstream. No GIS for upstream.

Figure 2-3 Upstream Margate Rivulet (Cardno, 2021)

3 Hydrological Model Setup

The hydrological modelling software RORB (version 6.45) was utilised for this flood mapping project. RORB calculates flood hydrographs from storm rainfall hyetographs and can be used for modelling natural, part urban and fully urban catchments. RORB is an industry standard hydrological model that has been used within the Australian Rainfall and Runoff 2019 (ARR2019) Guidelines and more widely in previous studies undertaken by Cardno.

The base hydrological model was created in GIS, utilising the MapInfo plug-in, MiRORB. MiRORB assists in calculating hydrological components such as catchment areas, slopes and other geometries required for implementation in the hydrological model itself. The methodology implemented in MiRORB is outlined in Sections 3.1, 3.2, 3.3 and 3.4 while the RORB modelling methodology has been outlined in Sections 4.1, 5 and 5.4.

3.1 Catchment / Sub-Catchment Delineation

An indicative catchment was obtained from The List as part of the Conservation of Freshwater Ecosystem Values (CVEV) state-wide catchment dataset. This catchment was reviewed and refined based on initial high level 2D only model results, topographic data, property information (where applicable) and Council drainage asset data.

Topography and drainage asset information was used to ensure that all areas which have the potential to contribute flow in the 1% AEP storm were included in the catchment, regardless of the flow mechanism (pipe or overland). Occasionally topographical flow paths contradict pipe flow directions and therefore, topographic flow paths were preferenced for catchment delineation. Following the derivation of the catchment, it was matched to the edge of property boundaries using property GIS information where applicable.

As with catchment delineation, sub-catchments were also delineated using the topographic and drainage asset information. Unlike the catchment boundary, the sub-catchments were not necessarily edge matched to property boundary information when applicable, but rather were edge matched to planning data. The catchment and subarea boundaries are illustrated in Figure 3-1.

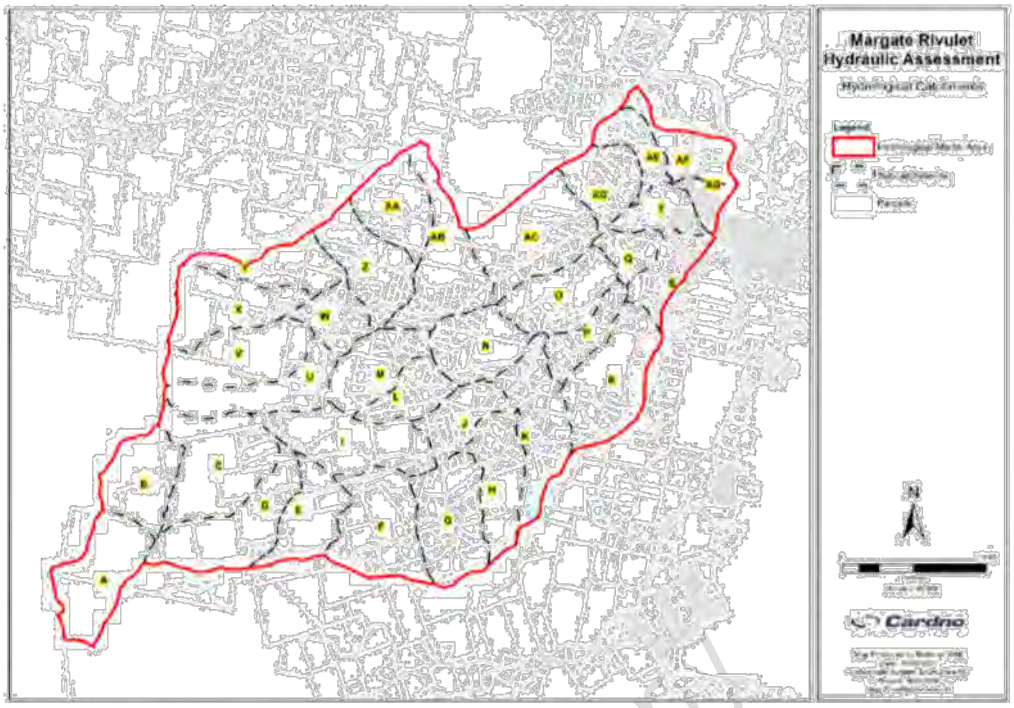


Figure 3-1 Hydrological Catchment and sub catchments

3.2 Nodes and Reaches

Nodes were located as required at centroids of subareas, at the downstream end of each subarea and at any confluence which was considered as a critical location. The nodes were placed so that they made some allowance for the time taken for subarea flows to reach the main channel, while flow routing from sub-catchments used control codes appropriate to the flow routing required.

Reach types were selected to represent the likely routing properties of the subareas. The majority of the reaches used in the hydrological model were reach type 1 (natural channel) and were adopted to represent the natural areas. Reach type 2 (excavated but unlined) was adopted to represent the urban areas within the catchment. It must be noted that while reach type 3 (lined channel or pipe) can be used to represent urban areas, experience suggests that this over estimates routing with under attenuation of flows.

Figure 3-2 of Appendix A illustrates the sub-catchments, nodes, reaches and storage locations.

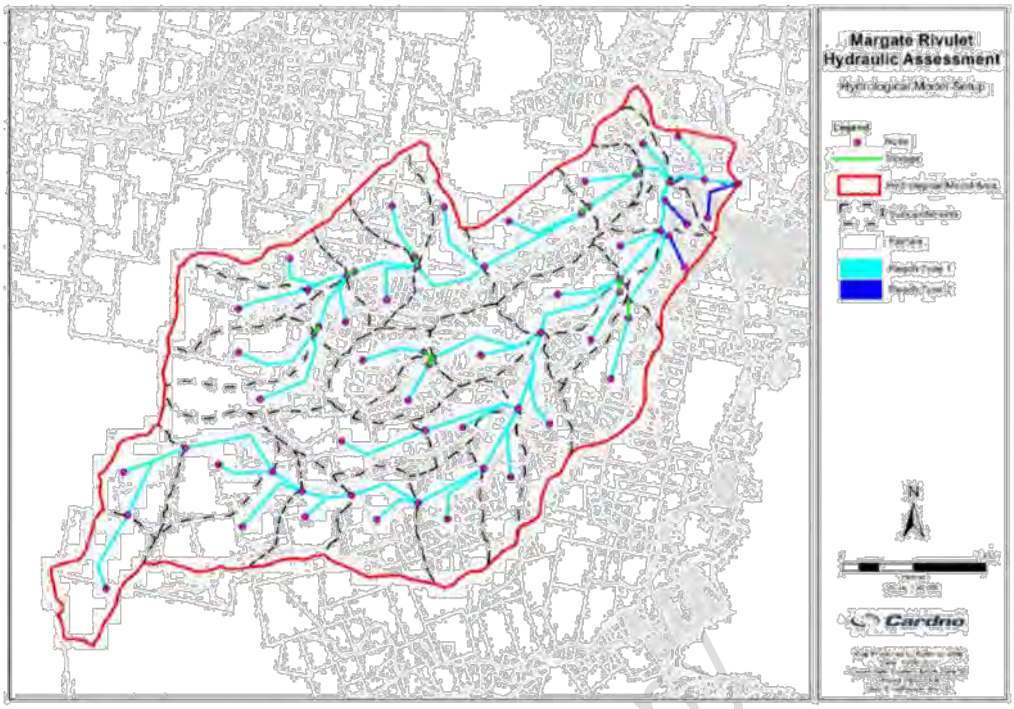


Figure 3-2 Hydrological Model Setup

3.3 Storages

Formal and informal storages that were determined to be critical to the retention of flows in the system were identified in the Data Review Report (dated 26/02/21). It must be noted that other storages were considered for inclusion, however, it was determined that these would not influence the critical flows within the catchment.

16 distinct informal storages were identified for inclusion in the hydrological model so that a critical duration can be estimated within RORB. The full effects of storages have been considered in the hydraulic model. Given some storages were in a linear orientation along major flow paths, some of these were combined to reduce model complexity.

Storage parameters for RORB were estimated using stage-storage relationships obtained from LiDAR with each storage individually assessed for spillway characteristics. It must be noted that it is likely that some of these storages have a pipe outlet, although as these are privately owned, no data was able to be provided by Council for this Project.

3.4 Effective Impervious Area Estimation

ARR 2019 (Book 5, Chapter 3) advises the loss model estimations are made of two aspects:

- Effective Impervious Areas (EIA)
  - Directly Connected Impervious Areas (DCIA) – impervious areas (e.g. roads, roofs and paved areas) which are directly connected to the drainage system (or where rainfall is directly connected to the drainage network)
  - Indirectly Connected Impervious Areas (ICIA) – impervious areas which are not directly connected, runoff from which flows over pervious surfaces before reaching the drainage system (e.g. a driveway that discharges onto a lawn) or pervious areas that interact with Indirectly Connected Impervious Areas (e.g. nature strips, garden areas next to paved patios, etc.) where some continuing losses occur

- Pervious Areas (PA) can be identified as regions in the catchment that features vegetation that is not directly and/or indirectly connected to drainage infrastructure. Typically, this is defined by untouched heavily wooded areas. However, this can also include farmland, parklands and cleared regions. The defining feature of PA is that generated runoff is conveyed through the defined PA as surface and/or ground water once the soil has been saturated without actively interacting with any impervious areas.

The following formula is typically used when estimating EIA for a sub-catchment:

$$EIA = DCIA + ICIA$$

As noted above, ARR 2019 outlines that the definition of a pervious area is untouched heavily wooded land (i.e. areas that largely remain unchanged from in their natural state). It has been assumed that the majority of areas that have been modified from their natural state in some way and therefore will flow to a designated drainage asset (be it an underground pipe, irrigation channel, constructed waterway, etc.).

ARR 2019 discusses that using GIS techniques to identify directly connected impervious areas (identifying road, roof and driveway areas) show that the Effective Impervious Area (EIA) is typically between 70% and 80% of the Total Impervious Area (TIA). However, this may trend to 100% as the catchment EIA increases to 100%. When measured at a catchment scale, without considering connectedness, the EIA is approximately 55-65% of the TIA (Phillips et al, 2014).

For this assessment, Cardno have adopted individual DCIA and ICIA values specified in Melbourne Water's Technical Specification (MW 2019) in GIS for each land use type. This method is current best practice and aligns with other industry guidance documents.

Specifically, the following methodology was adopted for estimating the EIA for the Margate Rivulet catchment:

- The areas in GIS were contextually assigned a 'DCIA' factor value according to the aerial imagery and corresponding planning data to reflect land use. This estimated whether the planning zone and corresponding parcel was impervious and how much of it was directly connected. A value of 1 would reflect an impervious area that conveys all runoff flows to the drainage network while a value of 0 would reflect either a completely pervious area or an impervious area that doesn't convey flows to the drainage network.
- The areas in GIS were then assigned an 'ICIA' factor value according to the parcel's proximity to drainage assets and its general direction of flow to determine the indirectly runoff connectiveness as specified in ARR 2019. A value of 1 would reflect an impervious area or pervious area which indirectly convey all its runoff to drainage infrastructure while a value of 0 would reflect a parcel that will not convey runoff directly into the drainage infrastructure.
- An area weighted average for each sub-catchment was then calculated using GIS queries for both the DCIA and ICIA values which were directly implemented into RORB to represent the EIA.
- RORB automatically determined the PA (Pervious Area) based on the EIA using the formula below:

$$PA = 1 - EIA$$

Appendix B summarises the sub-catchment DCIA, ICIA and PA that have been implemented into the RORB model and Table 3-1 summarises the range of DCIA, ICIA and PA values adopted according each planning zone.

Table 3-1 Planning Zone and values adopted for individual parcels to estimate Effective Impervious Area

Zone	DCIA	ICIA	PA	Rationale
12.0 Low Density Residential	Varying (0.05 – 0.7)	Varying (0.05 – 0.35)	Varying (0.15 – 0.875)	It is estimated that the majority of runoff from these impervious areas will enter directly into the pipe system through roof drainage. It must be noted that some of these areas are not fully developed or are similar to rural living, therefore lower values have been assigned to reflect this based on aerial imagery.
13.0 Rural Living	Varying (0 – 0.7)	Varying (0.025 – 0.15)	Varying (0.15 – 0.975)	Generally similar to low density residential areas (above) but with less impervious areas and less directly connected areas. Some sections feature significant impervious areas such as roads, however, this region largely represents cleared landscapes.
14.0 Environmental Living	Varying (0 – 0.7)	Varying (0.025 – 0.15)	Varying (0.15 – 0.975)	Similar to Rural Living with large areas of undeveloped and largely untouched regions. Some areas have developed sections with a high imperviousness and connectiveness.
17.0 Community Purpose	Varying (0.05 – 0.7)	Varying (0.05 – 0.3)	Varying (0.15 – 0.9)	Developed area with highly impervious regions that will have runoff directly into the pipe system through roof drainage. Some areas feature low lying cleared vegetation.
18.0 Recreation	0.5	0.25	0.25	A majority of the area has hard surfaces and there is some degree of connection to drainage in these areas.
19.0 Open Space	Varying (0 – 0.05)	Varying (0.025 – 0.1)	Varying (0.9 – 0.975)	Predominantly untouched regions with various types of low-lying vegetation.
20.0 Local Business	Varying (0.075 – 0.7)	Varying (0.05 – 0.4)	Varying (0.15 – 0.875)	Similar to Community Purpose areas with a high imperviousness and high degree of connectiveness to the drainage network.
26.0 Rural Resource	Varying (0 – 0.05)	Varying (0.025 – 0.5)	Varying (0.9 – 0.975)	Undeveloped area with minimal imperviousness and connections to the drainage infrastructure
28.0 Utilities	0.7	0.15	0.15	Significant hardstand areas with a high degree of connectiveness to the drainage network.
29.0 Environmental Management	Varying (0 – 0.05)	Varying (0.25 – 0.1)	Varying (0.9 – 0.975)	Predominantly untouched bushland with unsealed tracks and roads.
32.0 Particular Purpose	0.075	0.075	0.85	Similar to Rural Resource with largely undeveloped areas with minimal imperviousness and connections to the drainage infrastructure.

The weighted sub-catchment EIA derived from using the above DCIA and ICIA values is shown in Figure 3-3.

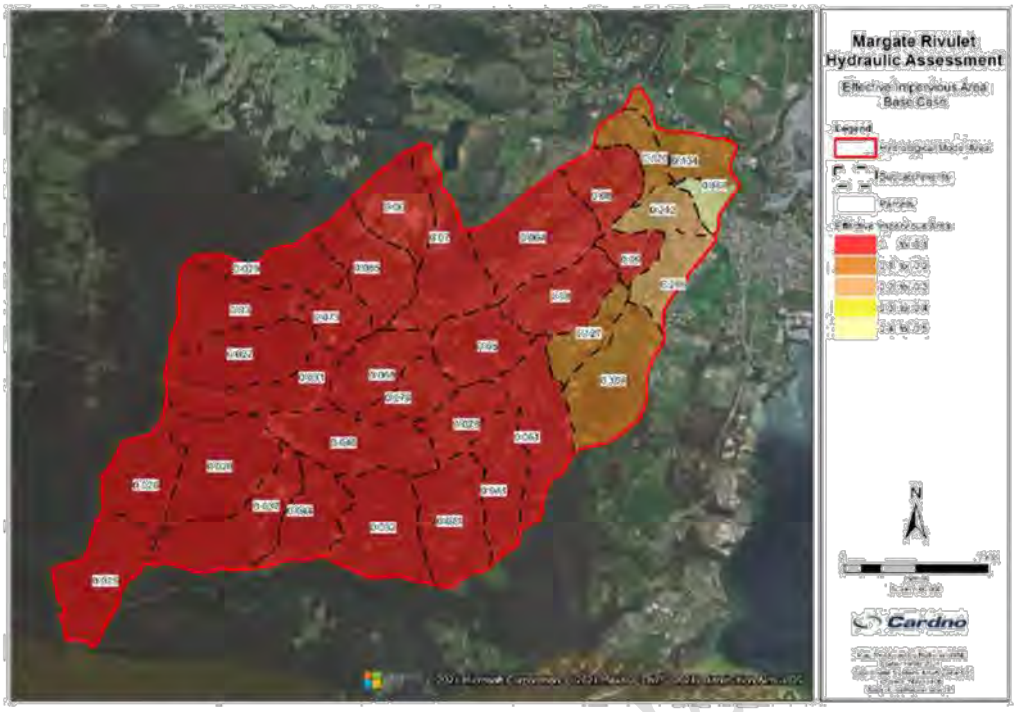


Figure 3-3 Effective Impervious Area – Base Case

3.4.2 Future Development Scenarios

As part of this study, Cardno hydrologically modelled two future development scenarios for the Margate Rivulet catchment. These scenarios have modelled an estimated EIA increase throughout the catchment, when compared to its current development conditions to reflect an indicative worst-case and best-case output. It should be noted that the boundaries do not relate to Kingborough Council's urban growth boundaries

Under current conditions (base case), the Margate township consists of low to medium density urban development with regions outside of the immediate township area consisting of rural to low density urban development as shown above in Figure 3-3. Therefore, for the worst-case scenario, the following changes have been made to the base case values:

- Margate township urban regions have had the assigned imperviousness (directly and/or indirectly connected areas) increased to reflect medium density urban development;
- All unsealed roads have had the assigned imperviousness (directly and/or indirectly connected areas) increased to reflect sealed roads; and
- Rural regions within close proximity to the Margate township have had the assigned imperviousness (directly and/or indirectly connected areas) increased to reflect a low-density urban development.

For the best-case scenario, the following changes have been made to the base case values:

- All unsealed roads have had the assigned imperviousness (directly and/or indirectly connected areas) increased to reflect sealed roads; and
- Rural regions within close proximity to the Margate township have had the assigned imperviousness (directly and/or indirectly connected areas) increased to values that match base case Margate township urban regions.

Figure 3-4 shows the proposed changes to the base case for the worst case developed scenario, while Figure 3-5 shows the proposed changes to the base case scenario for the best case developed scenario.

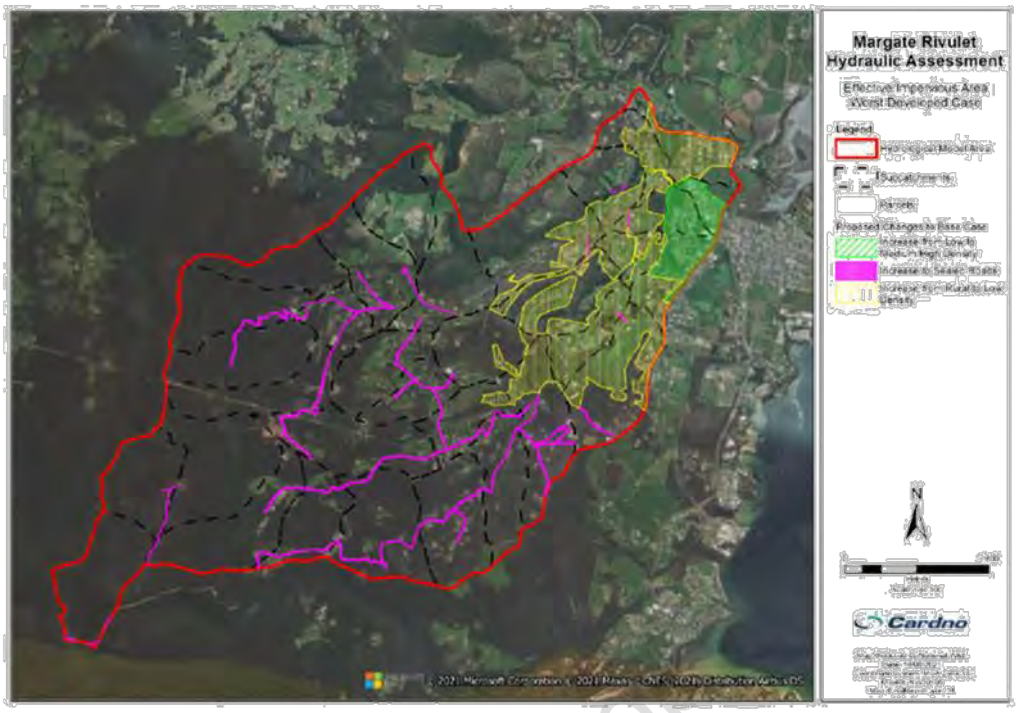


Figure 3-4 Proposed Effective Impervious Area Changes for Worst Case Development

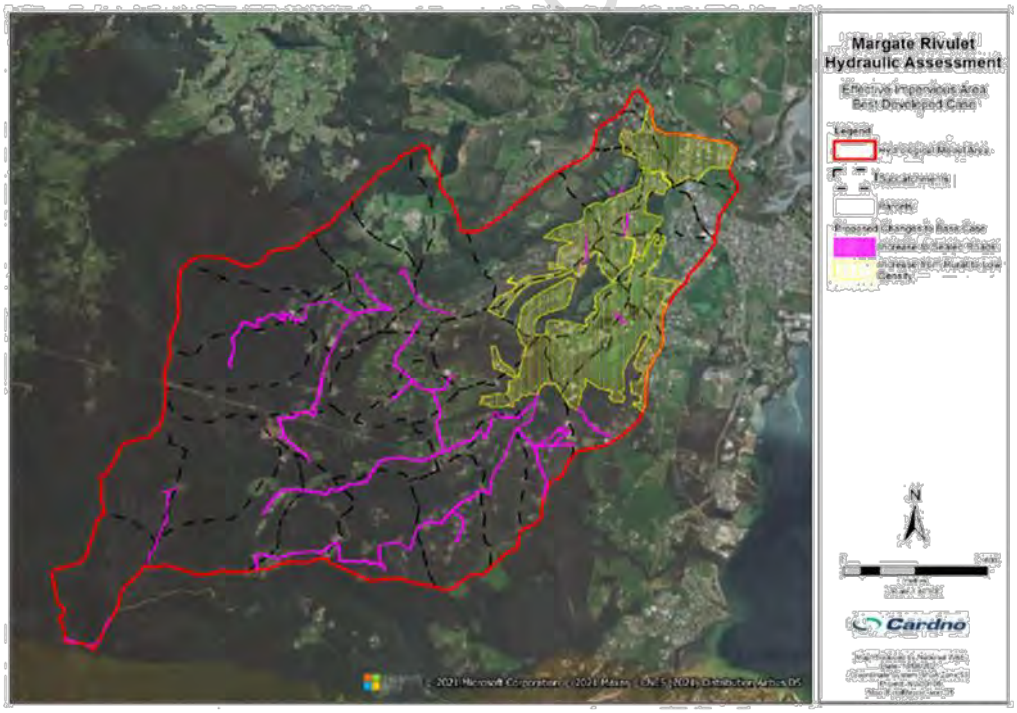


Figure 3-5 Proposed Effective Impervious Area Changes for Best Case Development

4 Hydrological Model Parameters

4.1 RORB Parameters

4.1.1 ARR Text File

The ARR Text File for the centroid of the catchment was downloaded from the ARR data hub. This file is typically used to specify the coefficients for the Areal Reduction Factor (ARF) formula and determine the estimate of regional losses. However, as the hydrological model is run at a sub-catchment scale, this information has been refined to suit the sub-catchment modelling approach. Further details of the adopted ARF are outlined in Section 4.1.4, while further details of the adopted losses are outlined in Section 4.1.5. The adopted ARR Text file is provided in Appendix C.

4.1.2 Temporal Patterns

An ensemble of 10 temporal patterns was downloaded from the ARR data hub. Given that the catchment area is not larger than 75 km^2, aerial temporal patterns are not required. No adjustments have been made to this information and these have been directly adopted into the model.

It should be noted that for temporal patterns that have an AEP rarer than the burst as a whole, the embedded bursts have been removed via the built-in RORB filtering technique that has been developed by *Scorah et al.* (2019). This has been adopted to ensure no skewed (also known as erroneous) temporal patterns are included in model results. While this feature is built-in, Cardno acknowledges that there may be potential for the erroneous temporal patterns to influence model results, and therefore Cardno has undertaken a visual inspection of results to ensure that this has not occurred once the models have been run.

4.1.3 BoM Intensity Frequency Duration (IFD) Depths

All required ARR 2019 Intensity Frequency Duration (IFDs) relationships for base case modelling have been downloaded from the Bureau of Meteorology (BoM) website for all design events. This included obtaining the standard and non-standard durations ranging from 10 minutes to 168 hours.

4.1.3.1 Rainfall Spatial Variance

As the total catchment size is greater than 20 km^2, an analysis of the spatial variance of rainfall was required. This was undertaken using multiple IFDs sampled from different locations throughout the catchment as shown in Figure 4-1. The four locations were chosen as they covered the spatial variance across the catchment and included:

- Centroid: -43.0377, 147.2342
- Margate Rivulet Outlet: -43.0234, 147.2626
- Top of Margate Rivulet: -43.0635, 147.1774
- Top of Catchment: -43.0560, 147.2227

The spatial variance of the four IFDs were analysed against one another in order to calculate a coefficient of variance (CV). A catchment is determined to have significant rainfall variance when the CV between the relevant rainfall intensities are equal to or greater than 5%. Results for the assessment shown in Table 4-1 demonstrated all storm events longer than 2hrs experience a spatial variation of rainfall.

A weighted IFD for the catchment was generated from rainfall depth ASCIIs that were obtained from BoM in order to capture this spatial variance. This utilises a point sampling method based on the centroid of each sub-catchment with rainfall depths statically processed to a median value for each AEP and duration. The weighted IFD is provided in Appendix D.

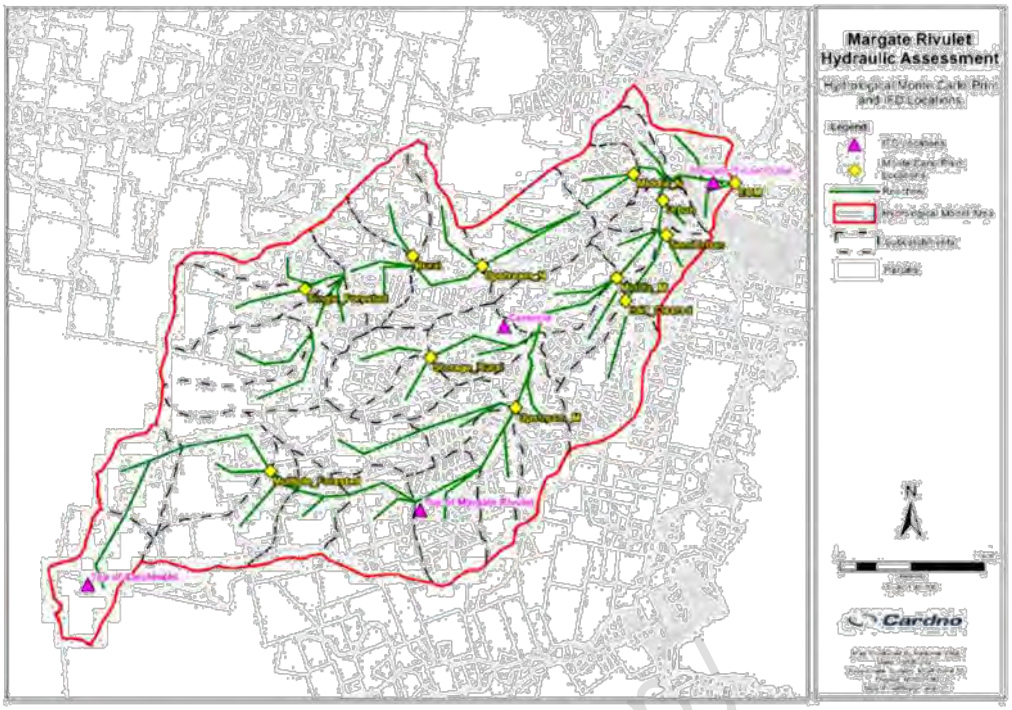


Figure 4-1 Assessed IFD Locations

Table 4-1 Coefficient of Variance Assessment for Four Key Locations throughout the Margate Rivulet Catchment

Duration	AEP							
	63.20%	50%	20%	10%	5%	2%	1%	0.50%
10 min	3%	3%	3%	3%	3%	3%	3%	4%
15 min	3%	3%	3%	3%	3%	3%	3%	4%
20 min	3%	3%	3%	3%	3%	3%	3%	3%
25 min	3%	3%	3%	3%	3%	3%	3%	4%
30 min	3%	3%	3%	3%	3%	3%	3%	3%
45 min	3%	3%	3%	3%	3%	3%	3%	4%
1 hour	3%	3%	3%	3%	4%	4%	3%	4%
1.5 hour	4%	4%	4%	4%	4%	4%	4%	4%
2 hour	5%	5%	5%	5%	5%	5%	4%	5%
3 hour	7%	7%	6%	6%	6%	6%	5%	6%
4.5 hour	9%	9%	8%	8%	7%	7%	7%	7%
6 hour	10%	10%	9%	9%	9%	8%	8%	9%
9 hour	13%	12%	12%	11%	11%	10%	10%	11%

Duration	AEP							
	63.2%	50%	20%	10%	5%	2%	1%	0.5%
12 hour	14%	14%	13%	13%	12%	12%	12%	12%
18 hour	17%	16%	15%	15%	15%	15%	15%	15%
24 hour	18%	18%	17%	17%	17%	16%	17%	17%
30 hour	19%	19%	18%	18%	18%	18%	18%	19%
36 hour	19%	19%	19%	19%	19%	19%	19%	20%
48 hour	20%	20%	20%	21%	21%	21%	21%	22%

4.1.3.2 *Climate Change*

A Climate Change IFD was developed to represent a predicted 2100 scenario based on the Climate Change document provided to Cardno by Kingborough Council (See Data Review Report date 23/02/2021). The values contained within the document identify expected changes relative to the 1961-1990 baseline period for the RCP8.5 emissions scenario for rainfall.

The Climate Change IFD was generated using the weighted IFD for the catchment (discussed in Section 4.1.3.1 above) as a basis. The conservative increased percentage from the *Climate Change Information for Decision Making* (Kingborough Council, 2021) of 12.9% for rainfall extremes across all events and durations has been adopted for this study, based on the assumption that that 2020 is taken as the current conditions. It must be noted that the previously completed Kingston Beach Flood Study adopted both a 10% and 30% increase in rainfall.

The Climate Change IFD has also been provided in Appendix D.

4.1.3.3 *Pre-Burst Rainfalls*

Median preburst data was downloaded from the ARR 2019 Data Hub for the centroid of the study area and has been implemented into RORB. This has been applied in a single increment prior to the design storm as per the process outlined in ARR 2019 which details using the in-built functionality of RORB. Given that preburst ratios for durations of less than one hour are not available from the ARR 2019 Data Hub, ratios for the one-hour duration have been adopted for all durations of less than one hour as per existing best practice.

The median preburst values have been adopted as they are the most defendable values without any additional guidance currently available in literature. Each of the time increments have been manually set to be compatible with the imported temporal pattern increments from the ARR 2019 Data Hub. The proposed median preburst data is shown in Table 4-2 below. It should be noted that the preburst values vary across the four locations, however, the values which occurred at a majority of the locations were selected.

Table 4-2 Infilled Preburst Ratios implemented into RORB for the Margate Rivulet catchment

Duration	AEP							
	63.2%	50%	20%	10%	5%	2%	1%	0.5%
10 min	0	37.5	33	30.8	29.1	19.3	13.8	0
15 min	0	37.5	33	30.8	29.1	19.3	13.8	0
20 min	0	37.5	33	30.8	29.1	19.3	13.8	0
25 min	0	37.5	33	30.8	29.1	19.3	13.8	0

Duration	ARF							
	23.23%	50%	20%	10%	5%	2%	1%	0.05%
30 min	0	37.5	33	30.8	29.1	19.3	13.8	0
45 min	0	37.5	33	30.8	29.1	19.3	13.8	0
1 hour	0	37.5	33	30.8	29.1	19.3	13.8	0
1.5 hour	0	23.6	19.8	18.1	16.9	17.6	17.9	0
2 hour	0	29.4	24.6	22.6	21.1	14.2	10.3	0
3 hour	0	33.7	25.9	22.7	20.4	31.1	37.1	0
4.5 hour	0	16.5	18.9	19.9	20.5	25.5	28.4	0
6 hour	0	16.5	18.9	19.9	20.5	25.5	28.4	0
9 hour	0	7.6	9.7	10.4	10.8	8.1	6.5	0
12 hour	0	7.6	9.7	10.4	10.8	8.1	6.5	0
18 hour	0	1.8	5.1	6.4	7.2	9.2	10.3	0
24 hour	0	0.7	5.4	7.1	8.2	6.6	5.7	0
30 hour	0	0.3	0.7	0.9	1	6.9	10	0
36 hour	0	0.3	0.7	0.9	1	6.9	10	0
48 hour	0	0	1.7	2.2	2.6	4.1	4.8	0
72 hour	0	0	0.7	1	1.2	0.6	0.3	0
96 hour	0	0	0	0	0	0	0	0
120 hour	0	0	0	0	0	0	0	0
144 hour	0	0	0	0	0	0	0	0
168 hour	0	0	0	0	0	0	0	0

4.1.4 Areal Reduction Factors (ARFs)

The total area of the Margate Rivulet catchment is 23.11km^2, however, the average contributing size of each sub-catchment delineated in the hydrological model is less than 1km^2. As the hydrological model has been developed with inclusion of accurate sub-catchments, water has been applied to the hydraulic model on a sub-catchment basis.

With respect to ARF application, using an ARF of 23.11km^2 would under-represent the actual volume of water generated, while adopting an ARF of 1km^2 would reflect a slightly conservative approach. As such, the RORB model was run with two different ARF values:

1. An ARF of 23.11km^2 – This has been adopted to check for critical durations at the catchment outlet and used for validation of the hydrological model (See Section 5); and
2. An ARF of 1 km^2 – This has been adopted to generate the required inflows for each sub-catchment within the hydraulic model boundary and the expectation that flows along the main drainage trunk lines will generate slightly conservative results.

It must be noted that when the ARF of 23.11km^2 is adopted, the ARR Data Hub coefficients have been utilised. However, when the ARF of 1km^2 has been adopted the ARR Data Hub coefficients are not utilised. These coefficients are presented in Table 4-3 and this approach is in alignment with ARR 2019 Guidelines (Book 2, Chapter 4, Table 2.4.1.)

Table 4-3 ARR 2019 Tasmania ARF Parameters

Parameter	Value
A	0.0605
B	0.347
C	0.2
D	0.283
E	0.00076
F	0.347
G	0.0877
H	0.012
I	-0.00033

4.1.5 Initial and Continuing Loss

The Margate Rivulet catchment was modelled as an Initial Loss (IL) / Continuing Loss (CL) model. ARR 2019 recommends that the IL and CL values vary according to the three different types of areas i.e. DCIA, ICIA and PA (previously defined in Section 3.4) represented in the model.

ARR2019 recommends that the loss rates for these areas are as follows:

- DCIA: IL = 1-2 mm, CL = 0mm/h
- ICIA: IL = 60-80% of adopted pervious loss, CL = 1-3 mm/h.
- PA: IL & CL = Rural loss rates provided in the ARR Data Hub Text File

As such, the regional rural loss estimates for the four locations assessed for Rainfall Spatial Variance (See Section 4.1.3.1) were downloaded from the ARR 2019 Data Hub for the Margate Rivulet catchment. The initial losses for all four locations were the same. For continuing losses, the centroid, the outlet and the south east were identical, while the north west differed by 0.2mm/h.

As three of the four locations specified have identical IL and CL, these values were considered reasonable to represent the entire catchment. Specifically, these were estimated as:

- Storm Initial Losses = 28.0mm
- Storm Continuing Losses = 3.4mm/h

Based on recommendations from ARR2019, the following loss rates have been adopted for use in this study:

- DCIA: IL = 1mm, CL = 0mm/h
- ICIA: IL = 19.6mm (70% of adopted pervious loss), CL = 2 mm/h.
- PA: IL = 28.0mm, CL = 3.4mm/h

It must be noted that these are the values recommended when no calibration and/or validation of the models can be undertaken. However, Cardno has determined that the hydrological model can be validated with supplied data from Kingborough Council (See Data Review Report dated 23/02/2021).

4.1.6 Model Time Step

The continuing loss has not been adjusted for the model time step. This is not required as the data used to generate the loss values is based on rainfall data recorded at 6 minute intervals and as such the loss rates are compatible with the RORB model minimum timestep.

4.1.7 Routing Parameters

The *m* routing parameter has been set to 0.8 which is typically the value assigned to RORB models. An *m* value of 1.0 would imply that discharge and storage increase at the same rate. Therefore, this value implies that flood magnitude discharge increases more rapidly than storage (ARR 2019).

5 Hydrological Model Results

5.1 Modelling Scenarios

The following scenarios were hydrologically modelled:

- A range of critical durations and associated temporal patterns for the 5%, 1% and 0.5% AEP base case events;
- A range of critical durations and associated temporal patterns for the 1% AEP climate change event; and
- A range of critical durations and associated temporal patterns for the 1% AEP event best and worst development scenarios.

5.2 Identification of Design Flow Events

5.2.1 RORB Monte Carlo Module

A probabilistic (Monte Carlo) assessment has been completed in order to determine the design flow events using the inbuilt RORB Monte Carlo module. The RORB Monte Carlo module automates the process to include:

- Undertaking multiple runs, using parameters, while sampling from the defined temporal patterns
- Undertaking 2,000 runs for each duration storm
- Extracting the average or median design event for each duration and locations, using statistics to derive the appropriate flood frequency curve
- Specifying the critical duration at strategically chosen locations

This methodology is a more efficient, more defensible and robust approach for deriving the appropriate flood frequency curve (and hence appropriate design events) for the catchment. It is also reproducible, as the sampling size is suitably large to reduce the uncertainty in the derived flood frequency curve.

The Monte Carlo assessment has been run using the MC analysis module in RORB. The module divides the rainfall distribution into 50 discretised intervals and runs 40 samples from each interval. This results in a total of 2,000 runs per storm duration as noted above. The flood frequency curve is then derived using exceedance probability calculations based on the total probability theorem.

An example of the outputs from the runs undertaken for a set of rainfall is shown in Table 5-1. This shows a wide range of flood hydrographs at a specific location depending on the parameters adopted including rainfall temporal pattern selected and/or loss rates. From this sample, a distribution of likely hydrograph peaks can be assessed and an expected peak flow rate assigned to the flood probability. This is shown as the red distribution in Figure 5-1. It should be noted that in this analysis, only the rainfall temporal patterns are varied as outlined above.

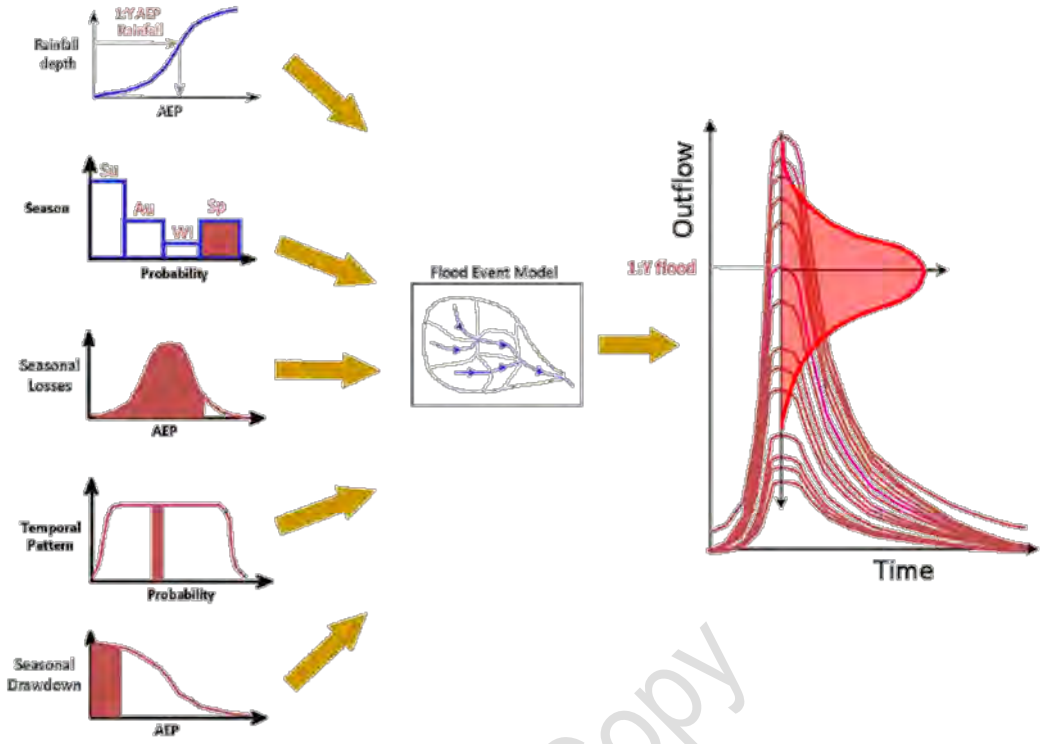


Figure 5-1 Example Monte Carlo Input Sampling (HARC, 2016)

The example above shows the assessment for a given location and expected rainfall probability. This approach can be extended across the full range of the rainfall frequency curve by breaking the curve down into intervals (in this case 50 intervals) and sampling a number of times from each interval. This result is an estimate of the distribution of the peak flow for each rainfall interval. Taking the expected peak flow for each interval yields the flood frequency curve. This curve can then be used to derive the appropriate selection of design flood events to represent the expected behaviour of the system. Figure 5-2 shows the flood frequency derivation process.

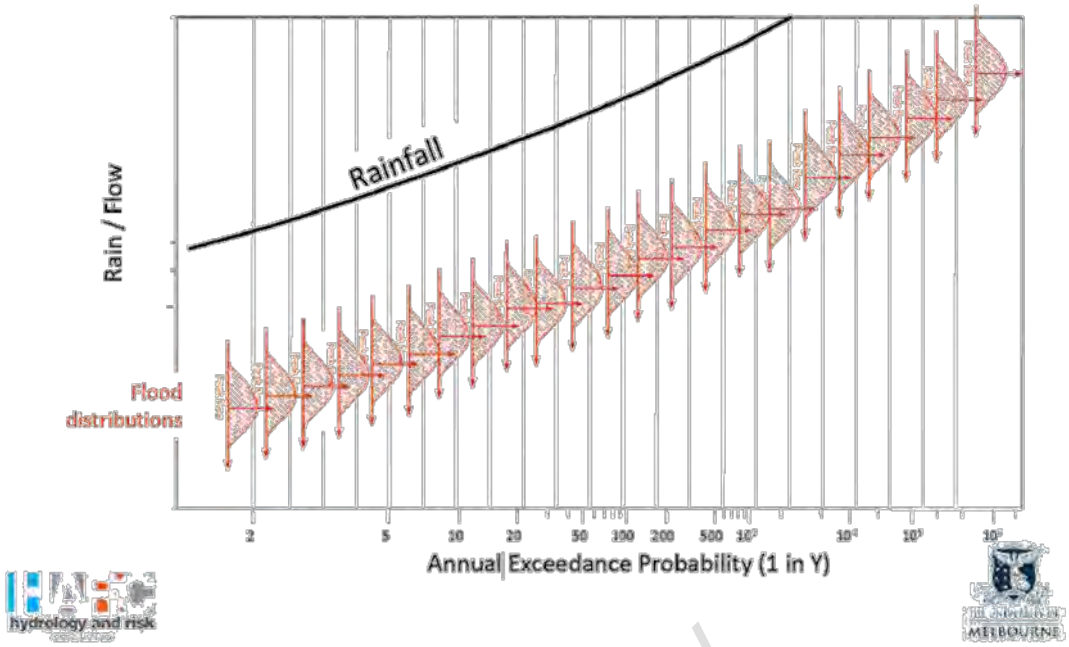


Figure 5-2 Deriving the Flood Frequency Curve (HARC, 2016)

5.2.2 K_c Analysis

K_c is a RORB input that defines the lag parameter in the catchment model and can be compared with other runoff-routing models and their parameters such as C, B and β used in WBNM, RAFTS and URBS respectively. RORB features a range of regional relationships that are listed in the known publications and involve a single catchment variable (area in km^2). This is because area has been found to be the dominant variable (ARR 2019).

It is for this reason, that Cardno assessed a range of K_c values that are appropriate for the Margate Rivulet based on catchment characteristics to determine a single K_c value that best represents the overall catchment. This is determined by undertaking a Monte Carlo simulation for the hydrological model with results generated at each print location compared to the median and mean flows. The K_c value that generates flows closest to the median (and mean) has been adopted. This adopted value, in conjunction with the loss values, generates outputs from the hydrological model for input into the hydraulic model.

Figure 5-3 and Figure 5-4 show the results of the Monte Carlo analysis for various K_c values. As the default equation for determining the K_c value in RORB results in a Kc significantly higher value than the other methods appropriate for the Margate Rivulet catchment, it is considered to be an outlier. Therefore, this value has not been included when calculating both the mean and median for the K_c values. The West Tasmanian method for determining the K_c generates flows closest to the median (and mean) and therefore has been adopted for the design events. The West Tasmanian method has a K_c value of 5.15 for the catchment.

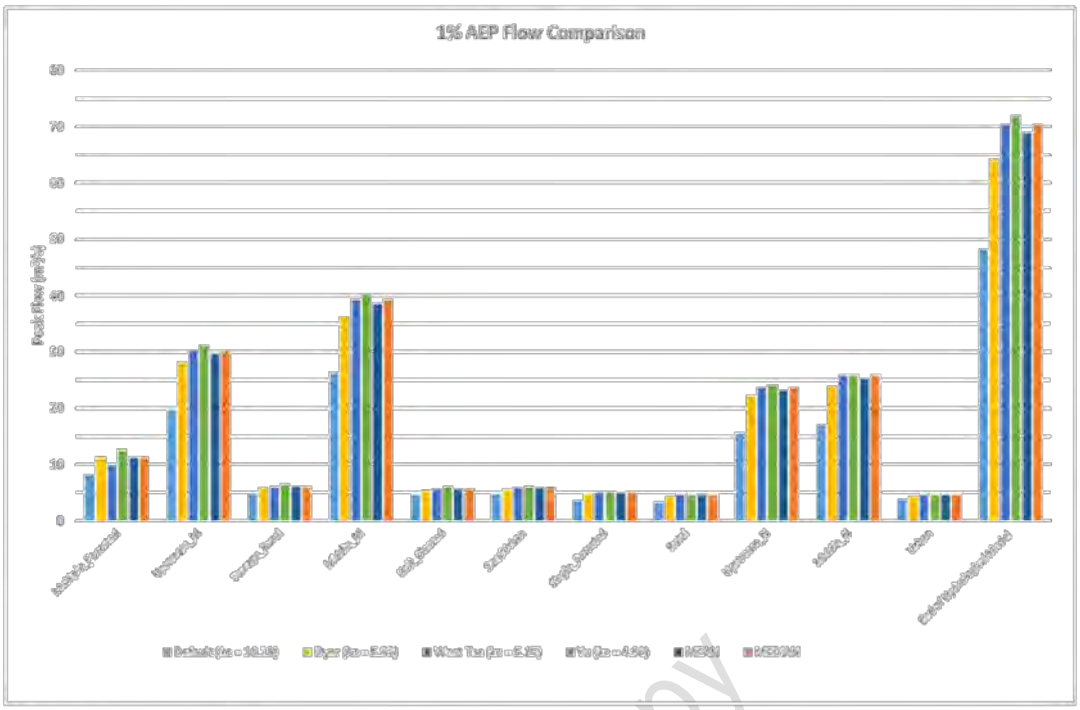


Figure 5-3 1% AEP Flow Comparison

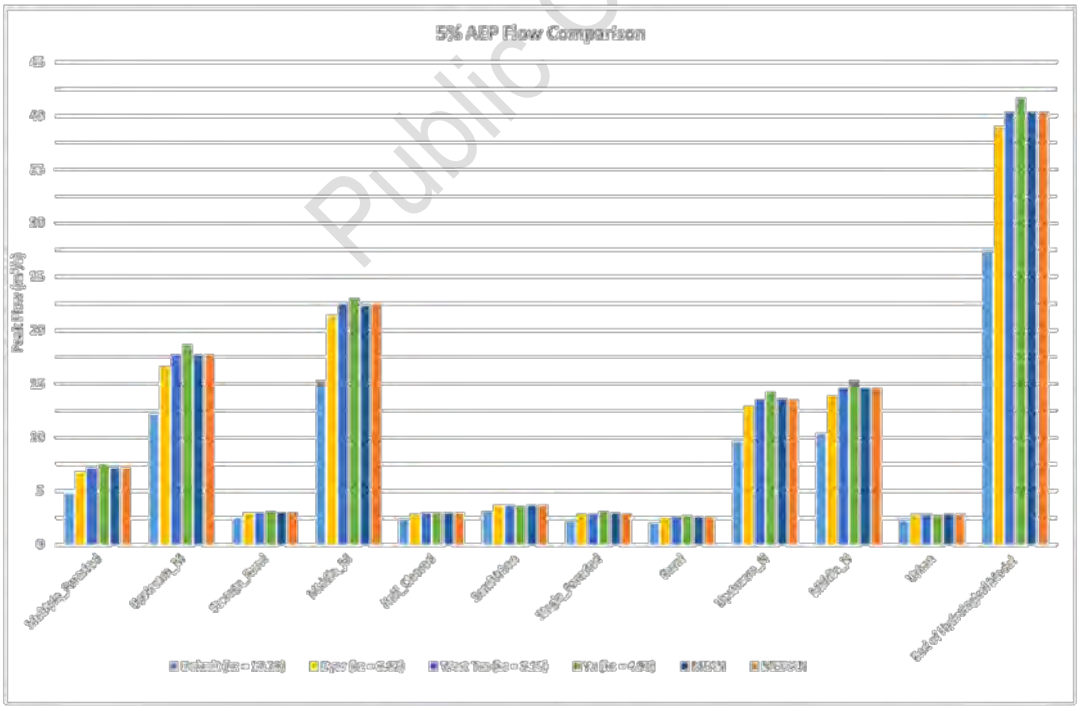


Figure 5-4 5% AEP Flow Comparison

5.2.3 RORB Ensemble and Design Modules

The Monte Carlo assessment process described in Section 5.2.1 above has been undertaken for 12 strategically chosen locations throughout the catchment as shown in Figure 5-5. These locations were strategically chosen throughout the catchment in order to capture sub-area variances. It was especially important to select a wide range of locations, representing upper areas (likely to have shorter critical durations) and main branch flow areas, as well as areas of differing fraction imperviousness.

