

Flood Assessment

Narwee Parklands Care Community

Prepared for Opal HealthCare c/o CYRE Projects / 03 July 2023

221473 CFAA

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Response to SSDA Submission Comments

This addendum has been prepared to support the Response to Submission Report for the Narwee Parklands Care Community State Significant Development Application (SSD-45024776) located at 59-67 Karne Street North, Narwee. The NSW Department of Planning and Environment (DPE) placed the Environmental Impact Statement and the accompanying technical documentation on public exhibition from 14 February 2023 until 13 March 2023. During the exhibition, a total of 22 submissions were received in response to the public exhibition of the EIS. These included submissions made by the State and Local Government agencies, authorities, as well as the general public.

This addendum provides a response to matters relating to the Flood Modelling and Assessment completed by TTW for the proposed development and it should be read in conjunction with the EIS and all supporting documentation originally submitted with the SEDA.

The table overleaf identifies the specific matters raised by the agencies and where these matters have been responded to.

Agency / Organisation	Agency Reference	Comment from Agency / Organisation	Section Reference / Response
SES	ID 1874	Zoning should not enable development that will result in an increase in risk to life, health or property of people living on the floodplain.	<ul style="list-style-type: none"> ▪ The proposed civil design considers draining flood waters such that it does not impact the site. As such, the proposed development is flood free during all events up to and including the PMF (refer Section 5.2). ▪ A flood impact assessment (FIA) has been carried out to ensure the proposed development would not worsen the existing flood conditions anywhere within the flood plain in the 1% AEP event (refer Section 7.0).
SES	ID 1874	Risk assessment should consider the full range of flooding, including events up to the Probable Maximum Flood (PMF) and not focus only on the 1% AEP flood.	<ul style="list-style-type: none"> ▪ The site's flood modelling and assessment have been completed for both the 1% AEP and Probable Maximum Flood (PMF) events (refer Section 5.0 for flood modelling results under 1% AEP and PMF events for both existing and proposed site conditions).
SES	ID 1874	Risk assessment should have regard to flood warning and evacuation demand on existing and future access/egress routes. Consideration should also be given to the impacts of localised flooding on evacuation routes.	<ul style="list-style-type: none"> ▪ A Flood Risk Management Plan (FRMP) has been prepared for the site to provide recommendations to ensure that in the event of a flood, risk to personal safety is appropriately managed (Refer Section 8.0). ▪ The Flood Emergency Response Plan (FERP) also provides appropriate flood response strategies for the future site users (refer Section 8.3).

Agency / Organisation	Agency Reference	Comment from Agency / Organisation	Section Reference / Response
SES	ID 1874	In the context of future development, self-evacuation of the community should be achievable in a manner which is consistent with the NSW SES's principles for evacuation.	<ul style="list-style-type: none"> ▪ Ditto as above.
SES	ID 1874	Future development must not conflict with the NSW SES's flood response and evacuation strategy for the existing community.	<ul style="list-style-type: none"> ▪ Ditto as above.
SES	ID 1874	Evacuation must not require people to drive or walk through flood water.	<ul style="list-style-type: none"> ▪ Ditto as above.
SES	ID 1874	Development strategies relying on deliberate isolation or sheltering in buildings surrounded by flood water are not equivalent, in risk management terms, to evacuation. 'Shelter in place' strategy is not an endorsed flood management strategy by the NSW SES for future development. Such an approach is only considered suitable to allow existing dwellings that are currently at risk to reduce their risk, without increasing the number of people subject to such risk. The flood evacuation constraints in an area should not be used as a reason to justify new development by requiring the new development to have a suitable refuge above the PMF. Allowing such development will increase the number of people exposed to the effects of flooding. Other secondary emergencies such as fires and medical emergencies may occur in buildings isolated by floodwater. During flooding it is likely that there will be a reduced capacity for the relevant emergency service agency to respond in these times. Even relatively brief periods of isolation, in the order of a few hours, can lead to personal medical emergencies that have to be responded to.	<ul style="list-style-type: none"> ▪ Ditto as above.

Agency / Organisation	Agency Reference	Comment from Agency / Organisation	Section Reference / Response
SES	ID 1874	Development strategies relying on an assumption that mass rescue may be possible where evacuation either fails or is not implemented are not acceptable to the NSW SES.	<ul style="list-style-type: none"> ▪ Ditto as above.
SES	ID 1874	The NSW SES is opposed to the imposition of development consent conditions requiring private flood evacuation plans rather than the application of sound land use planning and flood risk management.	<ul style="list-style-type: none"> ▪ Ditto as above.
SES	ID 1874	NSW SES is opposed to development strategies that transfer residual risk, in terms of emergency response activities, to NSW SES and/or increase capability requirements of the NSW SES.	<ul style="list-style-type: none"> ▪ Ditto as above.
SES	DOC23/109607	Consent authorities should consider the cumulative impacts any development will have on risk to life and the existing and future community and emergency service resources in the future.	<ul style="list-style-type: none"> ▪ Ditto as above.
DPE	DOC23/109607	The entry level of basement parking should be above the PMF level to mitigate the potential risk of flooding under the PMF Event.	<ul style="list-style-type: none"> ▪ Egress to the basement car park has average crest level of 25.75m AHD which is equivalent to the adjacent average PMF level of 25.75m AHD. Therefore, the proposed basement car park would not be inundated with floodwaters in any storm events up to and including the PMF. Refer Section 6.0 for details.

Agency / Organisation	Agency Reference	Comment from Agency / Organisation	Section Reference / Response
DPE	DOC23/109607	<p>The proponent should ensure the performance of retaining walls (such as reliability, stability and durability) under the PMF Event in order to eliminate any flood affectation at the basement of the building. Furthermore, a site emergency management plan should be developed by engaging a qualified professional to ensure the continuity of operations given the criticality and sensitivity of the proposed facility and its receptors under major flooding events including the PMF Event.</p>	<ul style="list-style-type: none"> ▪ The civil package considers draining flood waters such that it does not inundate the site. ▪ the proposed civil design package prepared by Henry & Hymas for the site effectively renders the site flood free during both 1% AEP and PMF events. Overland flows arriving from the northern site boundary are effectively redirected to Karne Avenue through the proposed retaining wall and drainage system at the northern boundary. ▪ The proposed retaining wall structure will be designed to withstand the forces of floodwater, debris and buoyancy up to and including the PMF (details to be provided by structural engineers at the detailed design stage). ▪ A Flood Risk Management Plan (FRMP) has been prepared for the site to provide recommendations to ensure that in the event of a flood, risk to personal safety is appropriately managed (Refer Section 8.0). ▪ The Flood Emergency Response Plan (FERP) also provides appropriate flood response strategies for the future site users (refer Section 8.3).

Agency / Organisation	Agency Reference	Comment from Agency / Organisation	Section Reference / Response
DPE	DOC23/109607	Flood emergency management plan and evacuation routes are to be provided. In preparation of these documents, the Applicant must engage with SES, considering any comments provided and all relevant guidelines.	<ul style="list-style-type: none"> ▪ A Flood Risk Management Plan (FRMP) has been prepared for the site to provide recommendations to ensure that in the event of a flood, risk to personal safety is appropriately managed (Refer Section 8.0). ▪ The Flood Emergency Response Plan (FERP) also provides appropriate flood response strategies for the future site users (refer Section 8.3). ▪ In preparation of the site's FRMP & FERP, concerns and recommendations of SES have been considered. ▪ Please refer Section 1.2 for the list of relevant guidelines that have been considered in preparation of this flood assessment as well as the FRMP & FERP.
Canterbury Bankstown Council	Council submission to State Significant Development Application (13 March 2023)	As per the flood assessment produced by TTW NSW, the existing peak flow entering from the northern site boundary is up to 190m ³ /sec in the 1% AEP event (page 10). Yet the PMF event is noted as 2.3m ³ /sec. A flow of 190m ³ /sec is considered to be an error as the volumes are too high for this site. The existing peak flood levels should be reviewed and revised with the correct volume figures.	<ul style="list-style-type: none"> ▪ The existing peak flow rates entering from the northern site boundary are 0.27 m³/s and 2.60 m³/s in the 1% AEP and PMF events respectively. The report has been updated to reflect the correct peak flow rates.