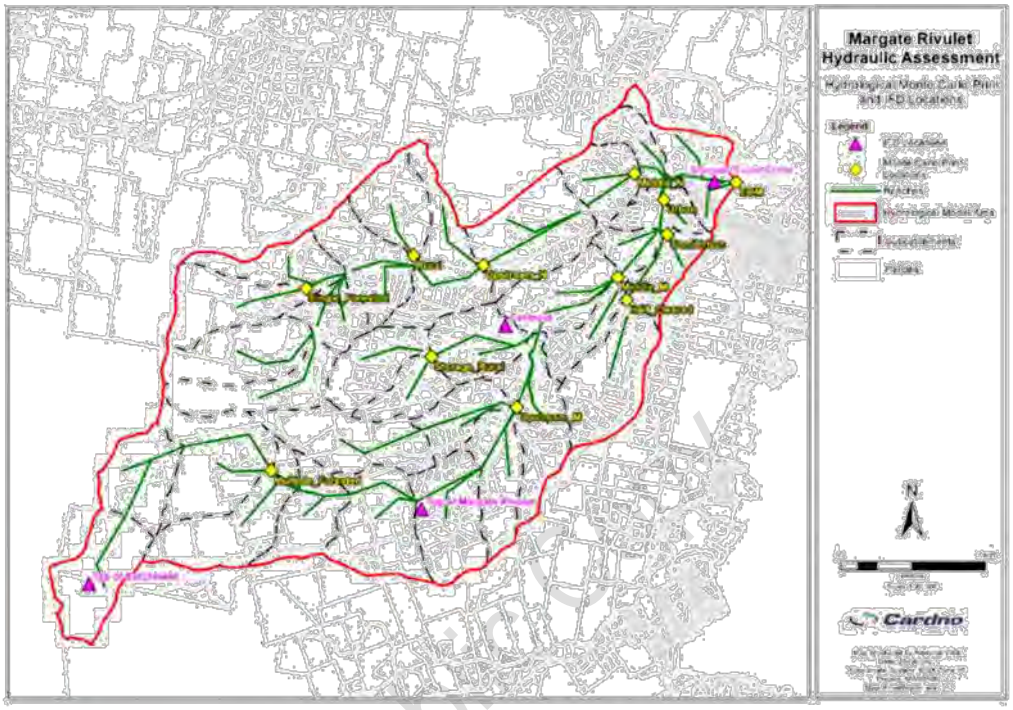


Figure 5-5 Assessed Monte Carlo Print Locations

The critical storm (duration) selection methodology has been undertaken using the following steps:

- ARR parameters were downloaded from the Data Hub including, temporal patterns, aerial reduction factors and rainfall pre-burst information
- BoM IFD parameters (2019 version) were also downloaded
- A RORB Monte Carlo analysis was run by varying the rainfall temporal pattern (using the files downloaded from the Datahub) while keeping losses, m and k_c fixed as derived using the methodology in Sections 4.1.5, 4.1.7 and 5.2.2

It should be noted that the RORB Monte Carlo analysis has been undertaken using a single ARF value (1km^2) for simplicity. Varying ARF values are not required as the ARF only applies a single scaling factor to the rainfall depths and so does not impact the selection of the median event.

Once the critical storm durations have been identified using the RORB Monte Carlo assessment, associated critical temporal patterns for each duration are selected by running a full suite of ensemble events through the RORB ensemble module. The temporal pattern which most closely matches the peak flowrate (at each of the analysis locations) for each critical duration from the RORB Monte Carlo output is then selected. In some cases, multiple temporal patterns are adopted for a single duration where they are producing similar peak flowrates as compared to the Monte Carlo outputs.

5.2.4 Selection of Critical Storm Events and Associated Temporal Patterns

The resultant critical storm events (and associated temporal patterns) are outlined in Table 5-1. In order to assess the impacts of changes in the level of development within the catchment and climate change, the same temporal patterns have been adopted with updated model inputs (Effectives Impervious Areas, IFD's etc.). By adopting the same temporal patterns, the impacts of both development and climate change are able to be determined without the effects of changes in temporal patterns influencing the results.

Table 5-1 Design Events

AEP	Duration	RORB Temporal Pattern
5% AEP	45 Minutes	14
	60 Minutes	17
	90 Minutes	15
	120 Minutes	16,17
	360 Minutes	12, 14, 16, 20
	540 Minutes	15
	720 Minutes	15
1% AEP	45 Minutes	22
	60 Minutes	30
	90 Minutes	26
	120 Minutes	28
	270 Minutes	29
	360 Minutes	23, 25, 26, 28
	540 Minutes	27
	720 Minutes	21
0.5% AEP	45 Minutes	22
	60 Minutes	30
	90 Minutes	23
	120 Minutes	28
	270 Minutes	29
	360 Minutes	24, 25, 26, 27, 29
	540 Minutes	24
	720 Minutes	25

5.3 Hydrological Model Validation

5.3.1 Flow Gauge Analysis

As no stream flow gauge is located within the Margate Rivulet catchment, the hydrological model is unable to be calibrated to recorded data.

5.3.2 Previous Flood Study Works

5.3.2.1 Margate Rivulet Flood Plain Study

The previous Margate Rivulet Flood Plain Study undertaken by Sinclair Knight Merz (SKM, 2006) used gauged flows from Snug River to 'calibrate' an XP-Rafts Snug River model in accordance with ARR1987. The loss values from this 'calibration' were then adopted for the XP-Rafts Margate Rivulet model to generate flows. This was undertaken to determine flooding for the previous Brookside Devmar Development Area directly adjacent to the Margate Rivulet near the Channel Highway.

Key adopted parameters from the 2006 study include:

- Initial Loss = 15mm
- Continuing Loss = 8mm/h
- Peak 1% AEP Flow Rate at the Channel Highway Culvert = 58.3 m^3/s

5.3.2.2 Snug River Flood Study

The Snug River Flood Study undertaken by Council (Kingborough Council, 2019) utilised the streamflow gauge which is approximately 2.8km upstream of the outlet on the Snug River. The hydrological and hydraulic models were developed using XPSWMM with ARR2016 guidance and three events were selected for event calibration. This was undertaken to map the flood behaviour for a range of coincidental storm events under both existing and future climate conditions in the Snug River catchment. It must be noted that this was undertaken for Snug River flooding only and did not explicitly consider flooding from stormwater within the Snug Township.

Key adopted parameters from the 2006 study include:

- Initial Loss = 10mm
- Continuing Loss = 3.2mm/h
- Modelled Peak Flows from Council's Snug River Model as shown below in Figure 5-6.

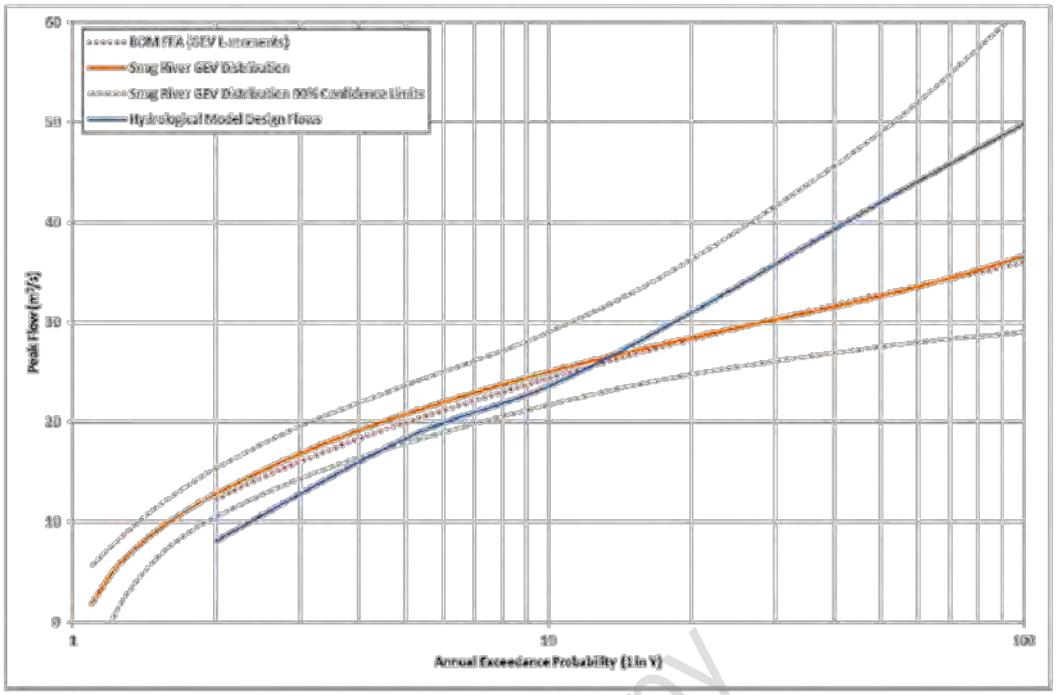


Figure 5-6 Snug River Flood Frequency Analysis compared with Council's XPSWMM Modelled Peak Flows (Kingborough Council, 2019)

5.3.3 Regional Flood Frequency Estimation (RFFE)

A Regional Flood Frequency Estimation (RFFE) has been obtained from the ARR Data Hub for the Margate Rivulet catchment and is shown below in Figure 5-7.

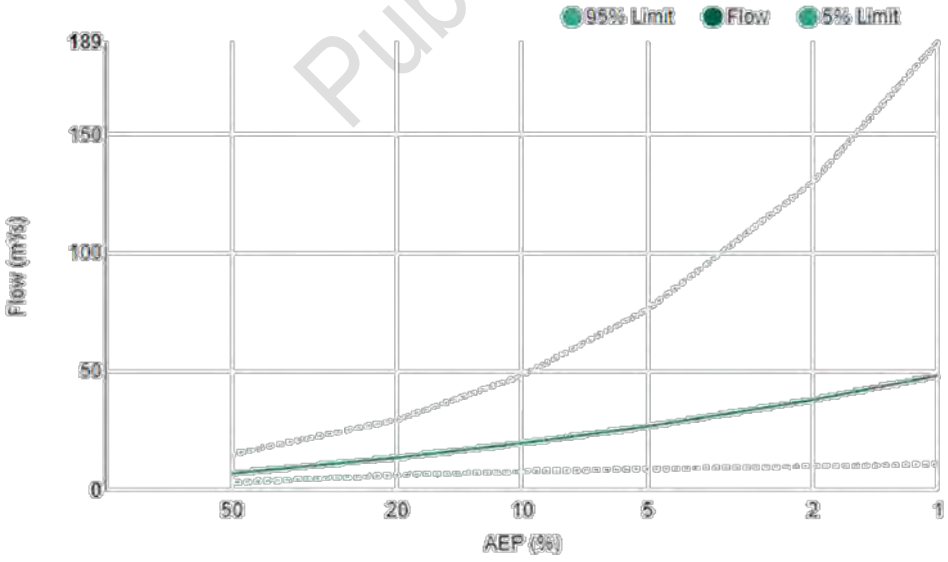


Figure 5-7 Margate Rivulet Regional Flood Frequency Estimation obtained from ARR Data Hub

5.3.4 Nikolaou/Vont Steen Equation

The Nikolaou/Vont Steen equations were developed by Nick Nikolaou and Roel Von't Steen for the Department of Natural Resources and Environment (Victoria) in 1997, based on both flood studies and large historical events, with the results shown in Figure 5-8.

For urban catchments the Nikolaou/Vont Steen equation is $Q_{1\% AEP} = 4.67A^{0.763}$

For rural catchments the Nikolaou/Vont Steen equation is $Q_{1\% AEP} = 10.29A^{0.71}$

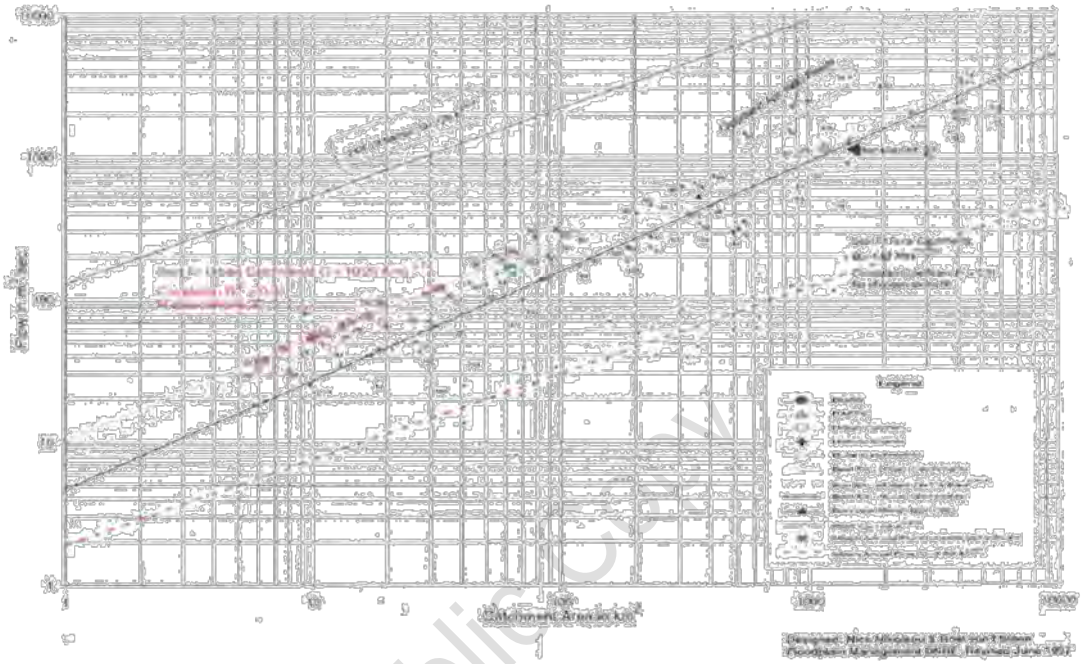


Figure 5-8 Nikolaou/Vont Steen Equation

5.3.5 Rules of Thumb

According to the Melbourne Water Technical Specifications and Smith & Smith 2015, a 'typical' small urban catchment will generate approximately $10m^3/s$ of runoff per 100ha (100ha = $1km^2$), while a rural catchment will generate $3m^3/s$ approximately per 100ha.

5.4 Validation of the Hydrological Results

The results of the Monte Carlo analysis for adopted k_c value (5.2.2) have been validated against the four comparative methodologies outlined above in section 5.3. The results outlined in Table 5-2, show that the adopted 1% AEP flow for this study fits within the expected range as per the comparative methodologies.

Table 5-2 Results of the RORB Model Validation

Method	Peak 1% AEP Flow Rate
Margate Rivulet Flood Plain Study	58.3m³/s (result from Sinclair Knight Merz model, 2006)
Snug River Flood Study	50 m³/s
RFFE	48.4 m³/s
Vont Steen Rural	51 m³/s
Vont Steen Urban	96 m³/s
Melbourne Water Rural Rule of Thumb	69 m³/s
Melbourne Water Urban Rule of Thumb	230 m³/s
Adopted Kc Value	70.3 m³/s (5% AEP = 40.3 m³/s)

The 2006 Margate Rivulet Flood Study was undertaken in line with ARR1987 with a predicted 1% AEP flow rate of 58.3 m^3/s. As this study has been undertaken in line with ARR2019, it would be expected that the 1% AEP peak flow rate would be different due changes in model parameters such as, losses, IFD data and the way fraction impervious is calculated.

As part of the Snug River Flood Study, the hydrological model was calibrated to the stream flow gauge located within the catchment. This calibration resulted in a peak 1% AEP flow rate of 50 m^3/s. While both the Snug River catchment and the Margate Rivulet Catchment are approximately the same size (21.9 km^2 vs. 23.1 km^2), it is not considered appropriate to directly use the calibration results from one catchment to apply them to a completely different catchment. However, as the Snug River catchment generally has the same shape, size and topographical characteristics, the results can be used to assist in understanding the likely magnitude of expected flowrates.

While the RFFE indicates a peak 1% AEP flow rate of 48.4 m^3/s for the Margate Rivulet Catchment, the 70.3 m^3/s identified as part of the Monte Carlo analysis is within the expected error bounds as shown in Figure 5-7

While the Margate Rivulet catchment is predominantly rural there are areas of urbanisation in the lower reaches. Comparing the 1% AEP peak flow rates from both the Vont Steen equation and the Melbourne Water rules of thumb, shows that the adopted 1% AEP peak flow rate as predicted by the Monte Carlo analysis falls between the rural and urban results for both methods as would be expected.

6 Hydraulic Model Setup

A 1D/2D hydraulic model has been developed for the Margate Rivulet catchment. This type of model allows for dynamic links between the overland flow and pipe components based on the capacity of the drainage system. As such, once the drainage system is exceeded, the resultant overland flow patterns are determined by the two-dimensional hydraulic model.

Cardno has utilised the TUFLOW 2D HPC (Heavily Parallelised Computing) and 1D ESTRY solvers (version 2020-10-AA\TUFLOW_iDP_w64) to undertaken the hydraulic modelling. The individual components of the model and their setup are detailed in the following Sections.

6.1 Digital Elevation Model

LiDAR used to construct the Digital Terrain Model (DTM) has been obtained from ELVIS (Elevation Information System) at a grid cell resolution of 3m.

6.1.1 LiDAR

As no single LiDAR dataset covered the entire study area, the DTM has been constructed from five separate datasets as outlined below:

- Wellington Range 1m LiDAR - Tasmanian Flood Recovery Project from 2019
- Greater Hobart 1m LiDAR - Tas Coastal Project from 2013
- Mt Wellington 1m LiDAR - Forestry Tasmania Project from 2011
- Derwent 1m LiDAR - Climate Futures Project from 2008
- Geoscience Australia 5m LiDAR – National Resampled Project from a collection of datasets

As each of the datasets have been captured at different times/resolutions they have been combined to ensure the newer datasets are take preference over older, historical datasets.

6.1.2 Topographic Modifications

As the hydraulic model is being run at resolution of 3m, topographic modifications are required to ensure key features are captured within the DTM.

In order to ensure that the inverts for both the Margate Rivulet and Nierinna Creek channels are properly captured within the DTM, gully lines have been used. The channel inverts for both waterways has been set based on the 1m LiDAR supplied for this study.

Inversely, ridge lines have been used to ensure the crest levels of key features such as dam walls and the levee located along Sandfly Road are adequately captured within the DTM

Where the DTM does not accurately represent a key topographic feature such as a bridge due to issues within the underlying LiDAR, z-shapes have been used.

Figure 6-1 shows the final model DTM and the location of all topographical modifications.

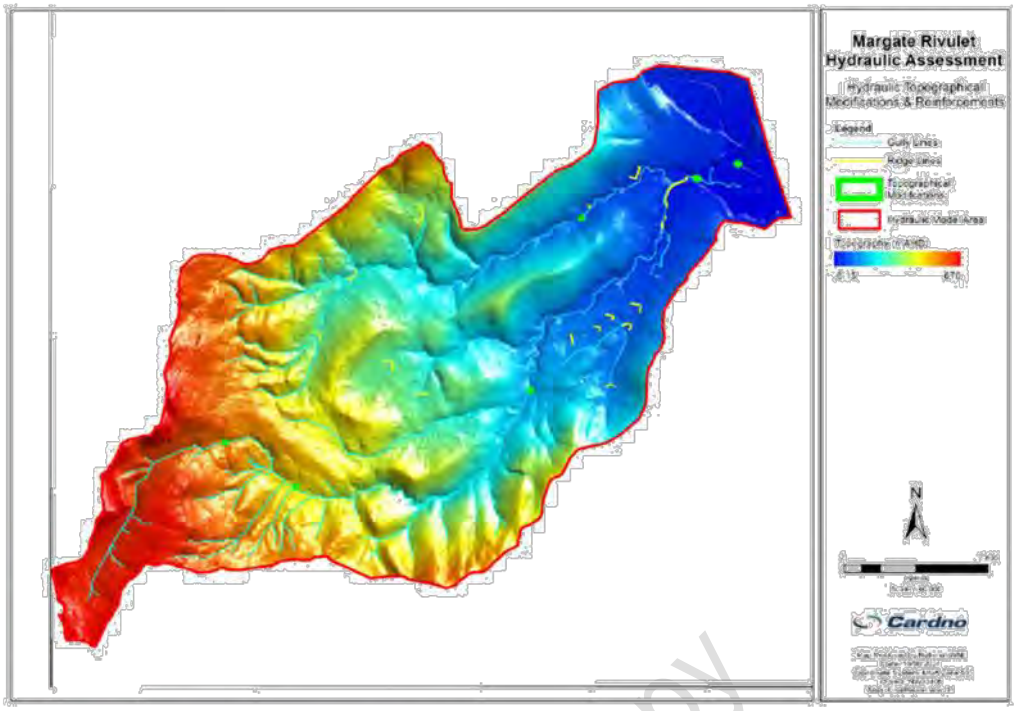


Figure 6-1 Final DTM and Topographic Modifications

6.2 Roughness Manning's 'n'

Water flows in the 2D elements of the model, according to the hydraulic properties of the land surface, as defined by the DTM and the hydraulic roughness.

The 2D hydraulic roughness was determined using property data, planning zones and aerial photography, with the Manning's 'n' values being consistent with industry guidelines and previous studies in the area. Manning's 'n' or hydraulic roughness is a co-efficient which corresponds to the roughness (friction) of the ground surface. The adopted roughness categories and associated values are detailed below in Table 6-1 and shown in Figure 6-2.

Table 6-1 Land Use and associated Manning's 'n' Values

Land Use	Manning's 'n' Value
Residential High Density Urban | Combined Parcel and Building	0.300
Residential Lower Density Rural | Combined Parcel and Building	0.100
Building	0.500
Industrial / Cemetery	0.300
Commercial	0.300
Open Pervious Areas | Minimal Grassed Vegetation	0.040
Open Pervious Areas | Moderate Shrubbed Vegetation	0.060
Open Pervious Areas | Thick Treed Vegetation	0.100
Waterways / Channels | Minimal Vegetation / Rock/Earth Lined	0.030
Waterways / Channels | Moderate Vegetation	0.060
Waterways / Channels | Heavy Vegetation	0.090
Paved Roads / Driveways	0.020
Lakes | No Emergent Vegetation	0.020
Wetlands | Emergent Vegetation	0.060
Estuaries / Oceans	0.030
Gravelled Surface | Rural Road	0.050
Artificial Turf / Handstand Sporting Surface	0.015
Agriculture / Farmland	0.050
Carparks	0.022
Education	0.2
Agriculture / Farmland with Buildings Combined	0.1

6.2.2 Vegetation Assessment Scenario

In order to assess the sensitivity of the catchment to changes in levels of vegetation along waterways, the following changes were made to hydraulic model roughness values for these modelled scenarios.

- Regions designated as "Waterways / Channels | Minimal Vegetation / Rock/Earth Lined" (0.030) have been maintained as is.
- Regions designated as "Waterways / Channels | Moderate Vegetation" (0.060) have been changed to "Waterways / Channels | Minimal Vegetation / Rock/Earth Lined" (0.030); and
- Regions designated as "Waterways / Channels | Heavy Vegetation" (0.090) have been changed to "Waterways / Channels | Moderate Vegetation" (0.060).

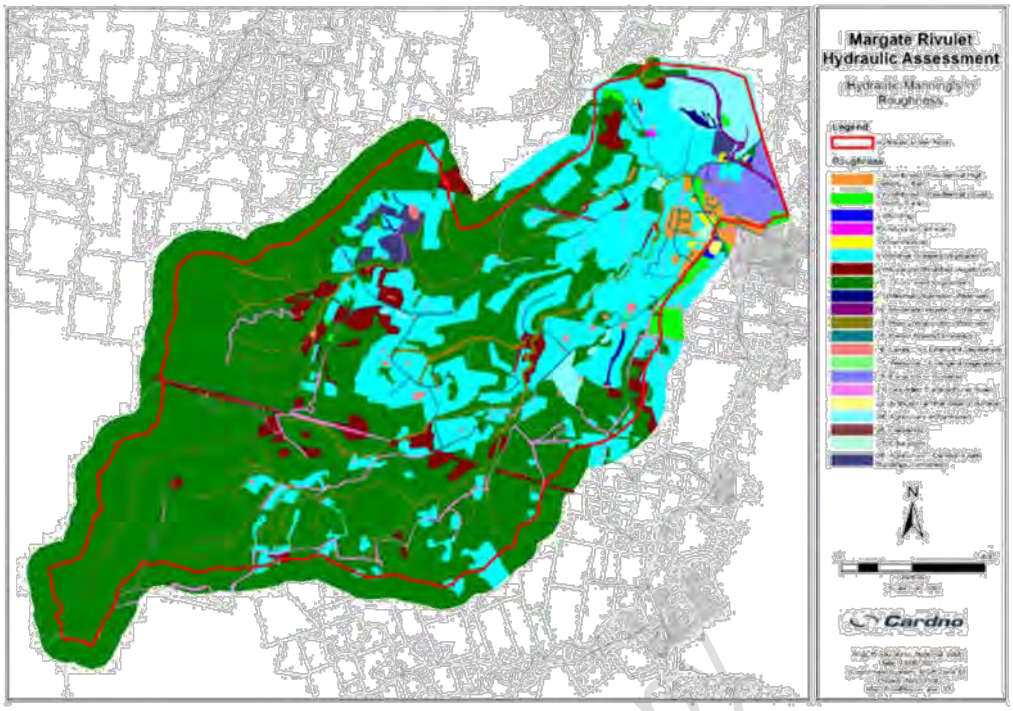


Figure 6-2 Assigned Roughness (Manning's 'n') for the Margate Rivulet Catchment

6.3 Pipe Infilling

As outlined in the Data Review Report (dated 11/11/19), a significant number of the received pipe data had missing inverts and diameters. These diameters and inverts were therefore required to be estimated based on the available information. Additionally, some inverts provided in the dataset were altered to facilitate model running, as these appeared to be incorrectly input into the GIS dataset due to typographical errors.

Further areas of discrepancy were also detected between pipe inverts and surface levels, particularly in areas that have recently changed due to development. Despite pipe inverts potentially being correct, they needed some degree of altering to ensure that they do not break the surface as the model will not run if pipes are found to do this.

Pipes which were originally supplied without inverts or sizes were primarily infilled from design plans that were received from council. Where council were not able to provide design plans, engineering judgment was used. Unknown diameters were infilled based on surrounding diameters and the location of the pipe. Unknown inverts were estimated by subtracting the diameter and an assumed 600mm cover from ground surface levels. They were then matched in with surrounding pipe inverts to ensure a realistic pipe network with all pipes able to flow downhill.

6.4 Pit Sizing

Pits were located in the model according to Council data, as outlined in the Data Review Report (dated 11/11/19). Additional pits were added where connections should be, but were not present in the data received. This was usually the case in newly developed areas and where there were missing pipes in the dataset. In some instances, the pipe was split and a junction pit added to enable a connection.

The following assumptions have been made regarding the modelled pits:

- Pits were assumed to be rectangular (R), with height and width per LGAT standard drawings (provided to Cardno after Data Review Report)
- Height and Width determined to be 1.2 by 1.2m. This was an assumption given the largest pipe in a network was 0.6m. The LGAT drawing TSD-SW05-01 shows the typical width of the concrete pit is 150mm, totalling 0.3m. Therefore, using the schematic, it was assumed internal width was 0.9 x0.9.
- Pit inverts were assumed to be the bottom of the pipe invert
- All Pits have been modelled as 2D SX connections except where the provided pit layer was used to identify manholes and house connections. These were set to nodes.
- Entry and exit losses are set to 0.5 and 1 respectively
- Each pit is connected to two additional 2D cells. As no "junction pits" have been labelled in the Kingborough Dataset, it has been assumed that pits labelled as "manholes" are actually junction pits.

6.5 Layered Flow Constriction Shapes

Based on Cardno's experience of modelling urban pipe networks, Cardno typically includes bridges and some large culverts within the 2d domain as layered flow constriction shapes (lfcsh). The main reason for this is that Cardno has found that they are less prone to causing instabilities and erroneous flow values than their 1d counterparts. In order to use lfsch files, various blockage and flow constriction factors are required for each layer (i.e. below the soffit, the bridge deck itself and railings above the bridge deck). These values were all estimated using the following (depending on availability):

- Design drawings
- Measurements from the site visit
- Site visit photos
- Aerial photos
- Google Street View photos

Furthermore, all flow constriction factor values were calculated using the methodologies outlined in Hydraulics of Bridge Waterways (1978) with the various bridge types considered according to those shown in Figure 6-3.

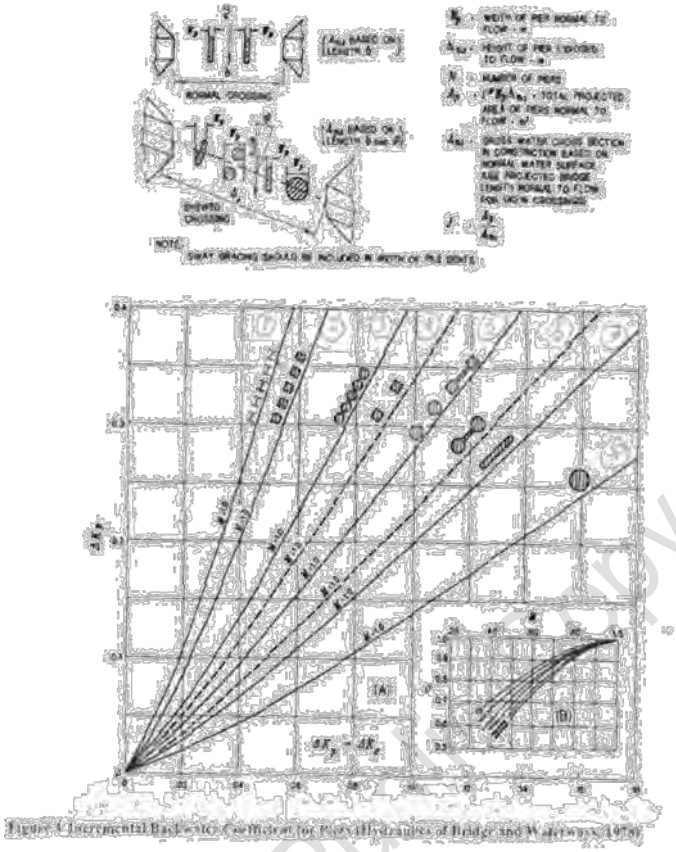


Figure 6-3 Bridge Types – source: Hydraulics of Bridge Waterways (1978) and TUFLOW Manual

All attributes used in the estimation of blockage and flow constriction factors are summarised in Table 6-2, with the locations of these bridges (Layered Flow Constriction Shapes) shown in Figure 6-4. Based on the observations from the site visit, all but two bridges were designated as clear single span bridges and therefore no blockage was associated with this bridge opening. For the two bridges which have piers, the blockage applied to the bridge opening was determined by the ratio of the width of the piers to the width of the bridge opening.

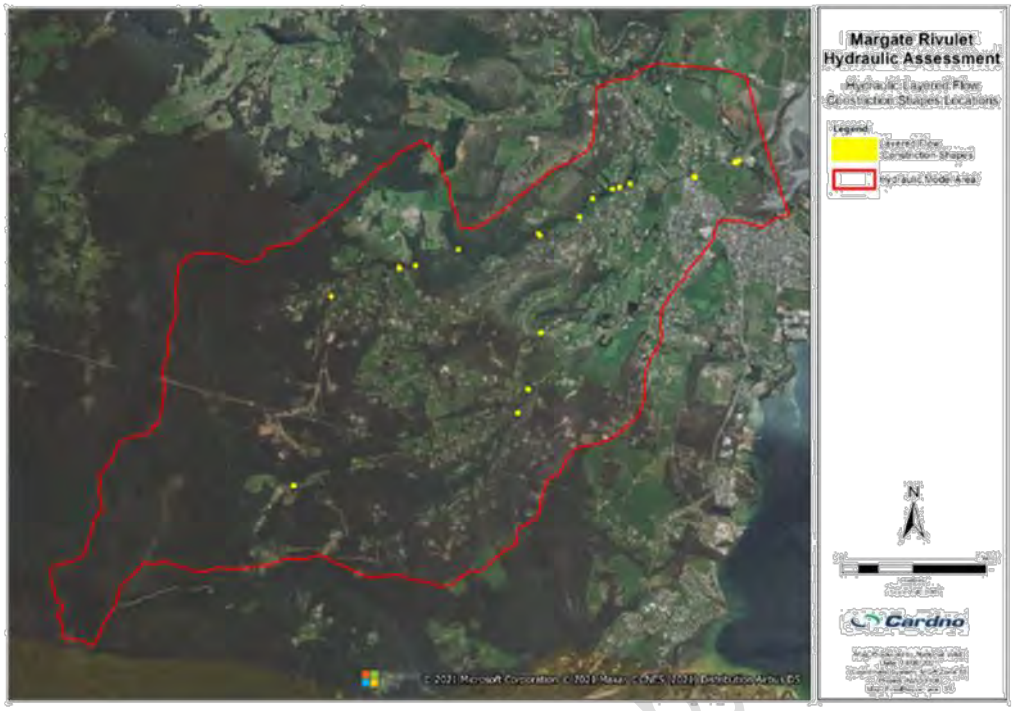


Figure 6-4 Bridge (Layered Flow Constriction Shapes) Locations

Table 6-2 Layered Flow Constriction Shapes Summary

ID	Invert	Bridge Obvert (mAHD)	L1* Blockage (%)	L1 LFC	Deck Width (m)	L2** Blockage (%)	L2 LFC	Railing Height (m)	L3*** Blockage (%)	L3 FLC
M1	-99999	5.90	3.17	0.008	1.00	100	0.106	0.75	30	0.006
M2	-99999	6.05	8.59	0.012	1.65	100	0.064	1.1	75	0.006
M3	-99999	14.41	0.00	0.000	1.00	100	0.149	0.5	45	0.006
M3a	-99999	24.21	0.00	0.000	0.30	100	0.172	0.5	40	0.006
M4	-99999	28.40	0.00	0.000	0.50	100	0.142	0.3	75	0.006
M5	-99999	31.43	0.00	0.000	0.50	100	0.119	0.3	75	0.006
M5a	-99999	35.80	0.00	0.000	0.30	100	0.159	0.5	40	0.006
M6	-99999	43.70	0.00	0.000	0.50	100	0.146	0	0	0.006
M6a	-99999	59.70	0.00	0.000	0.30	100	0.159	0.5	40	0.006
M7	-99999	143.80	0.00	0.000	0.50	100	0.071	0.5	45	0.006
M7a	-99999	124.70	0.00	0.000	0.30	100	0.310	0.5	40	0.006
M7b	-99999	131.01	0.00	0.000	0.30	100	0.310	0.5	40	0.006
M8	-99999	167.60	0.00	0.000	0.50	100	0.104	0.6	45	0.006
M9	-99999	65.10	0.00	0.000	0.30	100	0.044	0.6	45	0.006
M10	-99999	85.93	0.00	0.000	1.00	100	0.214	1.3	25	0.006
M11	-99999	97.55	0.00	0.000	0.60	100	0.126	0.6	60	0.006
M12	-99999	263.60	0.00	0.000	0.60	100	0.153	0.3	95	0.006

*L1 = bridge piers

**L2 = bridge deck

***L3 = bridge railings

6.6 Rainfall Application

Rainfall has been applied to the hydraulic model via 2d_sa (all) layers in the hydraulic model extent via excess rainfall hydrographs. The excess rainfall hydrographs have been derived from the RORB model, and evenly distributed over the relevant sub catchment.

6.7 Downstream Boundary Conditions

For the downstream boundary of the hydraulic model, the 5% AEP level within North West Bay of 1.47 mAHD has been adopted based on the analysis outlined below.

Due to the topography along Beach Road, there is a pipe which directs overland flow into the neighbouring catchment to the south. A 1d_bc has been applied to this pipe where it leaves the catchment, with the level set as the pipe obvert.

6.7.1 Influence of the North West River

As the North West River discharges into North West Bay in the direct vicinity of the Margate Rivulet, an assessment has been undertaken in order to determine how it influences results within the study area as shown in Figure 1-2.

The North West River has an upstream catchment of approximately 96 sq. km, with a stream flow gauge (5201-1 North West bay Rivulet @ Margate WS INT) located approximately 3.9 km upstream of the river mouth, just upstream of Miandetta Drive (between Allens Rivulet and Blue Gate Creek). This gauge has been active since 1965.

6.7.1.1 North West River Flood Frequency Analysis

In order to understand the expected likely peak flow rates of the North West River, and their influence on the Margate Rivulet catchment, a Flood Frequency Analysis (FFA) has been undertaken at the gauge location. As apart for the FFA, the quality and quantity of the recorded data was reviewed, with grade codes 11 (F-Issues) and 21 (E-Unknown) removed from the sampled dataset. This has resulted in 30 years of stream flow data being included within the FFA, with the largest maximum yearly flow rate of 207.5 m^3/s being recorded in 1986 and the lowest maximum yearly flow rate of 4.7 m^3/s being recorded in 2017. As shown in Figure 6-5, the FFA estimates the 1% AEP flow rate at the gauge in the North West River to be 330 m^3/s, which is significantly higher than the 249 m^3/s predicted by the RFFE of the same catchment.

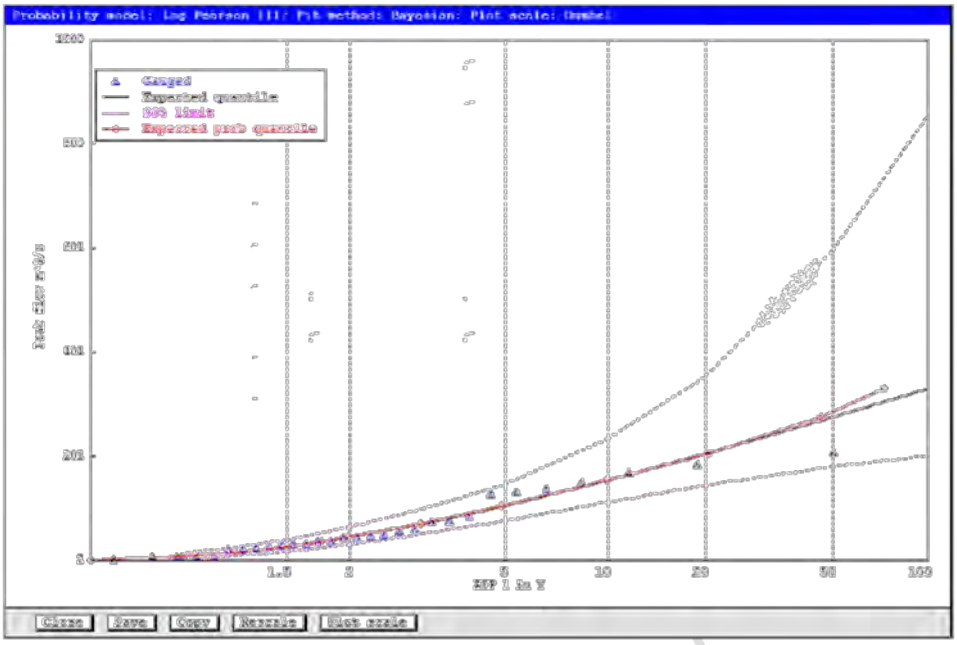


Figure 6-5 North West River Flood Frequency Analysis

6.7.1.2 *Flooding in the Lower Reaches of the North West River*

In order to determine the influence that the 1% AEP flood event (see section 6.7.1.1) has on flooding within the Margate Rivulet study area, a simple 2D hydraulic model was developed for the lower reaches of the North West River. This model applied an inflow of the peak 1% AEP inflow of 330 m^3/s (as per the FFA), with the hydraulic roughness being consistent with the Margate Rivulet hydraulic model and downstream boundary level of 1.47 mAHD.

It is expected that based on the assessment outlined above, for the 1% AEP event along the North West River, overland flows are generally contained within the waterway, with the overland flows backing up behind the Channel Highway and inundating the escarpment to the west of the river. As shown in Figure 6-6 there is likely to be overtopping of the Channel highway due to flows from the North West River. However, as they do no propagate up into the Margate Rivulet study area, it has been assessed that flooding in the North West River does therefore not impact on the modelled flood levels within the Margate Rivulet catchment.

Figure 6-6 1% AEP Flood Extent in the North West River at the Channel Highway

6.7.2 Coincidental Storm Surge and Tidal Data

In order to determine the appropriate downstream water level within North West Bay, an assessment utilising peak Nearshore Water Levels, as determined by the Water Research Laboratory of UNSW (2017), has been undertaken in order to quantify the impacts of different Tailwater levels on the flood levels within the study area. This assessment has been undertaken on both the 5% AEP and 1% AEP Peak Nearshore Water Levels of 1.47 mAHD and 1.57 mAHD (as well as their climate change equivalents) as shown in Figure 6-7.

Year	ARI	Sea Level Rise (m)	Tide at Peak (m AHD)	Anomaly at Peak (m)	Local Wind Setup at Peak (m)	Wave Setup at Peak (m) (Shoreline)	Peak Nearshore Water Level (m AHD)
Present Day	1	0	0.53	0.44	0	0.1	1.07
	10		0.53	0.68	0	0.16	1.37
	20		0.53	0.75	0	0.19	1.47
	50		0.53	0.84	0	0.13	1.5
	100		0.53	0.91	0	0.13	1.57
2050	1	0.3	0.53	0.44	0	0.1	1.37
	10		0.53	0.68	0	0.16	1.67
	20		0.43	0.75	0	0.19	1.67
	50		0.53	0.84	0	0.13	1.8
	100		0.53	0.91	0	0.13	1.87
2100	1	1	0.53	0.44	0	0.1	2.07
	10		0.53	0.68	0	0.16	2.37
	20		0.53	0.75	0	0.19	2.47
	50		0.53	0.84	0	0.13	2.5
	100		0.53	0.91	0	0.13	2.57

Figure 6-7 Water Levels in North West Bay

Due to the topography of the lower reaches of the study area, neither the 5% AEP nor the 1% AEP Peak Nearshore Water Levels in North West Bay (Present Day or Climate Change) propagate up into the study area as shown in Figure 6-8. As neither Peak Nearshore Water Levels propagate up into the study area, the 5% AEP level has been adopted in order to be consistent with the previous Snug Bay study, with the 5% AEP climate change level adopted for the climate change scenarios.

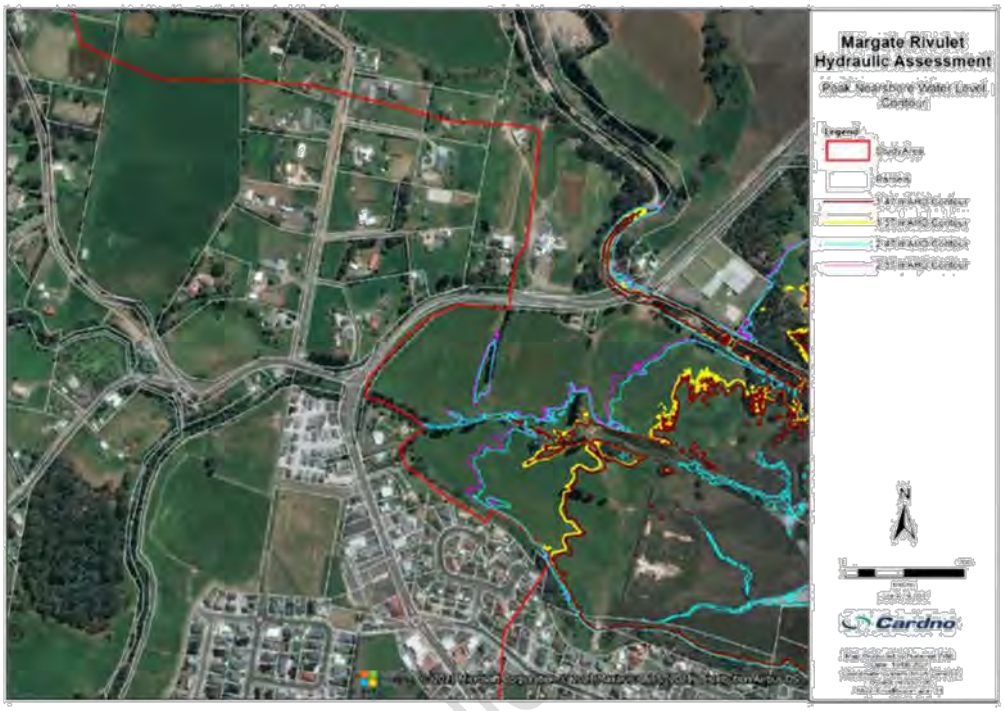


Figure 6-8 Peak Nearshore Water Level Contour

7 Hydraulic Model Parameters

The TUFLOW model has been run with the following key parameters:

- ESTRY Control File (1D)
  - Start Time == 0
  - Timestep (s) == 0.2
  - Output Interval (s) == 300
- TUFLOW Control File (2D)
  - Solution Scheme == HPC
  - Model TUFLOW Build == 2020-10-AA-isP-w64
  - Hardware == GPU
  - Timestep == Variable
  - Cell Wet/Dry Depth == 0.0002
  - Map Output Data Types == hVqdZAMIEdt
  - Start Map Output == 0
  - Map Output Format == GRID XMDF
  - Grid format == ASC
  - Grid Output Cell Size == 3
  - Map Output Interval == 300
  - Time Series Output Interval == 300
  - Maximums and Minimums Only For Grids == ON
  - Store Maximums and Minimums == ON MAXIMUMS ONLY
- TUFLOW Geometry Control
  - Origin == 514000,5231000
  - Orientation == 514000,5231000
  - Grid Size (X,Y) == 9000, 9000
  - Cell Size == 3

8 Hydraulic Model Results

8.1 Modelling Scenarios

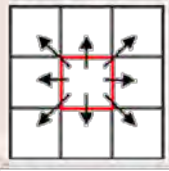
The following events have been hydraulically modelled:

- 5%, 1% and 0.5% AEP base case events;
- 1% AEP climate change event with the climate change tidal levels;
- 1% AEP event best and worst development cases; and
- 1% AEP event decreased vegetation (lowered Roughness Manning's 'n' values)

8.2 Results Processing

Raw outputs from each of the events assessed within the hydraulic model have been combined into a single set of results using an in-house Cardno tool, which essentially mimics TUFLOW's asc_to_asc tool by sampling the results at each grid cell and selecting the critical value. As the critical events have been identified as part of the hydrological modelling stage of the project (see section 5.2), the critical value selected is the maximum value from all the hydraulically modelled durations and temporal patterns for each event. Once the results have been combined into a single set of results based on the event, they have been filtered in order to produce a smoothed flood extent, using the process outlined in Table 8-1.

Table 8-1 Result Processing Methodology

Process	Description
Depth filtering	Results are filtered to remove any cells where the depth of flooding (D) is less than 0.05m
Area filtering	An area filter has been applied to remove isolated 'wet puddles' or 'dry islands' from the flood extent and provide a more cohesive shape. The area threshold adopted is 100m². In assessing the area of wet puddles or dry islands, it is assumed that diagonal connections constituted a connection. The schematic below shows all cells considered as neighbours and includes diagonal connections. 
Smoothing	To remove the staircase effect from the edge of the flood extent, the shape is then smoothed using a process developed by Cardno as mentioned above. This is the final step in the generation of the flood extent.
Provide grid results of the flood extent	The grid cells, which remain within the smoothed flood extent, are extracted to provide a dataset of flood modelling results.

8.3 Flood Maps

Flood maps have been included in Appendix A for the 5% AEP, 1% AEP and 0.5% AEP events.

Flood maps have been created for:

- Flood Level
- Flood Depth
- Flood Velocity
- Flood Hazard

8.4 Verification of Results

In order to verify the hydraulic model, a two-step process has been adopted as outlined below and discussed in the following Sections.

- Step 1 – Verify the results to an historical event
- Step 2 – Compare council hot spots to the design event model results

8.4.1 Historical Flooding Event

In order to verify that the hydraulic model is producing results in line with historical events, the May 2018 event has been hydraulically modelled. During this event, the Sunnyside rainfall gauge recorded 151mm of rainfall over a 24-hour period.

As the Sunnyside rainfall gauge only records daily rainfall and not pluviograph (sub-daily rainfall) data, the temporal patterns of this storm has been obtained from the Blackmans Bay Treatment Plant pluviograph station. As the total rainfall recorded by the Blackmans Bay station slightly varied from the Sunnyside station, the total rainfall recorded at Blackmans Bay has been scaled to match that recorded by the Sunnyside. As such, the rainfall temporal pattern has been adopted from the Blackmans Bay Treatment Plant location using the total rainfall recorded within the most relevant gauge.

Once the total rainfall and temporal pattern for the May 2018 had been determined, the excess rainfall hydrograph was calculated using RORB, with the same parameters (i.e. losses, EIA, KC value etc.) selected as for the design events adopted.

As shown in Figure 8-1 the hydraulic model generally corresponds to the reported council hotspots relating to the May 2018 event (see Table 2-2).