Agency / Organisation	Agency Reference	Comment from Agency / Organisation	Section Reference / Response
<p>Canterbury Bankstown Council</p>	<p>Council submission to State Significant Development Application (13 March 2023)</p>	<p>Given the above, the proposed development does not adequately demonstrate consistency with the Bankstown Development Control Plan 2015, DES and the NSW Floodplain Development Manual. Moreover, the development will need to demonstrate no worsening of flood conditions as a result of the proposal.</p>	<ul style="list-style-type: none"> ▪ The current flood assessment has been carried out in accordance with the NSW Floodplain Development Manual as well as other relevant guidelines as listed in Section 1.2. ▪ The site in its proposed conditions is not flood affected in all flood events up to and including the PMF. ▪ Sections 5.0 & 7.0 of the report show that there is no worsening of flood conditions in the 1% AEP flood event. ▪ A flood impact assessment (FIA) has been carried out to ensure the proposed development would not worsen the existing flood conditions anywhere within the flood plain in the 1% AEP event (refer Section 7.0). ▪ The proposed basement car park would not be inundated with floodwaters in any storm events up to and including the PMF (refer Section 6.0).

Agency / Organisation	Agency Reference	Comment from Agency / Organisation	Section Reference / Response
Canterbury Bankstown Council	Council submission to State Significant Development Application (13 March 2023)	It is requested that a development consent condition is included by the Department for a Flood Emergency Management Plan and evacuation routes endorsed by the State Emergency Service (SES) to be provided prior to any Construction Certificate being issued.	<ul style="list-style-type: none"> ▪ The evacuation route is fully described in section 8 Flood Risk Management Plan. ▪ A Flood Risk Management Plan (FRMP) has been prepared for the site to provide recommendations to ensure that in the event of a flood, risk to personal safety is appropriately managed (Refer Section 8.0). ▪ The Flood Emergency Response Plan (FERP) also provides appropriate flood response strategies for the future site users (refer Section 8.3).

1.0 Introduction

Taylor Thomson Whitting (NSW) Pty Ltd has been engaged by Opal HealthCare c/o CYRE Projects to prepare a Flood Assessment Report in response to the Secretary’s Environmental Assessment Requirements (SEARs), and in support of a State Significant Development (SSD-45024776) for the proposed Senior Housing at 59-67 Karne Street, Narwee NSW 2209 (the site).

The report provides an assessment on flood conditions of the site and summarises the flood modelling results for both existing and proposed site conditions in the 1% AEP and PMF events. The report also provides an impact assessment on neighbouring properties due to the proposed development.

1.1 Project Objectives and Methodology

The objective of this report is to address the flooding requirements of the SEARs (key issue 15):

- Identify any flood risk on-site having regard to adopted flood studies, the potential effects of climate change, and any relevant provisions of the NSW Floodplain Development Manual.
- Assess the impacts of the development, including any changes to flood risk on-site or off-site, and detail design solutions and operational procedures to mitigate flood risk where required.

<p>15. Flooding Risk</p> <ul style="list-style-type: none"> • Identify any flood risk on-site having regard to adopted flood studies, the potential effects of climate change, and any relevant provisions of the <i>NSW Floodplain Development Manual</i>. • Assess the impacts of the development, including any changes to flood risk on-site or off-site, and detail design solutions and operational procedures to mitigate flood risk where required. 	<ul style="list-style-type: none"> • Flood Risk Assessment
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Table 1- SEARs Flooding Requirements - SSD-45024776

1.2 Reference Documents

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

- Commonwealth of Australia (Geoscience Australia) (2016), Australian Rainfall and Runoff – A Guide to Flood Estimation.
- NSW Department of Planning and Infrastructure, Planning and Natural Resources (2005), Floodplain Development Manual.
- NSW Department of Planning and Environment, Flood Impact and Risk Assessment (2022).
- NSW Department of Planning and Environment, Support for Emergency Management Planning Flood Risk Management Guide EM01
- Canterbury Local Environmental Plan (LEP, 2012).
- Canterbury Development Control Plan (DCP, 2012).