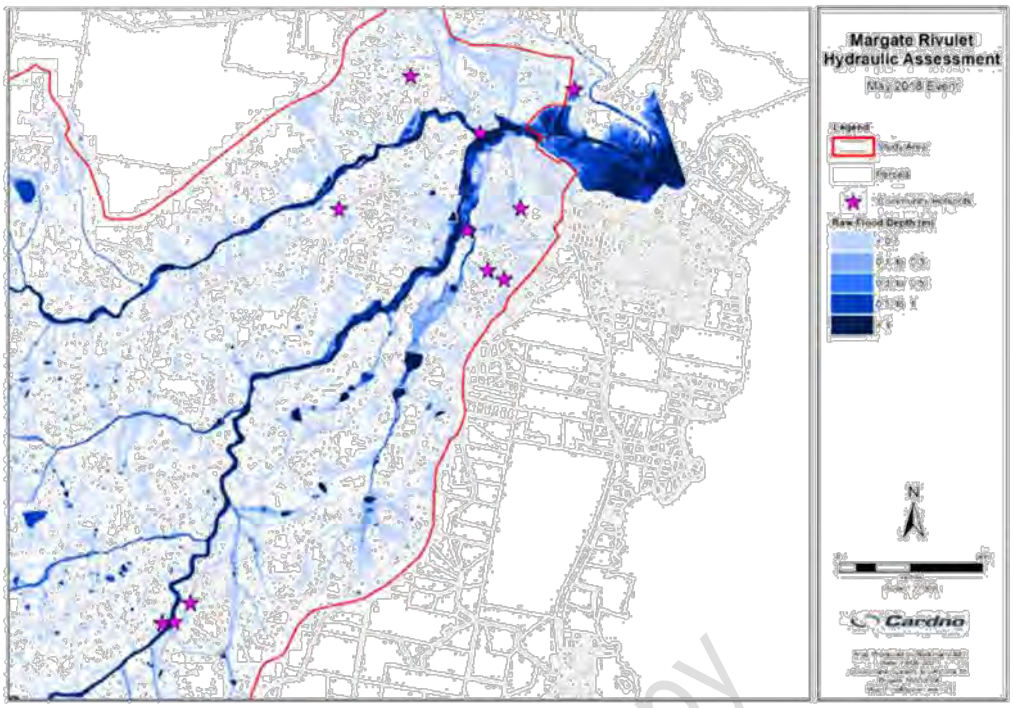


Figure 8-1 May 2018 Event Maximum Flood Depths and Recorded Hotspots

8.4.2 Base Case

In order to verify the design events, the model results have been cross checked against anecdotal flooding issues as outlined in Table 2-2 (community engagement survey) and Table 2-3 (site visit community engagement). Table 8-2 highlights where the filtered results from the hydraulic model indicate flooding in the vicinity of the anecdotal evidence and shows that for all identified locations, the hydraulic model accurately indicates flooding does occur.

Several of the reported locations (Dayspring Drive, Van Morey Road, Nierinna Road and Sandfly Road and Merediths Road) contain properties in the vicinity of the flooding which directly border onto the Rivulet.

Table 8-2 Highlights the locations where

Location	5% AEP	1% AEP	0.5% AEP
Dayspring Drive (community engagement survey)	√	√	√
Van Morey Road (community engagement survey)	√	√	√
Crimson Drive (community engagement survey)	√	√	√
Nierinna Road (community engagement survey)	√	√	√
Sandfly Road (community engagement survey and Site Visit Community Engagement)	√	√	√
Worsley Drive (community engagement survey)	√	√	√
Merediths Road (Site Visit Community Engagement)	√	√	√

8.5 Flood Risk Identification

The flood risk of the catchment has been undertaken in line with the ARR2019 Hazard categories H1-H6, where H1 is considered to the safest category and H6 the most unsafe, as shown in Figure 8-2.

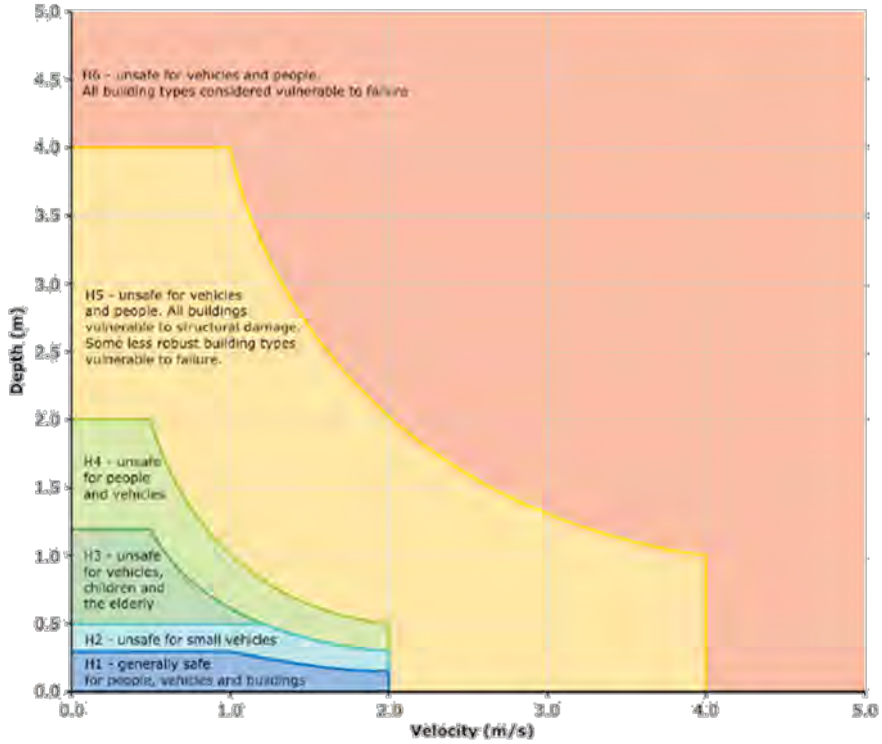


Figure 8-2 ARR2019 Hazard Classes

In the 1% AEP event, flooding within the rivulet is unsafe where it is classed predominantly as H5 and H6, due to both the high velocities and depth of the flooding. Outside of the rivulets, farm dams are generally classified as H3 and H4 due to the depth of flooding. In the urban areas in the 1% AEP event, flooding is generally very shallow, which results in this flooding being classed as H1. Figure 8-3 shows the location of areas of high flood risk within the Margate Rivulet catchment, with the Table 8-3 outlining these locations.

Table 8-3 Flood Risk Identification

ID	Location	Flood Risk
1	**The walking track along Margate Rivulet**	Directly upstream of the Channel Highway along the west side of Margate Rivulet, in the 1% AEP event the flooding along the Margate Rivulet Track is classified as H5, which is unsafe.
2	**Van Morey Road**	Along Van Morey Road the access for several properties is via bridges/culverts across Margate Rivulet. In the 1% AEP event the rivulet is classified at being subject to H5 and H6 flooding which is unsafe.
3	**The walking track along Nierinna Creek**	Upstream of Burnaby Drive, flooding along the Nierinna Creek Walking Track is classified as H5 and H6 which is unsafe, the Track crosses the rivulet several times.

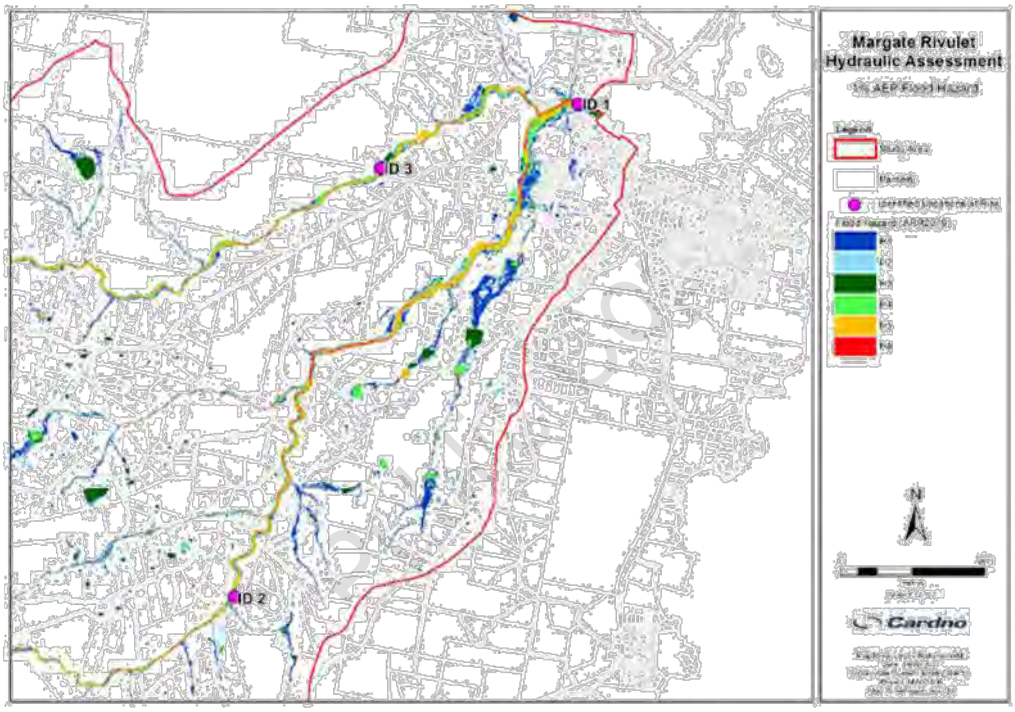


Figure 8-3 1% AEP Flood Hazard

9 Further Analysis

9.1 High-Level Erosion Assessment

Due to the mountainous nature of the Margate Rivulet catchment, slopes of over 60% are fairly common in the upper reaches. Further downstream, in the more residential areas towards the bottom of the catchment, the slope is normally less than 10%, except along the rivulets themselves. Due to the high slopes throughout the catchment velocities are generally very high, with velocities within topographically defined flow paths usually in excess of 2 m/s.

During the site visit undertaken on the 24th of March 2021 (Section 2.7), the following observations were made:

- There are areas within the forested regions that feature exposed and degraded soil due to erosion and sedimentation. This is predominantly along flow paths surrounding unsealed roads and in areas where the forest has been cleared.
- Both Margate Rivulet and Nierinna Creek have varying degrees of vegetation within the channel, with a large proportion of the main reach incised within natural bedrock.
- Both Margate Rivulet and Nierinna Creek typically feature undulating topographies such that there are shallow pools followed by an incised section, which is then again followed by shallow pools.
- Dispersive clay soils were observed throughout the catchment which leads to sedimentation and erosion likely to be a significant risk for the catchment.
- There are notable signs of erosion on the upper side of banks in the main channel, however, this is likely due to the dispersivity of soils in the region and will only arise as a potential issue in significantly large flood events (greater than 2% AEP).

Figure 9-1 shows significant signs of erosion that was observed during the site visit as per the comments above.

Figure 9-1 Examples of Erosion Observed During the Site Visit

Grass is generally able to provide erosion protection from velocities of only up to 1.2 m^2/s. Figure 9-2 highlights the areas within the catchment where in the modelled 1% AEP flood velocities are greater than 1.2m^2/s. Depending to the soil structure, presence of bedrock and level of vegetation, it is likely that erosion may be present in these areas.

Depending on the location and scale of erosion, there are several potential ways to control/limit these impacts, including:

- Sealing of gravel roads
- Increasing the level of vegetation in order to slow velocities, and help bind soils together
- Installation of protective rock work to absorb/dissipate the erosive energy of the water

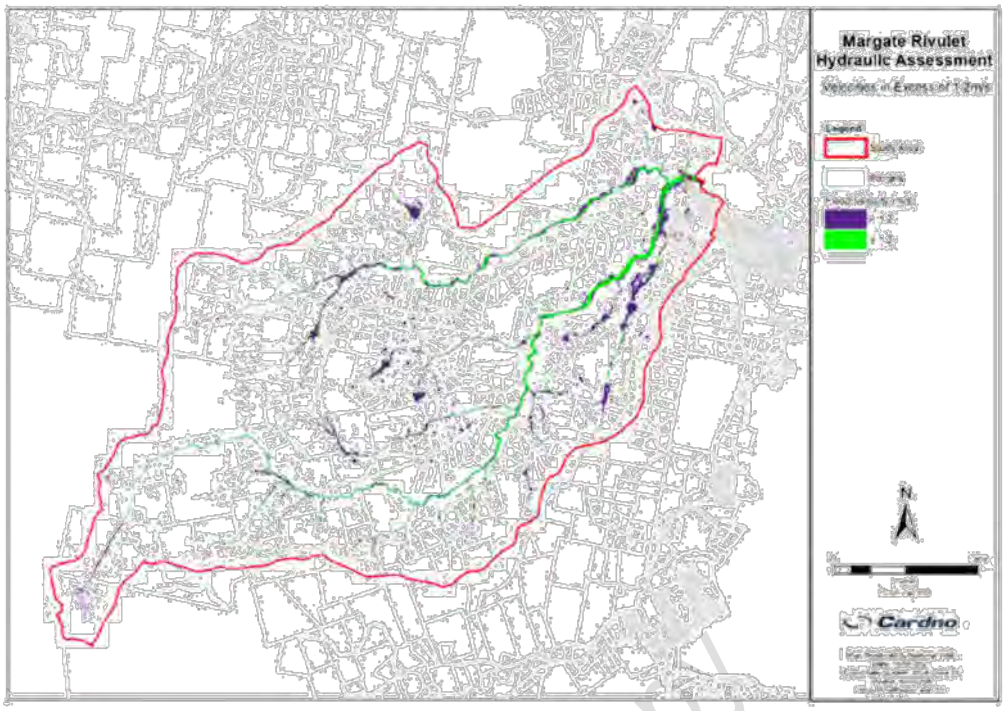


Figure 9-2 Velocities in excess of 1.2m/s

9.2 High-Level Vegetation Assessment

In order to help Council determine the potential impact of vegetation clearing along the Rivulet, an assessment has been undertaken with a reduced hydraulic roughness along the Rivulet to simulate partial clearing of vegetation.

For this assessment the following changes to the hydraulic roughness have been made:

- Regions designated as "Waterways / Channels | Minimal Vegetation / Rock/Earth Lined" remained as is
- Regions designated as "Waterways / Channels | Moderate Vegetation" were changed to "Waterways /Channels | Minimal Vegetation / Rock/Earth Lined"
- Regions designated as "Waterways / Channels | Heavy Vegetation" were changed to "Waterways /Channels | Moderate Vegetation"

As shown in Figure 9-3, clearing of vegetation along rivulets will likely result in a decrease in flood levels from the top of the catchment to the outlet in North West Bay. Due to an increase in flow conveyance in the upstream reaches of the Rivulet, a small number of limited/isolated areas witness small increases in flood levels of up to 0.1m

If the Council wish to undertake clearing of vegetation along the Rivulet, it is recommended that this process is started at the downstream reaches before moving into the upstream areas. This is to ensure that any increases in the flow capacity of the Rivulet due to the vegetation clearing does not result an increase in flood levels in the lower reaches where the capacity of the rivulet is maintained.

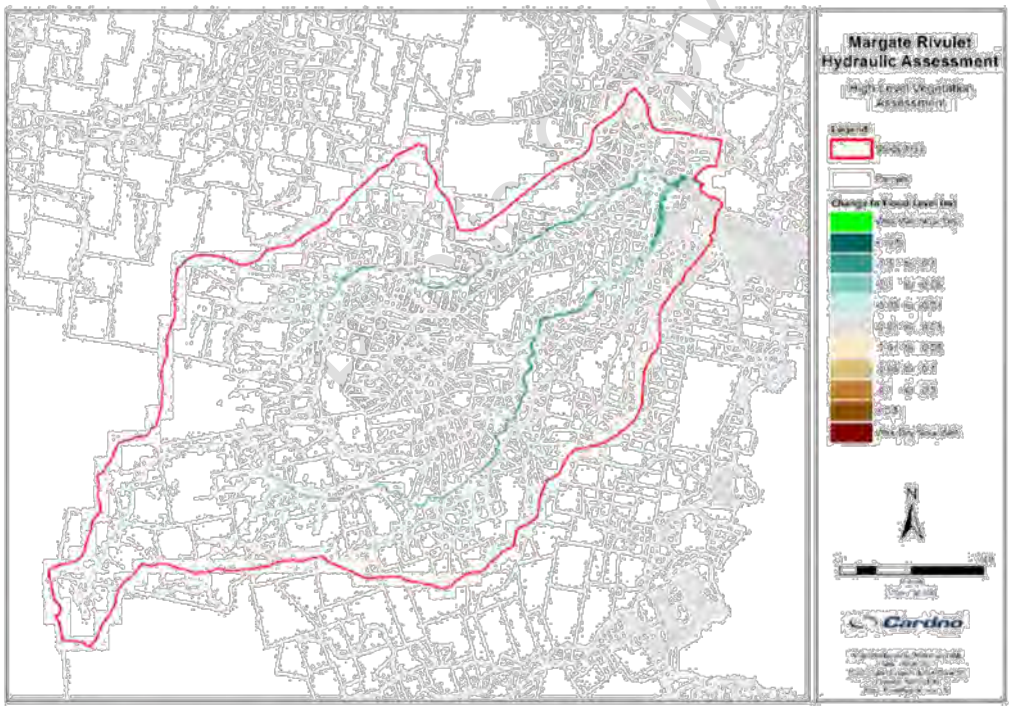


Figure 9-3 High Level Vegetation Assessment

9.3 Flood Mitigation Multi Criteria Analysis (MCA)

Based on both the outcomes of the community engagement and results of the hydraulic model, five potential mitigation options have been identified. Due to the topography of the catchment, flooding is predominantly limited to the rivulets. Furthermore, due to the relatively low level of current development within the catchment, there is limited impacts due flooding within the rivulets themselves.

Potential flood mitigation options have been identified by two key approaches:

- Mitigation Strategy
  - Proactive approach to mitigate flood risk
  - Quantification of structural measures
  - Qualification of non-structural measures
- Residual Risk Strategy
  - Reactive approach to flood risk response
  - Qualification of risk response measures

Table 9-1 presents relative levels of costs, constructability and potential flood reductions for each mitigation option. The following methodology has been used in defining these aspects:

- **Expected Cost** is mainly based on ease of construction. For example, if a major drainage alignment is required, it is expected to be relatively high cost compared to other options.
- **Constructability** is mostly linked to cost, such that high cost projects are typically difficult to construct and would therefore have low constructability.
- **Flood Reduction** has been based on the general potential for the reduction in flood affected properties with the introduction of the mitigation option.

Table 9-1 Identified Mitigation Measures

ID (S - structural, NS – non-structural, C – combined)	Mitigation Name	Description	Expected Cost ($, $$, $$$)	Constructability (Easy, Average, Difficult)	Flood Reduction (Good, Medium, Limited)
1 (NS)	Preventive Maintenance	As part of the community engagement survey, several responders identified blocked drainage infrastructure as being the cause of flooding. A preventative maintenance programme would include a list and schedule of where key drainage infrastructure is to be regularly inspected and any blockages cleared.	$	Easy	Limited
2 (NS)	Planning Controls	Planning controls would allow for development in flood prone areas to be undertaken sympathetically to any flooding issues. Planning controls would ensure (among other aspects) that any development does not increase the flood risk to neighbouring properties, all floor levels are constructed above the relevant flood level and there is safe access/egress to the site during a flood event.	$	Easy	Good
3 (S)	Channel Highway Bridge Upgrade	Due to limited conveyance capacity, flooding currently backs-up behind the Channel Highway Bridge in the 5% AEP event and impacts private property. Increasing the conveyance capacity of the bridge should help to reduce flood levels within private property upstream of the bridge. The Channel Highway Bridge is owned by the Department of State Growth and not by Kingston Council and therefore any works undertaken to the bridge would need to be undertaken in conjunction with this Department.	$$$	Difficult	Good
4 (S)	Nierinna Road	Due to the limited conveyance capacity of various culverts, flows overtop Nierinna Road in the 1% AEP event. Increasing the capacity of these culverts should help to reduce the amount of overtopping which occurs.	$$	Average	Good
5 (S)	Crimson Drive	In the 5% AEP event, there is ponding of water within the block bounded by Crimson Drive and Dayspring Drive. This is due to the location being a trapped low point and there being insufficient capacity in the downstream drainage. By upgrading the drainage from the trapped low point to the undeveloped areas, downstream flood levels should be able to be reduced along Crimson Drive.	$	Average	Good
6 (S)	Tarragon Drive	Flooding from the undeveloped land to the rear of the properties located along Tarragon Drive extends into private property in the 5% AEP event. Further sculpting of the land with either cut within the flooding plain or fill within the private properties should limit the amount of inundation within these private property.	$	Easy	Medium

ID (S - structural, NS – non-structural, C – combined)	Mitigation Name	Description	Expected Cost ($, $$, $$$)	Constructability (Easy, Average, Difficult)	Flood Reduction (Good, Medium, Limited)
7 (S)	Levee System Upstream of Channel Highway	Several properties are affected by flooding upstream of the Channel Highway Bridge in events as lower the 5% AEP event. Through the construction of a levee system, an increase in flood immunity may be able to be offered to properties protected. However, due to the construction of a levee system there may be increases to flood levels within the Rivulet which may reduce the flood immunity to other properties.	$$$	Difficult	Medium
8 (S)	Minor Roads	There are 12 minor roads which are overtopped in events as low as the 5% AEP. By increasing the conveyance capacity of the culverts located below these minor roads, or by raising the road level, it should be possible to increase the level of immunity offered by the roads. As these roads are only minor roads and the flooding generally doesn't affect residential dwellings, it would be expected that upgrading these roads should not be a priority for council (at least from a flood impact perspective). However, if council is already planning on undertaking significant works to these roads in the vicinity of existing culverts, then the impacts of flooding should be considered during the design process.	$$$ (Depending on number selected)	Average	Good

9.4 Stormwater Management Assessment and Stormwater Development Controls

9.4.1 Level of Service of Underground Drainage Assets

A stormwater management assessment has been undertaken in order to determine the level of service provided by the current stormwater network based on the AEP in which the pipes first run full. As can be seen in Figure 9-4, the majority of the pipes in the catchment are reported as having a greater then 200yr level of service, which is highly unlikely to be the case. As is clearly visible in the flood maps in Appendix A, no overland flow is shown as being located above the majority of the pipes and as such the hydraulic model is unable to transfer water from the 2D surface (as there are no overland flows) into the 1D pipes. However, the pipes which are not located within any of the flood extents still provide a vital role within the catchment. Due to the steepness of the area, the minor topographic features which these asset service are typically not captured within the 3m grid cells resolution of the hydraulic model extent.

Within the Margate township, the trunk drains are identified as having less than a 5% AEP capacity (which is the smallest event modelled). This level of service is typical in urban areas. This is further verified using the maximum flood depth results, which show that there are only two areas where there is ponding occurring where drainage is present in the 5% AEP event. Given urban drainage networks are typically designed for events less than the 5% AEP event, the existing drainage network within the Margate Township would be generally considered to be appropriately servicing the urban portion of the Margate catchment.

Within the Margate Township catchment there are 6 locations where piped flows discharge into the Rivulet, the maximum piped discharge in each of these locations are identified in Table 9-2.

Table 9-2 Existing Piped Discharge from the Margate Township

ID	Location	5% AEP Event	1% AEP Event	0.5% AEP Event
1	Between Merediths Road and Dayspring Road - Piped	0.04 m^3/s	0.05 m^3/s	0.06 m^3/s
2	The walking track along Margate Rivulet at Dayspring Drive - Piped	0.05 m^3/s	0.07 m^3/s	0.09 m^3/s
3	Between Margate Rivulet Track and Tarragon Drive - Piped	0.47 m^3/s	0.62 m^3/s	0.64 m^3/s
	Between Margate Rivulet Track and Tarragon Drive - Overland	0.00 m^2/s	0.048 m^3/s	0.385 m^3/s
4	Citrus Drive - Piped	0.21 m^3/s	0.26 m^3/s	0.35 m^3/s
5	Channel Highway - Piped	0.04 m^3/s	0.05 m^3/s	0.07 m^3/s
6	Riverdowns Drive North - Piped	0.04 m^3/s	0.05 m^3/s	0.06 m^3/s
7	Riverdowns Drive South - Piped	0.1 m^3/s	0.12 m^3/s	0.13 m^3/s
8	Crimson Drive North - Overland	0.00 m^2/s	0.32 m^3/s	0.51 m^3/s

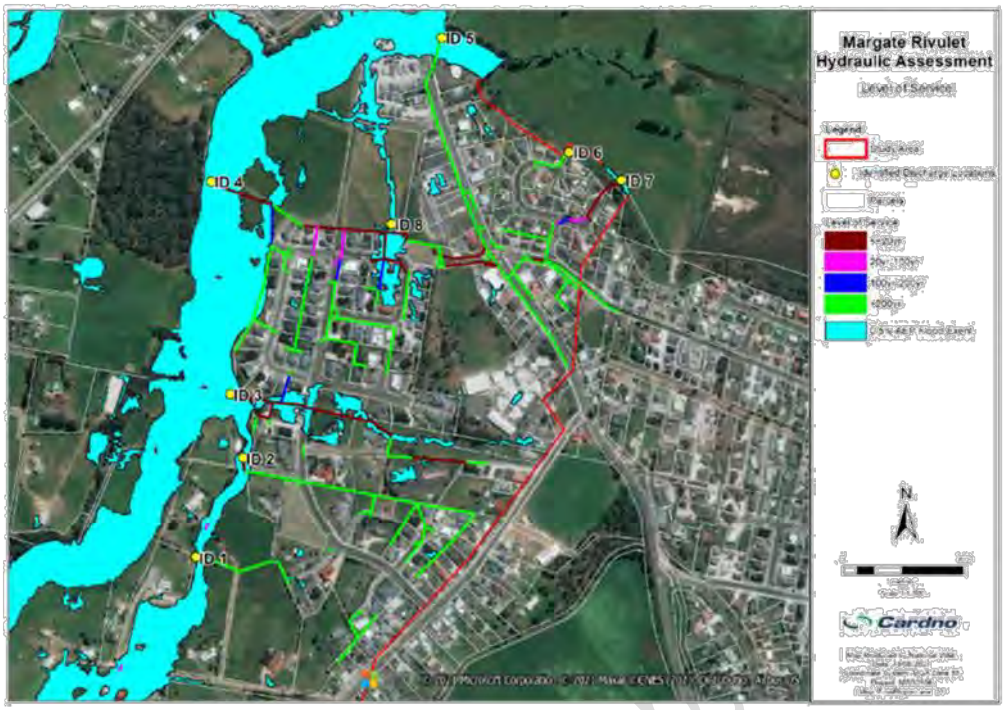


Figure 9-4 Stormwater Level of Service

9.4.2 Assessment of Increased Development Scenarios

An assessment of the increased development scenarios has been undertaken based on an increase to the effective impervious areas as outlined in Section 3.4.2, to represent potential future development within the catchment.

Flooding within the Margate Rivulet is driven by flooding within the upper reaches of the catchment, and therefore as shown in both Figure 9-5 and Figure 9-6, increases to the level of development in the lower reaches of the catchment do not result in large increases to flood levels.

While the increased levels of development do not lead to large increases in flood levels, this does not mean that future developments should not be required to meet best practise guidelines in terms of both controlling runoff volumes from the site/s and meeting water quality targets.

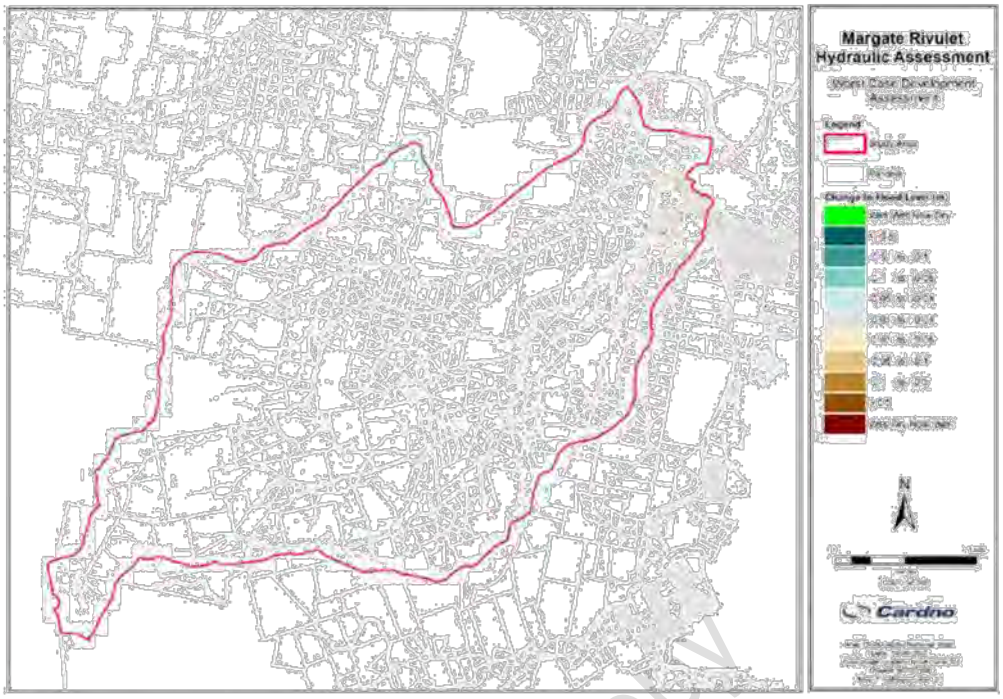


Figure 9-5 Worst Case Development Assessment

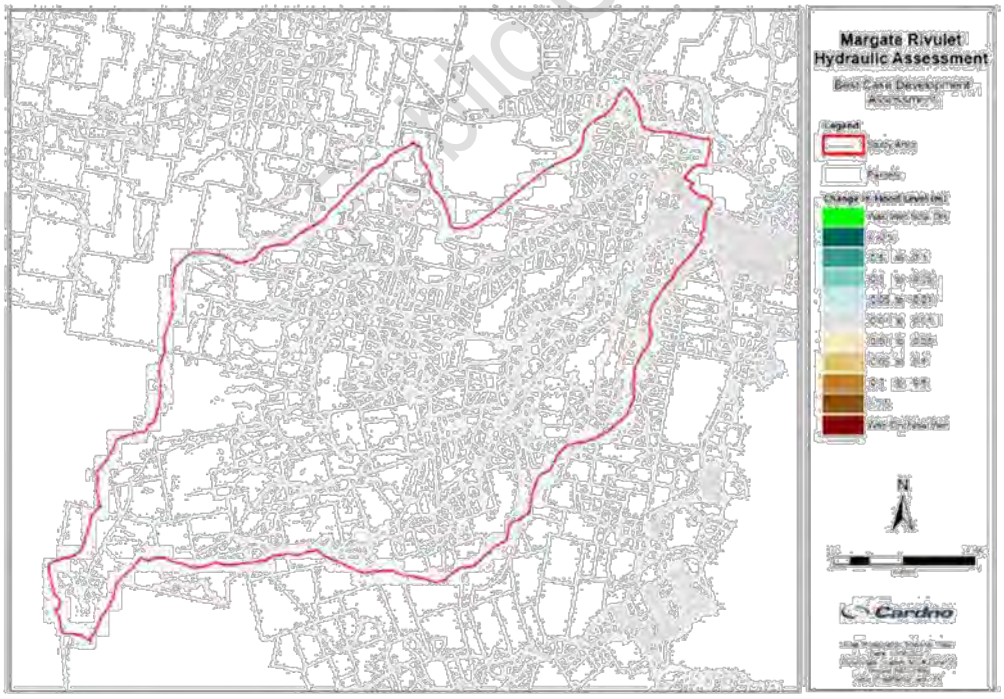


Figure 9-6 Best Case Development Assessment

10 Conclusions and Recommendations

The Margate Rivulet Flood Study provides an improved understanding of the flood behaviour throughout the Margate catchment and identifies a number of potential structural and non-structural mitigation measures which can improve the flood protection for both residents and visitors to the catchment.

As there is no pluviograph rainfall station located within the catchment and no verified flood levels along the rivulet, the hydrological model has been verified via four separate methods, with the hydraulic model verified to both the May 2018 event and the outcomes of the community engagement survey.

A series of design flood events have been modelled providing important intelligence in regards to the impact of flooding within the Margate Rivulet. A set of high-level options for potential flood mitigation have been identified for council to consider in order to reduce the overall flood risk of the catchment.

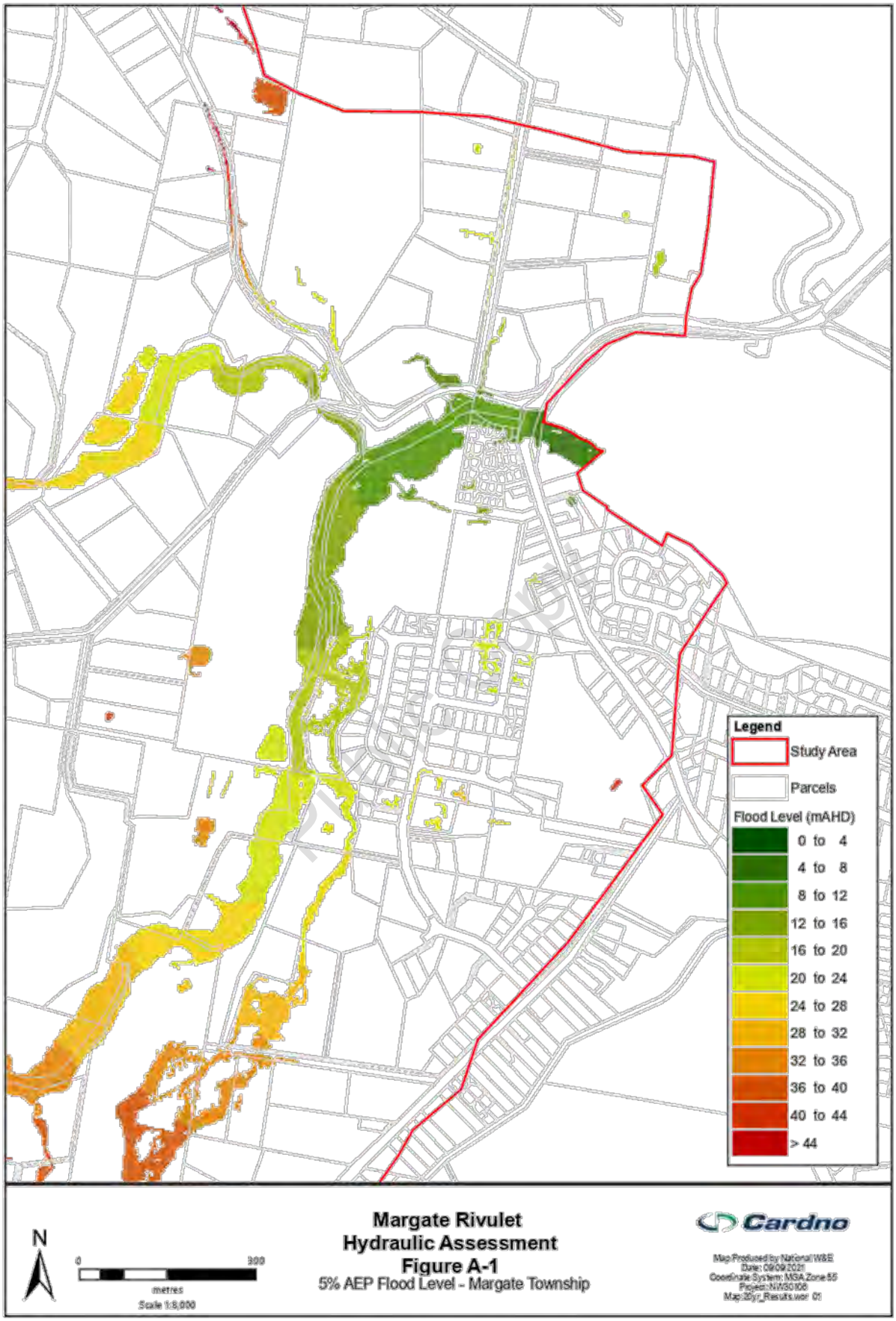
10.1 Recommendations

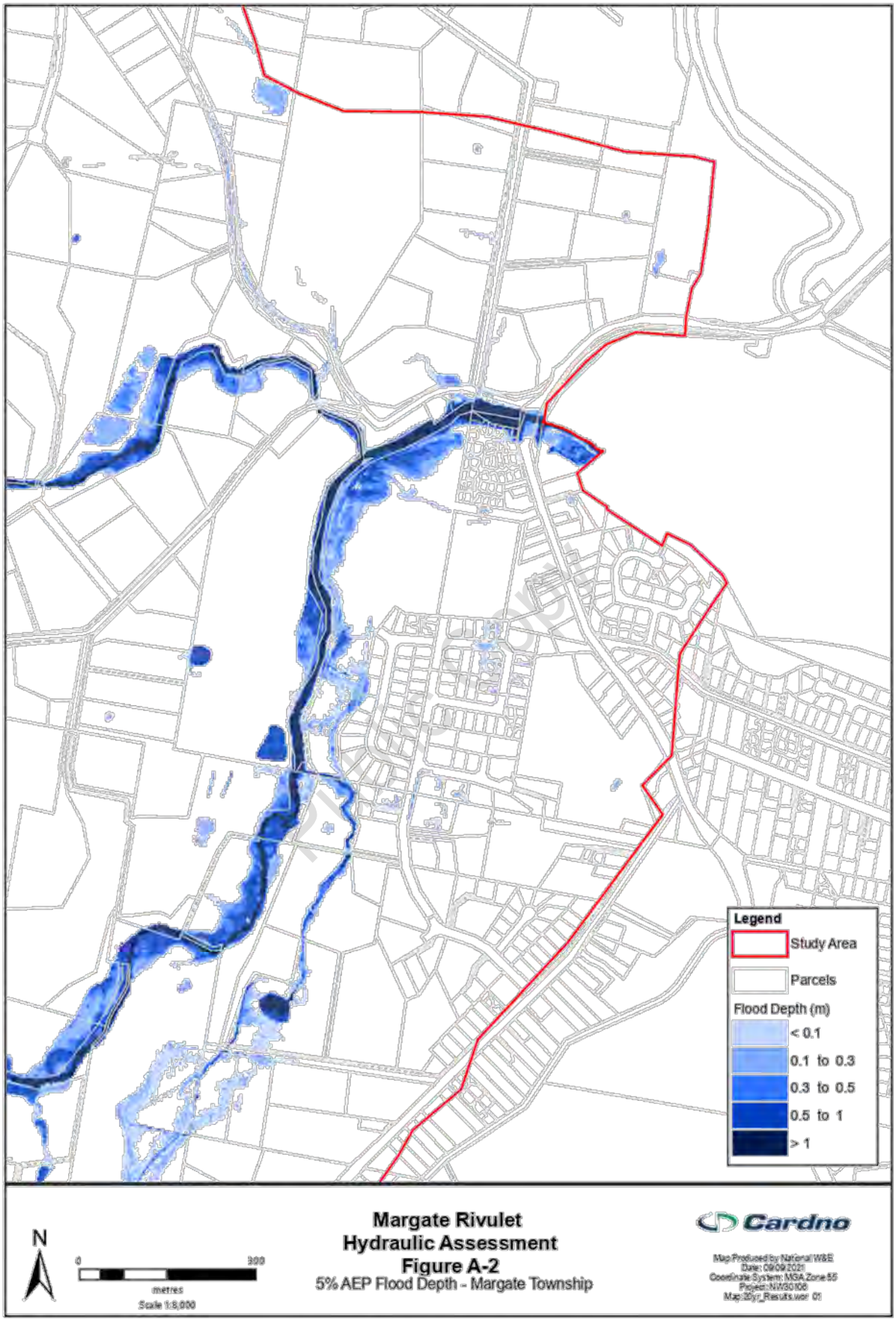
It is recommended that:

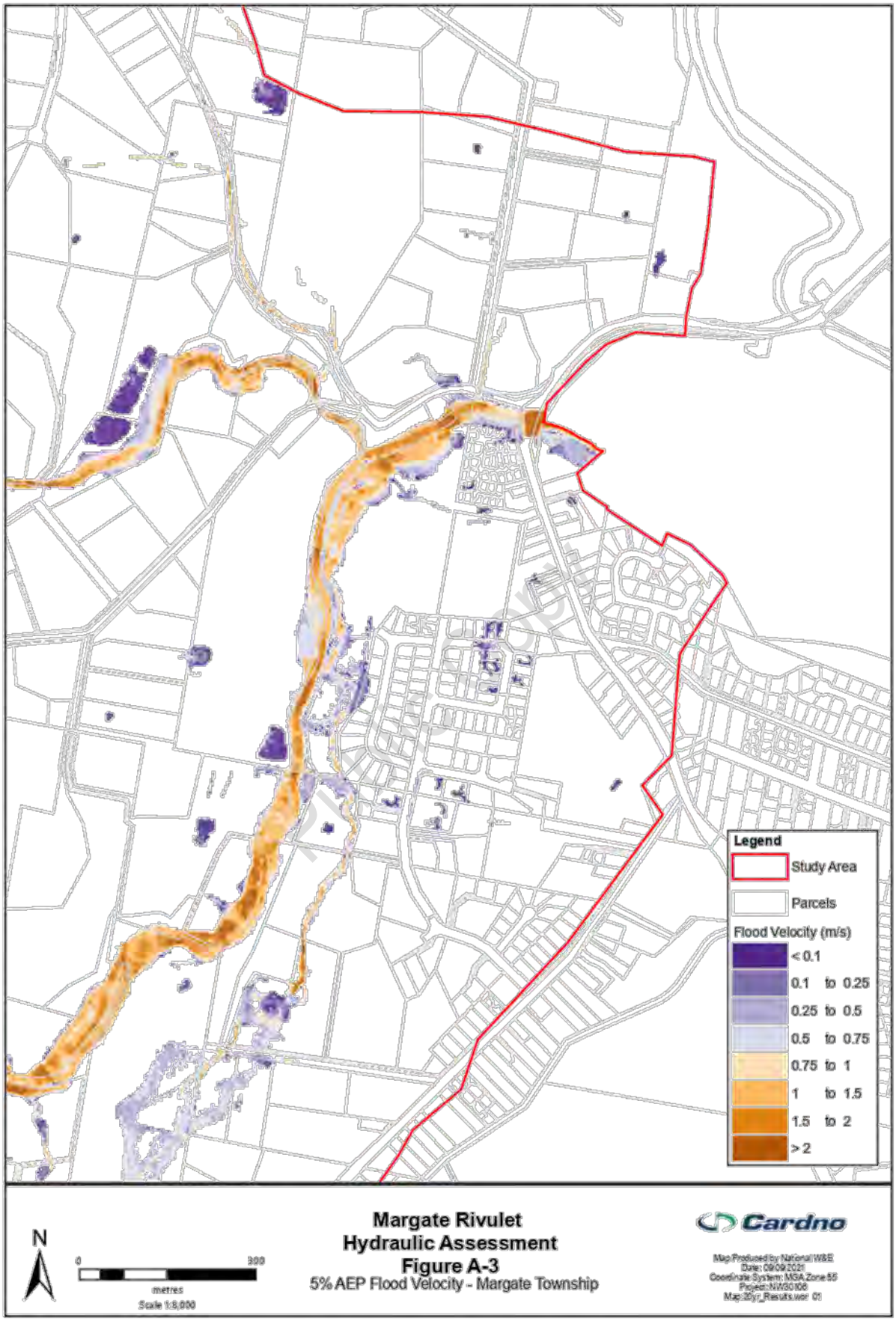
- Council make available the results of the flood study for the greater Margate catchment
- Council consider the potential mitigation options presented in this report to improve the overall flood risk of the catchment and control the impact of future development within the catchment

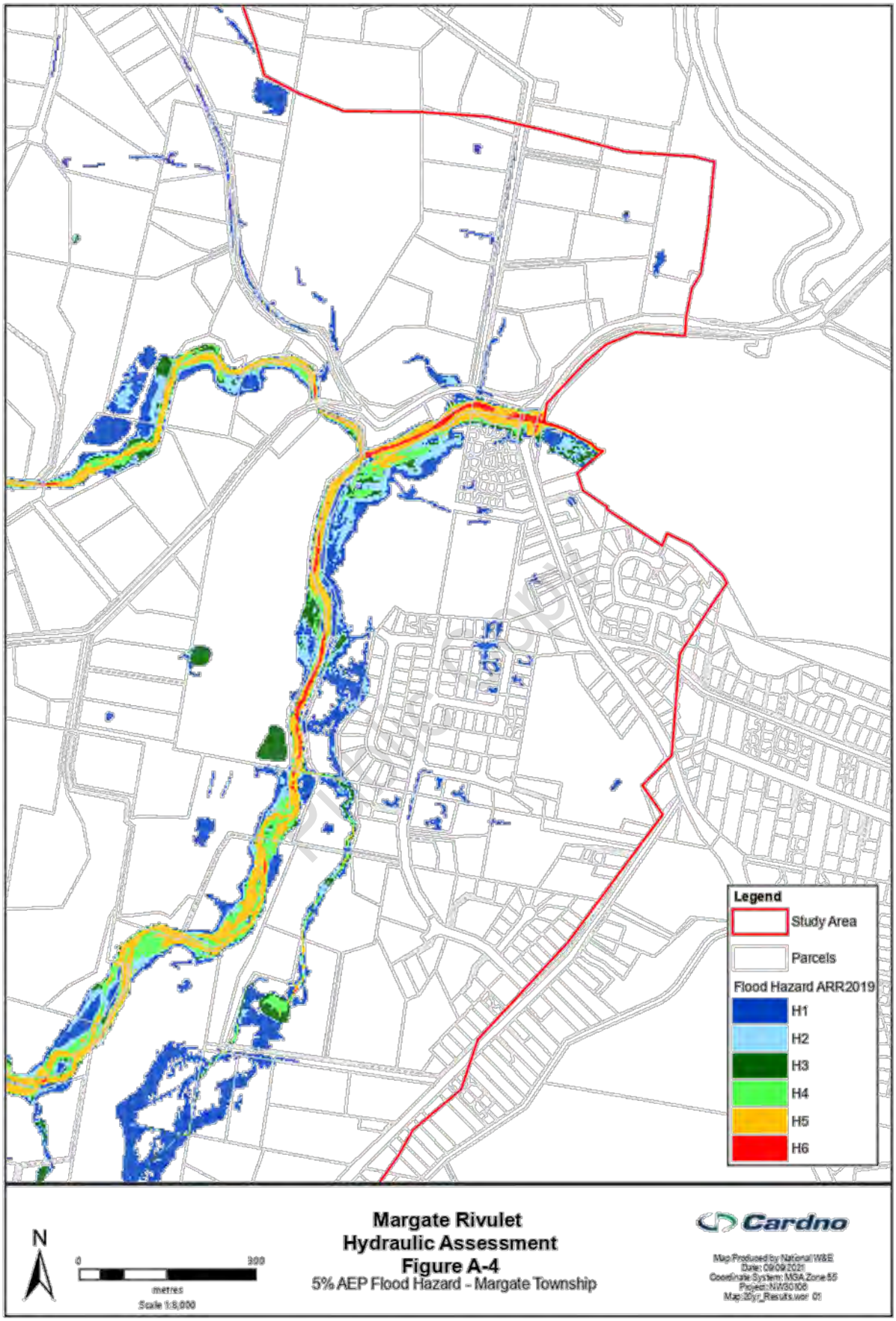
APPENDIX A

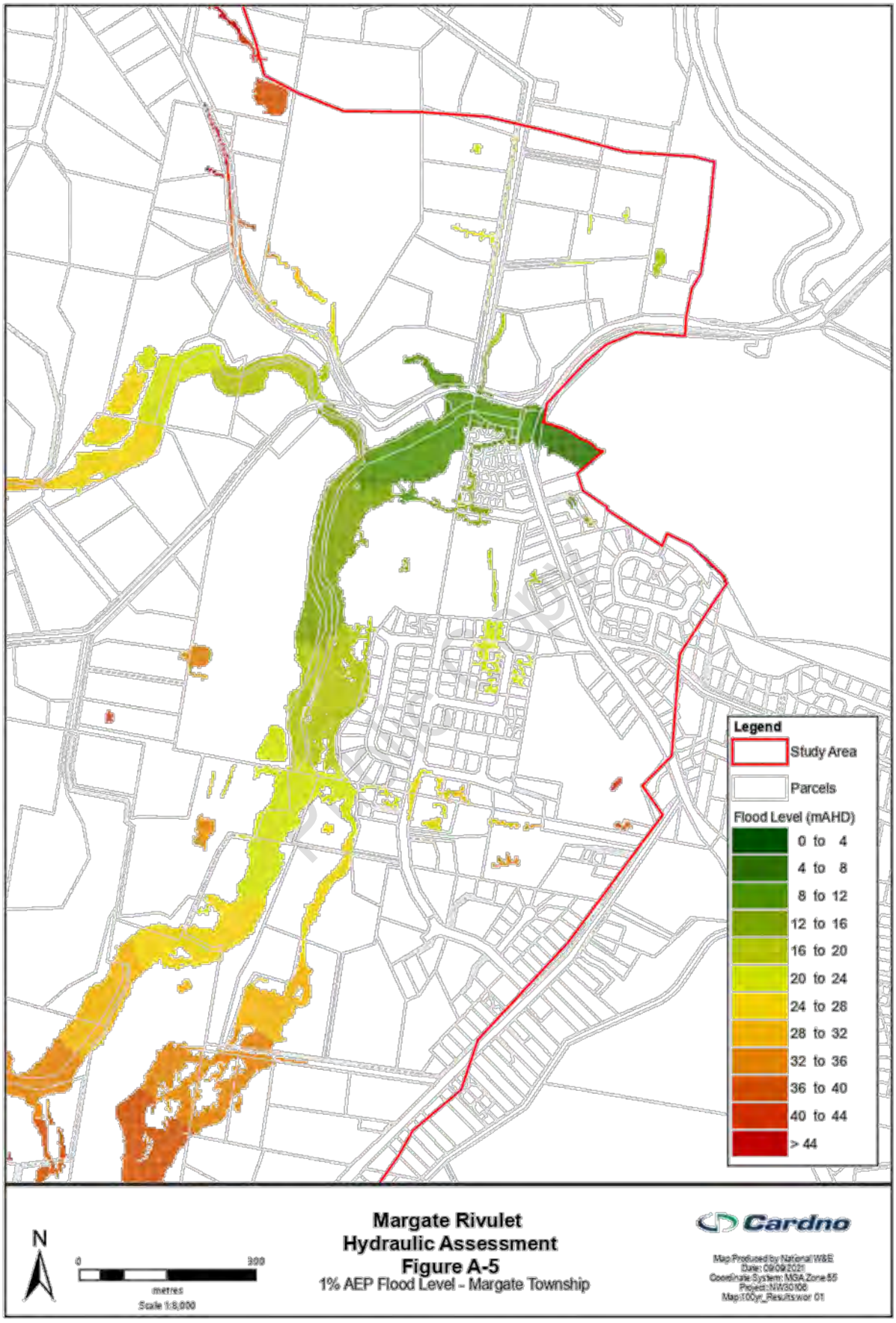
FIGURES

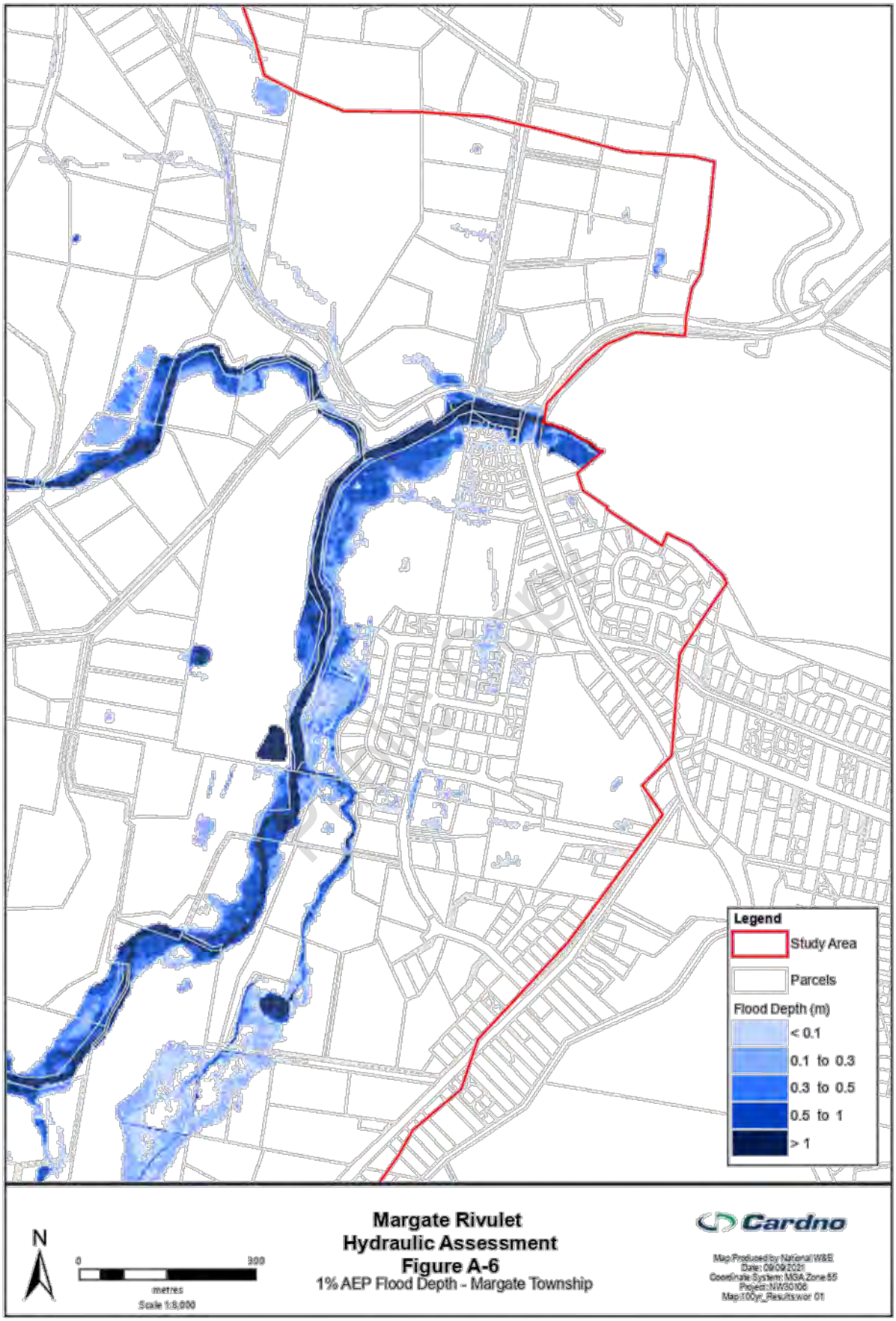

Legend
Study Area
Parcels
Flood Level (mAHD)
0 to 4
4 to 8
8 to 12
12 to 16
16 to 20
20 to 24
24 to 28
28 to 32
32 to 36
36 to 40
40 to 44
> 44
N
0
300
metres
Scale 1:8,000
Margate Rivulet
Hydraulic Assessment
Figure A-1
5% AEP Flood Level - Margate Township
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: 20yr_Results.wor 01