1.3 Site

The site is located at 59-67 Karne Street (Lots 2&3 of DP16063, Lot 2 of DP518877 and Lots C&D of DP403467) Narwee NSW 2209 and falls within the Canterbury Bankstown local government area (LGA). The site is bounded to Karne Street to the west, residential properties to the north and east, and Richard Podmore Dog Park to the south.

The site's total area is 7,145m² based on the survey data provided by V-Mark Survey Pty Ltd and incorporates two residential buildings, concrete slabs and vegetation including several trees in the existing conditions. The boundaries of the site are illustrated in Figure 1.



Figure 1 The Site Locality (Source: Six Maps)

2.0 Proposed Development

Architectural drawings prepared by Group GSA indicate that the proposed development involves demolition of the existing buildings onsite and construction of a 3-storey Senior Living complex including a basement.

The proposed architectural plan for ground floor is shown in Figure 2.

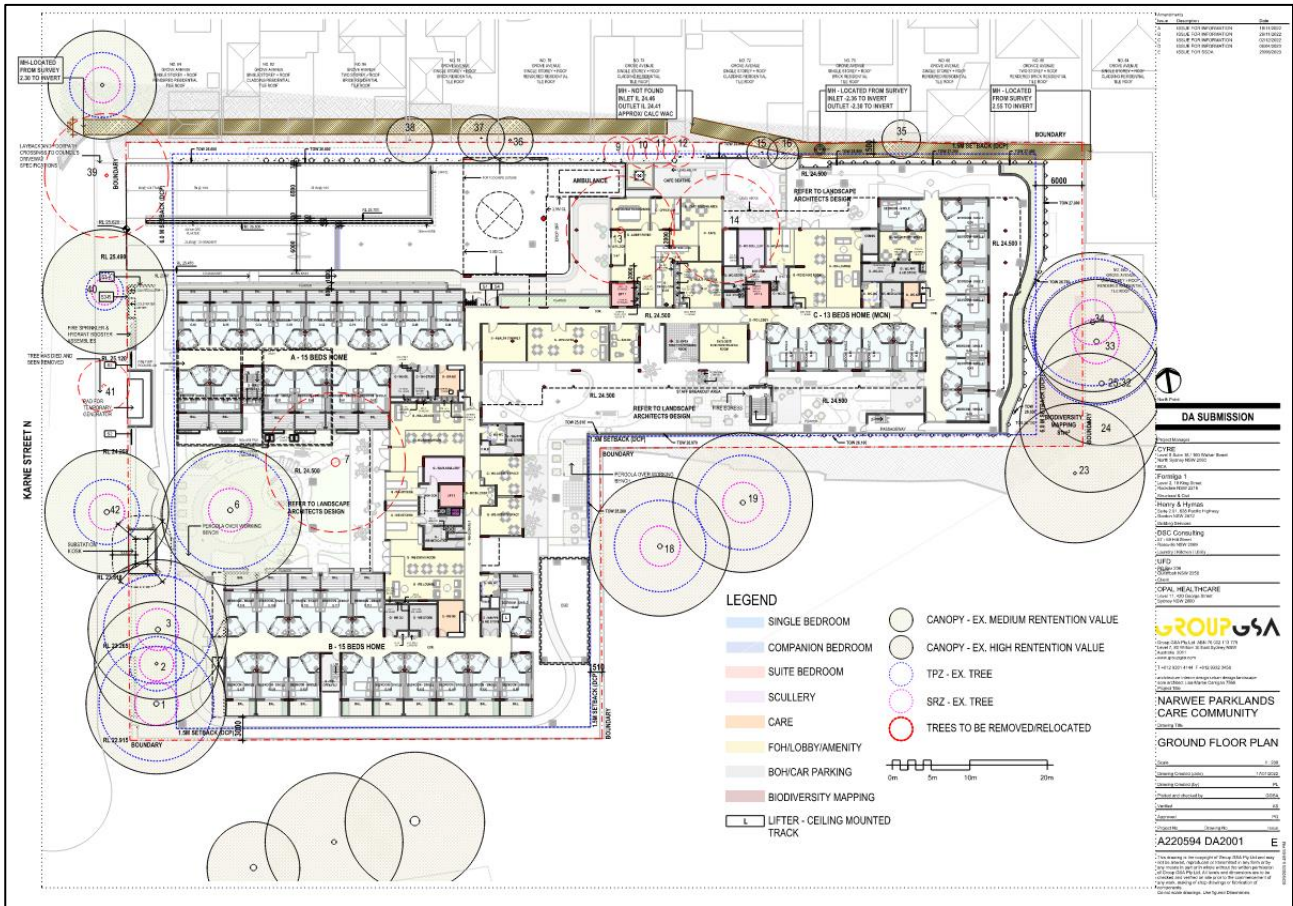


Figure 2. Proposed Architectural Plan (Ground Floor) – Group GSA

3.0 Available Data

This overland flow study used topographic, and flood related data obtained from a number of sources. The origin and types of information underpinning the assumptions used in this study are presented below.

3.1 Previous Flood Studies

The site is part of Salt Pan Creek catchment which falls within Canterbury Bankstown Local Governmental Area. Cardno has carried out an Overland Flow Study for the Salt Pan Creek Catchment on behalf of Canterbury City Council and summarised the outcomes in the Final Overland Flow Study Canterbury LGA Salt Pan Creek Catchment Report, 2016 (referred to as Council flood study, hereafter).

As part of the study, Cardno has prepared a hydraulic flood model for the catchment which TTW obtained from Council (referred to as Council flood model, hereafter) and used it as a basis to assess the flood conditions of the site in both predevelopment and post development conditions.

3.2 Survey Data

Survey information adopted for this study has been collated from the following sources:

- One metre resolution Digital Elevation Model (DEM), ALS.
- GIS layers of cadastre and satellite imagery provided by the NSW LPI.
- Site survey prepared by V-Mark Survey Pty Ltd.

4.0 Hydraulic Model Structure

The Council's TUFLOW hydraulic model was used to determine flood extents, levels, depths, velocities and hydraulic hazard during the critical 1% AEP and PMF events for the site in the existing and proposed conditions.

The procedure completed to create the site flood model is described in the below steps:

- Refine the TUFLOW model by updating the model data and incorporating additional site-specific data.
- Determine flood extents, levels, depths, velocities and hydraulic hazard during the critical 1% AEP and PMF events for the site in existing conditions.
- Update the TUFLOW model to allow simulation of the proposed site conditions.
- Determine flood extents, levels, depths, velocities and hydraulic hazard during the critical 1% AEP and PMF events for the site in proposed conditions.
- Carry out an offsite impact assessment and prepare a flood impact map for the 1% AEP event.
- Comment on flood characteristics and model outcomes in existing and proposed conditions.
- Undertake a compliance assessment based on the flood planning requirements of Canterbury Bankstown City Council.

4.1 2D Model Domain

The model domain received from Council covers a large area of approximately 600 ha with the site located towards upstream of the catchment. Hence, for the purpose of current flood assessment, the original 2D model domain was modified to an area of 115 ha by placing the downstream model boundary at Bennett Park (approximately 220m downstream of the site). TTW model domain is shown in Figure 2.

Council's model adopted a 2m grid cell size however, grid cell size was reduced to 1m to enable accurate flood simulation for the site.

4.2 Model Topography

The existing TUFLOW model surface was merged with the available site survey DTM triangles data including parts Karne Street and Gove Avenue to increase the accuracy of the existing model surface at the site proximity.