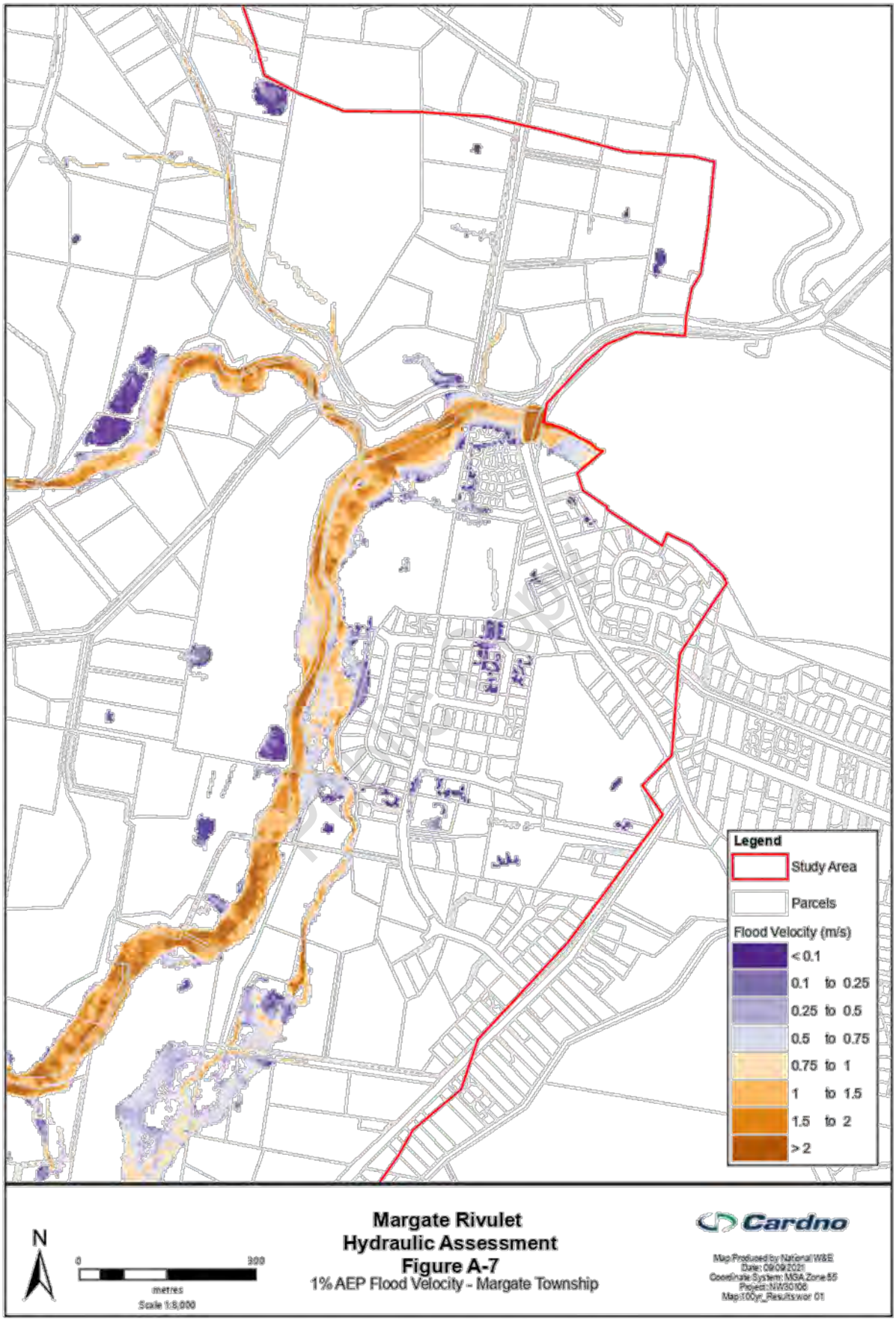

Legend
Study Area
Parcels
Flood Depth (m)
< 0.1
0.1 to 0.3
0.3 to 0.5
0.5 to 1
> 1
N
0
300
metres
Scale 1:8,000
Margate Rivulet
Hydraulic Assessment
Figure A-2
5% AEP Flood Depth - Margate Township
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: 20yr_Results.wor 01

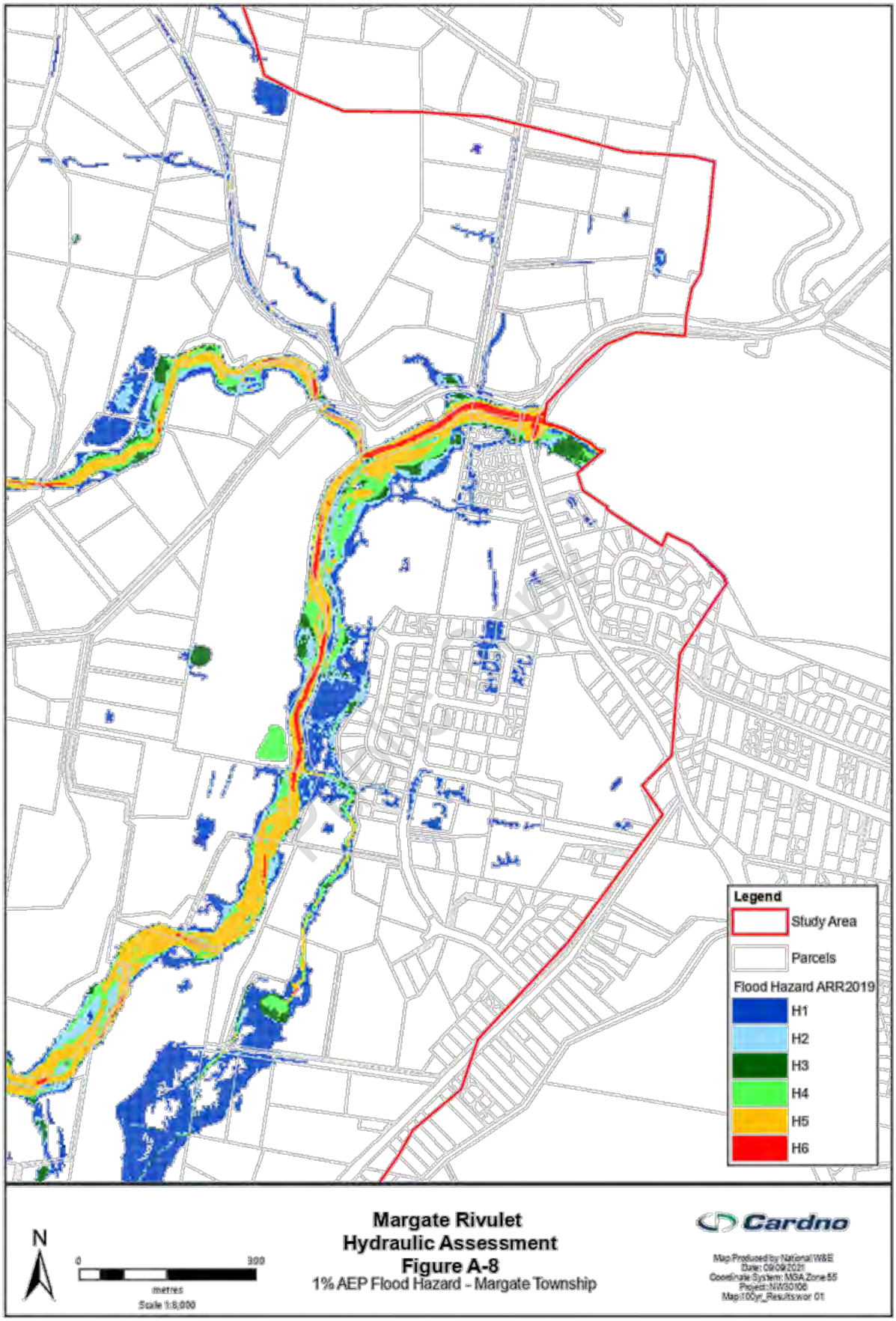

Legend
Study Area
Parcels
Flood Velocity (m/s)
< 0.1
0.1 to 0.25
0.25 to 0.5
0.5 to 0.75
0.75 to 1
1 to 1.5
1.5 to 2
> 2
N
0
300
metres
Scale 1:8,000
Margate Rivulet
Hydraulic Assessment
Figure A-3
5% AEP Flood Velocity - Margate Township
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: 20yr_Results.wor 01

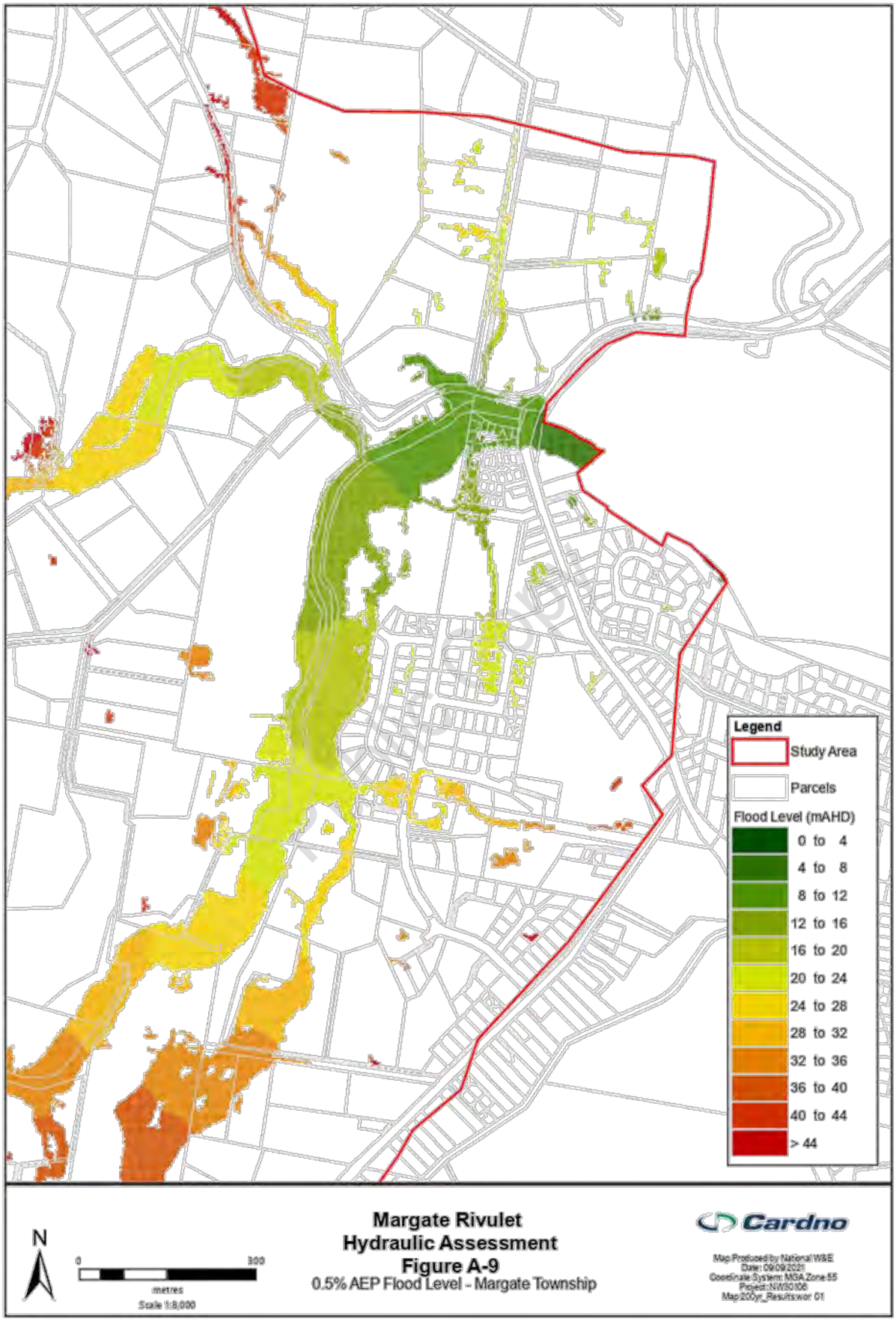

Legend
Study Area
Parcels
Flood Hazard ARR2019
H1
H2
H3
H4
H5
H6
N
0
300
metres
Scale 1:8,000
Margate Rivulet
Hydraulic Assessment
Figure A-4
5% AEP Flood Hazard - Margate Township
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: 20yr_Results.wor 01

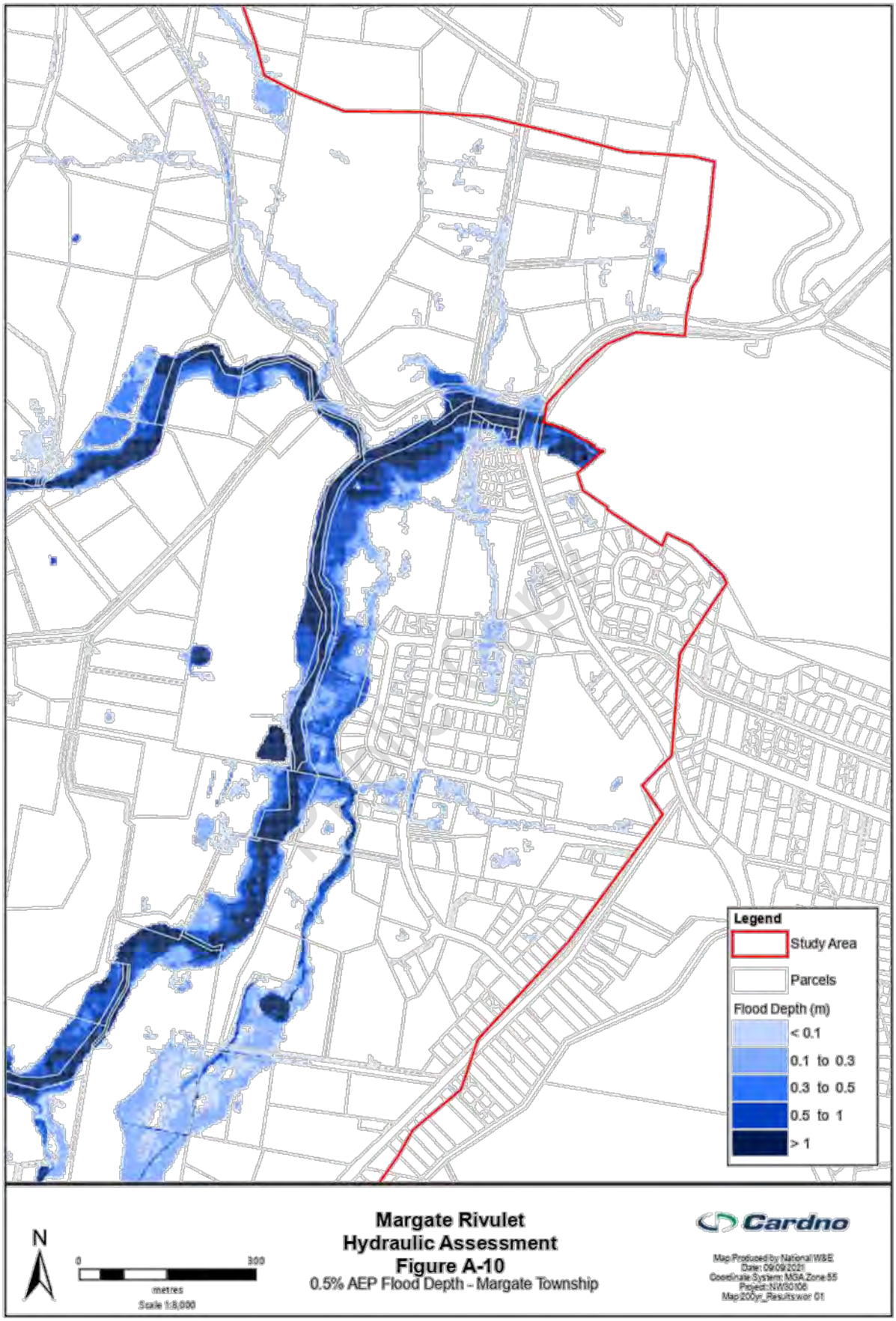

Legend
Study Area
Parcels
Flood Level (mAHD)
0 to 4
4 to 8
8 to 12
12 to 16
16 to 20
20 to 24
24 to 28
28 to 32
32 to 36
36 to 40
40 to 44
> 44
N
0
300
metres
Scale 1:8,000
Margate Rivulet
Hydraulic Assessment
Figure A-5
1% AEP Flood Level - Margate Township
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: 100yr_Results.wor 01

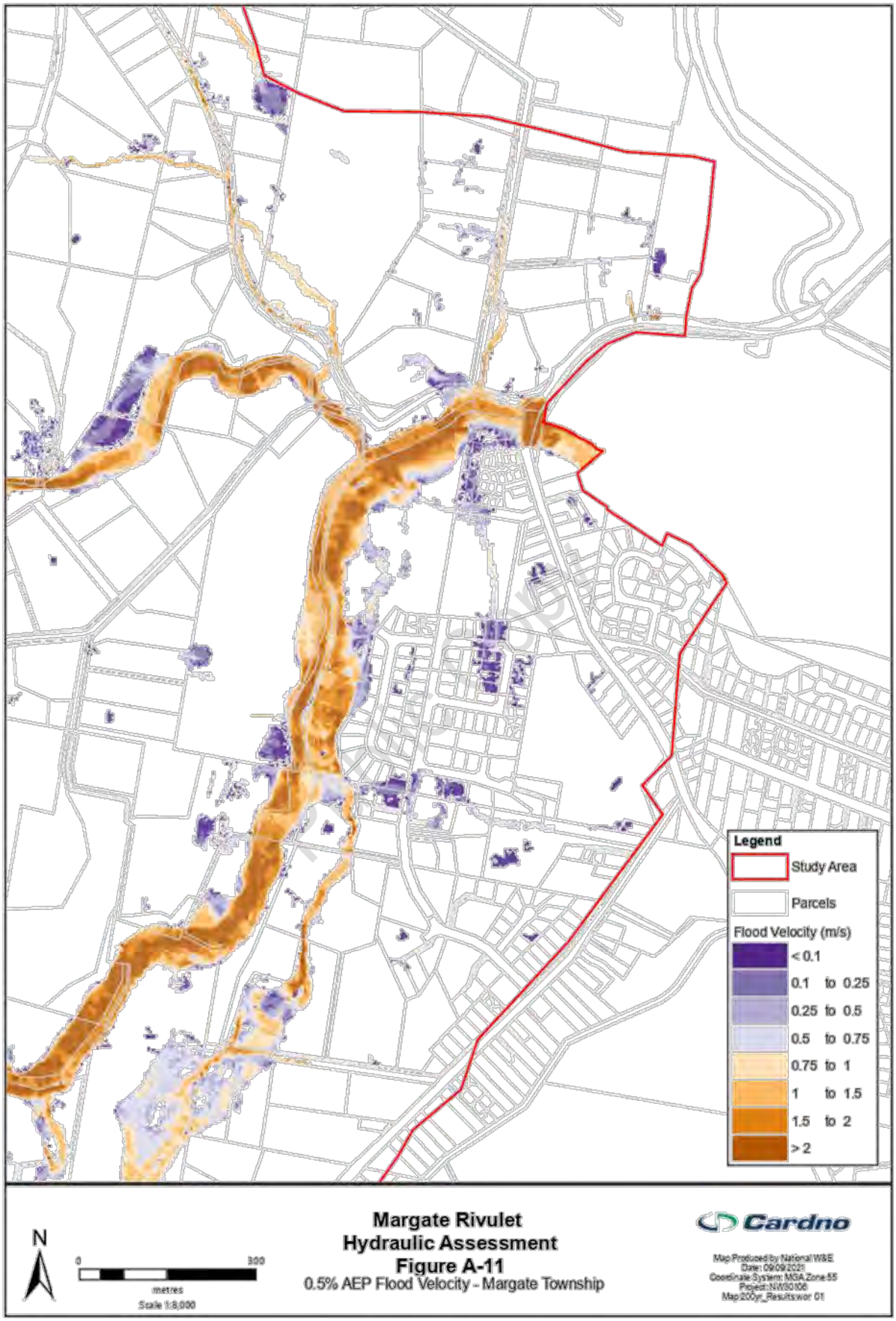

Legend
Study Area
Parcels
Flood Depth (m)
< 0.1
0.1 to 0.3
0.3 to 0.5
0.5 to 1
> 1
N
0
300
metres
Scale 1:8,000
Margate Rivulet
Hydraulic Assessment
Figure A-6
1% AEP Flood Depth - Margate Township
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map:100yr_Results.wor 01

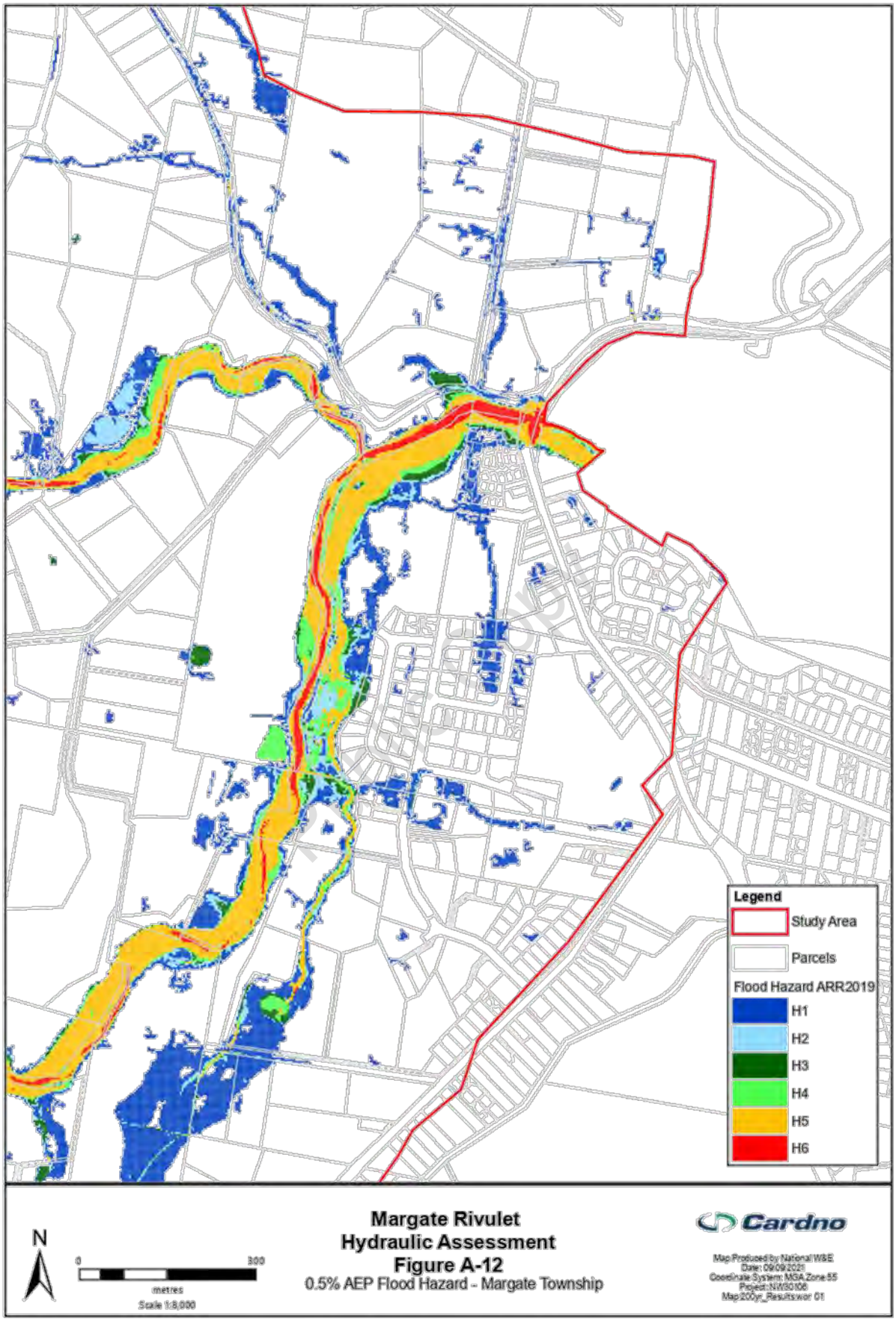

Legend
Study Area
Parcels
Flood Velocity (m/s)
< 0.1
0.1 to 0.25
0.25 to 0.5
0.5 to 0.75
0.75 to 1
1 to 1.5
1.5 to 2
> 2
N
0
300
metres
Scale 1:8,000
Margate Rivulet
Hydraulic Assessment
Figure A-7
1% AEP Flood Velocity - Margate Township
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: 100yr_Results.wor 01

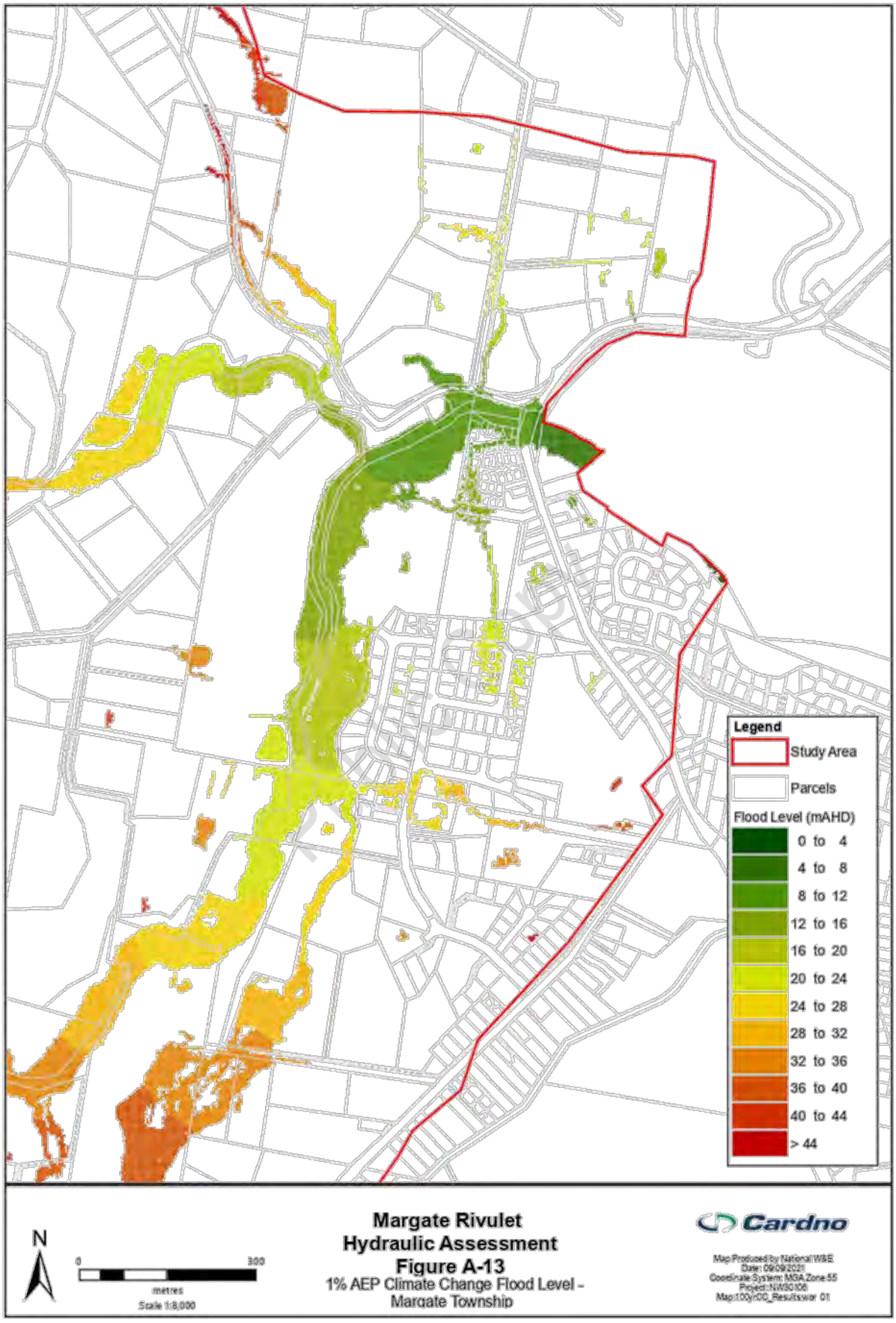

Legend
Study Area
Parcels
Flood Hazard ARR2019
H1
H2
H3
H4
H5
H6
N
0
300
metres
Scale 1:8,000
Margate Rivulet
Hydraulic Assessment
Figure A-8
1% AEP Flood Hazard - Margate Township
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: 100yr_Results.wor 01

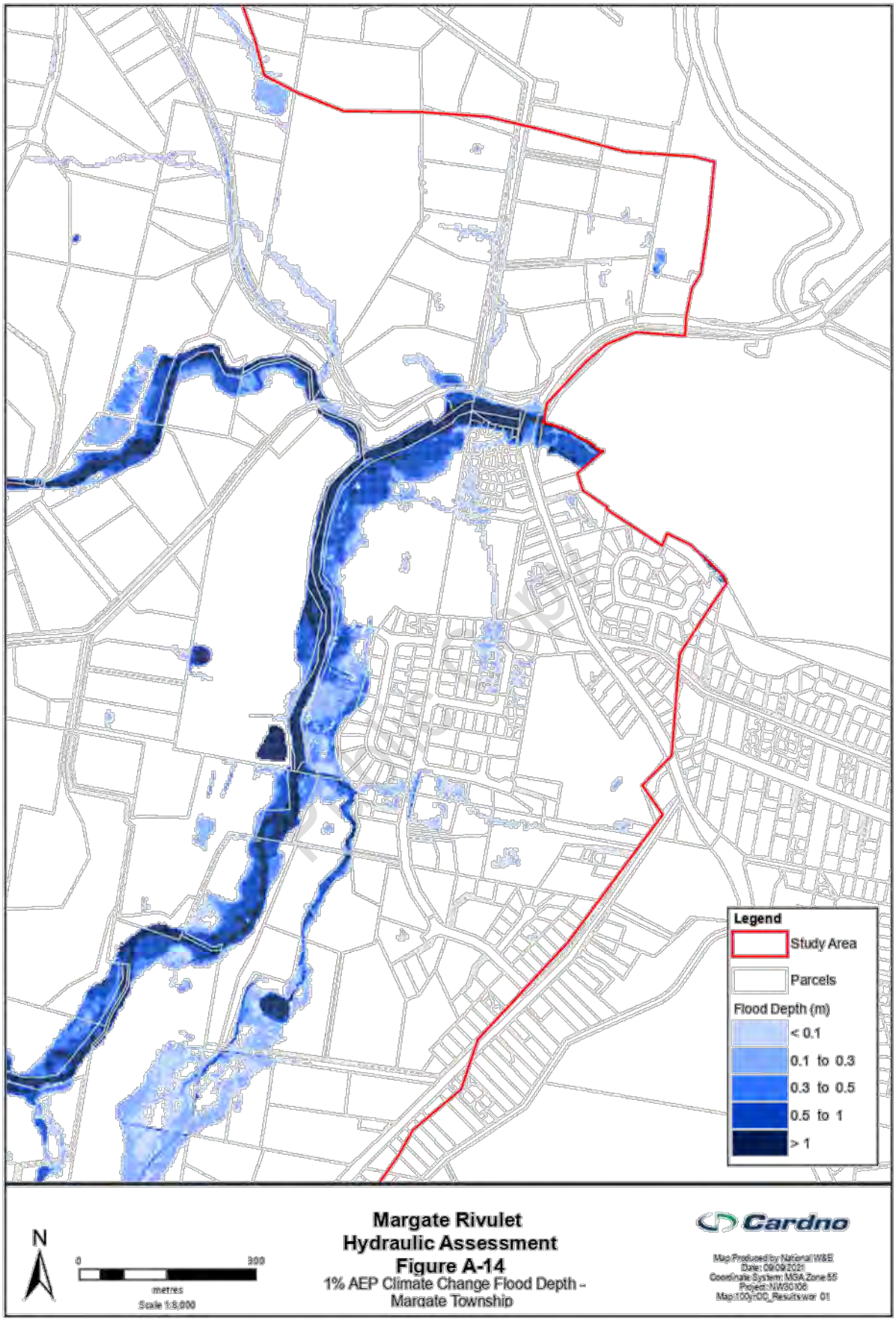

Legend
Study Area
Parcels
Flood Level (mAHD)
0 to 4
4 to 8
8 to 12
12 to 16
16 to 20
20 to 24
24 to 28
28 to 32
32 to 36
36 to 40
40 to 44
> 44
N
0
300
metres
Scale 1:8,000
Margate Rivulet
Hydraulic Assessment
Figure A-9
0.5% AEP Flood Level - Margate Township
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map 200yr_Results.wor 01

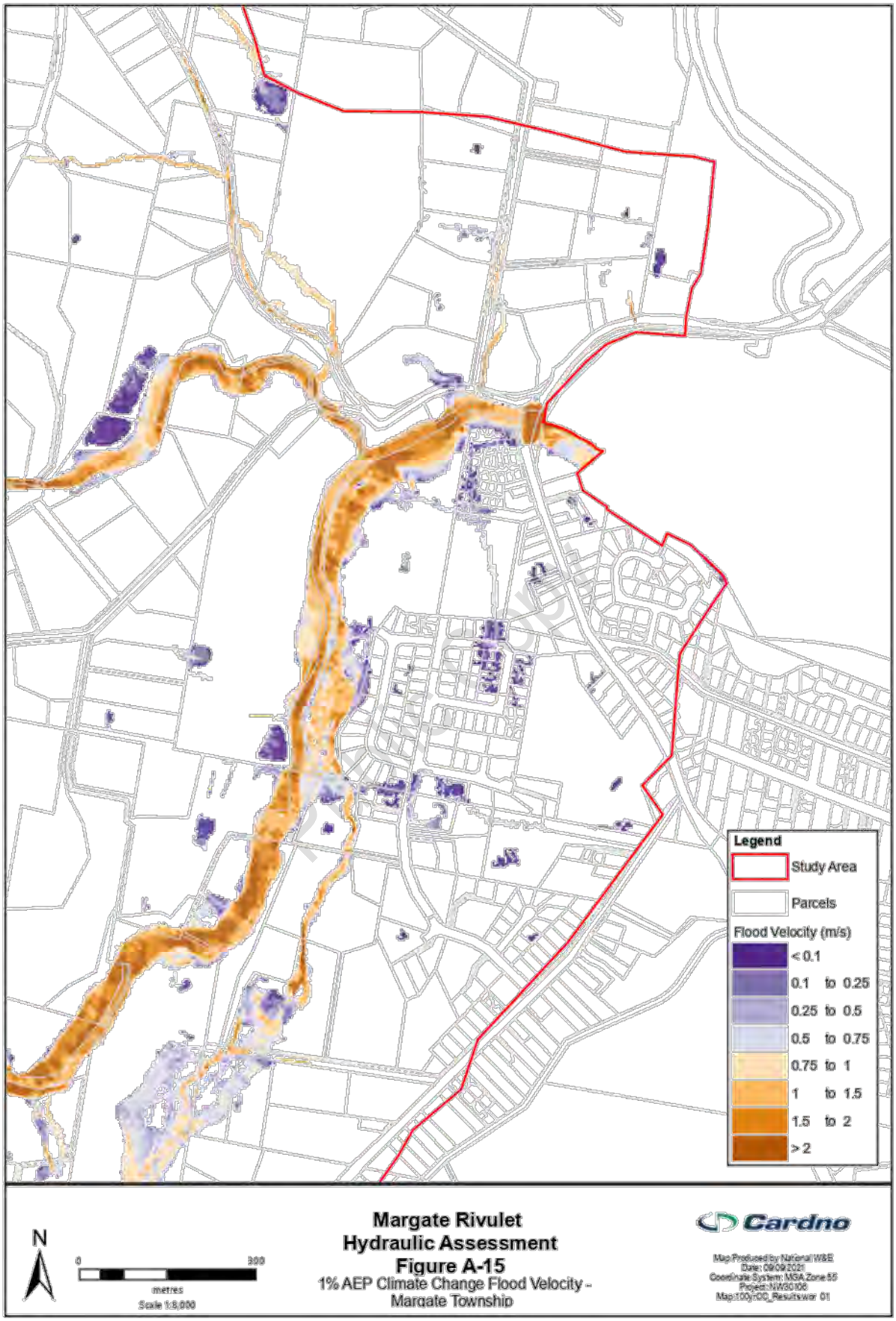

Legend
Study Area
Parcels
Flood Depth (m)
< 0.1
0.1 to 0.3
0.3 to 0.5
0.5 to 1
> 1
N
0
300
metres
Scale 1:8,000
Margate Rivulet
Hydraulic Assessment
Figure A-10
0.5% AEP Flood Depth - Margate Township
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map 200yr_Results.wor 01

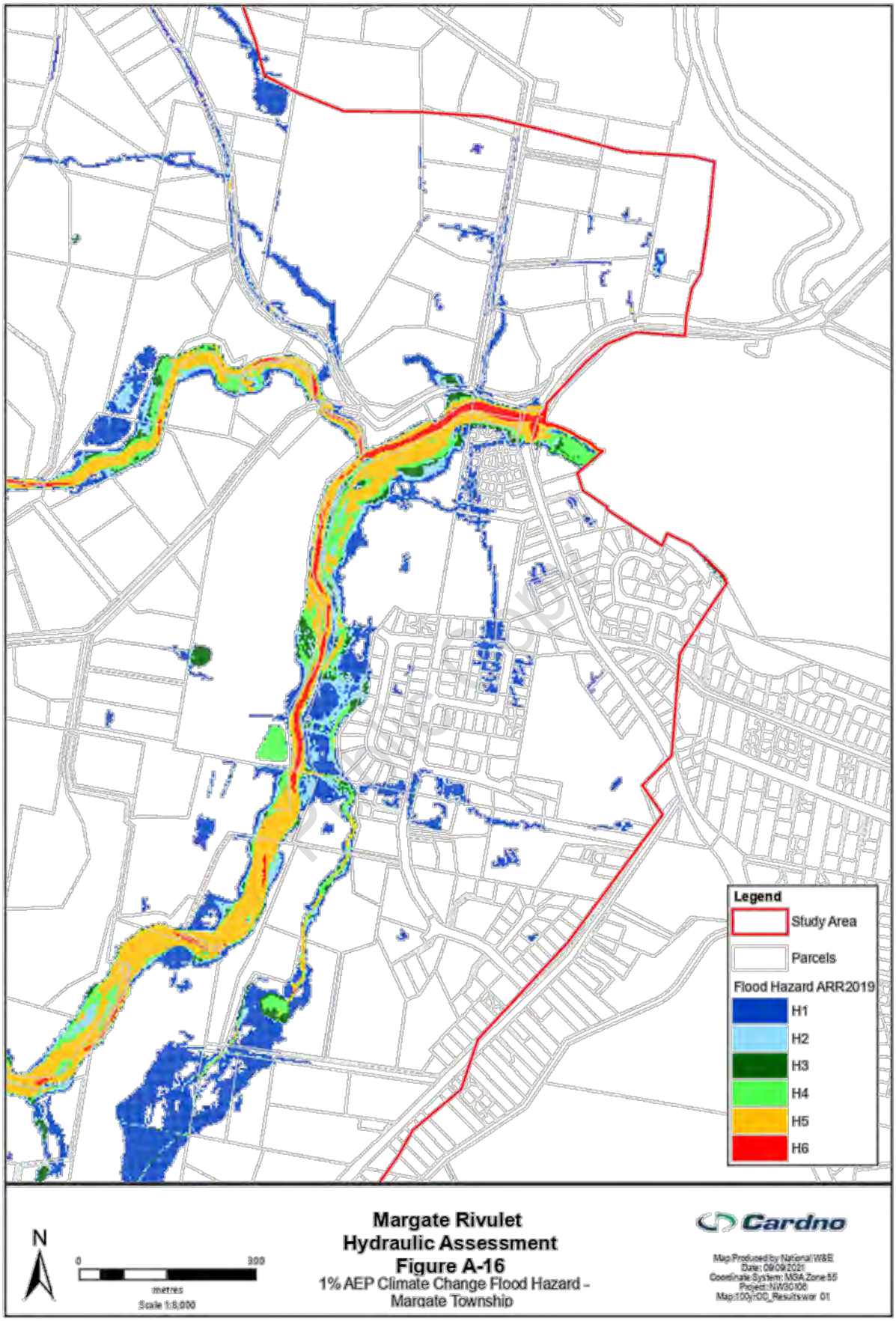

Legend
Study Area
Parcels
Flood Velocity (m/s)
< 0.1
0.1 to 0.25
0.25 to 0.5
0.5 to 0.75
0.75 to 1
1 to 1.5
1.5 to 2
> 2
N
0
300
metres
Scale 1:8,000
Margate Rivulet
Hydraulic Assessment
Figure A-11
0.5% AEP Flood Velocity - Margate Township
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map 200yr_Results.wor 01

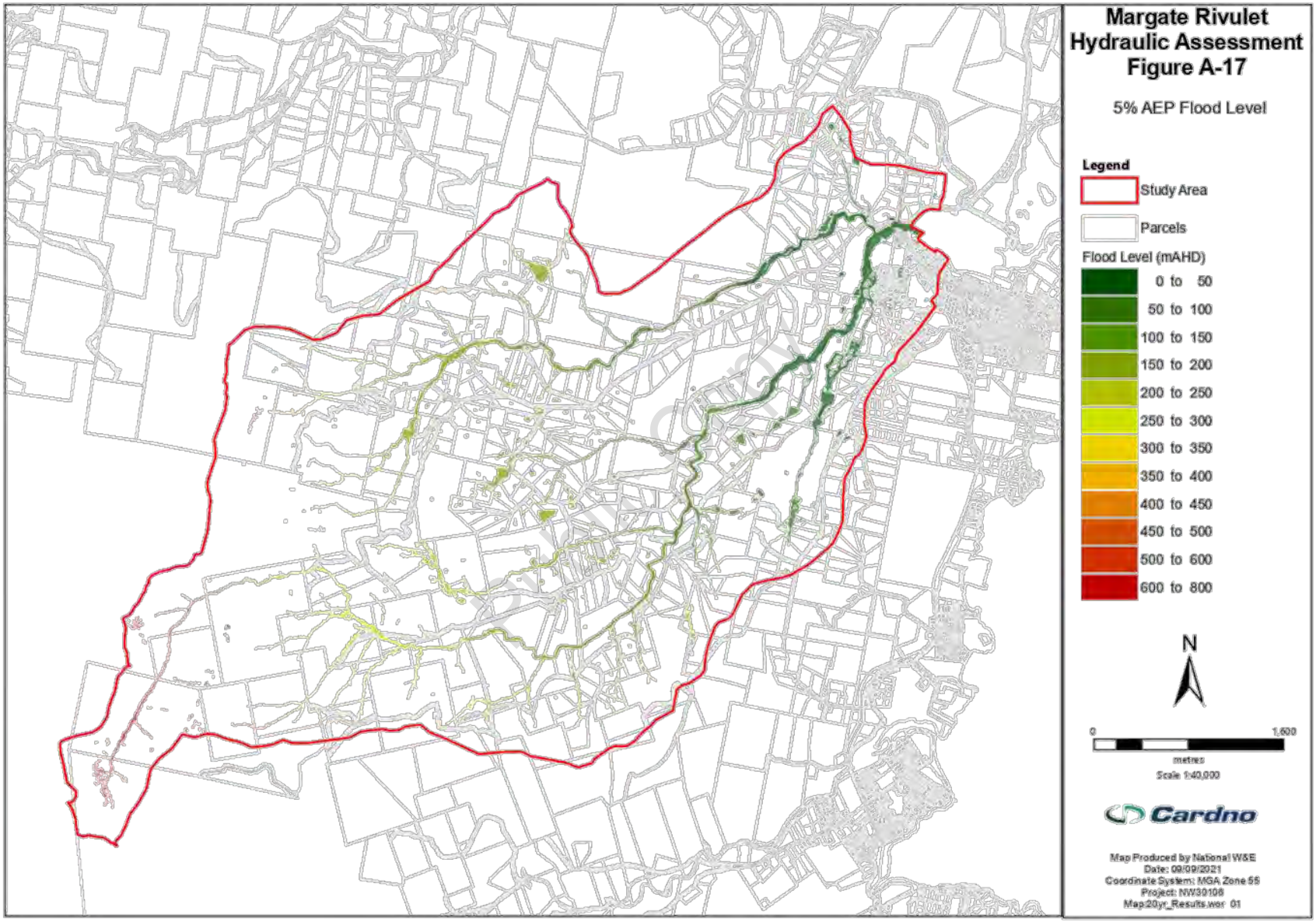

Legend
Study Area
Parcels
Flood Hazard ARR2019
H1
H2
H3
H4
H5
H6
N
0
300
metres
Scale 1:8,000
Margate Rivulet
Hydraulic Assessment
Figure A-12
0.5% AEP Flood Hazard - Margate Township
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map 200yr_Results.wor 01