4.3 Building Footprints

The footprints of buildings surrounding critical overland flow path to the north of the site are modelled as blocked elements within the 2D domain to act as flow blockage.

Building outlines of the existing buildings onsite as well as the nearby buildings were refined based on the site survey and aerial photographs.

4.4 Boundary Conditions

Definition of model inflow and outflow boundaries are explained in below sections:

4.4.1 Inflow boundary

Cardno model inflows are defined as per follows:

- A 'direct rainfall' boundary is applied to the entire 2D model domain.
- Additional inflow hydrographs are also applied to the model to account for the lateral catchments draining into the Saltpan Creek Catchment.

The location of discharge flows from lateral catchments are far enough from the site and have no material impact on the flood conditions of the site (refer Figure 2). Therefore, only the direct rainfall boundary was applied to the entire TTW model domain.

4.4.2 Downstream Boundary

Downstream model boundary was defined at allocation approximately 220m downstream of the site. A stage-discharge (water level versus flowrate) curve was adopted as the downstream boundary condition. This stage-discharge relationship was generated by TUFLOW by specifying a downstream boundary slope.

Figure 3 shows the TTW model domain and location of downstream boundaries.

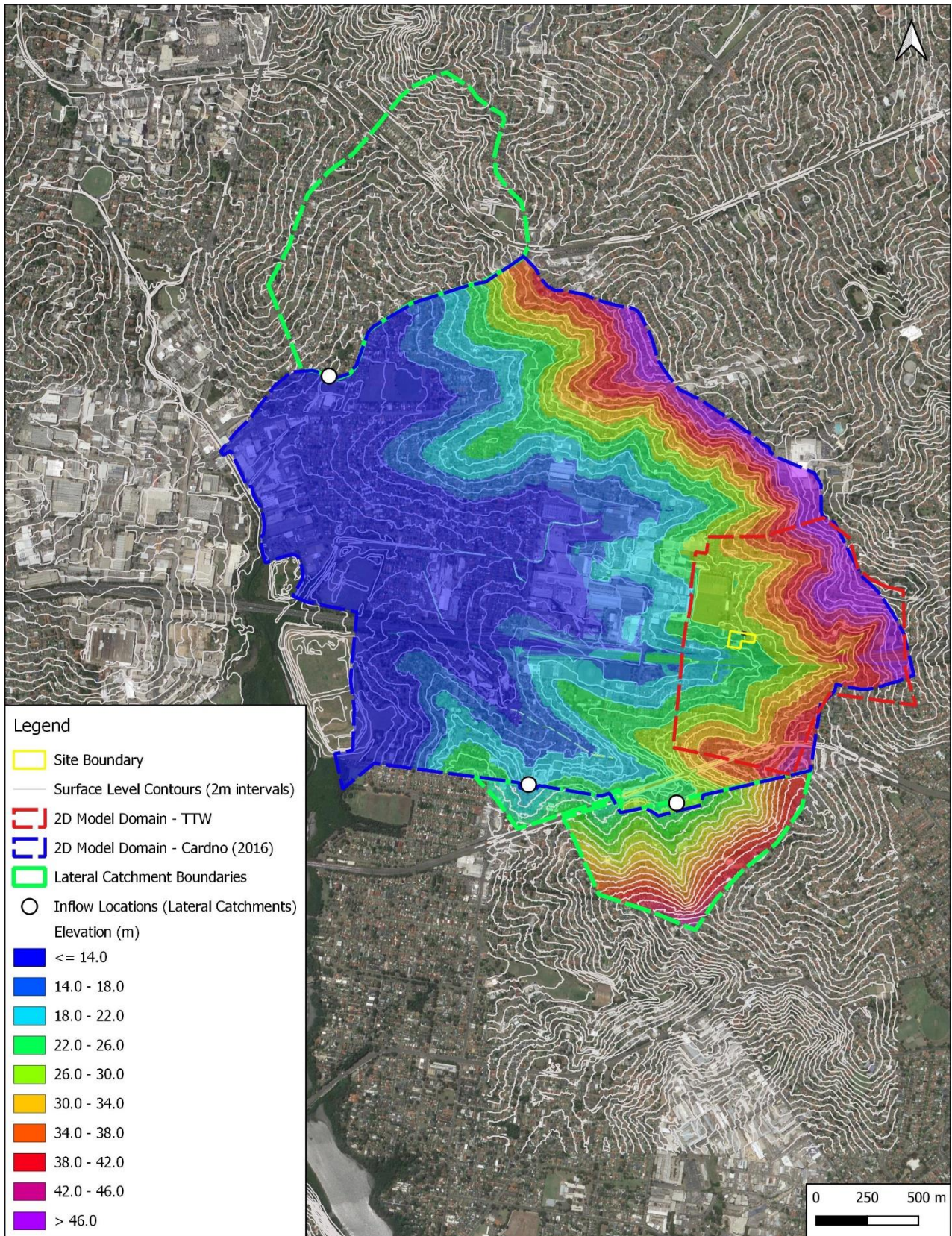


Figure 2 – Inflow locations of Lateral Catchments - Council Model Domain (Cardno, 2016)