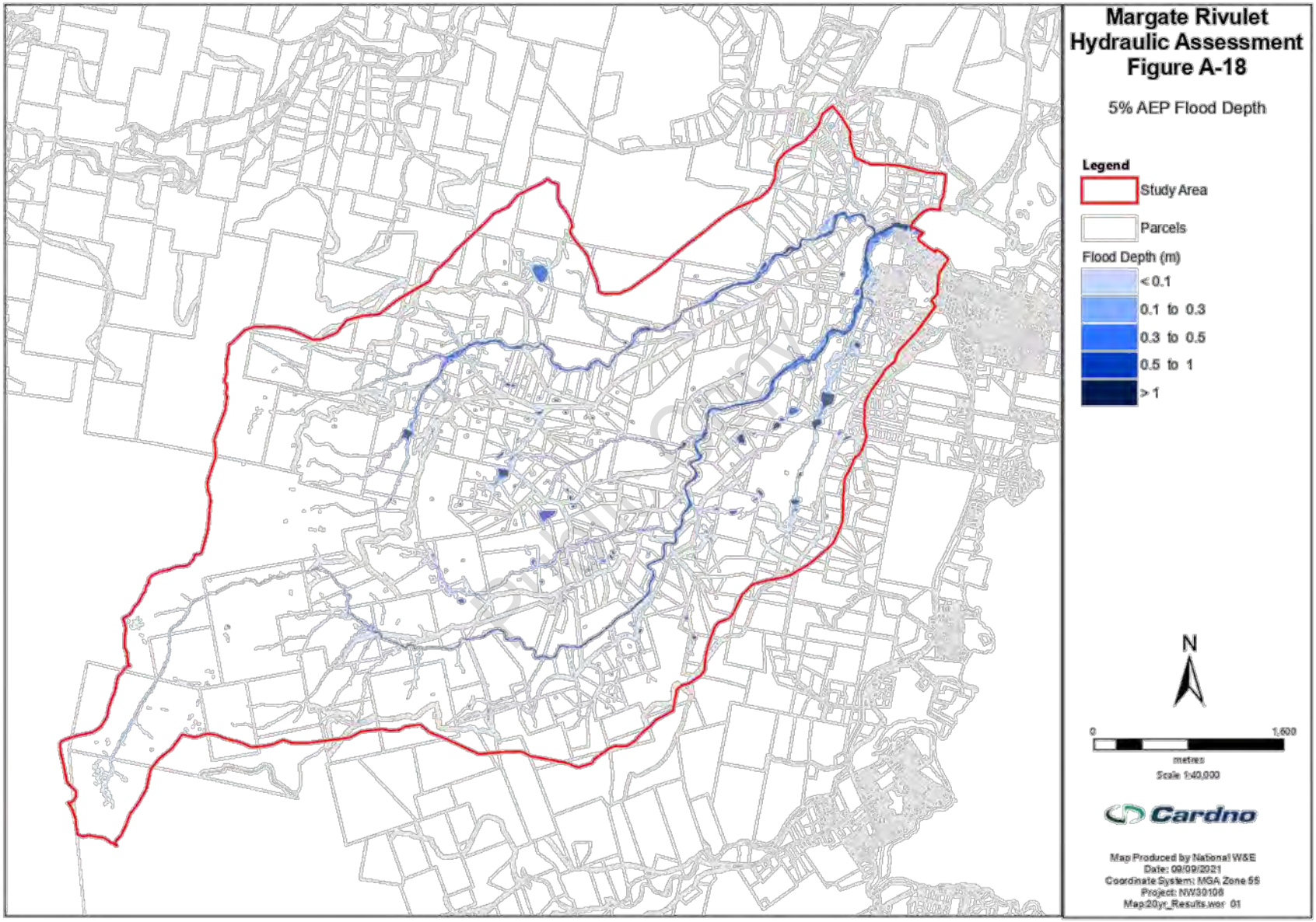

Legend
Study Area
Parcels
Flood Level (mAHD)
0 to 4
4 to 8
8 to 12
12 to 16
16 to 20
20 to 24
24 to 28
28 to 32
32 to 36
36 to 40
40 to 44
> 44
N
0
300
metres
Scale 1:8,000
Margate Rivulet
Hydraulic Assessment
Figure A-13
1% AEP Climate Change Flood Level - Margate Township
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map:100yrCC_Results.wor 01

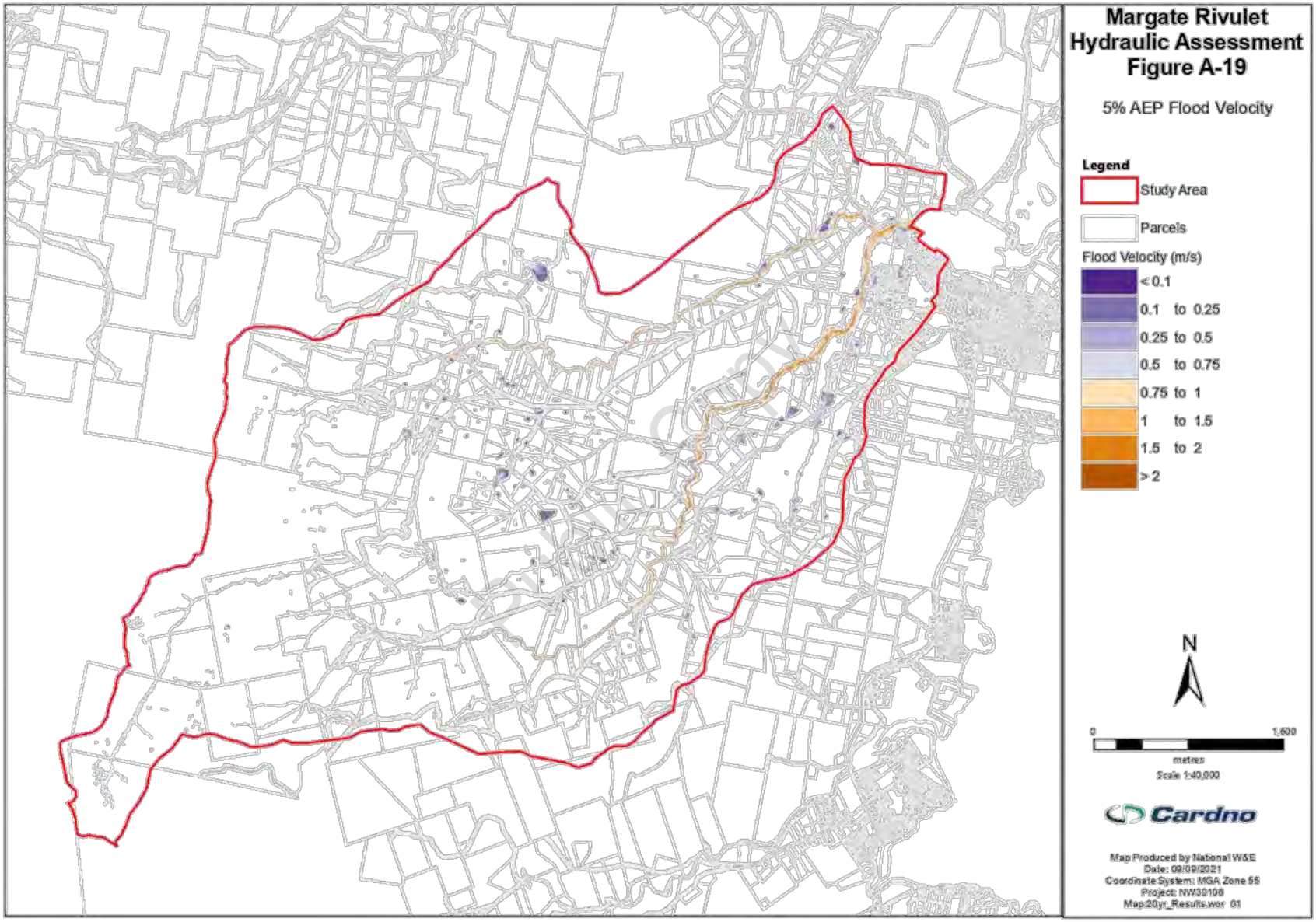

Legend
Study Area
Parcels
Flood Depth (m)
< 0.1
0.1 to 0.3
0.3 to 0.5
0.5 to 1
> 1
N
0
300
metres
Scale 1:8,000
Margate Rivulet
Hydraulic Assessment
Figure A-14
1% AEP Climate Change Flood Depth - Margate Township
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map:100yrCC_Results.wor 01

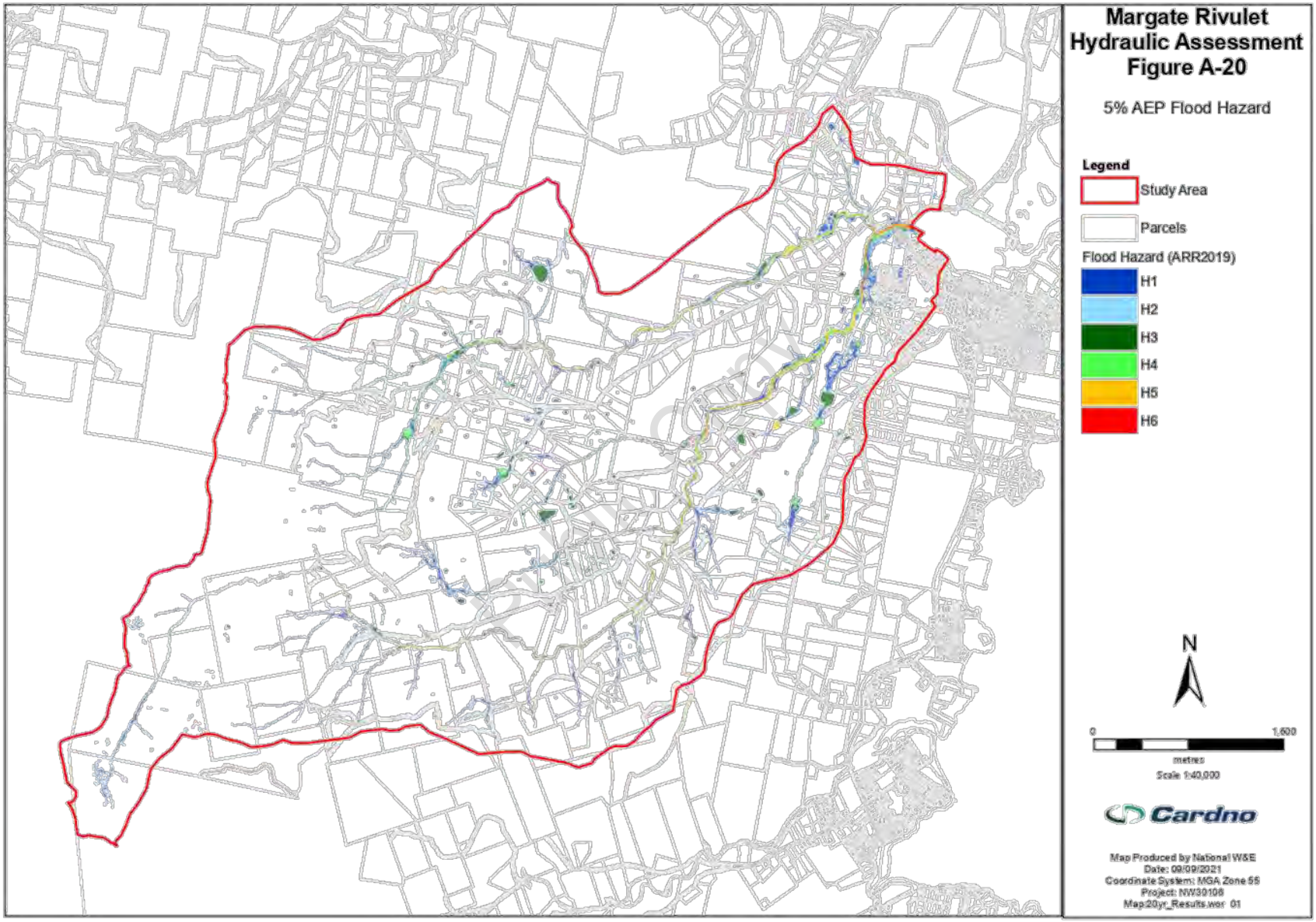

Legend
Study Area
Parcels
Flood Velocity (m/s)
< 0.1
0.1 to 0.25
0.25 to 0.5
0.5 to 0.75
0.75 to 1
1 to 1.5
1.5 to 2
> 2
N
0
300
metres
Scale 1:8,000
Margate Rivulet
Hydraulic Assessment
Figure A-15
1% AEP Climate Change Flood Velocity -
Margate Township
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map:100yrCC_Resultswor 01

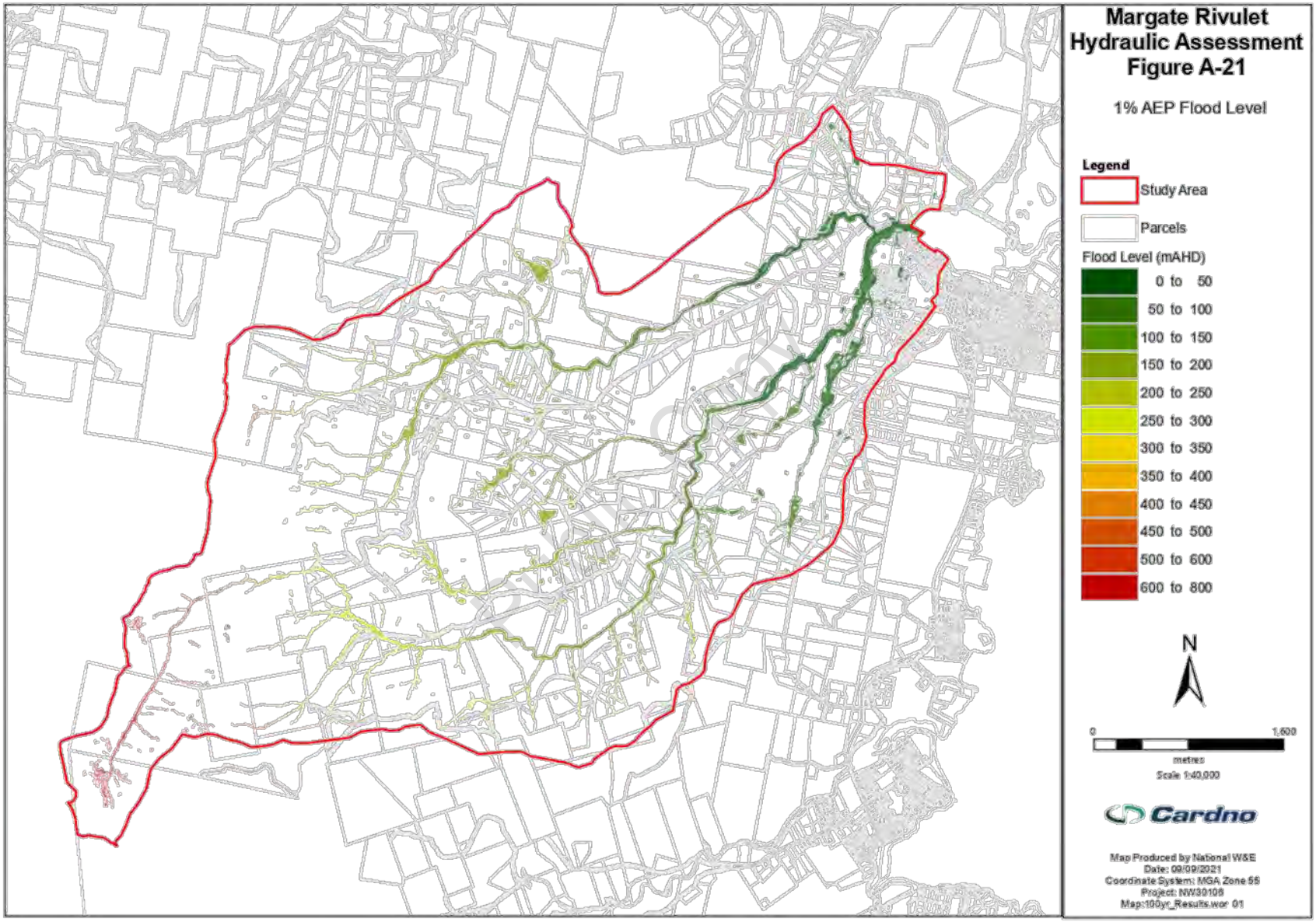

Legend
Study Area
Parcels
Flood Hazard ARR2019
H1
H2
H3
H4
H5
H6
N
0
300
metres
Scale 1:8,000
Margate Rivulet
Hydraulic Assessment
Figure A-16
1% AEP Climate Change Flood Hazard -
Margate Township
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map:100yrCC_Results.wor 01

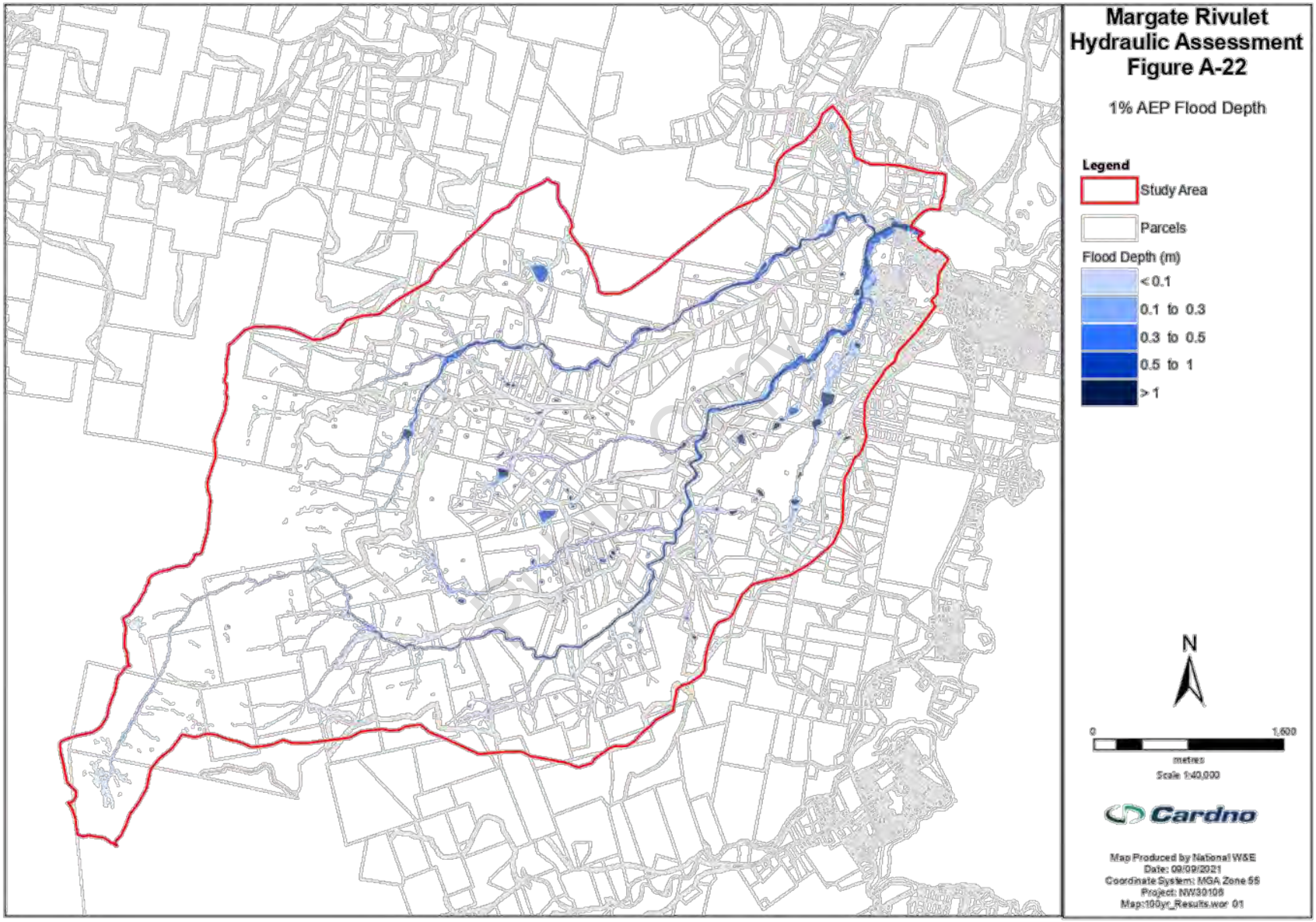

Margate Rivulet
Hydraulic Assessment
Figure A-17
5% AEP Flood Level
Legend
Study Area
Parcels
Flood Level (mAHD)
0 to 50
50 to 100
100 to 150
150 to 200
200 to 250
250 to 300
300 to 350
350 to 400
400 to 450
450 to 500
500 to 600
600 to 800
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30108
Map:20yr_Results.wor 01

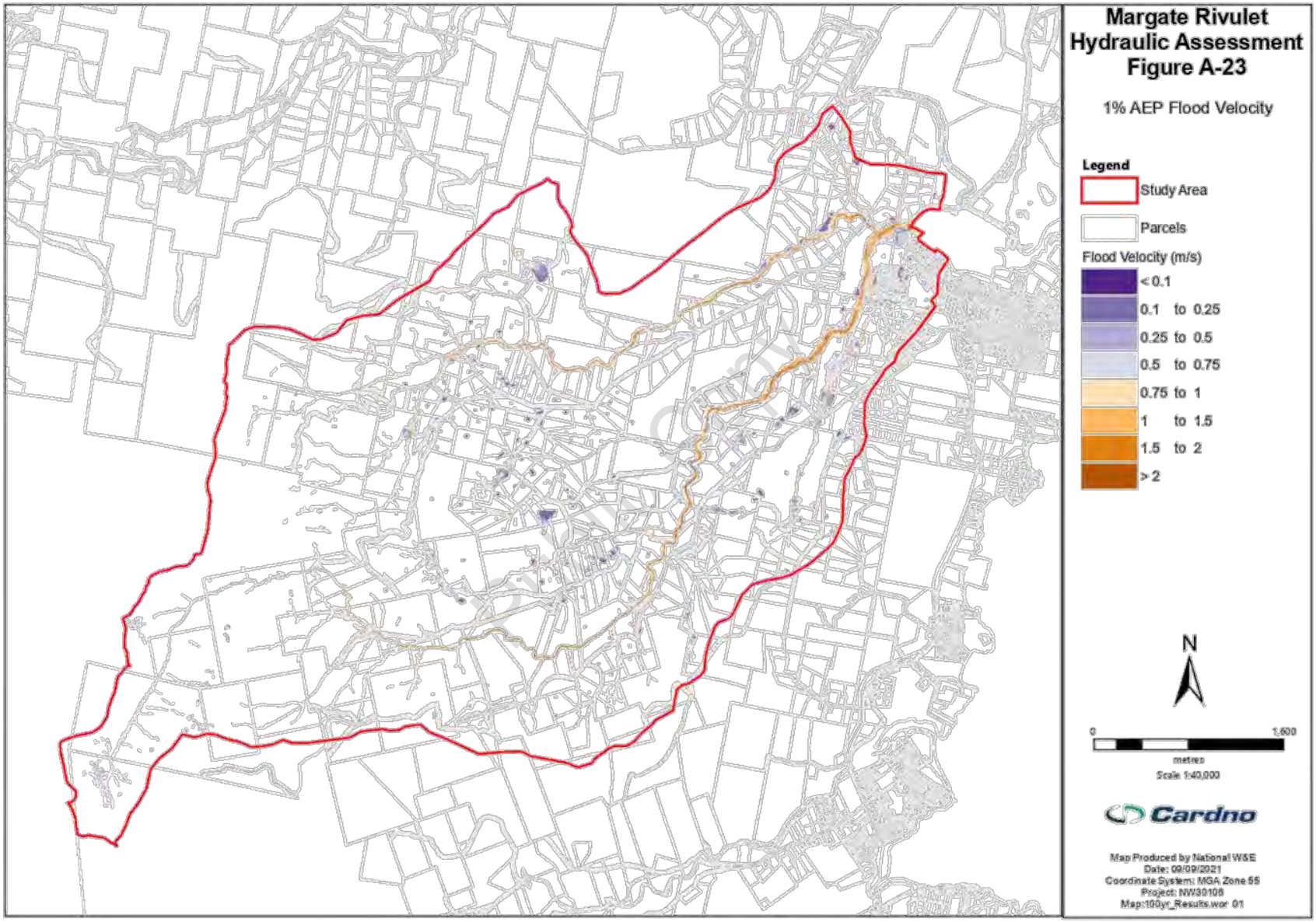

Margate Rivulet
Hydraulic Assessment
Figure A-18
5% AEP Flood Depth
Legend
Study Area
Parcels
Flood Depth (m)
< 0.1
0.1 to 0.3
0.3 to 0.5
0.5 to 1
> 1
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30108
Map:20yr_Results.wor 01

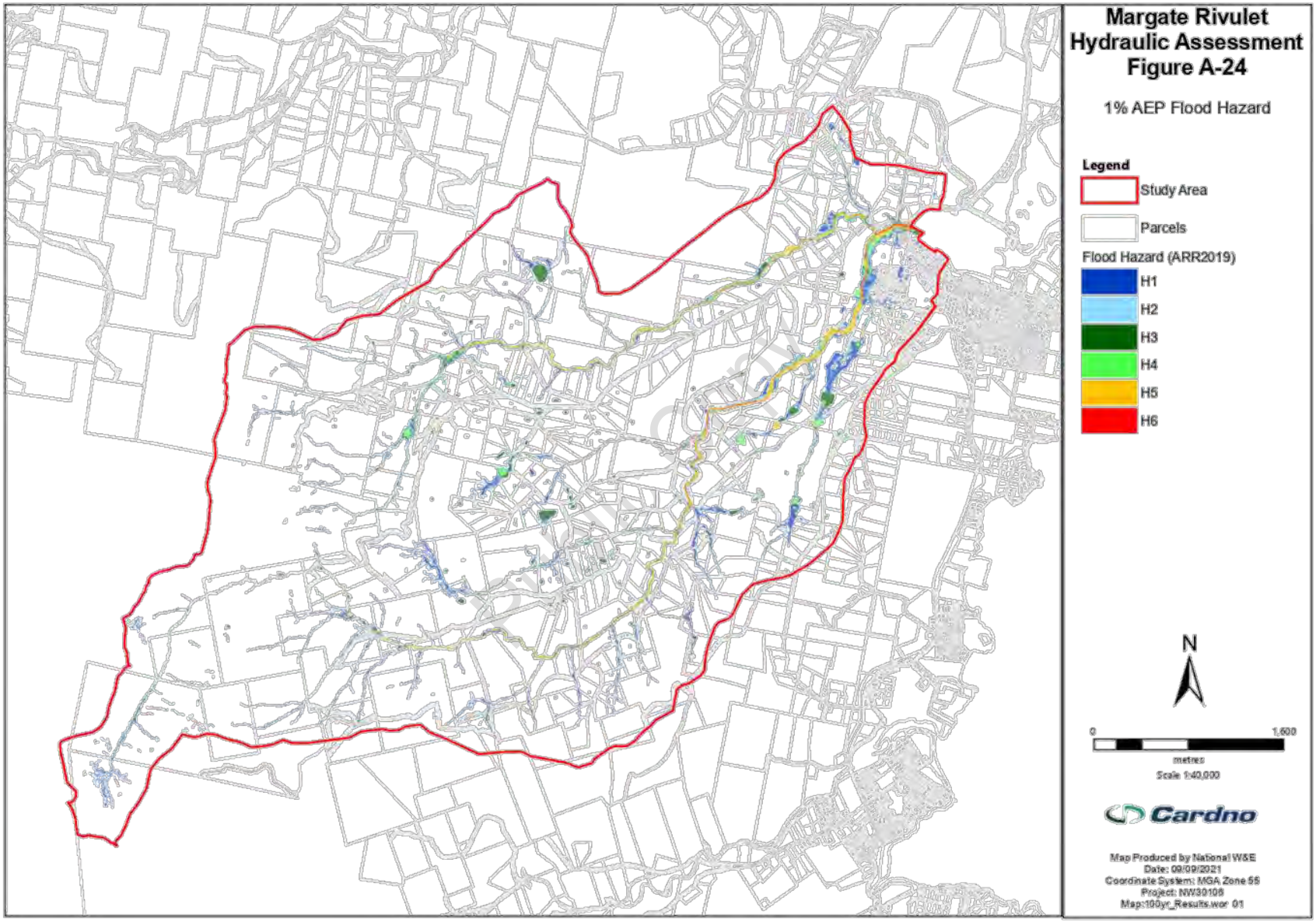

Margate Rivulet
Hydraulic Assessment
Figure A-19
5% AEP Flood Velocity
Legend
Study Area
Parcels
Flood Velocity (m/s)
< 0.1
0.1 to 0.25
0.25 to 0.5
0.5 to 0.75
0.75 to 1
1 to 1.5
1.5 to 2
> 2
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30108
Map:20yr_Results.wor 01

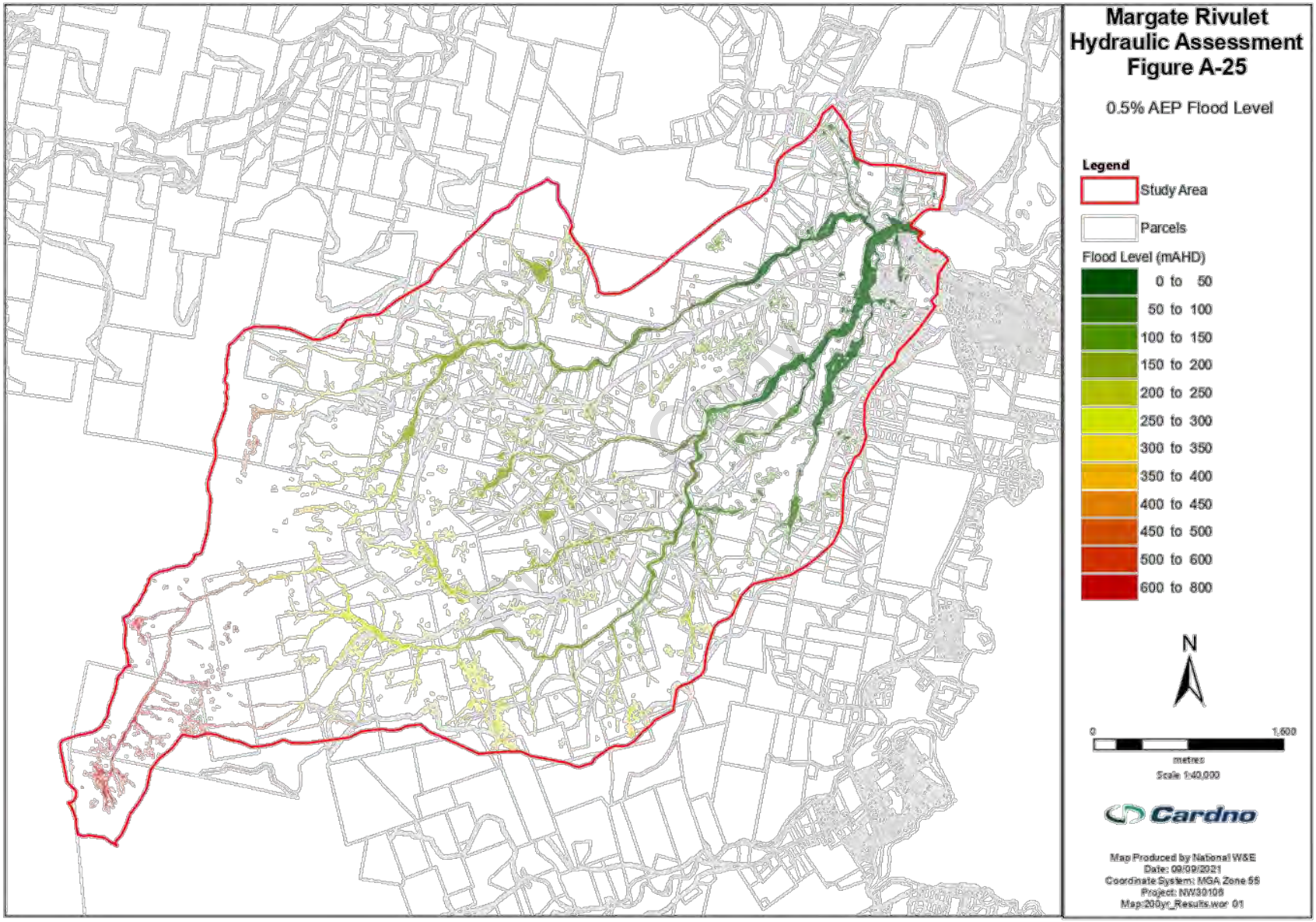

Margate Rivulet
Hydraulic Assessment
Figure A-20
5% AEP Flood Hazard
Legend
Study Area
Parcels
Flood Hazard (ARR2019)
H1
H2
H3
H4
H5
H6
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30108
Map:20yr_Results.wor 01

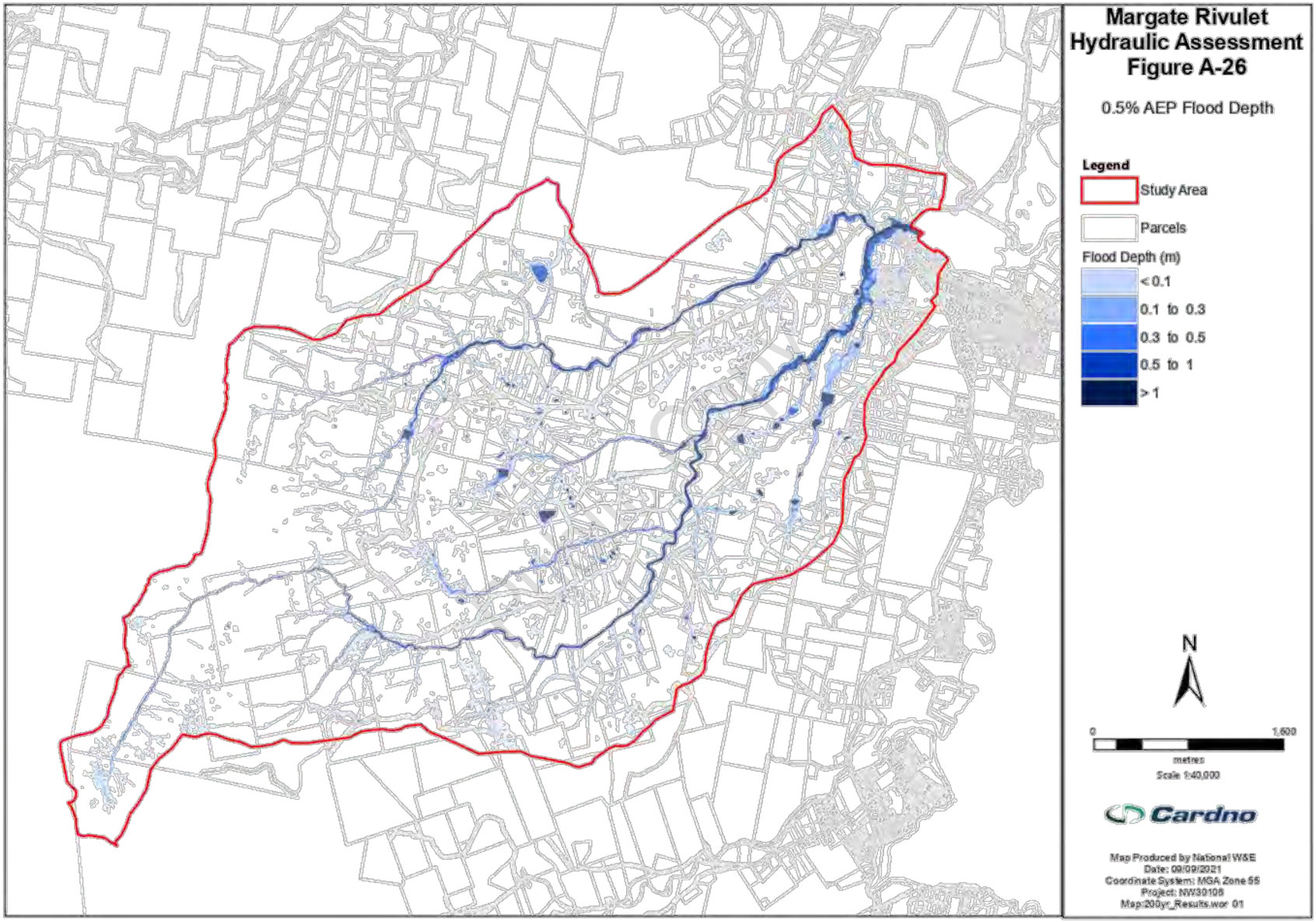

Margate Rivulet
Hydraulic Assessment
Figure A-21
1% AEP Flood Level
Legend
Study Area
Parcels
Flood Level (mAHD)
0 to 50
50 to 100
100 to 150
150 to 200
200 to 250
250 to 300
300 to 350
350 to 400
400 to 450
450 to 500
500 to 600
600 to 800
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30108
Map:100yr_Results.wor 01

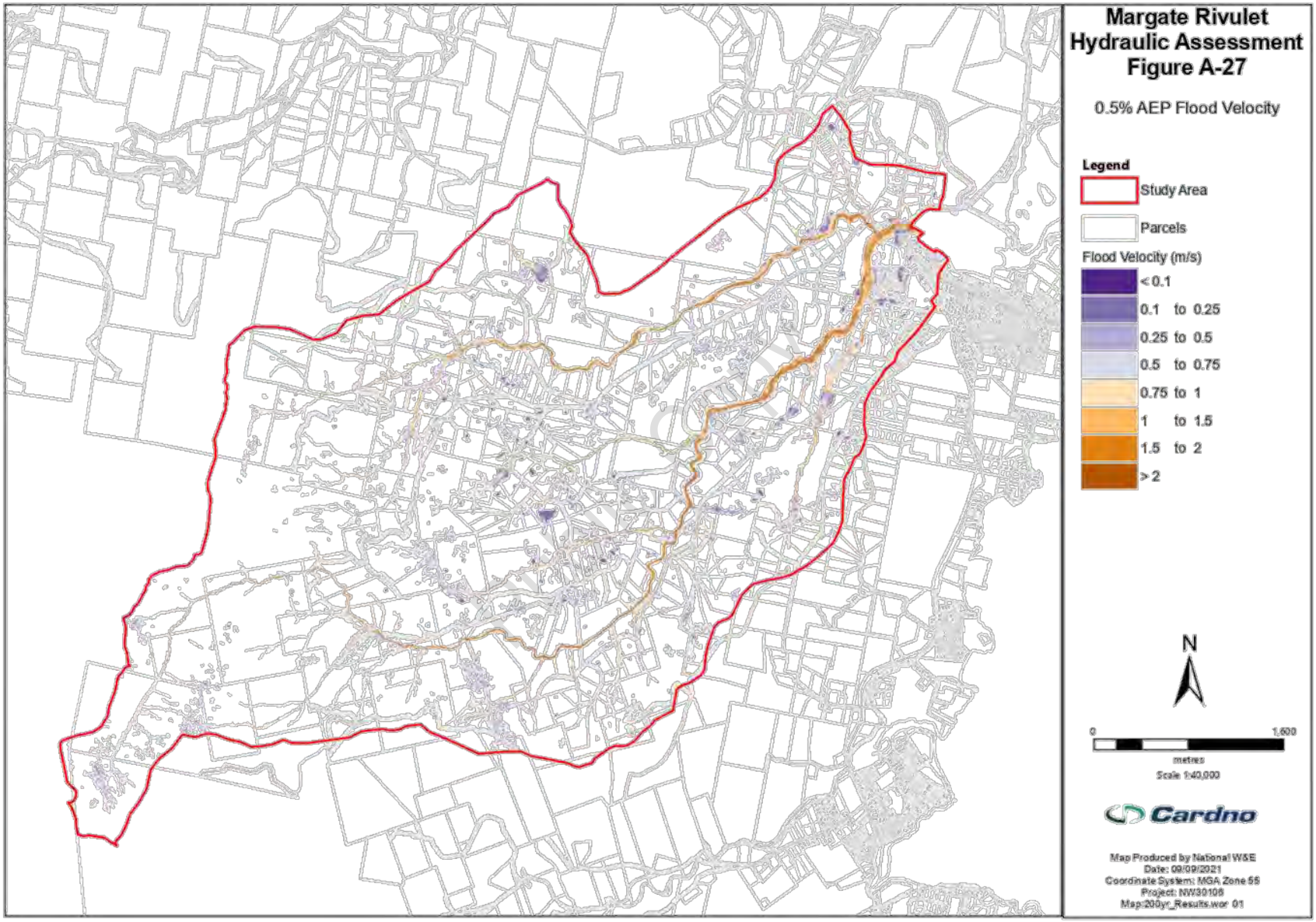

Margate Rivulet
Hydraulic Assessment
Figure A-22
1% AEP Flood Depth
Legend
Study Area
Parcels
Flood Depth (m)
< 0.1
0.1 to 0.3
0.3 to 0.5
0.5 to 1
> 1
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30108
Map:100yr_Results.wor 01

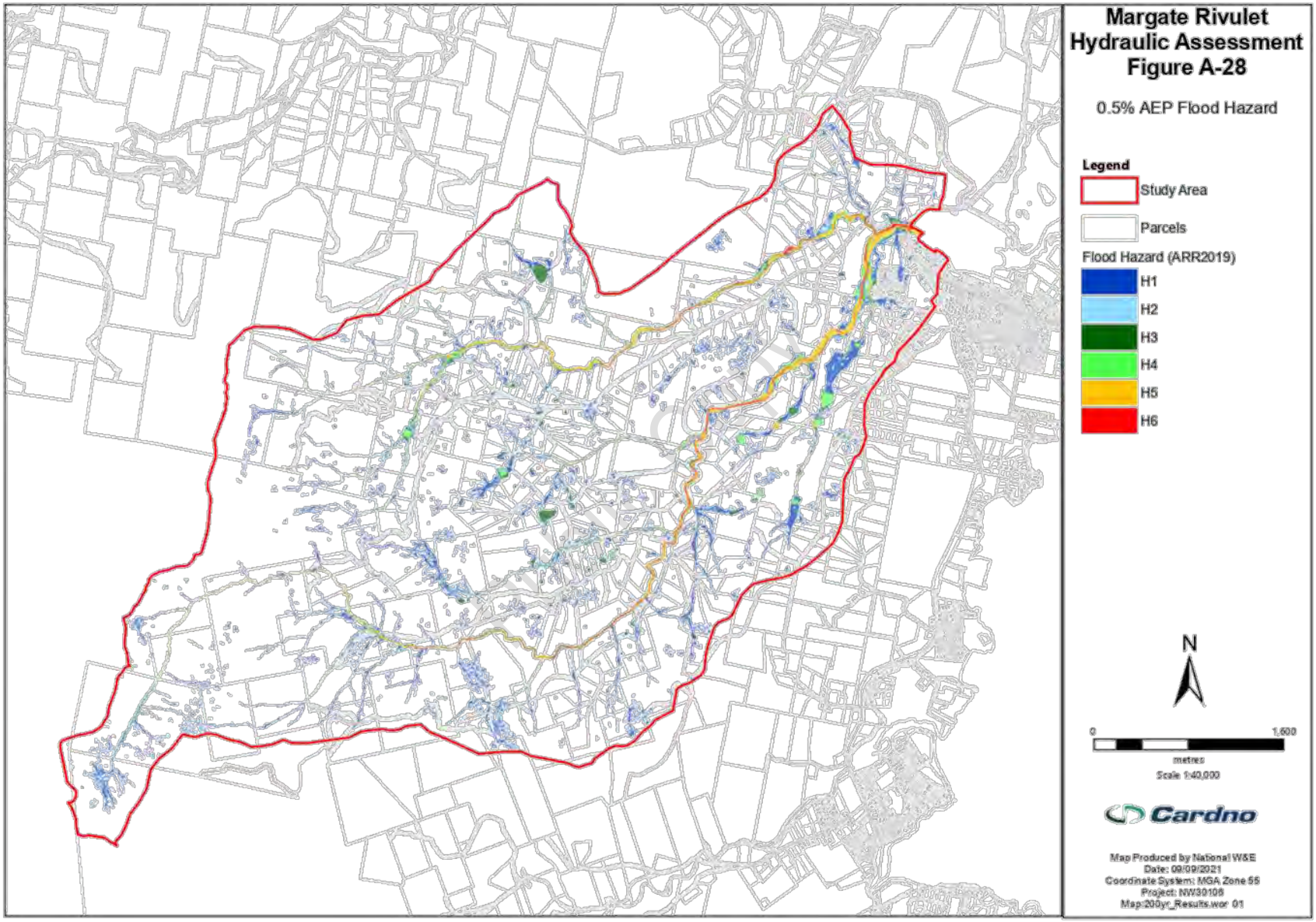

Margate Rivulet
Hydraulic Assessment
Figure A-23
1% AEP Flood Velocity
Legend
Study Area
Parcels
Flood Velocity (m/s)
< 0.1
0.1 to 0.25
0.25 to 0.5
0.5 to 0.75
0.75 to 1
1 to 1.5
1.5 to 2
> 2
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30108
Map:100yr_Results.wor 01

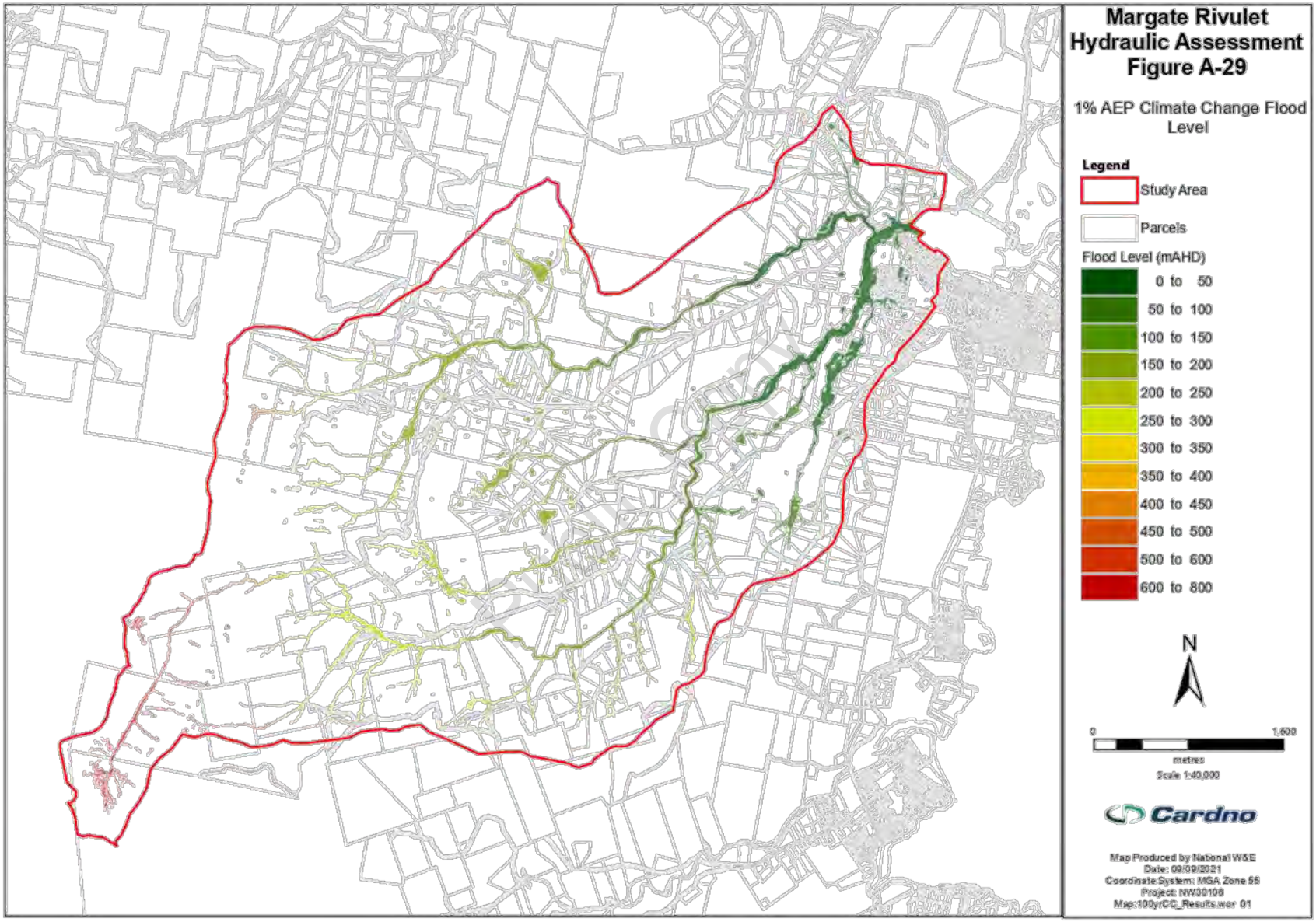

Margate Rivulet
Hydraulic Assessment
Figure A-24
1% AEP Flood Hazard
Legend
Study Area
Parcels
Flood Hazard (ARR2019)
H1
H2
H3
H4
H5
H6
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30108
Map:100yr_Results.wor 01

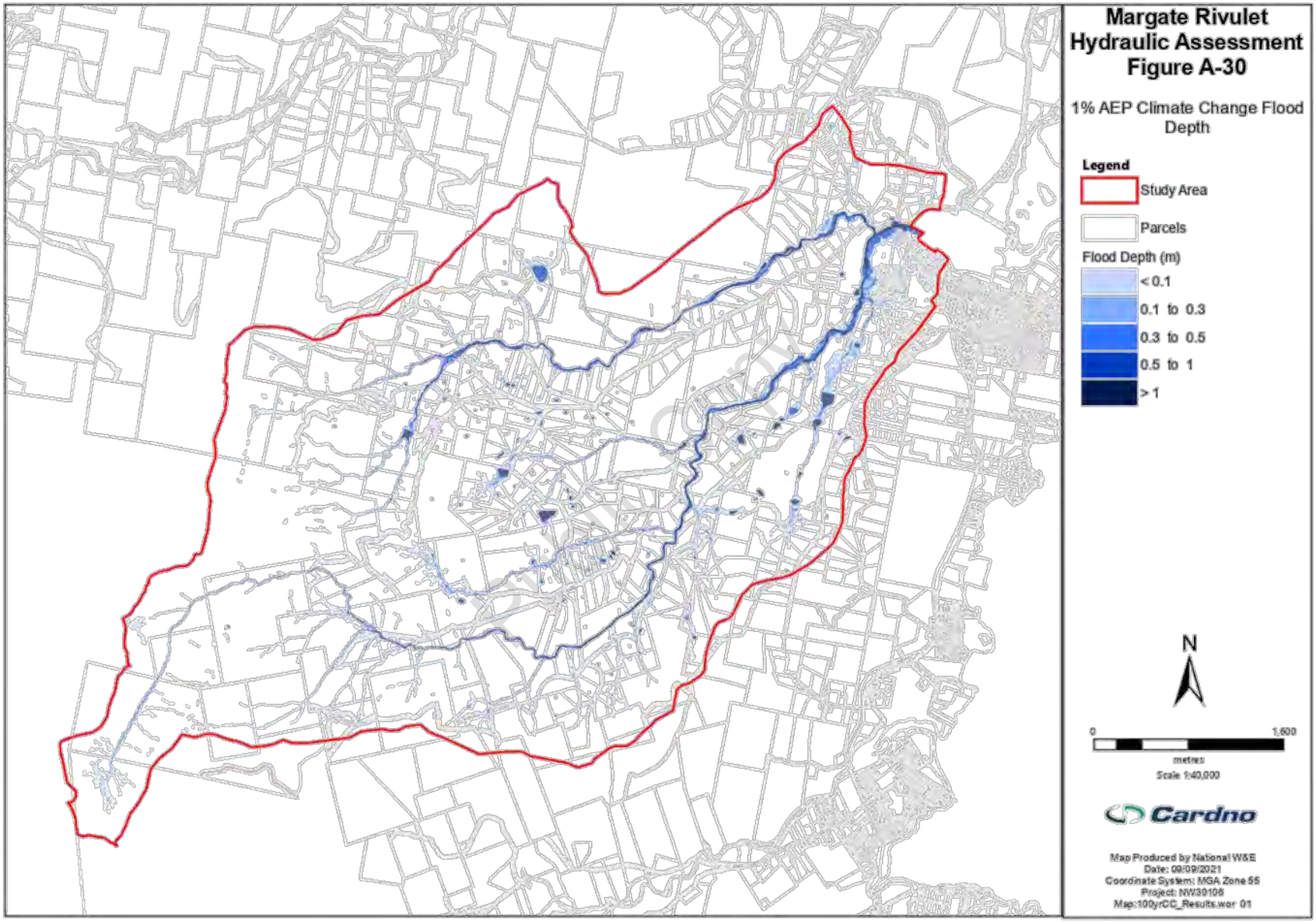

Margate Rivulet
Hydraulic Assessment
Figure A-25
0.5% AEP Flood Level
Legend
Study Area
Parcels
Flood Level (mAHD)
0 to 50
50 to 100
100 to 150
150 to 200
200 to 250
250 to 300
300 to 350
350 to 400
400 to 450
450 to 500
500 to 600
600 to 800
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30108
Map:200yr_Results.wor 01

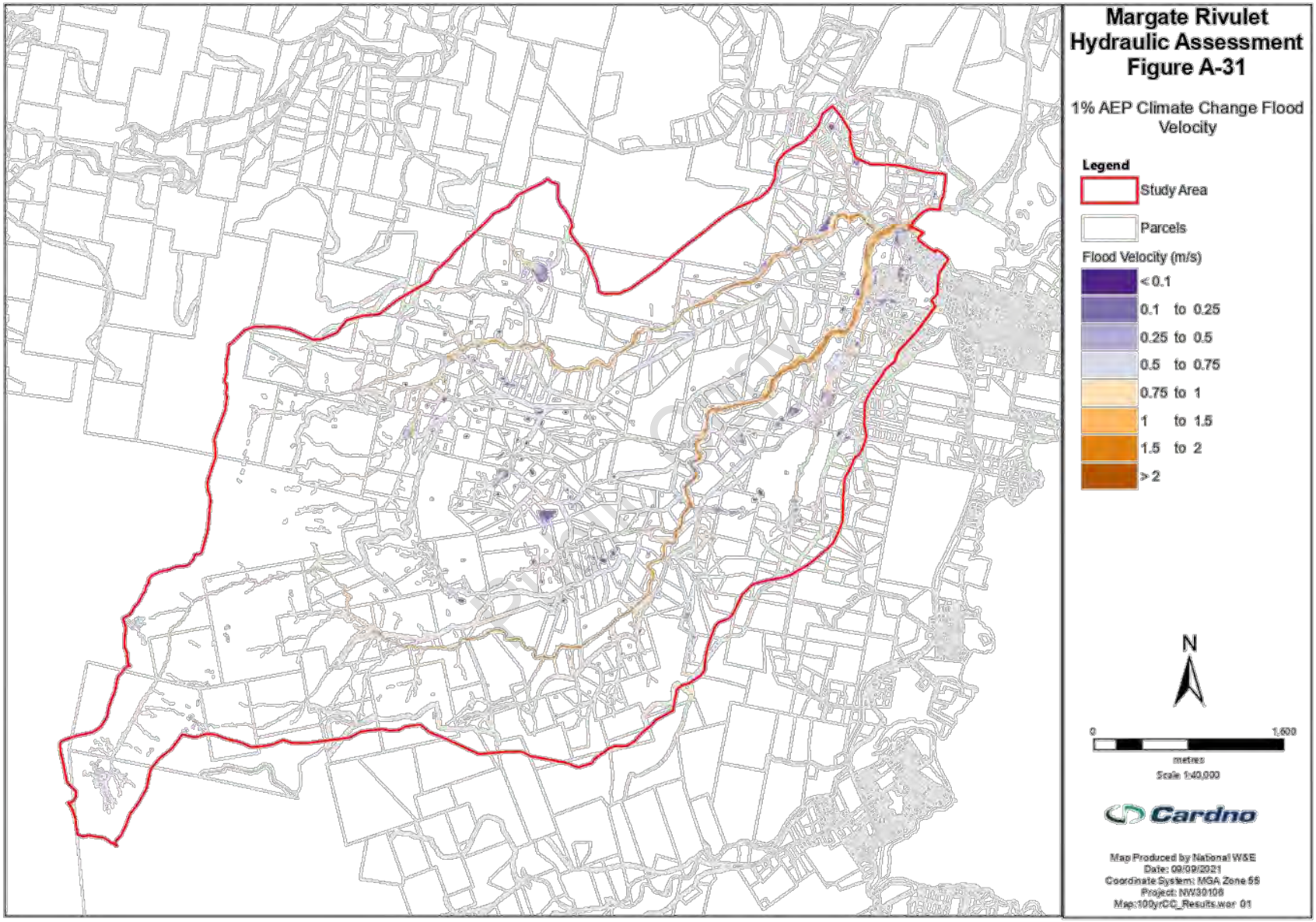

Margate Rivulet
Hydraulic Assessment
Figure A-26
0.5% AEP Flood Depth
Legend
Study Area
Parcels
Flood Depth (m)
< 0.1
0.1 to 0.3
0.3 to 0.5
0.5 to 1
> 1
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30108
Map:200yr_Results.wor 01

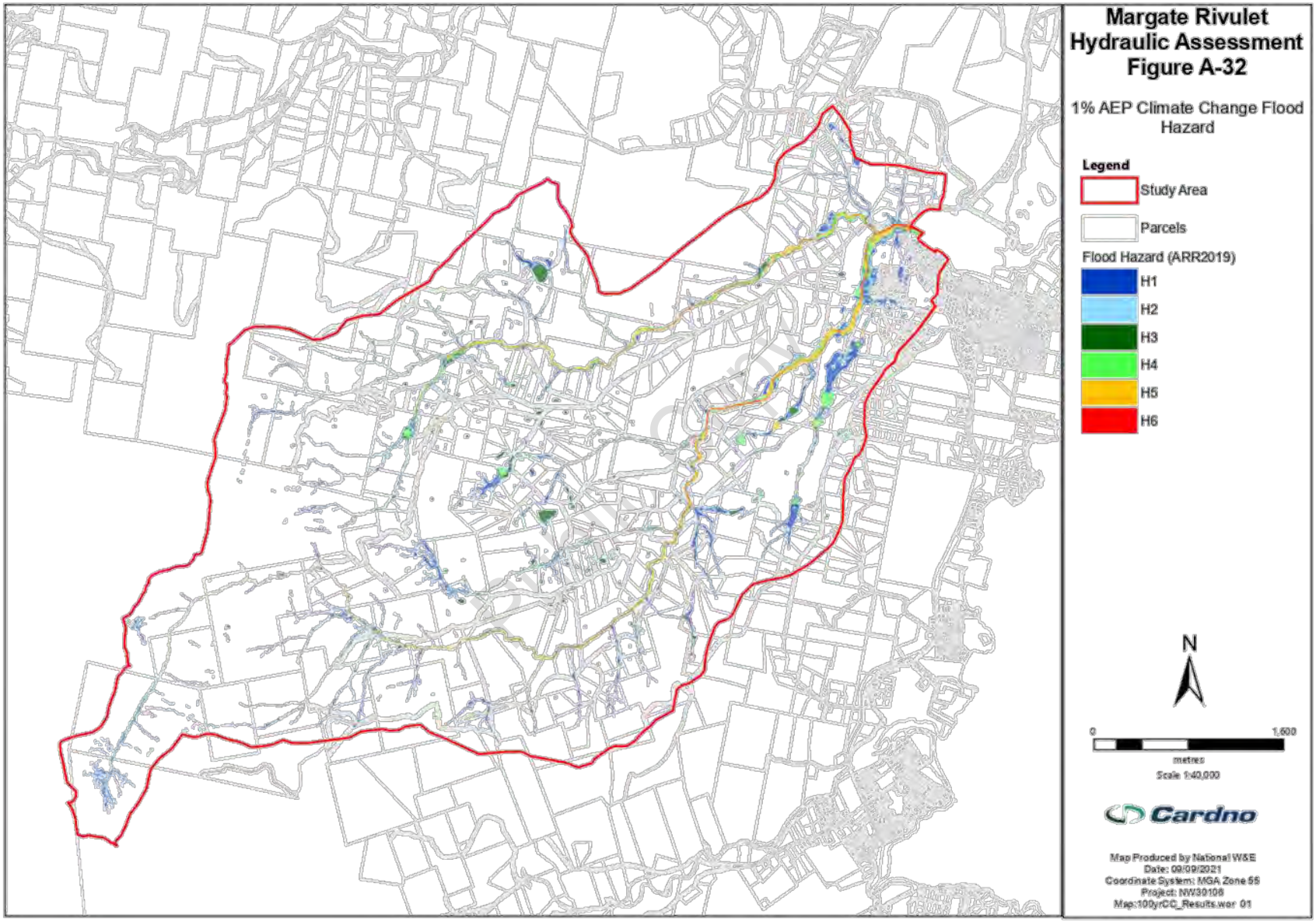

Margate Rivulet
Hydraulic Assessment
Figure A-27
0.5% AEP Flood Velocity
Legend
Study Area
Parcels
Flood Velocity (m/s)
< 0.1
0.1 to 0.25
0.25 to 0.5
0.5 to 0.75
0.75 to 1
1 to 1.5
1.5 to 2
> 2
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30108
Map:200yr_Results.wor 01


Margate Rivulet
Hydraulic Assessment
Figure A-28
0.5% AEP Flood Hazard
Legend
Study Area
Parcels
Flood Hazard (ARR2019)
H1
H2
H3
H4
H5
H6
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30108
Map:200yr_Results.wor 01


Margate Rivulet
Hydraulic Assessment
Figure A-29
1% AEP Climate Change Flood Level
Legend
Study Area
Parcels
Flood Level (mAHD)
0 to 50
50 to 100
100 to 150
150 to 200
200 to 250
250 to 300
300 to 350
350 to 400
400 to 450
450 to 500
500 to 600
600 to 800
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30108
Map:100yrCC_Results.wor 01


Margate Rivulet
Hydraulic Assessment
Figure A-30
1% AEP Climate Change Flood Depth
Legend
Study Area
Parcels
Flood Depth (m)
< 0.1
0.1 to 0.3
0.3 to 0.5
0.5 to 1
> 1
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30108
Map:100yrCC_Results.wor 01


Margate Rivulet
Hydraulic Assessment
Figure A-31
1% AEP Climate Change Flood Velocity
Legend
Study Area
Parcels
Flood Velocity (m/s)
< 0.1
0.1 to 0.25
0.25 to 0.5
0.5 to 0.75
0.75 to 1
1 to 1.5
1.5 to 2
> 2
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30108
Map:100yrCC_Results.wor 01


Margate Rivulet
Hydraulic Assessment
Figure A-32
1% AEP Climate Change Flood Hazard
Legend
Study Area
Parcels
Flood Hazard (ARR2019)
H1
H2
H3
H4
H5
H6
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 09/09/2021
Coordinate System: MGA Zone 55
Project: NW30108
Map:100yrCC_Results.wor 01

APPENDIX B

SUB-CATCHMENT CHARACTERISTICS

SubArea Number	SubArea ID	Area (km²)	DCIA	ICIA	PA
1	A	0.904	0	0.025	0.975
2	B	0.718	0	0.026	0.974
3	C	1.176	0.002	0.026	0.972
4	D	1.002	0.007	0.03	0.963
5	E	0.633	0.011	0.033	0.956
6	F	1.022	0.003	0.029	0.968
7	G	0.933	0.009	0.032	0.959
8	H	0.7	0.009	0.032	0.959
9	I	0.986	0.012	0.034	0.954
10	J	0.484	0.034	0.044	0.922
11	K	0.894	0.023	0.038	0.939
12	L	0.432	0.03	0.044	0.926
13	M	0.647	0.028	0.04	0.932
14	N	0.684	0.017	0.033	0.95
15	O	0.759	0.04	0.04	0.92
16	P	0.386	0.075	0.052	0.873
17	Q	0.282	0.043	0.047	0.91
18	R	1.042	0.058	0.046	0.896
19	S	0.449	0.157	0.129	0.714
20	T	0.369	0.123	0.089	0.788
21	U	0.747	0.003	0.028	0.969
22	V	0.867	0.001	0.026	0.973
23	W	0.415	0.03	0.043	0.927
24	X	0.829	0.002	0.028	0.97
25	Y	0.581	0.003	0.026	0.971
26	Z	0.783	0.037	0.048	0.915
27	AA	0.676	0.029	0.031	0.94
28	AB	0.985	0.033	0.037	0.93
29	AC	1.126	0.028	0.036	0.936
30	AD	0.559	0.04	0.04	0.92
31	AE	0.369	0.076	0.05	0.874

32	AF	0.47	0.082	0.052	0.866
33	AG	0.203	0.268	0.2	0.532

APPENDIX C

ARR DATAHUB TEXT FILE

```
Results - ARR Data Hub
[STARTTXT]

Input Data Information
[INPUTDATA]
Latitude,-43.037700
Longitude,147.234200
[END_INPUTDATA]

River Region
[RIVREG]
Division,Tasmania
River Number,5
River Name,Kingston Coast
[RIVREG_META]
Time Accessed,27 April 2021 09:53AM
Version,2016_v1
[END_RIVREG]

ARF Parameters
[LONGARF]
Zone,Tasmania
a,0.0605
b,0.347
c,0.2
d,0.283
e,0.00076
f,0.347
g,0.0877
h,0.012
i,-0.00033
[LONGARF_META]
Time Accessed,27 April 2021 09:53AM
Version,2016_v1
[END_LONGARF]

Storm Losses
[LOSSES]
ID,10530.0
Storm Initial Losses (mm),28.0
Storm Continuing Losses (mm/h),3.4
[LOSSES_META]
Time Accessed,27 April 2021 09:53AM
Version,2016_v1
[END_LOSSES]

Temporal Patterns
[TP]
code,SStas
Label,Southern Slopes (Tas)
[TP_META]
Time Accessed,27 April 2021 09:53AM
Version,2016_v2
[END_TP]

Areal Temporal Patterns
[ATP]
code,SStas
arealabel,Southern Slopes (Tas)
[ATP_META]
Time Accessed,27 April 2021 09:53AM
Version,2016_v2
[END_ATP]

Median Preburst Depths and Ratios
[PREBURST]
```

```
min (h)\AEP(%),50,20,10,5,2,1
60 (1.0),4.3 (0.346),6.0 (0.348),7.2 (0.345),8.2 (0.340),6.1 (0.209),4.5 (0.135)
90 (1.5),4.3 (0.285),4.7 (0.222),4.9 (0.195),5.1 (0.175),6.1 (0.176),6.8 (0.175)
120 (2.0),6.2 (0.352),6.4 (0.262),6.5 (0.225),6.7 (0.198),6.1 (0.154),5.7 (0.128)
180 (3.0),7.7 (0.352),8.7 (0.286),9.4 (0.259),10.0 (0.240),16.6 (0.339),21.6 (0.395)
360 (6.0),7.7 (0.243),11.1 (0.249),13.4 (0.250),15.6 (0.251),20.8 (0.284),24.7 (0.302)
720 (12.0),5.2 (0.116),8.5 (0.131),10.7 (0.136),12.8 (0.139),12.5 (0.114),12.3 (0.100)
1080 (18.0),5.0 (0.092),6.9 (0.088),8.2 (0.086),9.5 (0.085),11.7 (0.086),13.3 (0.087)
1440 (24.0),4.3 (0.071),6.0 (0.068),7.1 (0.066),8.1 (0.064),10.0 (0.066),11.5 (0.066)
2160 (36.0),2.8 (0.041),2.8 (0.028),2.7 (0.022),2.7 (0.019),11.6 (0.066),18.3 (0.091)
2880 (48.0),1.5 (0.021),3.8 (0.035),5.2 (0.040),6.7 (0.043),10.6 (0.056),13.5 (0.063)
4320 (72.0),0.0 (0.000),2.1 (0.018),3.4 (0.025),4.7 (0.029),2.9 (0.014),1.4 (0.006)
[PREBURST_META]
Time Accessed,27 April 2021 09:53AM
Version,2018_v1
Note,Preburst interpolation methods for catchment wide preburst has been slightly
altered. Point values remain unchanged.
[END_PREBURST]From preburst class

10% Preburst Depths
[PREBURST10]
min (h)\AEP(%),50,20,10,5,2,1
60 (1.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
90 (1.5),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
120 (2.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
180 (3.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
360 (6.0),0.0 (0.000),0.1 (0.001),0.1 (0.002),0.1 (0.002),1.5 (0.020),2.5 (0.031)
720 (12.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),1.0 (0.009),1.8 (0.015)
1080 (18.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
1440 (24.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
2160 (36.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.1 (0.000)
2880 (48.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
4320 (72.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
[PREBURST10_META]
Time Accessed,27 April 2021 09:53AM
Version,2018_v1
Note,Preburst interpolation methods for catchment wide preburst has been slightly
altered. Point values remain unchanged.
[END_PREBURST10]From preburst class

25% Preburst Depths
[PREBURST25]
min (h)\AEP(%),50,20,10,5,2,1
60 (1.0),0.8 (0.067),1.0 (0.055),1.0 (0.050),1.1 (0.046),1.0 (0.035),0.9 (0.028)
90 (1.5),0.7 (0.044),0.7 (0.035),0.8 (0.030),0.8 (0.027),0.8 (0.022),0.8 (0.019)
120 (2.0),1.0 (0.056),0.7 (0.029),0.5 (0.019),0.4 (0.011),0.3 (0.008),0.3 (0.007)
180 (3.0),0.4 (0.018),0.5 (0.015),0.5 (0.014),0.6 (0.013),2.9 (0.058),4.6 (0.084)
360 (6.0),0.6 (0.020),2.3 (0.050),3.3 (0.062),4.4 (0.070),6.3 (0.086),7.7 (0.094)
720 (12.0),0.1 (0.002),0.6 (0.010),1.0 (0.012),1.3 (0.014),3.2 (0.029),4.6 (0.037)
1080 (18.0),0.1 (0.002),0.3 (0.003),0.4 (0.004),0.5 (0.004),1.9 (0.014),3.0 (0.020)
1440 (24.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.1 (0.000),0.0 (0.000),0.0 (0.000)
2160 (36.0),0.0 (0.000),0.1 (0.001),0.1 (0.001),0.1 (0.001),0.5 (0.003),0.8 (0.004)
2880 (48.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.1 (0.001),0.2 (0.001)
4320 (72.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
[PREBURST25_META]
Time Accessed,27 April 2021 09:53AM
Version,2018_v1
Note,Preburst interpolation methods for catchment wide preburst has been slightly
altered. Point values remain unchanged.
[END_PREBURST25]From preburst class

75% Preburst Depths
[PREBURST75]
min (h)\AEP(%),50,20,10,5,2,1
60 (1.0),18.5 (1.487),21.9 (1.268),24.2 (1.167),26.4 (1.088),27.3 (0.937),27.9 (0.847)
90 (1.5),18.1 (1.193),20.6 (0.980),22.3 (0.887),23.9 (0.818),28.8 (0.829),32.4 (0.832)
```

```
120 (2.0),20.4 (1.162),22.8 (0.934),24.4 (0.838),25.9 (0.768),31.6 (0.794),35.8 (0.805)
180 (3.0),23.4 (1.077),29.0 (0.956),32.7 (0.905),36.3 (0.869),43.3 (0.881),48.5 (0.886)
360 (6.0),26.1 (0.825),32.2 (0.718),36.2 (0.675),40.0 (0.645),41.0 (0.559),41.6 (0.509)
720 (12.0),21.8 (0.487),30.8 (0.475),36.7 (0.468),42.4 (0.462),43.2 (0.394),43.8 (0.355)
1080 (18.0),30.0 (0.557),37.3 (0.477),42.2 (0.443),46.8 (0.418),82.2 (0.609),108.7 (0.711)
1440 (24.0),27.6 (0.459),34.1 (0.388),38.4 (0.358),42.5 (0.336),83.2 (0.544),113.8 (0.654)
2160 (36.0),21.5 (0.315),26.3 (0.263),29.4 (0.241),32.4 (0.225),42.2 (0.240),49.5 (0.247)
2880 (48.0),15.1 (0.205),28.9 (0.270),38.1 (0.292),46.8 (0.303),46.6 (0.248),46.5 (0.217)
4320 (72.0),5.6 (0.070),22.2 (0.194),33.2 (0.239),43.8 (0.267),57.3 (0.289),67.5 (0.298)
[PREBURST75_META]
Time Accessed,27 April 2021 09:53AM
Version,2018_v1
Note,Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.
[END_PREBURST75]From preburst class

90% Preburst Depths
[PREBURST90]
min (h)\AEP(%),50,20,10,5,2,1
60 (1.0),38.9 (3.130),50.0 (2.893),57.3 (2.764),64.3 (2.653),58.5 (2.010),54.1 (1.640)
90 (1.5),37.5 (2.478),46.7 (2.219),52.7 (2.098),58.5 (2.004),59.8 (1.725),60.8 (1.561)
120 (2.0),64.1 (3.652),58.3 (2.392),54.5 (1.876),50.8 (1.510),61.3 (1.542),69.2 (1.555)
180 (3.0),65.0 (2.988),65.2 (2.148),65.4 (1.808),65.5 (1.568),70.9 (1.441),74.9 (1.367)
360 (6.0),75.6 (2.394),83.7 (1.868),89.0 (1.660),94.1 (1.515),89.6 (1.223),86.3 (1.055)
720 (12.0),66.6 (1.485),83.1 (1.281),94.0 (1.199),104.5 (1.140),114.9 (1.049),122.7 (0.995)
1080 (18.0),64.4 (1.199),89.0 (1.137),105.3 (1.106),120.9 (1.080),152.7 (1.132),176.5 (1.155)
1440 (24.0),59.3 (0.987),84.0 (0.958),100.4 (0.938),116.1 (0.919),145.7 (0.953),167.9 (0.965)
2160 (36.0),66.9 (0.976),73.0 (0.731),77.1 (0.632),81.0 (0.561),83.5 (0.476),85.4 (0.426)
2880 (48.0),53.2 (0.720),86.5 (0.808),108.5 (0.831),129.7 (0.840),112.0 (0.597),98.8 (0.460)
4320 (72.0),42.7 (0.532),73.7 (0.643),94.2 (0.677),113.8 (0.695),141.6 (0.714),162.4 (0.718)
[PREBURST90_META]
Time Accessed,27 April 2021 09:53AM
Version,2018_v1
Note,Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.
[END_PREBURST90]From preburst class

Interim Climate Change Factors
[CCF]
,RCP 4.5,RCP6,RCP 8.5
2030,0.648 (3.2%),0.687 (3.4%),0.811 (4.0%)
2040,0.878 (4.4%),0.827 (4.1%),1.084 (5.4%)
2050,1.081 (5.4%),1.013 (5.1%),1.446 (7.3%)
2060,1.251 (6.3%),1.229 (6.2%),1.862 (9.5%)
2070,1.381 (7.0%),1.460 (7.4%),2.298 (11.9%)
2080,1.465 (7.4%),1.691 (8.6%),2.719 (14.2%)
2090,1.496 (7.6%),1.906 (9.7%),3.090 (16.3%)

[CCF_META]
Time Accessed,27 April 2021 09:53AM
Version,2019_v1
Note,ARR recommends the use of RCP4.5 and RCP 8.5 values. These have been updated to the values that can be found on the climate change in Australia website.
[END_CCF]


Baseflow Factors
[BASEFLOW]
```

```
Downstream,0
Area (km2),440.214336
Catchment Number,11527
Volume Factor,0.123618
Peak Factor,0.032059
[BASEFLOW_META]
Time Accessed,27 April 2021 09:53AM
Version,2016_v1
[END_BASEFLOW]

[ENDTXT]
```

APPENDIX D

WEIGHTED IFDS

All Design Rainfall Depth (mm)
Issued: 26-Apr-21
Location Label:
Requested Latitude -43.0377 Longitude 147.2342
Nearest gri Latitude 43.0375 (S Longitude 147.2375 (E)

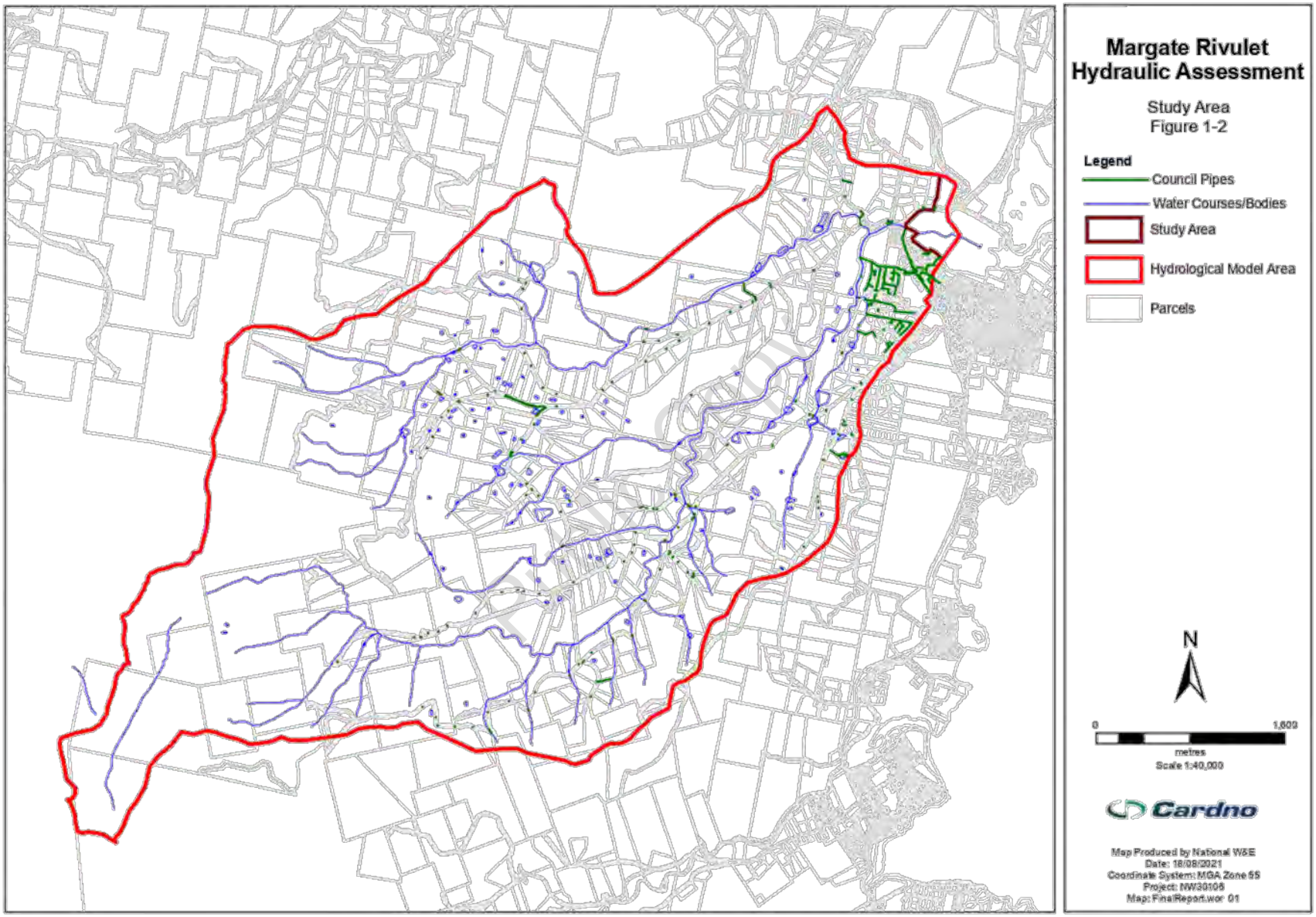
		Exceedanc	Annual Exceedance Probability (AEP)						
Duration	Duration in	50%	20%	10%	5%	2%	1%	0.50%	0.20%
10 min	10	6.17	7.86	9.59	11.4	14.07	16.27	18.6	21.68
15 min	15	7.46	9.51	11.6	13.83	17.07	19.8	22.61	26.36
20 min	20	8.49	10.78	13.14	15.66	19.3	22.27	25.49	29.67
25 min	25	9.38	11.9	14.46	17.18	21.06	24.3	27.74	32.32
30 min	30	10.18	12.88	15.59	18.51	22.58	25.96	29.66	34.53
45 min	45	12.25	15.38	18.56	21.84	26.39	30.1	34.32	39.97
1 hour	60	14.06	17.65	21.15	24.75	29.63	33.54	38.28	44.57
1.5 hour	90	17.27	21.54	25.71	29.86	35.42	39.74	45.34	52.84
2 hour	120	20.09	25.09	29.89	34.58	40.75	45.49	51.94	60.49
3 hour	180	25.19	31.53	37.43	43.15	50.66	56.33	64.31	74.9
4.5 hour	270	31.69	39.92	47.49	54.71	64.22	71.35	81.62	95.02
6 hour	360	37.32	47.32	56.42	65.15	76.64	85.3	97.61	113.44
9 hour	540	46.68	59.85	71.74	83.18	98.48	110.33	126.11	146.97
12 hour	720	54.2	70.08	84.39	98.28	117.35	131.52	150.65	175.85
18 hour	1080	65.74	85.71	103.92	122.09	146.53	165.8	190.02	221.47
24 hour	1440	74.06	96.99	118.05	139.21	168.3	191.43	218.66	254.74
30 hour	1800	80.33	105.33	128.8	152.28	184.66	210.22	241.73	281.63
36 hour	2160	85.19	111.74	136.7	161.78	196.88	224.91	257.47	300
48 hour	2880	92.14	120.64	147.93	175.13	213.02	243.68	276.74	322.5
72 hour	4320	100.77	130.59	159.21	188.69	228.45	260.42	293.35	341.64
96 hour	5760	106.32	135.92	164.97	194.83	234.4	266.5	299.51	348.79
120 hour	7200	110.63	140.2	169.07	198.55	237.61	269.06	303.22	352.28
144 hour	8640	114.74	144.33	173.11	201.67	240.89	271.29	305.54	354.96
168 hour	10080	119.42	149.18	177.58	205.55	244.12	274.75	308.17	357.9

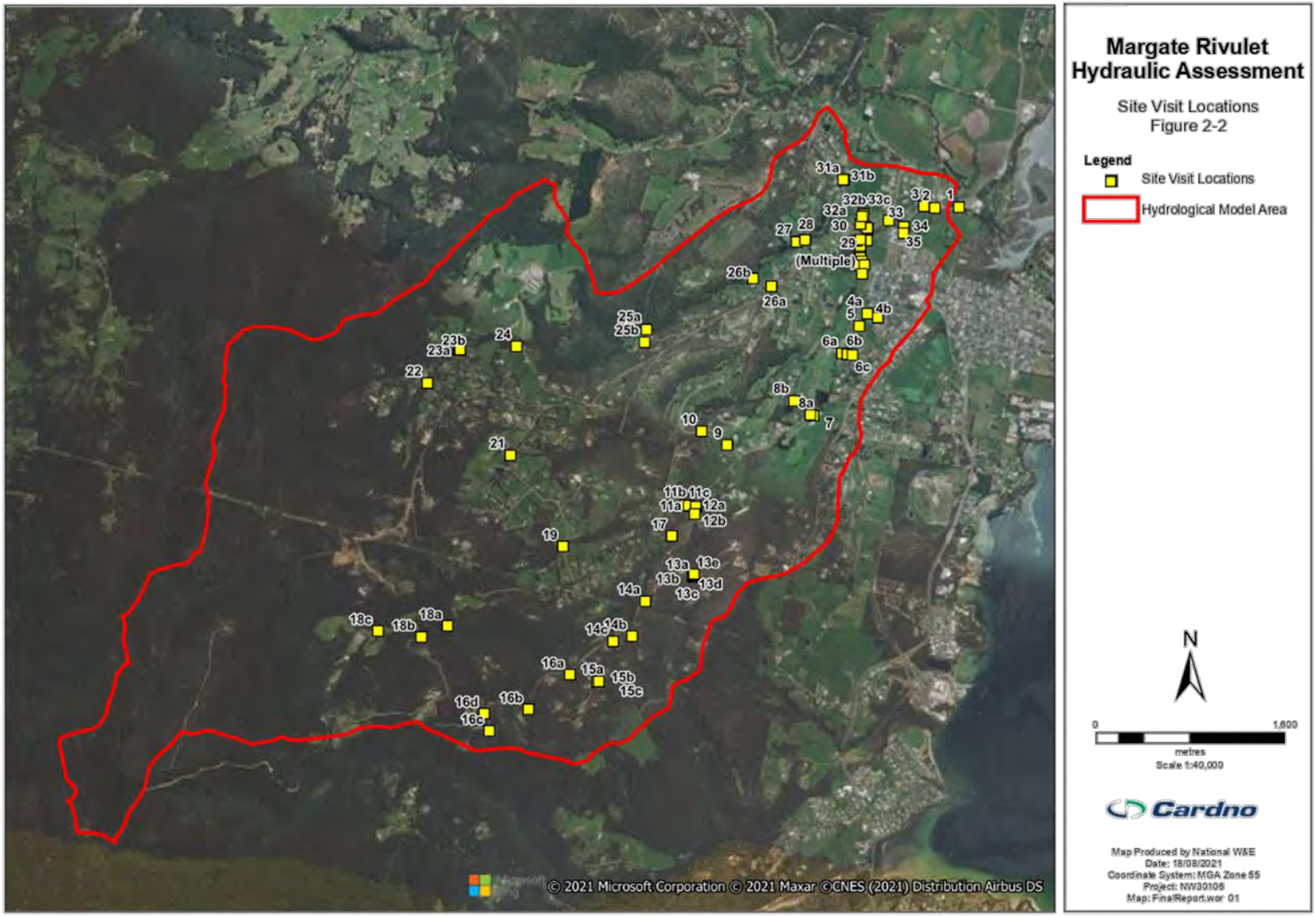
All Design Rainfall Depth (mm) - Inclusive of Climate Change
Issued: 26-Apr-21
Location Label:
Requested Latitude -43.0377 Longitude 147.2342
Nearest gri Latitude 43.0375 (S) Longitude 147.2375 (E)

		Exceedanc	Annual Exceedance Probability (AEP)						
Duration	Duration in	50%	20%	10%	5%	2%	1%	0.50%	0.20%
10 min	10	6.96593	8.87394	10.82711	12.8706	15.88503	18.36883	20.9994	24.47672
15 min	15	8.42234	10.73679	13.0964	15.61407	19.27203	22.3542	25.52669	29.76044
20 min	20	9.58521	12.17062	14.83506	17.68014	21.7897	25.14283	28.77821	33.49743
25 min	25	10.59002	13.4351	16.32534	19.39622	23.77674	27.4347	31.31846	36.48928
30 min	30	11.49322	14.54152	17.60111	20.89779	25.49282	29.30884	33.48614	38.98437
45 min	45	13.83025	17.36402	20.95424	24.65736	29.79431	33.9829	38.74728	45.12613
1 hour	60	15.87374	19.92685	23.87835	27.94275	33.45227	37.86666	43.21812	50.31953
1.5 hour	90	19.49783	24.31866	29.02659	33.71194	39.98918	44.86646	51.18886	59.65636
2 hour	120	22.68161	28.32661	33.74581	39.04082	46.00675	51.35821	58.64026	68.29321
3 hour	180	28.43951	35.59737	42.25847	48.71635	57.19514	63.59657	72.60599	84.5621
4.5 hour	270	35.77801	45.06968	53.61621	61.76759	72.50438	80.55415	92.14898	107.2776
6 hour	360	42.13428	53.42428	63.69818	73.55435	86.52656	96.3037	110.2017	128.0738
9 hour	540	52.70172	67.57065	80.99446	93.91022	111.1839	124.5626	142.3782	165.9291
12 hour	720	61.1918	79.12032	95.27631	110.9581	132.4882	148.4861	170.0839	198.5347
18 hour	1080	74.22046	96.76659	117.3257	137.8396	165.4324	187.1882	214.5326	250.0396
24 hour	1440	83.61374	109.5017	133.2785	157.1681	190.0107	216.1245	246.8671	287.6015
30 hour	1800	90.69257	118.9176	145.4152	171.9241	208.4811	237.3384	272.9132	317.9603
36 hour	2160	96.17951	126.1545	154.3343	182.6496	222.2775	253.9234	290.6836	338.7
48 hour	2880	104.0261	136.2026	167.013	197.7218	240.4996	275.1147	312.4395	364.1025
72 hour	4320	113.7693	147.4361	179.7481	213.031	257.9201	294.0142	331.1922	385.7116
96 hour	5760	120.0353	153.4537	186.2511	219.9631	264.6376	300.8785	338.1468	393.7839
120 hour	7200	124.9013	158.2858	190.88	224.163	268.2617	303.7687	342.3354	397.7241
144 hour	8640	129.5415	162.9486	195.4412	227.6854	271.9648	306.2864	344.9547	400.7498
168 hour	10080	134.8252	168.4242	200.4878	232.066	275.6115	310.1928	347.9239	404.0691

APPENDIX E

HIGH QUALITY REPORT FIGURES


Margate Rivulet
Hydraulic Assessment
Study Area
Figure 1-2
Legend
Council Pipes
Water Courses/Bodies
Study Area
Hydrological Model Area
Parcels
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 18/08/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: FinalReport.wor 01


Margate Rivulet
Hydraulic Assessment
Site Visit Locations
Figure 2-2
Legend
Site Visit Locations
Hydrological Model Area
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 18/08/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: FinalReport.wor 01
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31a
31b
32b
33c
32a
33
32
1
34
27
28
30
29
35
(Multiple)
26b
26a
4a
5
4b
25a
25b
24
23b
23a
6a
6b
6c
22
8b
8a
7
10
9
21
11b
11c
11a
12a
12b
17
19
13a
13e
13b
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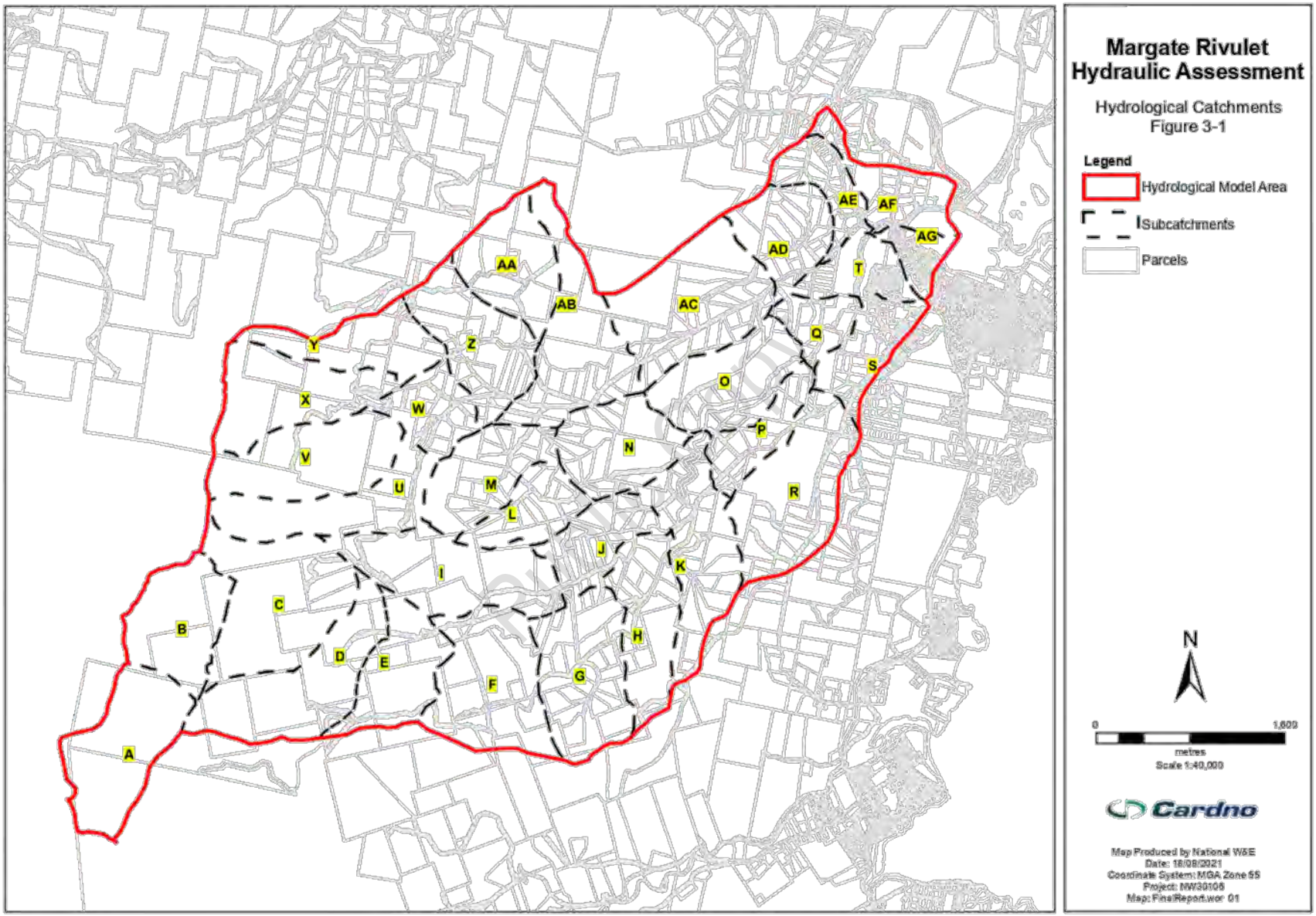
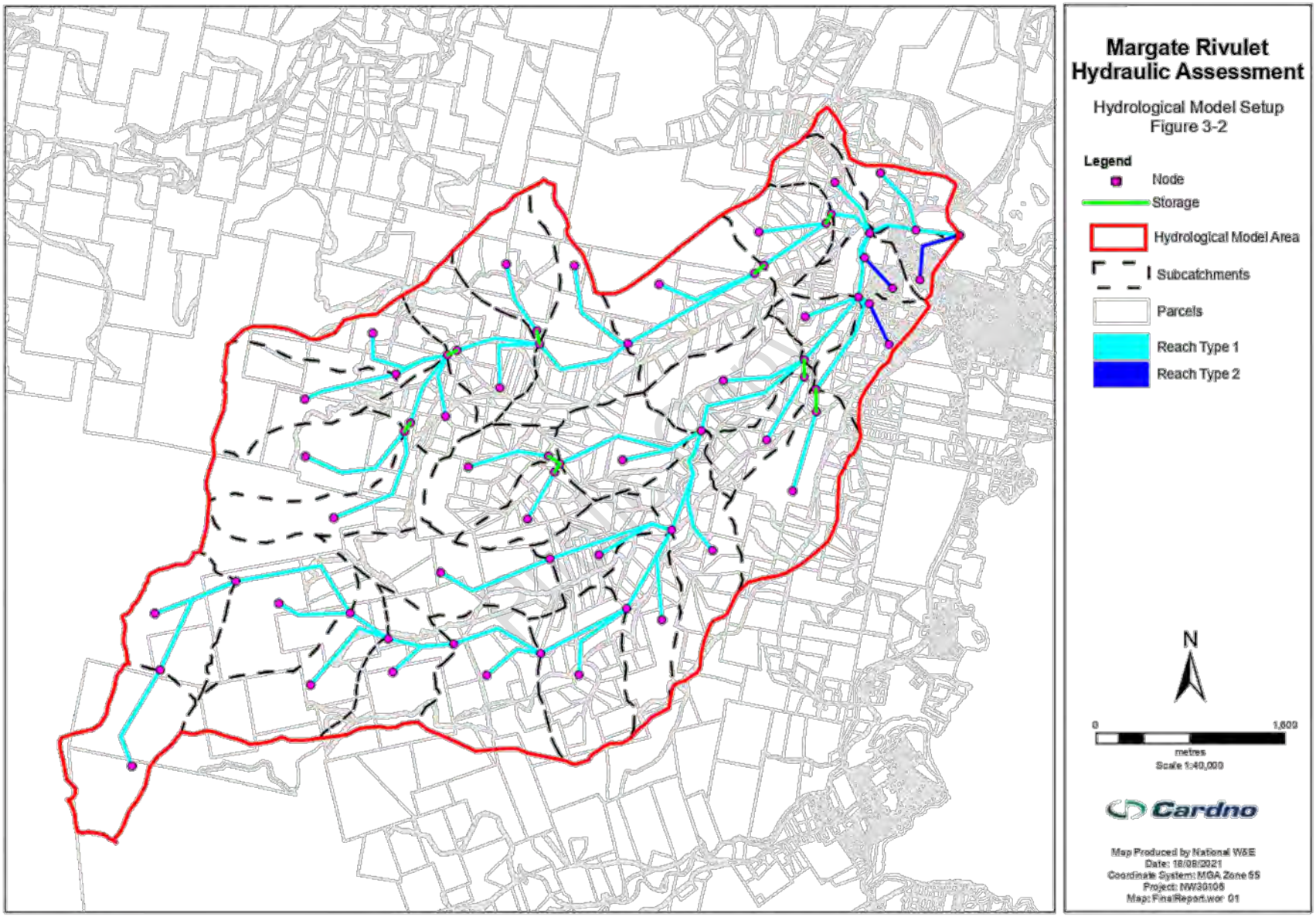
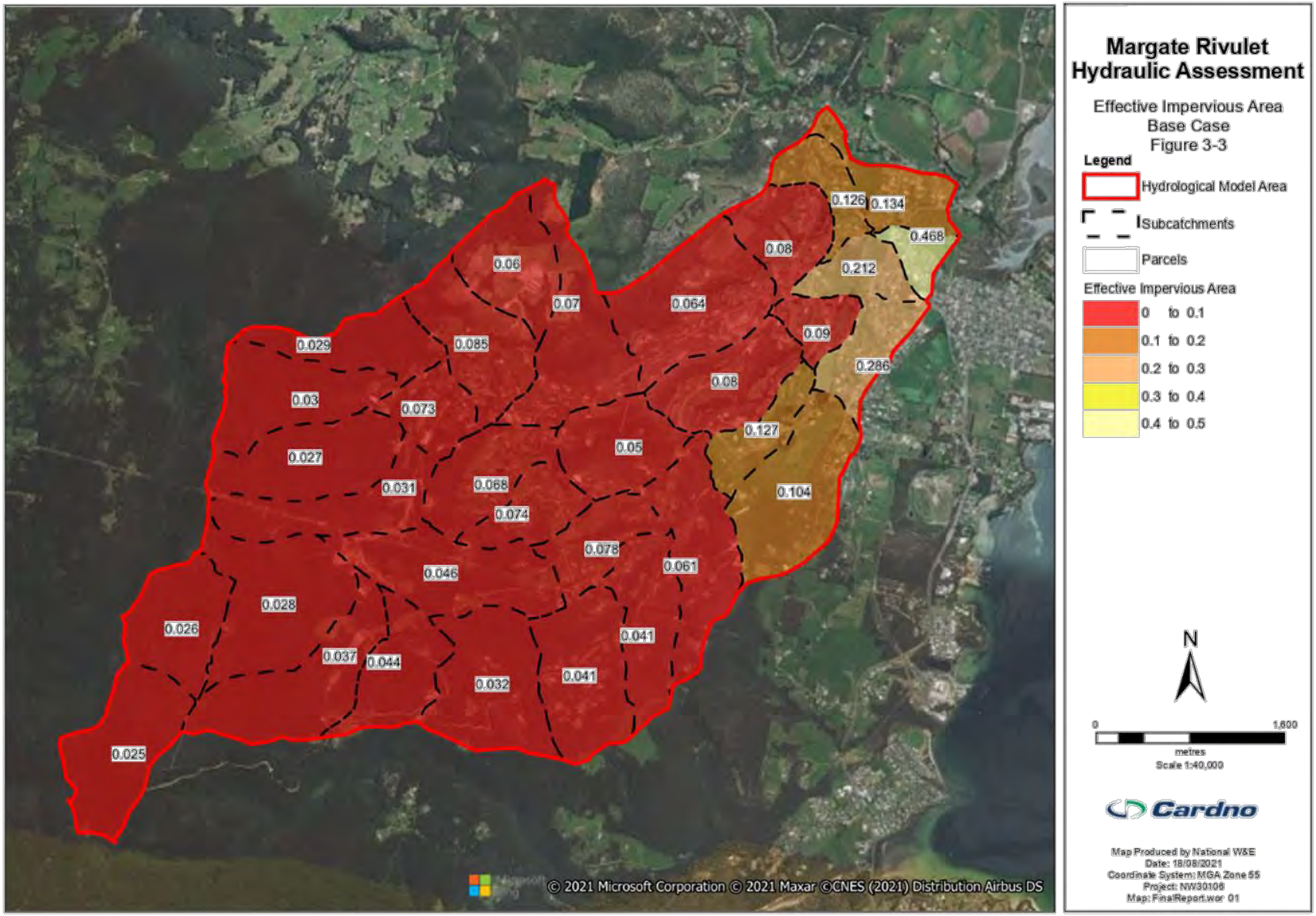
16a
15a
15b
15c
16d
16b
16c


Margate Rivulet
Hydraulic Assessment
Hydrological Catchments
Figure 3-1
Legend
Hydrological Model Area
Subcatchments
Parcels
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T
U
V
W
X
Y
Z
AA
AB
AC
AD
AE
AF
AG
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 18/08/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: FinalReport.wor 01