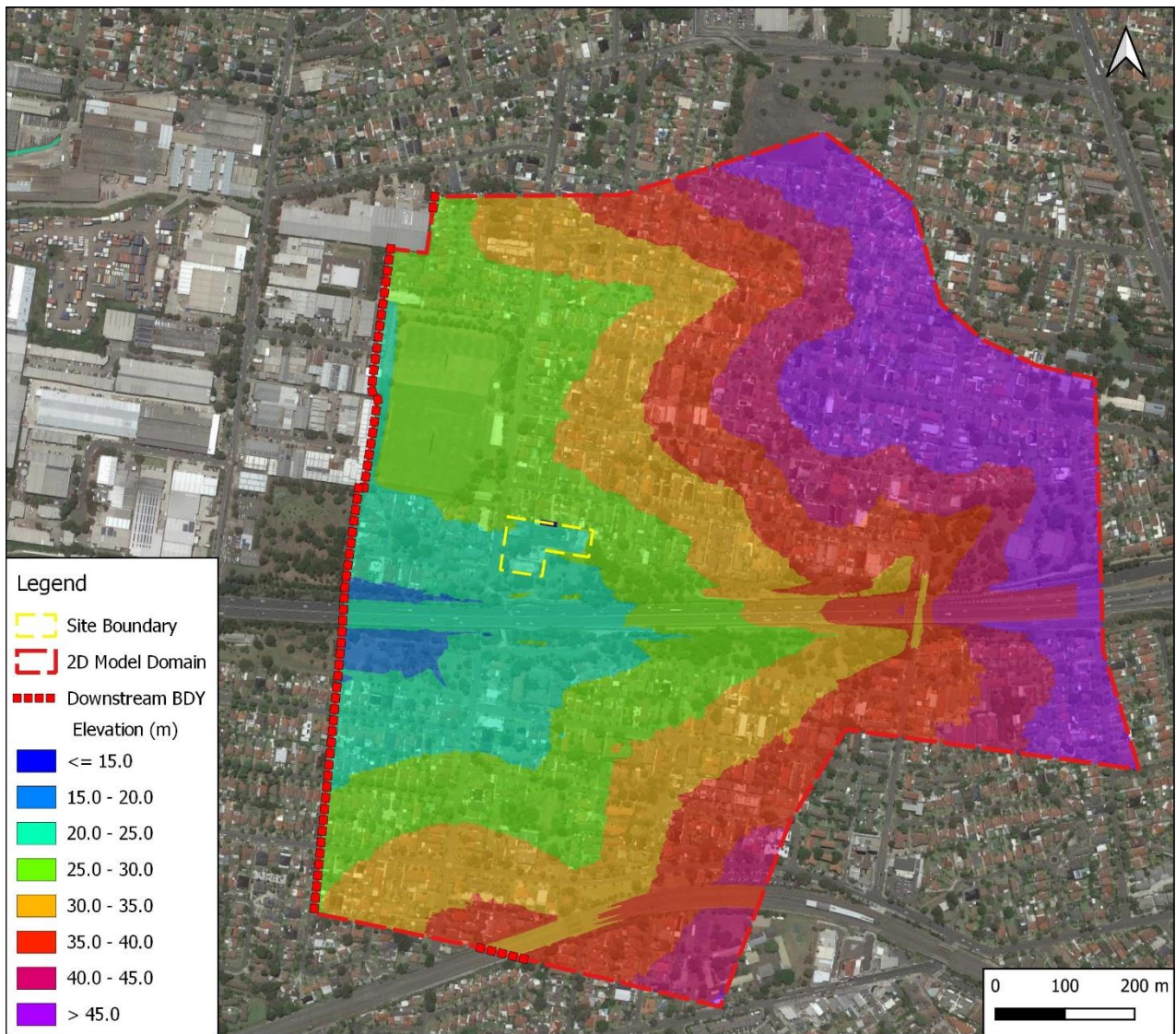


Figure 3 – TTW Model Domain and Location of Downstream Model Boundary

4.5 1D Model Domain

The existing 1D network was retained inside the model, consistent with the Council's model. Pit blockages were also retained consistent with the Council's model.

Existing drainage network through Grove Avenue and Karne Street were updated based on the latest survey and CCTV investigations completed by V-Mark Survey Pty Ltd. Refer to survey maps (Appendix A) for details.

4.6 Hydraulic Roughness and Rainfall Losses

Cardno has defined the rainfall losses and Manning's values based on various catchment land uses and in accordance with the Australian Rainfall and Runoff Book 2 (Engineers Australia, 1987) as well as typical loss rates for catchments in this region. Adopted Manning's values and rainfall losses are summarised in Table 2.

Table 2 - Adopted Manning's and Rainfall Losses

Land Use	Initial Loss (mm)	Continuing Loss (mm / hour)	Manning's
Roads	0	0	0.02
Paved Ground	0	0	0.03
Open Space/Park/Light Vegetation	15	1.5	0.035
Residential	15	1.5	0.1
Industrial/Commercial	3.75	0.75	0.1

Manning's values and rainfall losses were retained in the model consistent with Council's model.

4.7 Design Storm Events and Rainfall Data

Rainfall data used for the Saltpan Creek overland study (Cardno, 2016) is based on the AR&R 87 which has now been superseded and replaced with AR&R 2016. Therefore, the rainfall data in the model was updated with AR&R 2016 IFD and associated temporal patterns.