Margate Rivulet
Hydraulic Assessment
Hydrological Model Setup
Figure 3-2
Legend
Node
Storage
Hydrological Model Area
Subcatchments
Parcels
Reach Type 1
Reach Type 2
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 18/08/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: FinalReport.wor 01


0.126
0.134
0.468
0.08
0.212
0.06
0.07
0.064
0.09
0.029
0.085
0.286
0.08
0.03
0.073
0.127
0.05
0.027
0.031
0.068
0.104
0.074
0.078
0.061
0.046
0.028
0.026
0.041
0.037
0.044
0.032
0.041
0.025
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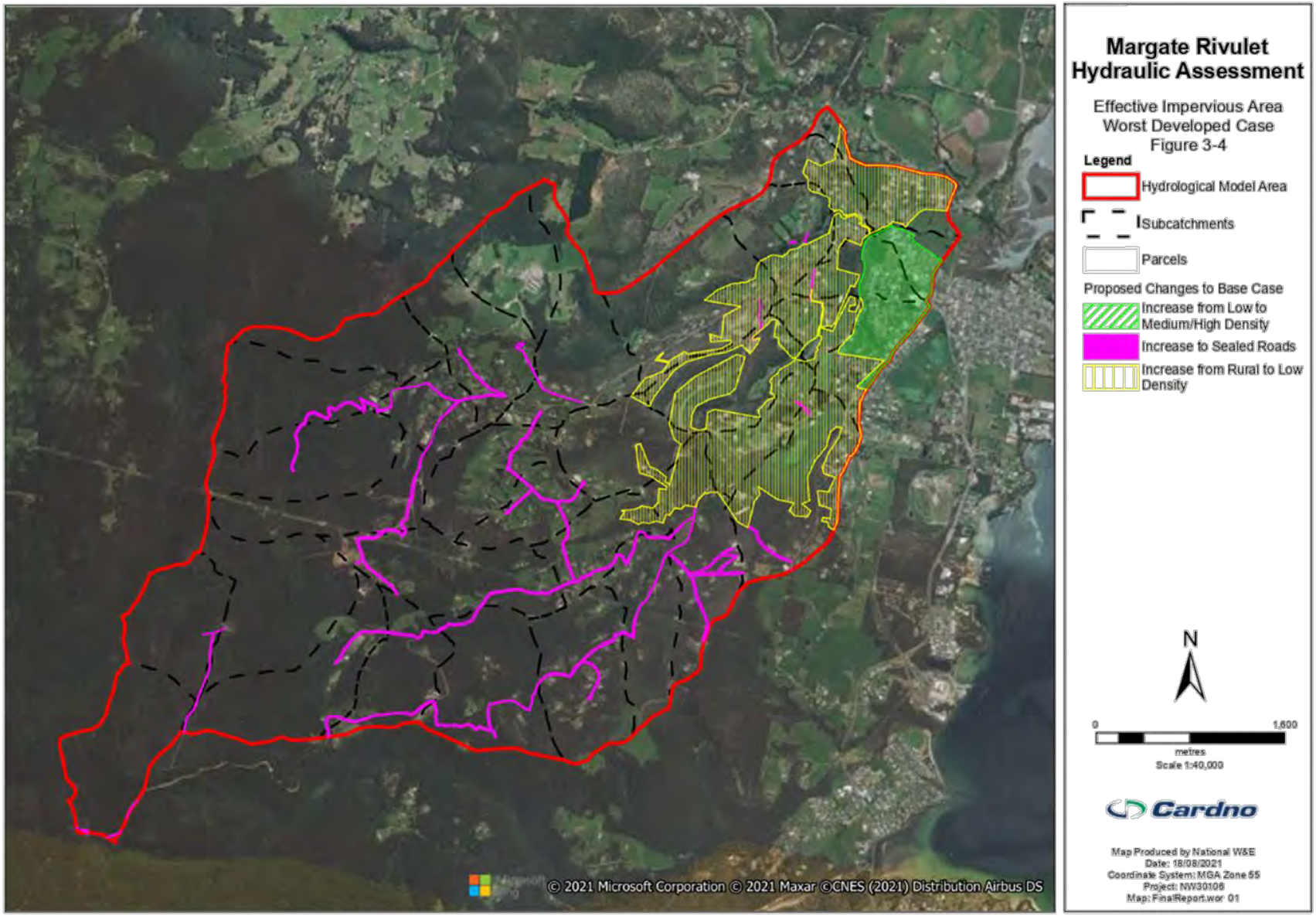
Margate Rivulet
Hydraulic Assessment
Effective Impervious Area
Base Case
Figure 3-3
Legend
Hydrological Model Area
Subcatchments
Parcels
Effective Impervious Area
0 to 0.1
0.1 to 0.2
0.2 to 0.3
0.3 to 0.4
0.4 to 0.5
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 18/08/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: FinalReport.wor 01


Margate Rivulet
Hydraulic Assessment
Effective Impervious Area
Worst Developed Case
Figure 3-4
Legend
Hydrological Model Area
Subcatchments
Parcels
Proposed Changes to Base Case
Increase from Low to Medium/High Density
Increase to Sealed Roads
Increase from Rural to Low Density
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 18/08/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: FinalReport.wor 01
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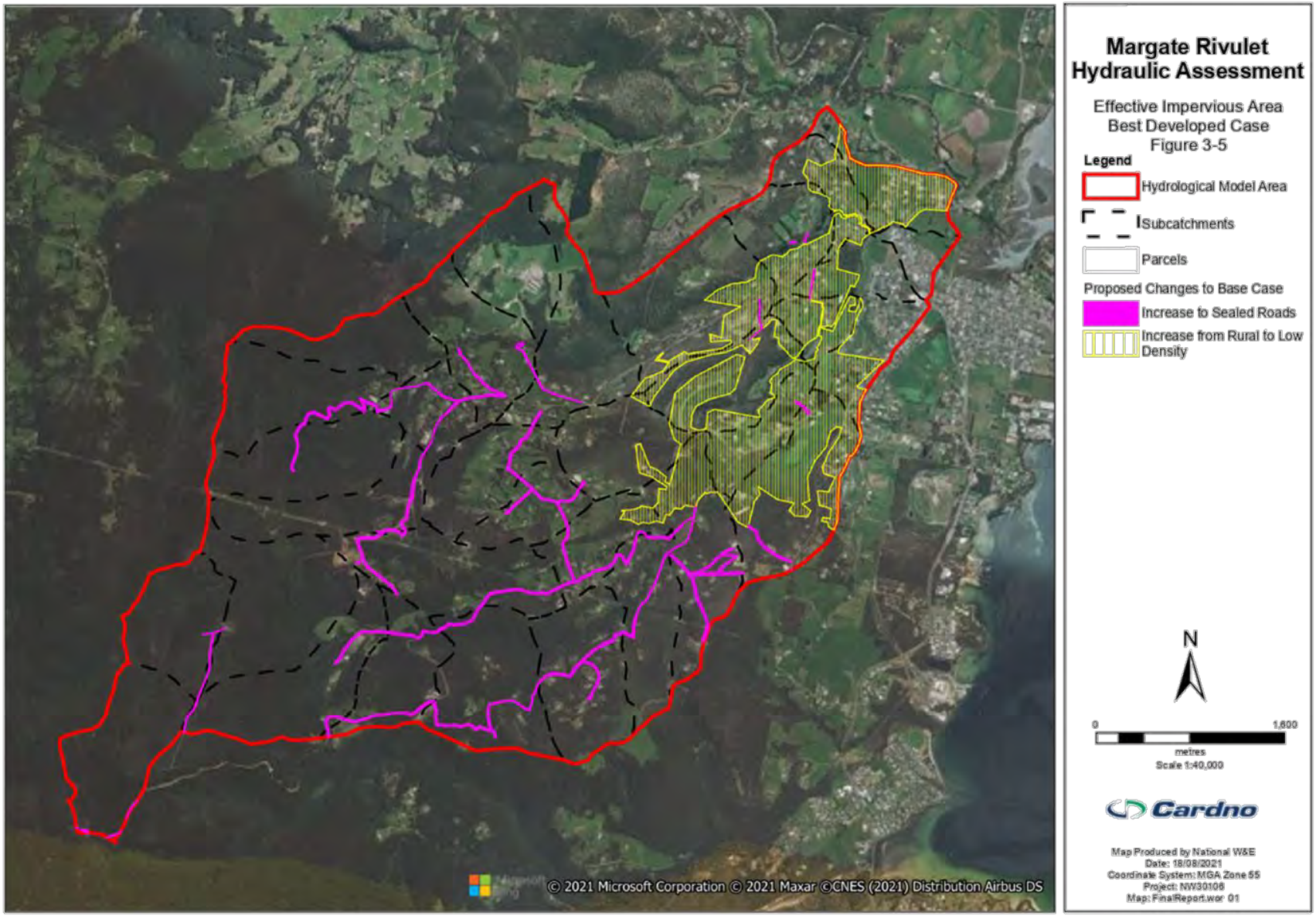
Margate Rivulet
Hydraulic Assessment
Effective Impervious Area
Best Developed Case
Figure 3-5
Legend
Hydrological Model Area
Subcatchments
Parcels
Proposed Changes to Base Case
Increase to Sealed Roads
Increase from Rural to Low Density
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
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Coordinate System: MGA Zone 55
Project: NW30108
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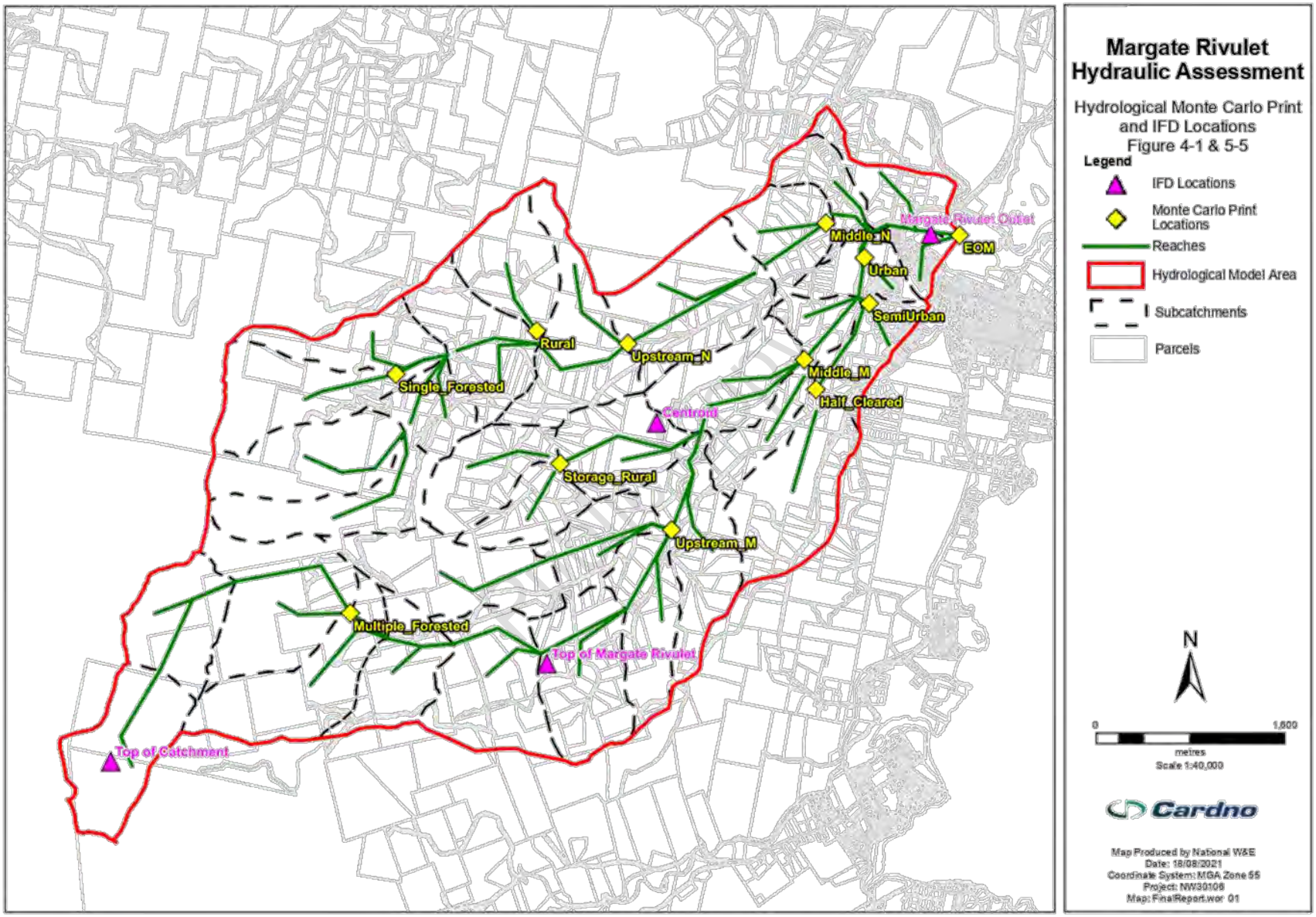
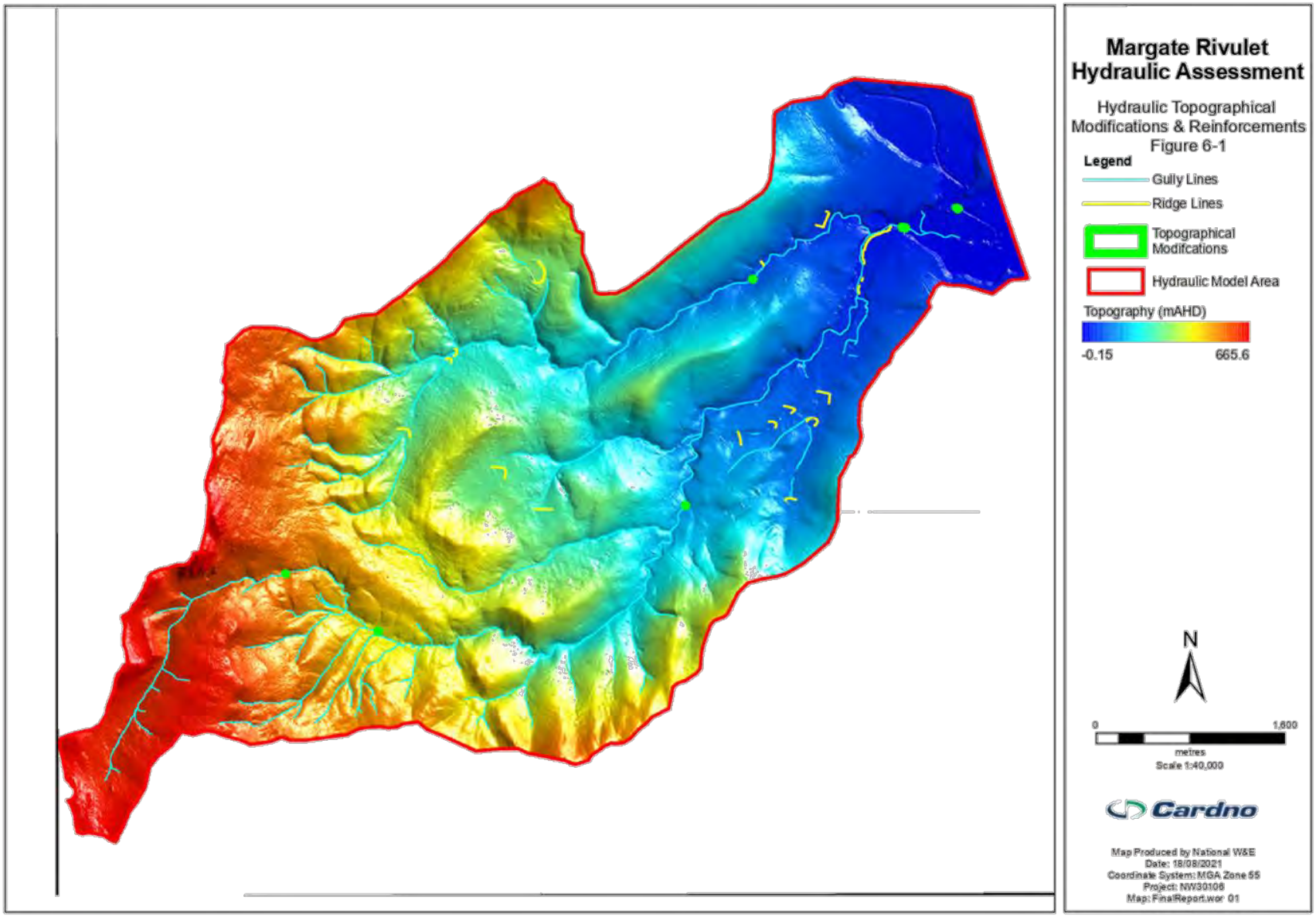

Margate Rivulet Outlet
Middle_N
EOM
Urban
SemiUrban
Rural
Upstream_N
Middle_M
Single_Forested
Half_Cleared
Centroid
Storage_Rural
Upstream_M
Multiple_Forested
Top of Margate Rivulet
Top of Catchment
Margate Rivulet Hydraulic Assessment
Hydrological Monte Carlo Print and IFD Locations
Figure 4-1 & 5-5
Legend
IFD Locations
Monte Carlo Print Locations
Reaches
Hydrological Model Area
Subcatchments
Parcels
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 18/08/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: FinalReport.wor 01


Margate Rivulet
Hydraulic Assessment
Hydraulic Topographical Modifications & Reinforcements
Figure 6-1
Legend
Gully Lines
Ridge Lines
Topographical Modifcations
Hydraulic Model Area
Topography (mAHD)
-0.15
665.6
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 18/08/2021
Coordinate System: MGA Zone 55
Project: NW30106
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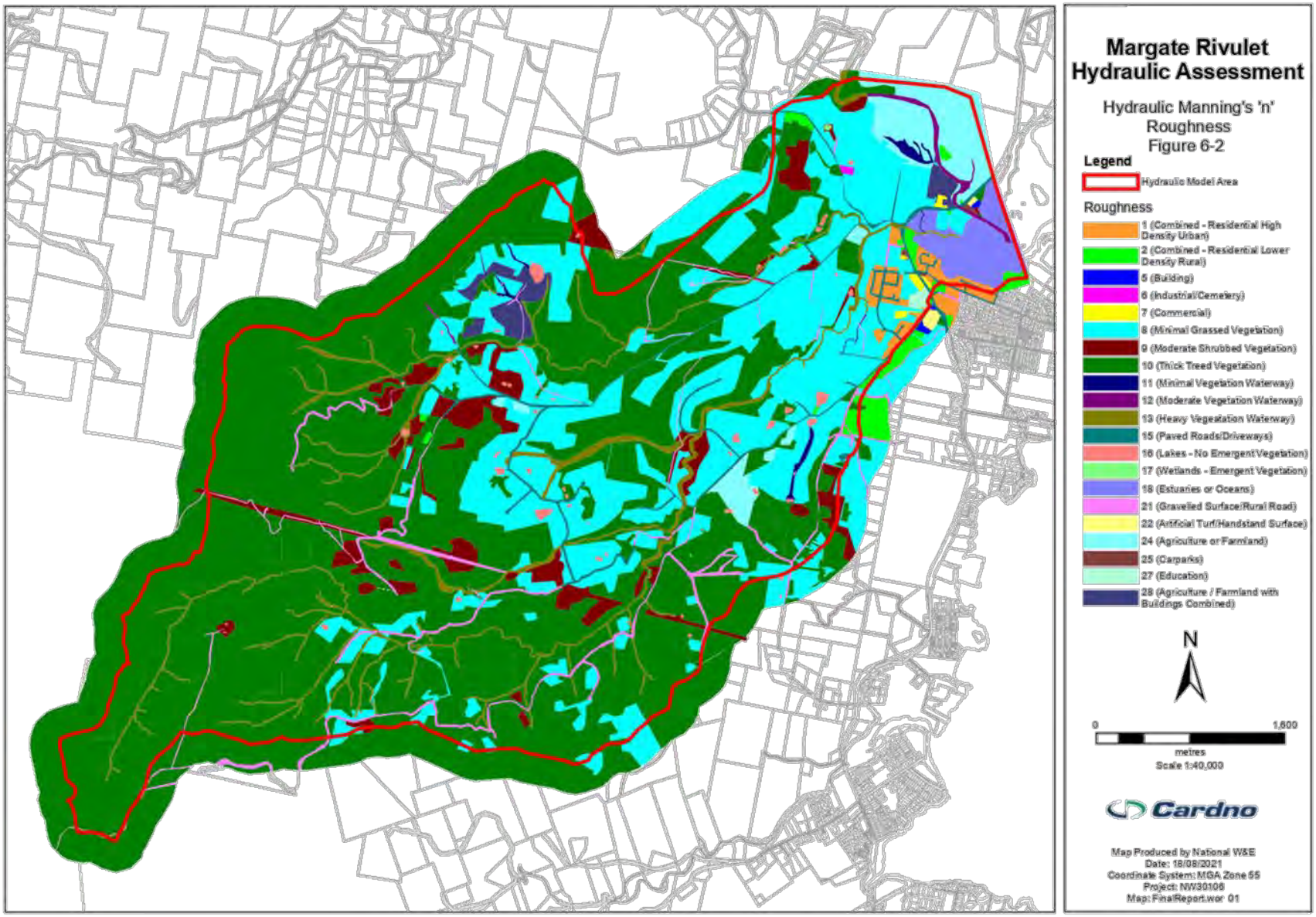
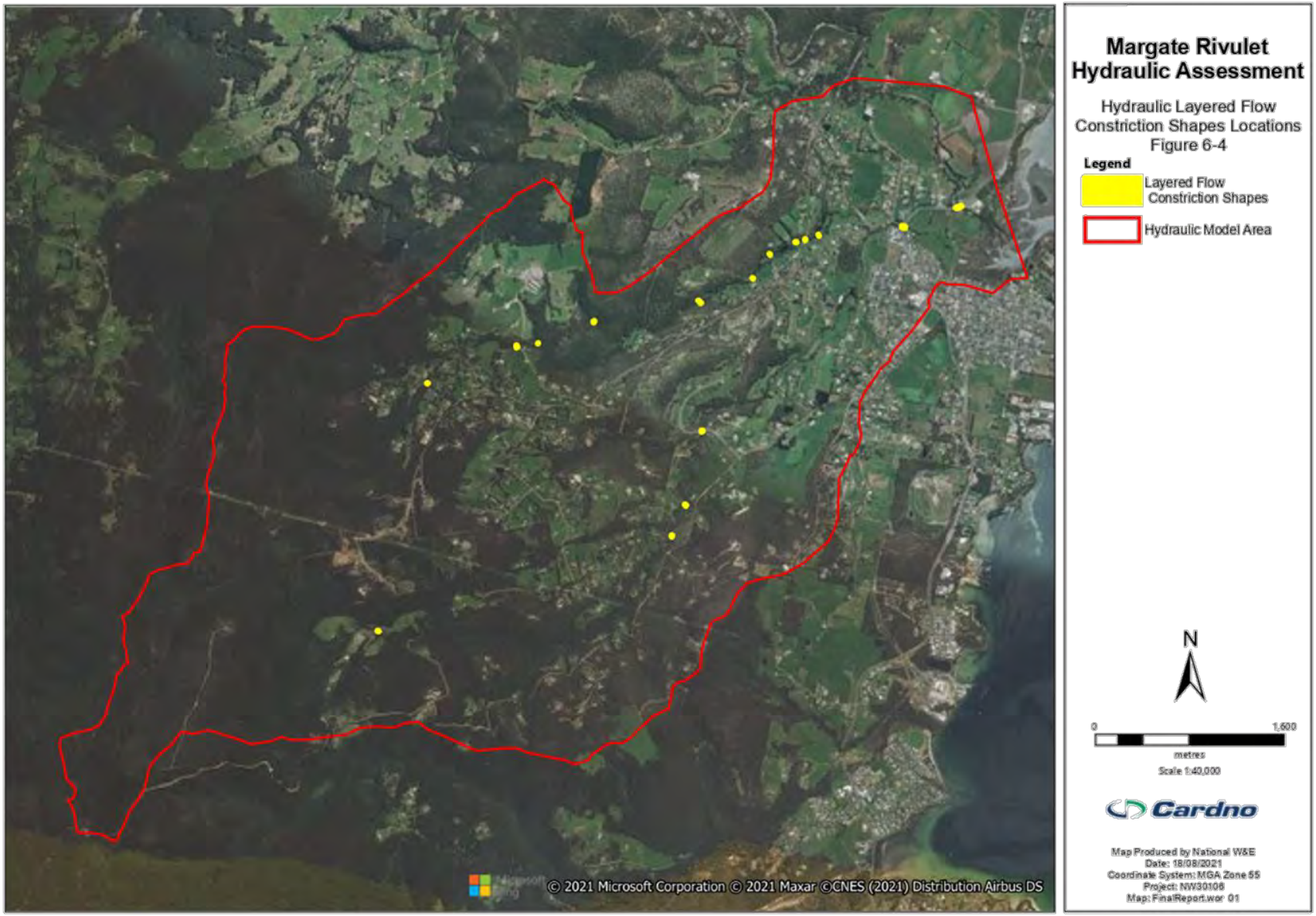

Margate Rivulet
Hydraulic Assessment
Hydraulic Manning's 'n'
Roughness
Figure 6-2
Legend
Hydraulic Model Area
Roughness
1 (Combined - Residential High Density Urban)
2 (Combined - Residential Lower Density Rural)
5 (Building)
6 (Industrial/Cemetery)
7 (Commercial)
8 (Minimal Grassed Vegetation)
9 (Moderate Shrubbed Vegetation)
10 (Thick Treed Vegetation)
11 (Minimal Vegetation Waterway)
12 (Moderate Vegetation Waterway)
13 (Heavy Vegetation Waterway)
15 (Paved Roads/Driveways)
16 (Lakes - No Emergent Vegetation)
17 (Wetlands - Emergent Vegetation)
18 (Estuaries or Oceans)
21 (Gravelled Surface/Rural Road)
22 (Artificial Turf/Handstand Surface)
24 (Agriculture or Farmland)
25 (Carparks)
27 (Education)
28 (Agriculture / Farmland with Buildings Combined)
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 18/08/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: FinalReport.wor 01


Margate Rivulet
Hydraulic Assessment
Hydraulic Layered Flow
Constriction Shapes Locations
Figure 6-4
Legend
Layered Flow
Constriction Shapes
Hydraulic Model Area
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 18/08/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: FinalReport.wor 01
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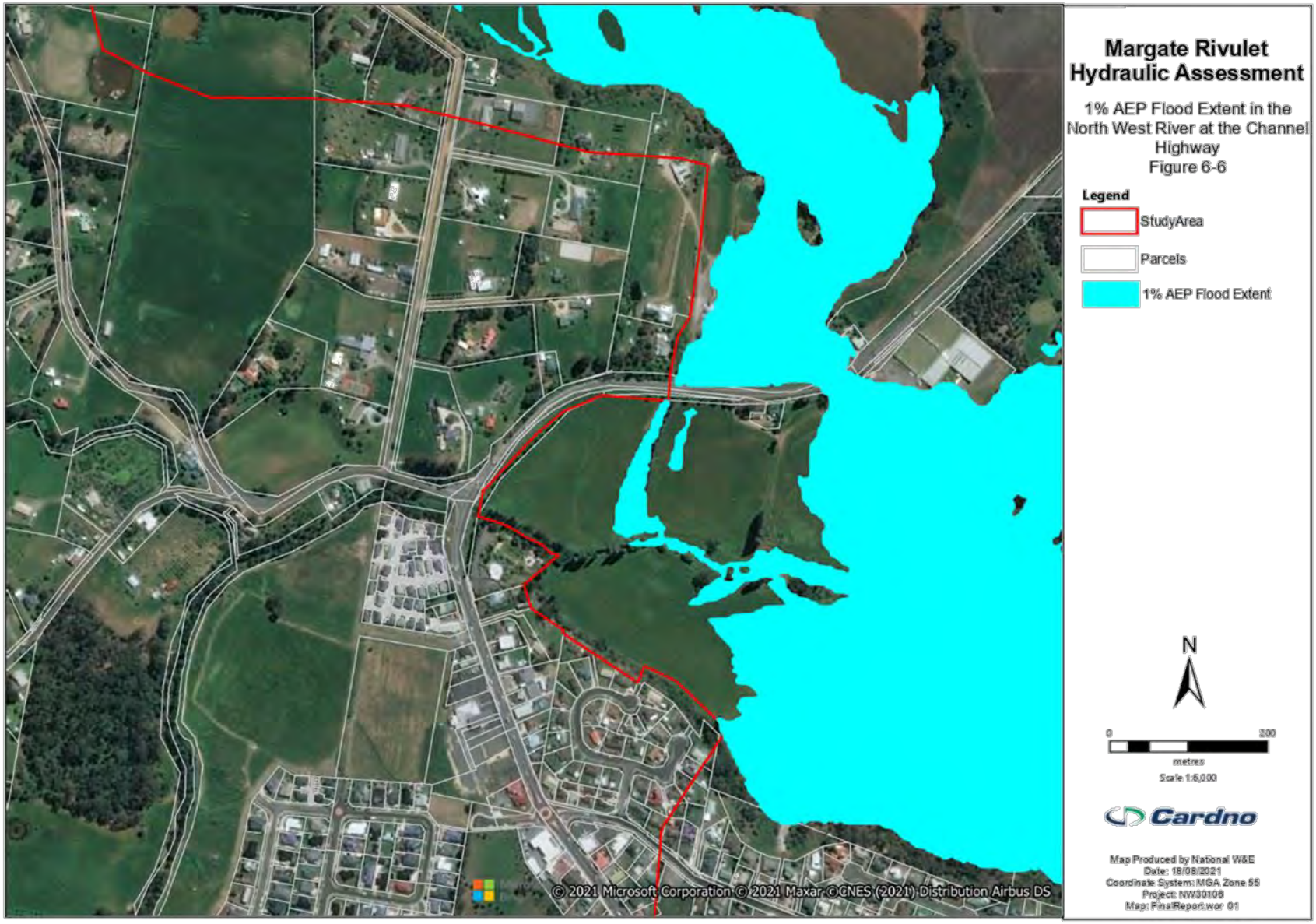
Margate Rivulet
Hydraulic Assessment
1% AEP Flood Extent in the North West River at the Channel Highway
Figure 6-6
Legend
StudyArea
Parcels
1% AEP Flood Extent
N
0
200
metres
Scale 1:6,000
Cardno
Map Produced by National W&E
Date: 18/08/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: FinalReport.wor 01
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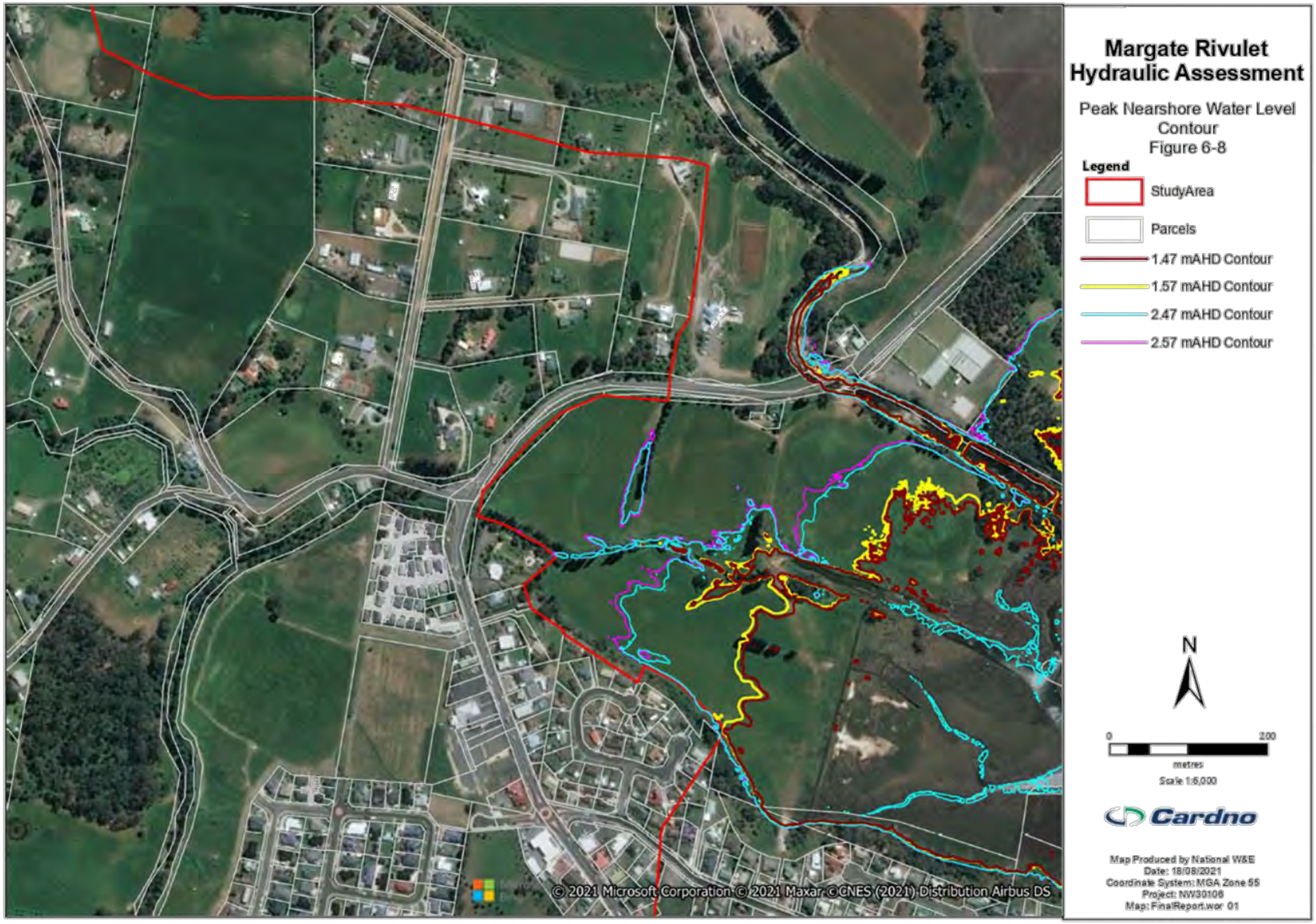
Margate Rivulet
Hydraulic Assessment
Peak Nearshore Water Level
Contour
Figure 6-8
Legend
StudyArea
Parcels
1.47 mAHD Contour
1.57 mAHD Contour
2.47 mAHD Contour
2.57 mAHD Contour
N
0
200
metres
Scale 1:6,000
Cardno
Map Produced by National W&E
Date: 18/08/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: FinalReport.wor 01
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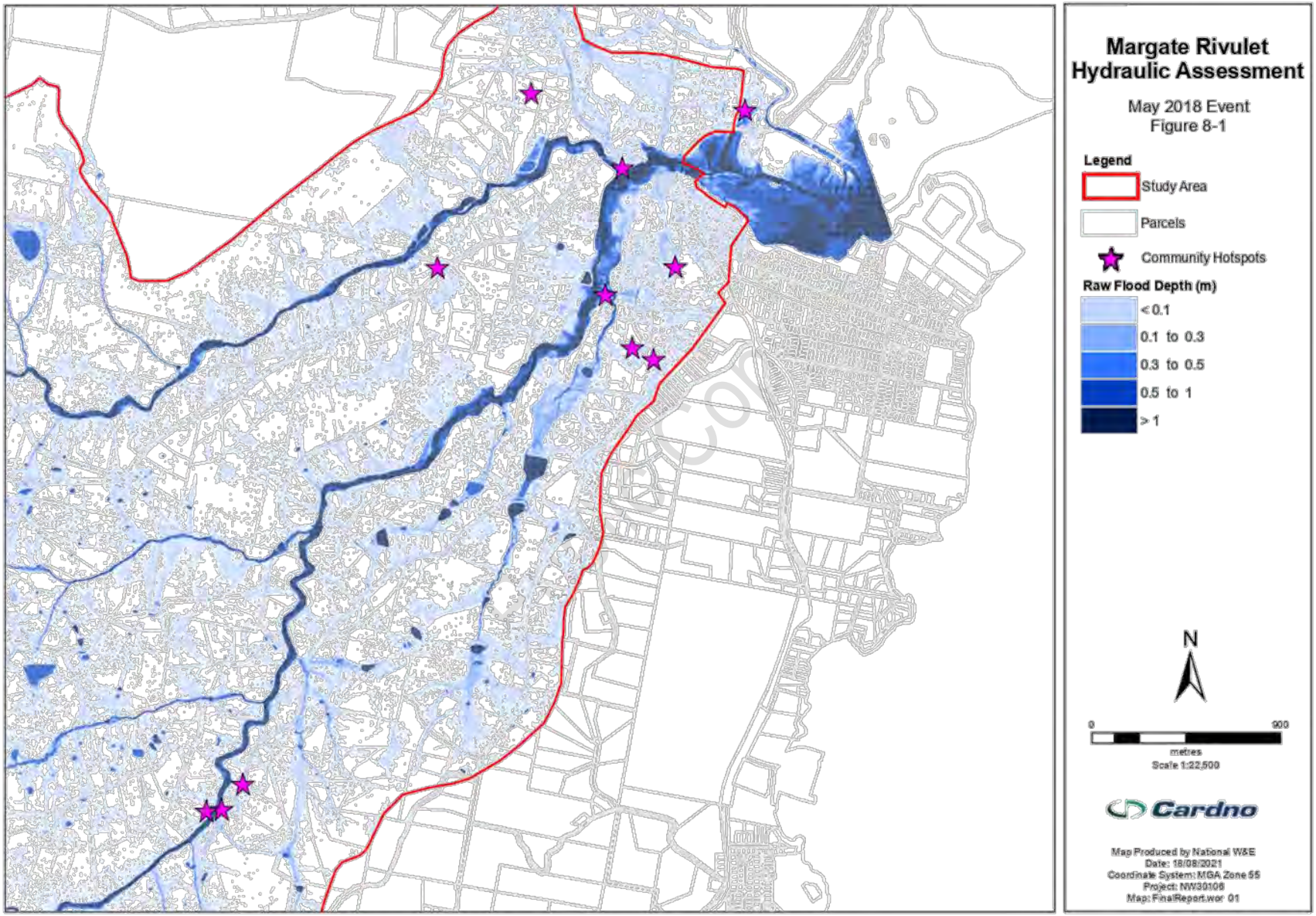
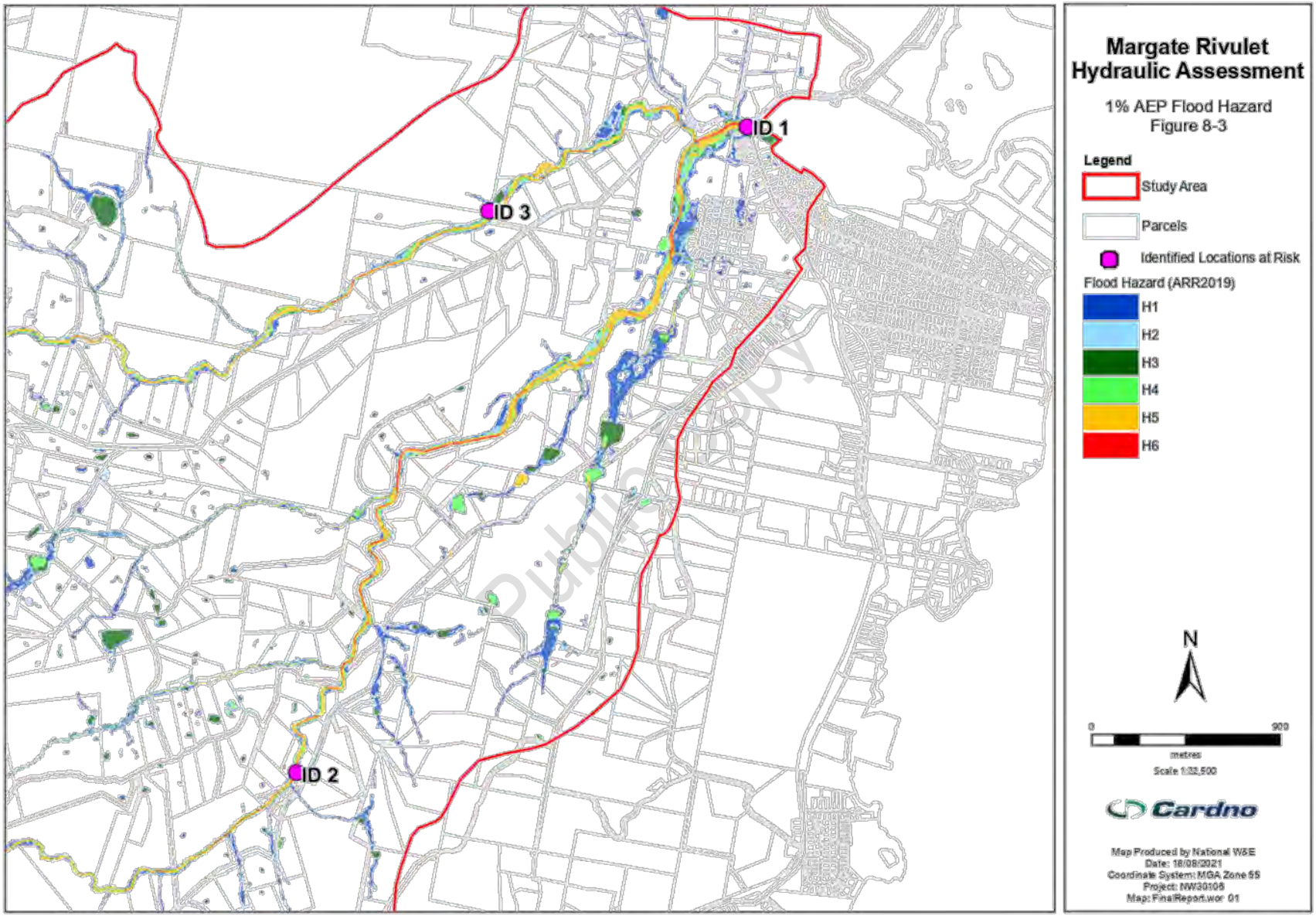

Margate Rivulet
Hydraulic Assessment
May 2018 Event
Figure 8-1
Legend
Study Area
Parcels
Community Hotspots
Raw Flood Depth (m)
< 0.1
0.1 to 0.3
0.3 to 0.5
0.5 to 1
> 1
N
0
900
metres
Scale 1:22,500
Cardno
Map Produced by National W&E
Date: 18/08/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: FinalReport.wor 01


ID 1
ID 3
ID 2
Margate Rivulet
Hydraulic Assessment
1% AEP Flood Hazard
Figure 8-3
Legend
Study Area
Parcels
Identified Locations at Risk
Flood Hazard (ARR2019)
H1
H2
H3
H4
H5
H6
N
0
900
metres
Scale 1:32,500
Cardno
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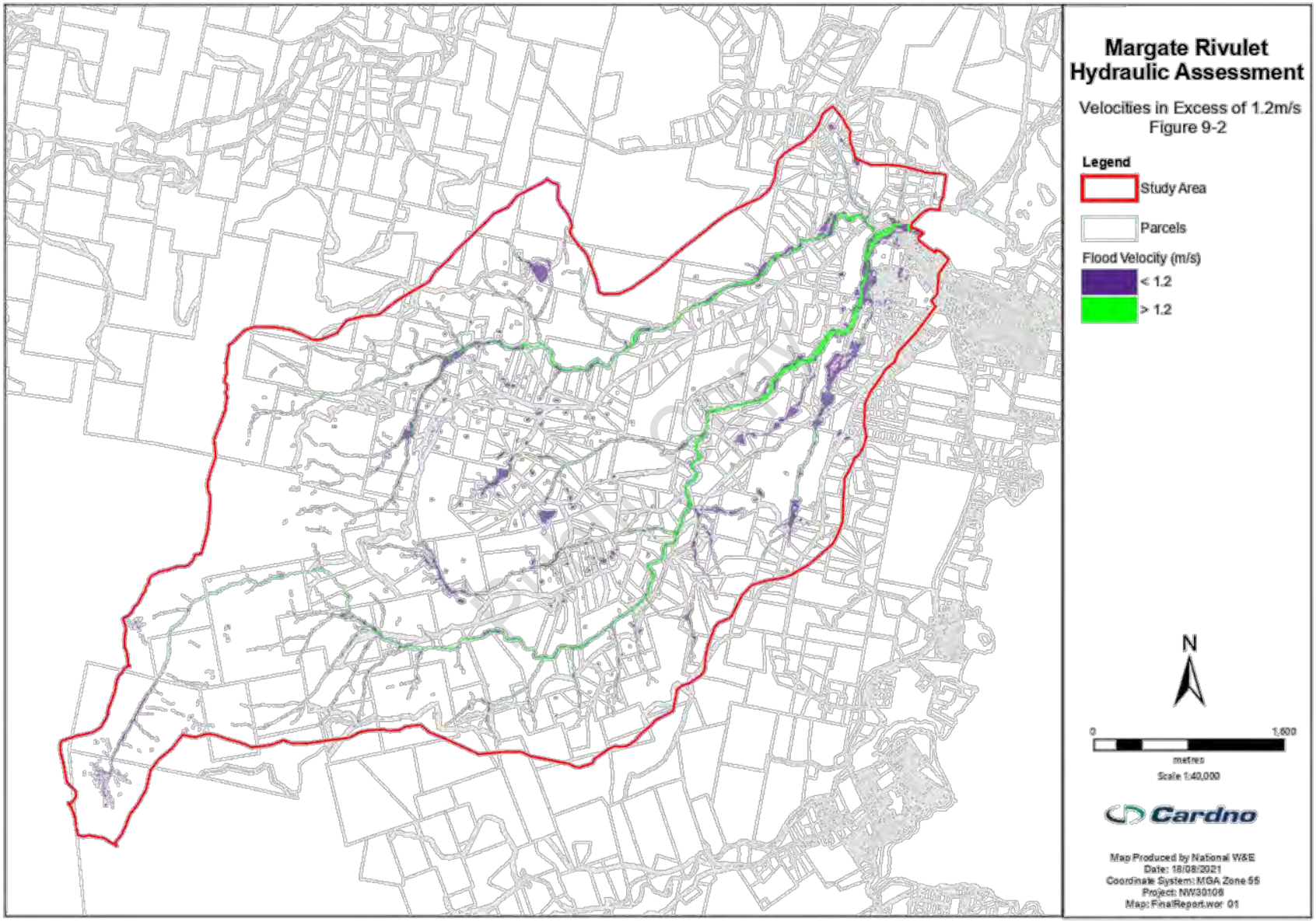
Coordinate System: MGA Zone 55
Project: NW30106
Map: FinalReport.wor 01


Margate Rivulet
Hydraulic Assessment
Velocities in Excess of 1.2m/s
Figure 9-2
Legend
Study Area
Parcels
Flood Velocity (m/s)
< 1.2
> 1.2
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
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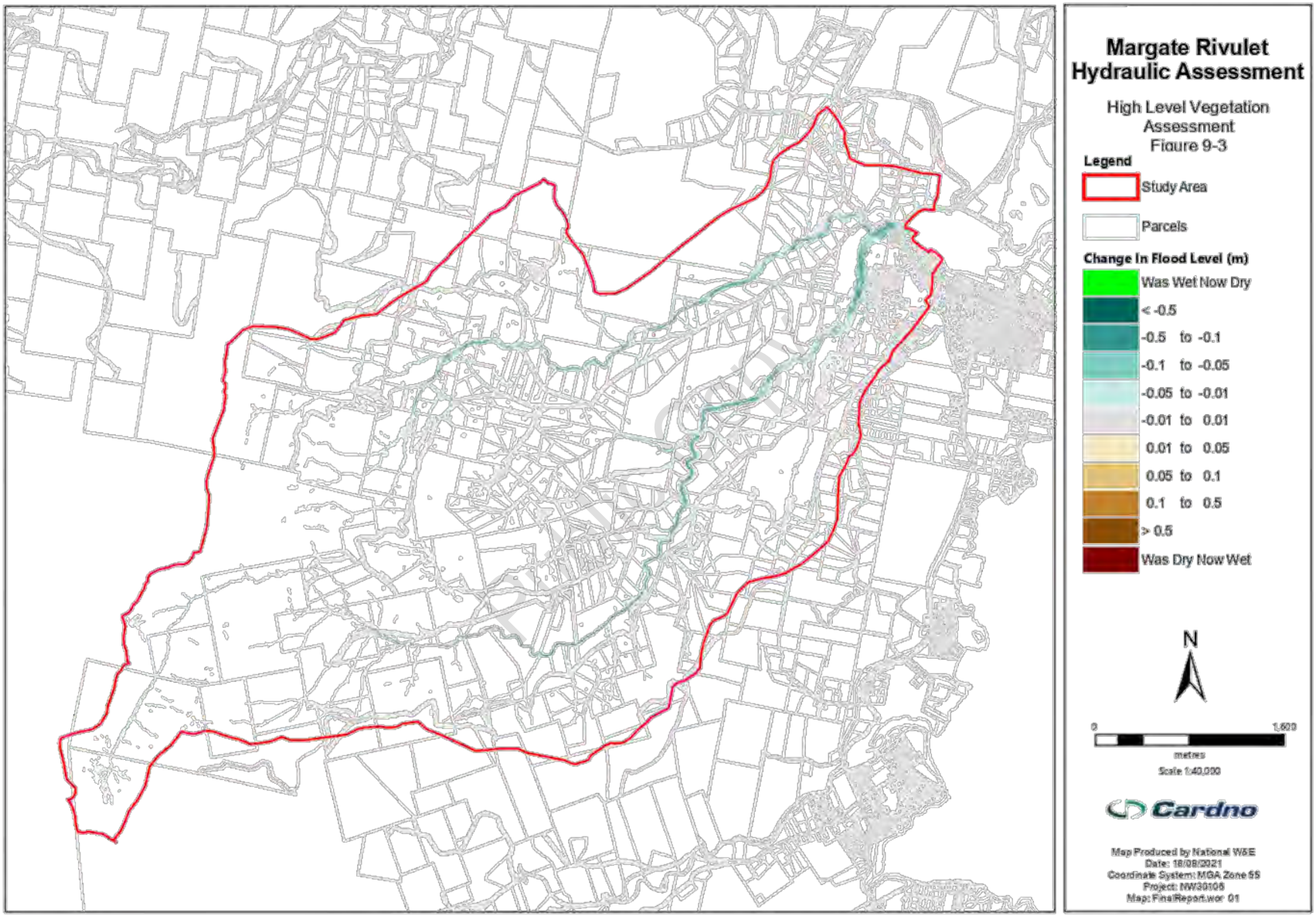
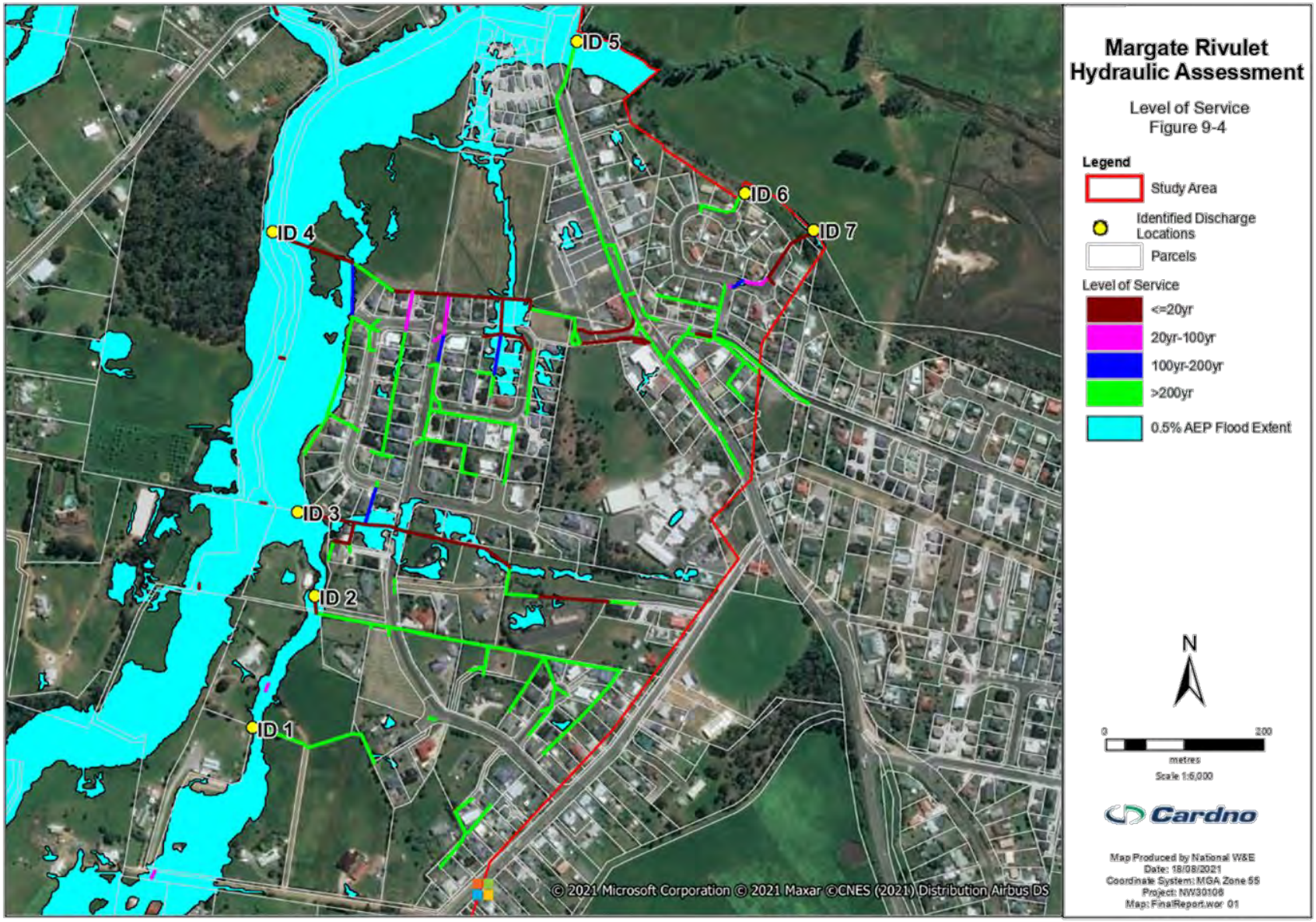

Margate Rivulet
Hydraulic Assessment
High Level Vegetation
Assessment
Figure 9-3
Legend
Study Area
Parcels
Change In Flood Level (m)
Was Wet Now Dry
< -0.5
-0.5 to -0.1
-0.1 to -0.05
-0.05 to -0.01
-0.01 to 0.01
0.01 to 0.05
0.05 to 0.1
0.1 to 0.5
> 0.5
Was Dry Now Wet
N
0
1,600
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 18/08/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: FinalReport.wor 01


ID 5
ID 6
ID 7
ID 4
ID 3
ID 2
ID 1
© 2021 Microsoft Corporation © 2021 Maxar ©CNES (2021) Distribution Airbus DS
Margate Rivulet
Hydraulic Assessment
Level of Service
Figure 9-4
Legend
Study Area
Identified Discharge Locations
Parcels
Level of Service
<=20yr
20yr-100yr
100yr-200yr
>200yr
0.5% AEP Flood Extent
N
0
200
metres
Scale 1:6,000
Cardno
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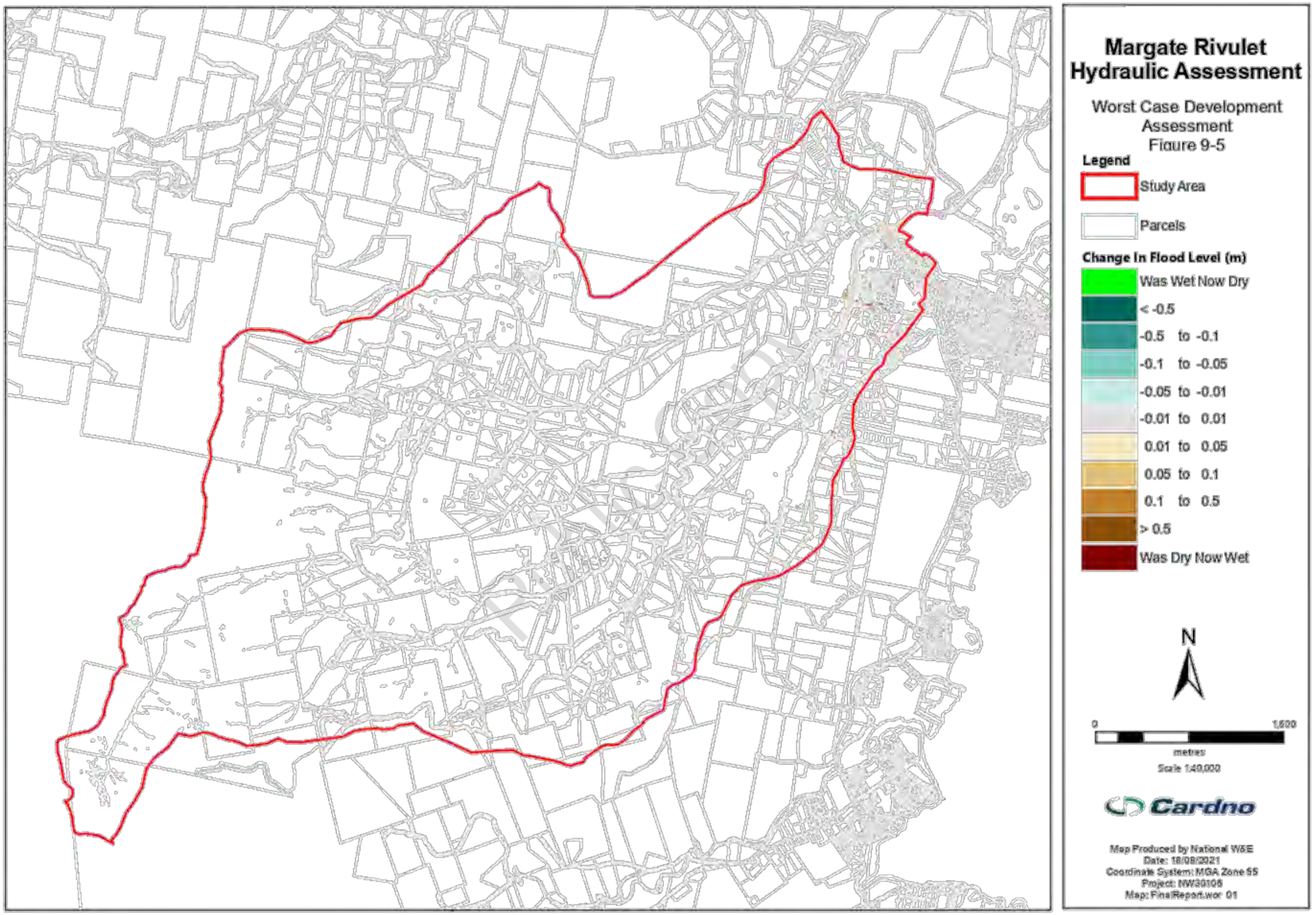
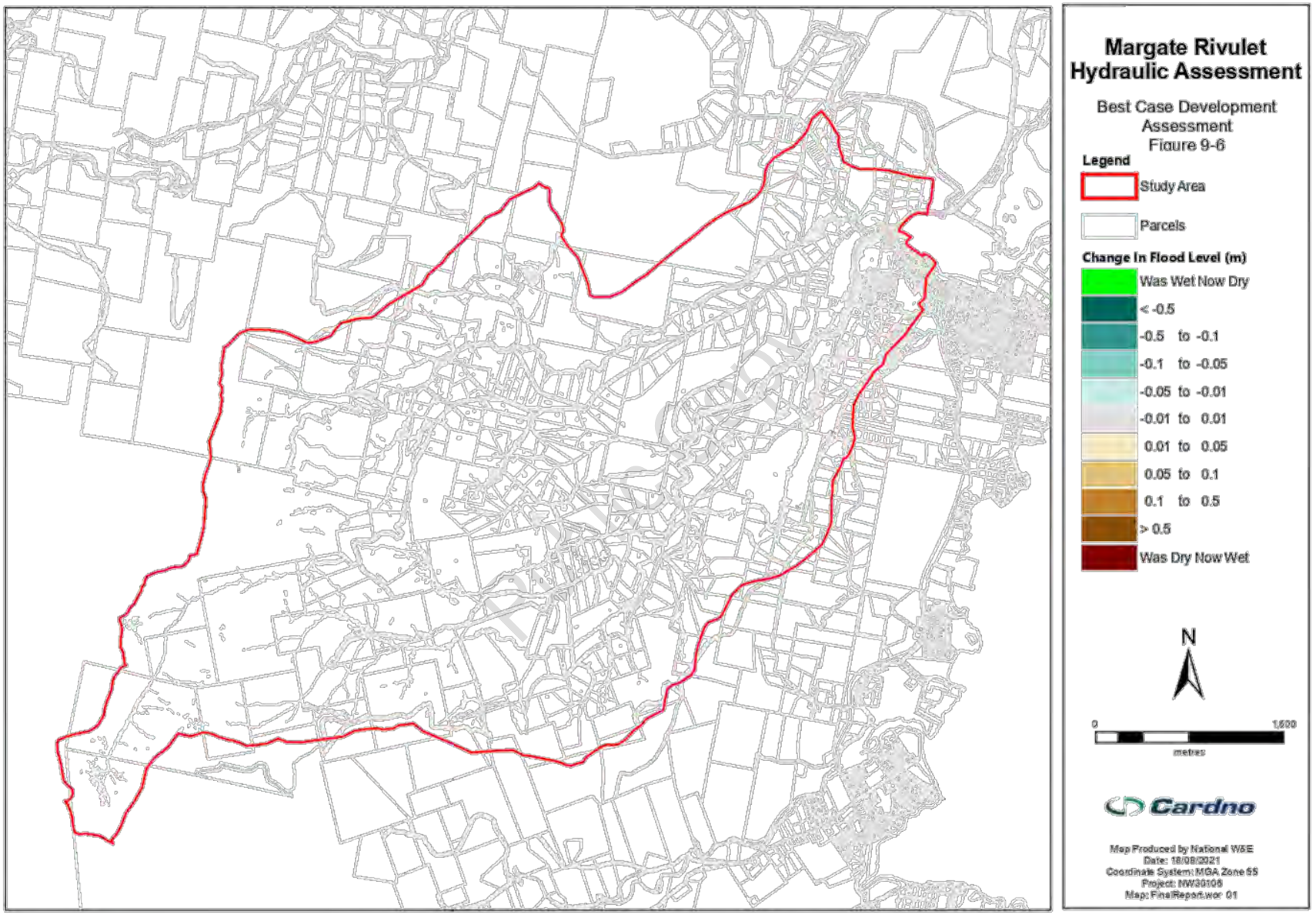
Date: 18/08/2021
Coordinate System: MGA Zone 55
Project: NW30108
Map: FinalReport.wor 01


Margate Rivulet
Hydraulic Assessment
Worst Case Development
Assessment
Figure 9-5
Legend
Study Area
Parcels
Change In Flood Level (m)
Was Wet Now Dry
< -0.5
-0.5 to -0.1
-0.1 to -0.05
-0.05 to -0.01
-0.01 to 0.01
0.01 to 0.05
0.05 to 0.1
0.1 to 0.5
> 0.5
Was Dry Now Wet
N
0
1,500
metres
Scale 1:40,000
Cardno
Map Produced by National W&E
Date: 18/08/2021
Coordinate System: MGA Zone 55
Project: NW30106
Map: FinalReport.wor 01


Margate Rivulet
Hydraulic Assessment
Best Case Development
Assessment
Figure 9-6
Legend
Study Area
Parcels
Change In Flood Level (m)
Was Wet Now Dry
< -0.5
-0.5 to -0.1
-0.1 to -0.05
-0.05 to -0.01
-0.01 to 0.01
0.01 to 0.05
0.05 to 0.1
0.1 to 0.5
> 0.5
Was Dry Now Wet
N
0
1,500
metres
Cardno
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Map: FinalReport.wor 01

17.2 ANNUAL PLAN 2021/2022

File Number: **25.3, 25.19**

Author: **Gary Arnold, General Manager**

Strategic Plan Reference

Key Priority Area:	1	Encourage and support a safe, healthy and connected community.
Strategic Outcome:	1.1	A Council that engages with and enables its community.

1. PURPOSE

1.1 The purpose of this report is to present Council with the Annual Plan 2021/2022.

2. BACKGROUND

2.1 At the Special Council meeting on 15 June 2021, Council adopted the Estimates of Revenue and Expenditure for the 2021-2022 financial year. The approved Annual Estimates has been incorporated within the Annual Plan 2021-2022.

2.2 The proposed actions for 2021-2022 are held within the Strategic Plan 2020-2025.

3. STATUTORY REQUIREMENTS

3.1 Section 66 of the *Local Government Act 1993* requires that Council prepare and maintain a Strategic Plan.

3.2 Section 71 of the *Local Government Act* 1993 requires that Council adopt an Annual Plan. The Annual Plan is to be:

(a) Consistent with the strategic plan;

(b) Include a statement of the manner in which the council is to meet the goals and objectives of the strategic plan;

(c) Include a summary of the estimates adopted under section 82; and

(d) Include a summary of the major strategies to be used in relation to the Council's public health goals and objectives.

4. DISCUSSION

4.1 The Annual Plan 2021-2022 highlights a summary of activities developed in line with the Strategic Plan adopted by Council on 9 September 2019 (Minute C609/18-19 refers).

4.2 The activities highlighted in the Annual Plan are not an exhaustive list of Council's programs for the coming year. They provide a snapshot of activities that are to be implemented for each strategic priority.

4.3 The Annual Plan has been redesigned to reflect Council's request for strategies and actions to be clear and achievable. It is a more concise and accessible document than has been drafted previously.

5. FINANCE

5.1 The Annual Plan incorporates the Estimates of Revenue and Expenditure for the 2021-2022 financial year, as approved by Council on 15 June 2021 (minute C296/11-2021 refers).

6. ENVIRONMENT

6.1 There are no environmental matters associated with this report.

7. COMMUNICATION AND CONSULTATION

7.1 The Annual Plan will be placed on Council's website and printed copies made for any person who requires a copy.

8. RISK

8.1 Following the adoption of the Estimates, there is no risk in adopting the Annual Plan.

9. CONCLUSION

9.1 The Annual Plan, including the summary of Strategic Actions and Estimates, describes Council's main activities for the 2020-2021 financial year.

10. RECOMMENDATION

That in accordance with Section 71 of the *Local Government Act 1993*, Council adopts the Annual Plan for the 2021-2022 financial year and instructs the General Manager to:

a) Make a copy of the Annual Plan available for public inspection at the Civic Centre and on Council's website; and

b) Provide a copy of the Annual Plan to the Director of Local Government and to the Director of Public Health.

ATTACHMENTS

1. Draft Annual Plan 2021/22

Kingborough

Annual Plan 2021/22

Published by :

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Kingston Tas 7050

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Acknowledgement to Traditional Custodians

We acknowledge the Traditional Custodians who have walked upon and cared for this land for thousands of years.

We pay our respects to the elders, past and present, and acknowledge today's Tasmanian Aboriginal people who follow in their ancestors' footsteps.

Image: Allan Mansell - Black Ant Art

CONTENTS

MAYOR'S MESSAGE

With ongoing uncertainty throughout the world due to COVID-19, now, more than ever, it is crucial that Kingborough Council continues to operate responsibly and through well-considered plans to provide the greatest benefit to the whole community.

While the pandemic posed many challenges, we are fortunate that, as a Council, we were able to come through last year in a financial position that was better than anticipated. Thankfully, this, in turn, enables us to continue to support our community and deliver programs and services.

In late 2019 when we adopted Council's new five year Strategic Plan, we didn't anticipate a pandemic would be on the horizon. It showed me that the Council's vision of "our community is at the heart of everything we do" is even more important than ever. The Annual Plan ensures we remain focused on achieving this vision.

Importantly, the Annual Plan enables our community to see how we will work together to achieve the outcomes identified in our Strategic Plan over the next twelve months. It's also a way for the community to hold us to account for our work as Councillors, ensuring that the decisions we make are made thoughtfully and in a well-considered framework with a central vision.

Kingborough Council is fortunate to have a group of staff who care deeply about our community. While the pandemic provided changes in some work arrangements, I am grateful for the way that our staff overcame these obstacles to continue to provide excellent service to our residents.

After the doom of last year, it was exciting to see the opening of the Kingston Park playground in April. It has fast become a popular place, not just with locals but also with people from all around Tasmania. We are exceptionally proud of this great facility and the fact that it's now been touted as one of the best, if not the best, playground in the State.

This year's focus will be starting Stage 2 of this project with a large public open space area for kicking the ball or walking a dog and a small amphitheatre. In addition, there will be exercise equipment, more BBQs and toilet facilities, areas for bike riding and much more.

This year's capital works program has budgeted to deliver over $20million in infrastructure projects - our highest ever spend. In addition to the above project, we will begin the redevelopment of the Channel Highway in the centre of Kingston. The Transform Kingston project will bring new life into the central Kingston CBD, and I can't wait to see this area revitalised. We all know it's been long overdue.

My vision as your newly elected Mayor is that we work towards more connected communities, both in terms of the physical linkages through pathways, roads, and open spaces. Still, importantly, we foster and encourage partnerships and bring communities together. There were some terrific examples of community associations that worked tirelessly during the pandemic to ensure that vulnerable people were looked after. I would like to thank them all for the work they have done in bringing communities together. We can continue to keep Kingborough moving and make it a wonderful place to live by all working together.

Cr Paula Wriedt
MAYOR

ELECTED MEMBERS

Mayor
Councillor Paula Wriedt

Deputy Mayor
Councillor Jo Westwood

Councillor Sue Bastone

Councillor Gideon Cordover

Councillor Flora Fox

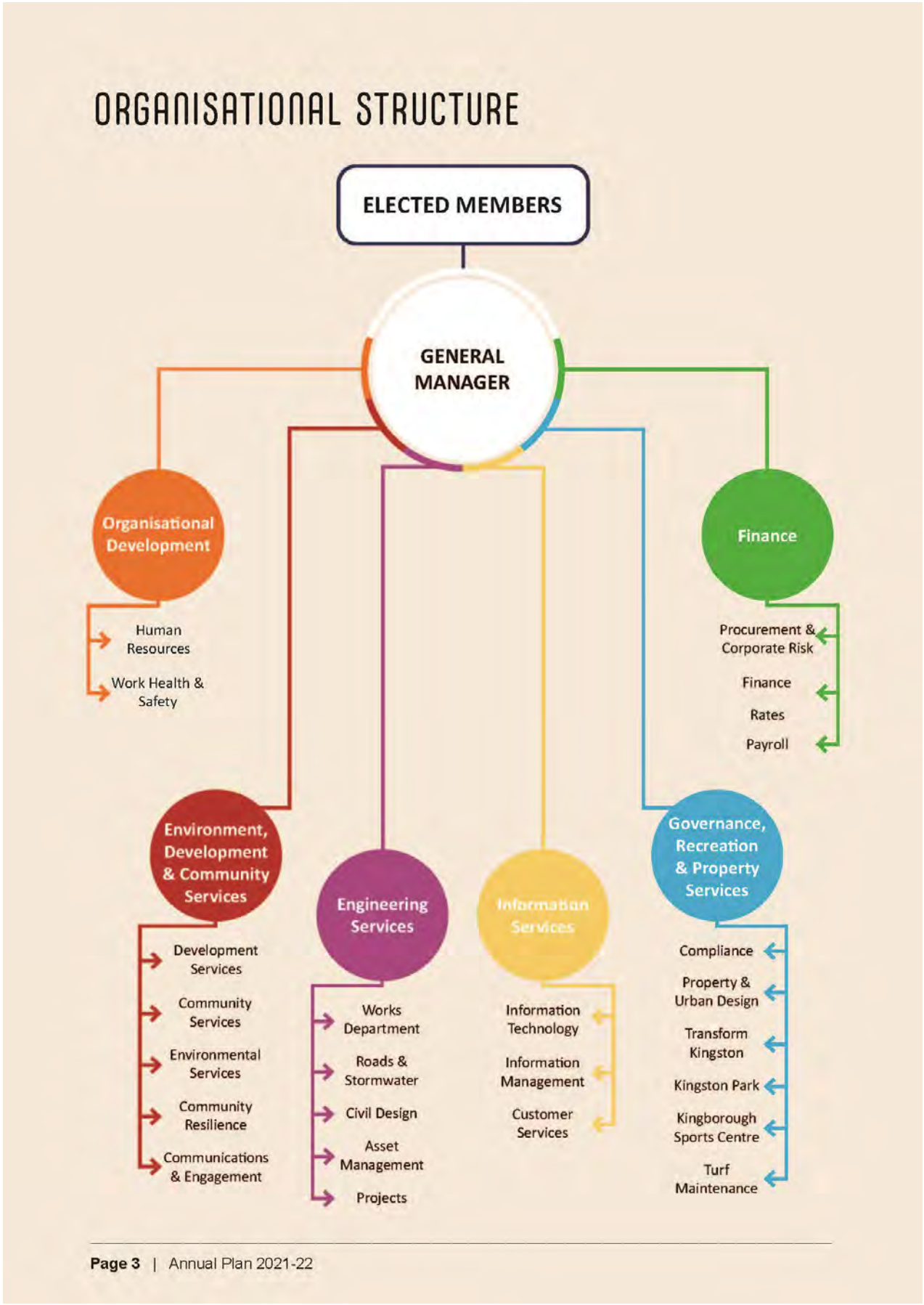
Councillor Clare Glade-Wright

Councillor David Grace

Councillor Amanda Midgley

Councillor Christian Street

Councillor Steve Wass


ORGANISATIONAL STRUCTURE
ELECTED MEMBERS
GENERAL MANAGER
Organisational Development
Human Resources
Work Health & Safety
Finance
Procurement & Corporate Risk
Finance
Rates
Payroll
Environment, Development & Community Services
Development Services
Community Services
Environmental Services
Community Resilience
Communications & Engagement
Engineering Services
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Roads & Stormwater
Civil Design
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Projects
Information Services
Information Technology
Information Management
Customer Services
Governance, Recreation & Property Services
Compliance
Property & Urban Design
Transform Kingston
Kingston Park
Kingborough Sports Centre
Turf Maintenance
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INTRODUCTION

The Annual Plan outlines how we will monitor our progress and report on actions for the year ahead. Read in conjunction with the Strategic Delivery Plan 2020 - 2025, it guides the planning, development and allocation of resources and provision of services to the Kingborough community. Under Section 71 of the *Local Government Act 1993* all Councils must prepare an Annual Plan.

Budget Estimates

The budget estimates link to the achievement of the Strategic Plan within an overall planning framework.

This framework guides Council in identifying community needs and aspirations over the long term (Our Vision), medium term (Strategic Plan) and short term (Annual Plan and Budget Estimates) and then holding itself accountable through the Audited Financial Statements and Annual Report.

Strategic Framework

The Strategic Plan summarises the financial and non-financial objectives and strategies. The budget estimates are framed taking into consideration the Strategic Plan and the activities and initiatives included in the Strategic Delivery Plan 2020 - 2025.

The budget estimates on page 18 provide detail on how Council will fund its services and projects. Performance indicators are provided as a means of measuring whether Council achieves the tasks it has set itself. Council's success in meeting these outcomes is provided in the Annual Report which is produced later in the calendar year.

STRATEGIC PLAN 2020 - 2025

The Strategic Plan 2020 - 2025 is based on three key priorities. Each priority is supported by five strategic outcomes that describe what Council aims to achieve, and that are consistent with its vision. Actions to achieve these outcomes have been developed and included in a Service Delivery Plan.

1 Encourage & support a safe, healthy and connected community

Strategic Outcome 1.1

A Council that engages with and enables its community

Appoint an Engagement Officer:

- Support community engagement activities and act as a liaison for community groups.

Waste Management Community Education and Awareness Plan:

- Develop and implement a Waste Avoidance and Reduction Plan with an emphasis on community engagement and education.
- Deliver a school education program supporting waste reduction.

Land Use Planning System (LUPAA)

- Build community awareness in collaboration with LGAT, the Planning Policy Unit and other councils.

Playground and Reserve Engagements Programs

- Engage with community members through stakeholder meetings and community surveys around playgrounds/parks at Silverwater Park, Willowbend, Alamo Close and Springfarm Estate.
- Consult on the public toilets and public grounds at Longley Reserve.

Strategic Outcome 1.2

An inclusive community that has a strong sense of pride and local identity

Hub Activation Program

- Locate Community Service staff in the Community Hub to improve facilitation of events, integration with Kingston Park and day-to-day facility management.

Community Events

- Continue to deliver a variety of events (subject to public health/COVID 19 advice) to support our business, visitor and residential community in areas such as health, art, natural areas and biodiversity and waste management. Events such as Youth Art Showcase, Intergenerational Morning Tea and National Tree Day.

Strategic Outcome 1.3

A resilient community with the capacity to flourish

Emergency Management

- Continue to build strong working relationships within State and Local Government to ensure a robust emergency management capacity exits within the municipality.
- Deliver a Kingston Beach Flood Response Plan to establish warning response procedures

Supporting community and education programs (TFS) (SES)

- Continue to work with TFS Bushfire Ready Neighbours Margate.
- Continue to support Bushfire Awareness Sessions.

All-Hazard Community Preparation Program

- Maintain work with community organisations and other groups to prepare for emergency events.

COVID-19 Community and Workplace Initiatives

- Continue to support the Department of Health's (DoH) COVID-19 Vaccination Rollout.
- Maintain regular liaison with DoH, through Environmental Health Officers, to better communicate with community.
- Provide support to staff and Council with up-to-date information and procedures.

Strategic Outcome 1.4

A Council that acknowledges the existence of a climate change and biodiversity emergency and has in place strategies to respond

Climate Change Policy and Plan

- Develop a new Climate Change Policy.
- Undertake a status review of the Kingborough Council Climate Change Plan.

Waste Minimisation Programs

- Rollout the Food Organics and Garden Organics (FOGO) waste collection scheme to municipality.

Emissions and Greenhouse Gas Reduction Initiatives

- Undertake the installation of solar panels and a battery storage system at the Kingborough Sports Centre.
- Facilitate the installation of an electric vehicle rapid charge facility in Kingston.
- Introduce a full electric vehicle into Council's light fleet.

Coastal Hazards Program

- Evaluate the potential risks of climate change impacts and mechanisms to assist in long-term adaptation planning, using the Snug community as a case study.
- Develop and consider a Coastal Hazards Strategy.

Land Use Planning

- Ensure the relevant planning controls are applied through the implementation of the incoming Tasmanian Planning Scheme.
- Include the provision of additional Specific Area Plans.

Stormwater Strategy

- Using flood maps and studies to identify a broad range issues and actions.
- Develop guidelines for water sensitive urban design development and management.

Strategic Outcome 1.5

An active and healthy community, with vibrant, clean local areas that provide social, recreational and economic opportunities

Recreational Water Quality

- Review the Recreational Water Quality Management Strategy, sampling framework and overall program.

Kingston Park and CBD

- Implement a designated team to manage the cleaning of park and central business area in Kingston.

Parks and Playgrounds

- Continue to manage the maintenance and cleanliness of public spaces.

2 Deliver Quality Infrastructure & Services

Strategic Outcome 2.1

Service provision meets the current and future requirements of residents and visitors

Transforming Kingston

- Continue to implement the Kingston CBD and Kingston Park plans throughout the year.
- Commence the second stage of the public open space development in Kingston Park and complete Goshawk Way.

Development Services

- Continue to provide high quality, accurate and timely advice in relation to planning and building requirements.

Community Services - Outside Urban Kingborough

- Working in partnership with others, advocate for a range of community health and wellbeing services and events across the municipality.

Strategic Outcome 2.2

Infrastructure development and service delivery are underpinned by strategic planning to cater for the needs of a growing population

Delivering Capital Works and Asset Management

- Continue to deliver the capital works program across the municipality.
- Undertake condition assessments of footpaths.
- Review the Footpath Asset Management Plan.
- Conduct a review into the Long Term Asset Management Plan.

Greater Hobart Collaboration

- Work collaboratively with other stakeholders as part of the Hobart City Deal and Greater Hobart Act, ensuring both regional cohesion and strong representation of Kingborough's needs.

Infrastructure advocacy

- Advocate for the appropriate level of hard and soft infrastructure provision by State Government in recognition of the growth in Kingborough.

Economic Profile of Kingborough

- Collect and analyse data to develop an evidence base economic profile of Kingborough which will support strategic growth, land use planning and economic development activities.

Strategic Outcome 2.3

Community facilities are safe, accessible and meet contemporary standards

Public Facilities

- Develop new public toilet facilities in Kettering and at the Margate Hall.
- Deliver and plan for accessible toilets around the municipality.

Dru Point Playground

- Upgrade the playground to meet contemporary standards which include accessible equipment.

Kingborough Playground Strategy

- Implement an upgrade to security cameras to support public safety.

Kingston Park Stage 2

- Continue to develop the public space and improve the connecting links to the Kingborough Community Hub, Park and CBD.

Community Hall Strategy

- Continue the ongoing maintenance and upgrade of Council's community halls.
- Promote active hall management involvement with local community.

Turf Maintenance

- Continue to provide a range of sports grounds throughout the Municipal Area to meet community needs.

Strategic Outcome 2.4

The organisation has a corporate culture that delivers quality customer service, encourages innovation and has high standards of accountability

Development Services

- Undertake a customer service survey of development applicants to support continuous improvement in our service standards.

Complaints Management Framework

- Implement a complaints management framework to ensure that a consistent, fair and transparent approach is taken in the management of complaints.

Customer Service Strategy

- Finalise a customer service strategy which focuses on continuous improvement in service delivery across a range of channels.

Strategic Outcome 2.5

Council is a desirable place to work, attracting committed and engaged staff through progressive human resource practices and a positive work environment

Staff Initiatives

- Finalise negotiations for the Kingborough Council Enterprise Agreement and commence negotiations for the Kingborough Sports Centre Enterprise Agreement.
- Develop and implement the 2022 Workforce Plan which sets the priorities for workforce strategies, learning and development programs and resourcing capacity.
- Undertake the employee engagement survey.
- Review Council's Work Health and Safety Management Plan and System and deliver the identified WHS strategies to meet Council's obligations under the *Work Health and Safety Act 2012* (Tas).
- Deliver employee health and well-being initiatives with a key focus around personal and psychological wellbeing.

3 Sustaining the Natural Environment Whilst Facilitating Development for our Future

Strategic Outcome 3.1

A Council that values and prioritises its natural environment, whilst encouraging investment and economic growth

Kingborough Environmental Fund

- Review and update the Kingborough Environmental Fund Implementation Plan 2018-2022 to guide the expenditure of financial biodiversity offsets.
- Finalise seven new private land reserves that will protect the environmental values targeted by the fund and support these landowners to complete restoration work and monitoring within the new reserves.
- Deliver restoration projects in threatened vegetation communities (including Black Peppermint forest on sandstone) and to restore habitat for threatened species.

Natural Area Reserve Network

- Continue to protect, manage and monitor the network of bushland, riparian and coastal reserves under Council's care.
- Develop new reserve management plans for the Allum Cliffs and Denison reserves.
- Grow 10 000 native plants in Council's nursery for local restoration projects.

Water Quality and Stormwater Impacts

- Deliver Creek Maintenance Plans for Coffee Creek, Whitewater Creek and Mary Knoll Rivulet.
- Improve management of rainwater gardens, bioretention basins and swales through internal training and community engagement.
- Continue to protect creeks on Council land through the replacement of native vegetation on banks, weed control and management of water quality impacts.

Strategic Outcome 3.2

A community that has a well developed sense of natural and cultural heritage

Bruny Island Community Ranger

- Support a pilot initiative for an Aboriginal trainee to assist as a community ranger on Bruny Island, working to support the Bruny Island Cat Management program as well as participating in cultural opportunities.

Natural Areas Interpretation Program

- Continue to deliver a range of events, information and opportunities to the community and schools encouraging the exploration of local reserves, the value of older trees, improving water quality and the role of habitat for wildlife in urban areas.

Landcare program

- Maintain support and guidance for local Landcare groups working to restore and monitor natural areas managed by council.
- Improve data collection and knowledge sharing between landcare groups and Council.

Strategic Outcome 3.3

Council is able to demonstrate strong environmental stewardship and leadership

Cat Management Program

- Provide education and assistance to the community to support responsible cat management.
- Actively manage the impacts of cats on specific natural areas adjacent to residential areas.

Reducing Waste to Landfill

- Rollout the new FOGO service with education campaigns for schools and community on waste reduction/re-use and minimisation.
- In partnership with Aspire, provide tools for businesses to find opportunities for re-use of their waste by others, through a waste portal.

Weed Management

- Implement the Kingborough Weed Management Strategy including the delivery of the Ragwort biocontrol project, Weed Alert app and projects to eradicate newly emerging weeds.

Environmental Impact Assessments

- Continue to develop and implement environmental impact assessment practices and standards to minimise risk of environmental harm.

Strategic Outcome 3.4

Best practice land use planning systems are in place to manage the current and future impacts of development

Deliver the Local Provision Schedule for Kingborough

- Collaboratively work with the Tasmanian Planning Commission to ensure the Kingborough Local Provision Schedule is finalised and implemented for the community.

Kingston CBD Masterplan

- Work towards finalising the Kingston CBD Masterplan.
- Providing a blueprint for the future of Kingston to guide Council's planning and investment decisions into the future.

Significant Tree Register

- Continue to ensure trees in Kingborough have appropriate protections and work through the planning process involved in managing the register.

Strategic Outcome 3.5

Management of environmental assets is based on professional advice and strategic planning

Bushfire Risk Reduction

- Progress implementation of the Bushfire Risk Reduction Strategy to reduce the risk from bushfire on Council land through fire breaks, trails and fuel reduction burns.
- Work with other agencies to improve the level of community bushfire preparedness and resilience.

Manage Environmental Assets

- Ensure appropriate consideration of environmental assets when assessing development applications and work on Council assets.
- Ensure that the Local Provision Schedule maximises the protection of Kingborough's environmental assets.

Biodiversity Monitoring Program

- Continue to develop and implement a framework which will guide biodiversity monitoring in bushland reserves.
- Identify and manage impacts to important wildlife areas including threatened species habitat and shorebird colonies.

PUBLIC HEALTH STATEMENT

The Environmental Health Team covers a wide range of public and environmental health aspects of the natural and built environment that may affect the health and well-being of the community. The Department is responsible for ensuring the statutory obligations under the *Public Health Act 1997*, the *Environmental Management and Pollution Control Act 1994*, the *Food Act 2003* and the *Local Government Act 1993* are met.

Public health is about the wellbeing of the community. It is about protecting and improving health through education, promotion and monitoring of hazards.

Our public health programs include immunisations, food safety, water quality monitoring (recreational waterways/public pools/spas), smoke-free areas, public health risk activities, safety of public buildings and the regulatory management of these issues.

Food Safety

Our EHOs routinely inspect registered food premises within the municipality and check to make sure that these businesses are operating in line with the requirements of the Food Act 2003 and the Food Safety Standards.

EHOs take the following into consideration when doing inspections:

- Cleanliness
- Safe food handling practices
- Appropriate temperature control of potentially hazardous food
- Food labelling
- Whether the premises and equipment are being maintained to an acceptable level

An online food safety training package is available for free via Council's website.

Immunisation

Council continues to coordinate and implement a range of immunisation programs, including school-based immunisations, infant clinics and after-hours catch up clinics. The school immunisation program is conducted over several visits throughout the school year.

Water Quality

Council monitors recreational water quality at a number of beach locations from Taroona to Middleton and Bruny Island, and also monitors water quality in public pools. Water quality monitoring at beach locations is generally conducted between December to March, as part of the Derwent Estuary Program.

BUDGET

The budget is compiled by Council officers commencing in January of each year. Draft consolidated estimates are then prepared and various iterations are considered by Councillors at workshops held from March to May. The draft estimates are also submitted to the public for consultation and feedback. Consideration is given to Kingborough's Long Term Financial Plan (LTFP) and long term financial sustainability. The LTFP enables Council to continue to deliver services, maintain assets and achieve its strategic objectives in a financially sustainable manner.

Proposed estimates are prepared in accordance with the *Local Government Act 1993* and are submitted to Council at a Special Budget meeting in June each year, for approval and adoption of rating resolutions.

The estimates must be adopted by an absolute majority. They must be adopted before 31 August each year, but not more than one month before the start of the financial year. The related Annual Plan and estimates must be provided to the Director of Local Government and the Director of Public Health.

Operating Statement
Year ended 30 June 2021

	Budget 2021/22 $'000	Forecast 2021/22 $'000
Income		
Rates - All	32,210	30,030
Income Levies	1,799	1,663
Statutory Fees & Fines	2,615	2,564
User Fees	1,299	1,257
Grants Recurrent	2,765	2,853
Contributions - Cash	207	177
Reimbursements	1,200	1,150
Other Income	1,204	1,159
Internal Charges Income	220	220
Total Income	**43,519**	**41,073**
Expenses		
Employee Costs	15,877	14,916
Expenses Levies	1,799	1,663
Loan Interest	98	98
Materials and Services	10,372	10,067
Other Expenses	4,381	3,959
Internal Charges Expense	220	220
Total Expenses	**32,747**	**30,923**
Net Operating Surplus/(Deficit) before:	**10,772**	**10,150**
Depreciation	11,933	11,374
Loss/(Profit) on Disposal of Assets	400	400
Net Operating Surplus/(Deficit) before:	**(1,561)**	**(1,624)**
Interest	98	94
Dividends	620	310
Share of Profit from Invest. in Assoc	250	250
NET OPERATING SURPLUS/(DEFICIT)	**(593)**	**(970)**
Grants Capital	3,000	5,976
Contributions - Non Monetory Assets	1,000	1,000
Initial Recognition of Infrastructure Assets	-	-
NET SUPRPLUS/(DEFICIT)	**3,407**	**6,006**
UNDERLYING RESULT	**(593)**	**(970)**
TOTAL CASH GENERATED	**11,519**	**10,893**

Statement of Financial Position
Year ended 30 June 2021

	Budget 2021/22 $'000	Forecast 2021/22 $'000
Current Assets		
Cash and Investments	23,700	23,500
Receivables	1,000	960
Other	50	50
Total Current Assets	24,750	**24,600**
Non-Current Assets		
Land and Buildings	146,000	142,000
Plant and Equipment	6,200	5,700
Infrastructure Assets	432,000	399,610
Intangible Assets	400	380
Right of Use Assets	230	230
Investment - Copping Waste Authority	3,400	3,400
Investment - Taswater	90,200	90,200
Trade and Other Receivables	350	350
Total Non-Current Assets	**678,780**	**641,870**
TOTAL ASSETS	703,530	**666,470**
Current Liabilities		
Creditors	2700	2,700
Provisions	2900	2,800
Lease Liability	100	100
Other	3500	3,480
Total Current Liabilities	**9,080**	**9,080**
Non-Current Liabilities		
Loan Borrowings	22320	22,320
Provisions	780	760
Lease Liability	130	130
Total Non-Current Liabilities	**23,210**	**23,210**
TOTAL LIABILITIES	**32,290**	**32,290**
NET ASSETS	**671,240**	**634,180**
Community Equity		
Reserves	319,140	285,000
Accumulated Surplus	352,100	349,180
TOTAL COMMUNITY EQUITY	**671,240**	**634,180**

Statement of Cash Flow
Year ended 30 June 2021

	Budget 2020-21 $'000	Forecast 2019-20 $'000
	Inflows (Outflows)	Inflows (Outflows)
CASH FLOWS FROM OPERATING ACTIVITIES		
Rates & Fire Levies	34,009	32,264
Statutory Fees and Fines	2,615	2,616
User Fees	2,400	2,914
Grants	2,765	3,860
Other Cash Inflows (Incl. Reimbursements)	3,521	3,489
Dividend Revenue	620	616
Interest	98	40
Payment to Suppliers	(14,753)	(14,299)
Payment to Employees	(16,427)	(15,985)
Finance Costs	(98)	(92)
Payment of Fire Levy	(1,799)	(1,666)
Net Cash Flow from Operating Activities	**12,951**	**13,757**
CASH FLOWS FROM INVESTING ACTIVITIES		
Proceeds from Sale of Property, Infrastructure, Plant & Equipment	3,450	3,199
Capital Grants	3,000	4,239
Payment for Property, Infrastructure, Plant & Equipment	(19,200)	(15,045)
Net Cash Flow used in Investing Activities	**(12,750)**	**(7,607)**
CASH FLOWS FROM FINANCING ACTIVITIES		
Repayment of Community Organisation Loans	0	43
Repayment of Lease Liability	(100)	(83)
Receipt/Payment of Interest Bearing Loans and Borrowings	0	9,424
Net Cash Flow from Financing Activities	**(100)**	**9,384**
NET (DECREASE)/INCREASE IN CASH HELD	101	15,534
Cash at the Beginning of the Year	23,594	8,060
CASH AT THE END OF THE YEAR	23,695	23,594

18 CONFIRMATION OF ITEMS TO BE DEALT WITH IN CLOSED SESSION

RECOMMENDATION

That in accordance with the *Local Government (Meeting Procedures) Regulations 2015* Council, by absolute majority, move into closed session to consider the following items:

Confirmation of Minutes

Regulation 34(6) *In confirming the minutes of a meeting, debate is allowed only in respect of the accuracy of the minutes.*

Applications for Leave of Absence

Regulation 15(2)(h) *applications by councillors for a leave of absence*

98 Beach Road, Kingston proposed lease to Raine & Horne

Regulation 15(2)(f) *proposals for the council to acquire land or an interest in the land or for the disposal of land*.

In accordance with the Kingborough Council *Meetings Audio Recording Guidelines Policy,* recording of the open session of the meeting will now cease.

Open Session of Council adjourned at

OPEN SESSION ADJOURNS

OPEN SESSION RESUMES

RECOMMENDATION

The Closed Session of Council having met and dealt with its business resolves to report that it has determined the following:

Item	Decision
Confirmation of Minutes	
Applications for Leave of Absence	
98 Beach Road, Kingston proposed lease to Raine & Horne	

CLOSURE

APPENDIX

A General Manager's Diary 30 August 2021 - 24 September 2021

B Current and Ongoing Minute Resolutions (Open Session)

A GENERAL MANAGER'S DIARY 30 AUGUST 2021 - 24 SEPTEMBER 2021

30 August	Participated in weekly Metro GM's catchup
	Attended Council Workshop
31 August	Attended the Derwent Estuary Program Board Meeting
6 September	Participated in weekly Metro GM's catchup
	Attended Council Meeting
7 September	Attended the Hobart City Deal Implementation Plan review
8 September	Attended Greater Hobart General Managers meeting with LGAT and DSG
13 September	Participated in weekly Metro GM's catchup
	Attended Council Workshop
16 September	Met with Mr Dennis Redman to discuss commercial operations
20 September	Participated in weekly Metro GM's catchup
	Attended Council Meeting
21 September	Attended the Greater Hobart Mayors Forum and General Manager's Meeting
23 September	Attended 'Liveability in Tasmania' Place Score Forum
24 September	Met with JLT to discuss National Local Government Vulnerability Risk Profiling Program

B CURRENT AND ONGOING MINUTE RESOLUTIONS (OPEN SESSION)

CURRENT	
Resolution Title	**Woodbridge Recreation Ground Master Plan 2020 – Engagement Activity**
Meeting Date	6 September 2021
Minute No.	C485/18-2021
Status	In progress
Responsible Officer	Director Governance, Recreation & Property Services
Officers Comments	Engagement underway
Anticipated Date of Completion	October 2021
Resolution Title	**24 Hour Police Station in Kingston**
Meeting Date	20 September 2021
Minute No.	C514/19-2021
Status	Action completed
Responsible Officer	Director Governance, Recreation & Property Services
Officers Comments	Correspondence sent
Anticipated Date of Completion	Complete
Resolution Title	**Workshops**
Meeting Date	20 September 2021
Minute No.	C515/19-2021
Status	In progress
Responsible Officer	Director Governance, Recreation & Property Services
Officers Comments	Guidelines to be drafted
Anticipated Date of Completion	October 2021

STILL BEING ACTIONED	
Resolution Title	**Delegated Authority Policies**
Meeting Date	5 July 2021
Minute No.	C357/13-2021
Status	In progress
Responsible Officer	Director Governance, Recreation & Property Services
Officers Comments	Awaiting legal advice
Anticipated Date of Completion	October 2021
Resolution Title	**Climate Change Resourcing**
Meeting Date	21 June 2021
Minute No.	C313/12-2021
Status	In progress
Responsible Officer	Chief Financial Officer
Officers Comments	Reviewed in the mid-year financial review.
Anticipated Date of Completion	December 2021

Resolution Title	**Play Space at Spring Farm or Whitewater Park Estates**
Meeting Date	19 April 2021
Minute No.	C179/7-2021
Status	Complete
Responsible Officer	Director Governance, Recreation & Property Services
Officers Comments	Funds transferred
Anticipated Date of Completion	Complete
Resolution Title	**Kingborough Bicycle Advisory Committee**
Meeting Date	3 May 2021
Minute No.	C211/8-2021
Status	Ongoing
Responsible Officer	Manager Development Services
Officers Comments	To form part of larger submission to Planning Commission
Anticipated Date of Completion	December 2021
Resolution Title	**Petition: Development of Walking Track in Spring Farmand Whitewater Park Estates to Connect to Huntingfield**
Meeting Date	1 March 2021
Minute No.	C94/4-2021
Status	In progress
Responsible Officer	Director Governance, Recreation & Property Services
Officers Comments	DA lodged
Anticipated Date of Completion	Unknown
Resolution Title	**New Complaints Handling Framework**
Meeting Date	26 October 2020
Minute No.	C624/20-2020
Status	In Progress
Responsible Officer	Chief Information Officer
Officers Comments	Complaints Management Policy has been drafted for internal review and council workshop.
Anticipated Date of Completion	October 2021
Resolution Title	**Properties for Disposal**
Meeting Date	26 October 2020
Minute No.	C626/20-2020
Status	In progress
Responsible Officer	Director Governance, Recreation & Property Services
Officers Comments	Two properties sold
Anticipated Date of Completion	July 2022

Resolution Title	**Hobart City Deal and Implementing the Kingston Place Strategy**
Meeting Date	13 July 2020
Minute No.	C397/13-2020
Status	Ongoing
Responsible Officer	Director Governance, Recreation & Property Services
Officers Comments	A major project which will be ongoing for the next three years and regular reports will be provided to Council
Anticipated Date of Completion	Ongoing
Resolution Title	**Funding for Public Infrastructure Required to Support Large Sub-divisions**
Meeting Date	22 July 2020
Minute No.	C429/14-2020
Status	In progress
Responsible Officer	Manager Development Services
Officers Comments	LGAT is taking the lead for a collaborative approach across all Councils. They will be surveying the Councils as part of the project development. There has been work with TasWater specifically about the contributions related to them. We will continue to keep Council updated on the progress, however, there has not been any recent updates for this.
Anticipated Date of Completion	Unknown
Resolution Title	**Paid Parking Within Central Kingston**
Meeting Date	13 January 2020
Minute No.	C30/1-20
Status	In progress
Responsible Officer	Director Governance, Recreation & Property Services
Officers Comments	This is to be revisited following the completion by the State government of the Huntingfield park and ride.
Anticipated Date of Completion	March 2022
Resolution Title	**Bruny Island Boat Club Petition**
Meeting Date	9 December 2019
Minute No.	C797/24-19
Status	In progress
Responsible Officer	Director Governance, Recreation & Property Services
Officers Comments	The Boat Club is investigating the potential for a direct lease with the Crown
Anticipated Date of Completion	Unknown
Resolution Title	**Information & Communications Technology Review**
Meeting Date	27 May 2019
Minute No.	C364/10-19
Status	In progress
Responsible Officer	Chief Information Officer
Officers Comments	Funding source yet to be determined.
Anticipated Date of Completion	Unknown

Resolution Title	**Proposed Transfer of Land Owned by UTAS to Council at Taroona Beach**
Meeting Date	25 March 2019
Minute No.	C233/6-19
Status	In progress
Responsible Officer	Director Governance, Recreation & Property Services
Officers Comments	Awaiting sub-division by UTAS
Anticipated Date of Completion	Unknown