Model was then run for a range of 1% AEP storm durations from 30 minutes to 180 minutes using 10 temporal patterns to determine the critical storm duration at the site. The critical 1% AEP storm duration was determined to be 45minutes for the site based on the AR&R 2016 rainfall data and 15 minutes for the PMF.

5.0 Model Results

The behaviour of the overland floodwaters across the site and in the vicinity of the site during the critical 1% AEP and PMF events for the existing and proposed site conditions are described in general terms, and offsite flood impacts due to the proposed development are investigated.

5.1 Existing Conditions

The peak flood levels depths, velocities and hazards for the critical duration 1% AEP and PMF events for existing site conditions are shown in Figure 4 to Figure 6 and Figure 7 to Figure 9 respectively.

The results confirm that the site is not affected by the overland flows of Grove Avenue however, the overland flows from private properties to the north enter the site via the northern boundary and traverse the site towards the southern boundary where they eventually discharge to Richard Podmore Dog Park. The peak flow entering from the northern site boundary is up to 0.27 m³/s in the 1% AEP event.

There are a few ponding areas over the local trapped-low points within the site in existing conditions which are generally of low hazard.

During the PMF though, floodwaters in Grove Avenue overtop the kerb onto private properties to the north of the site and run south towards the site. The peak flow rate arriving to the site through the northern site boundary is circa 2.60 m³/s during the PMF event. Flood depths are generally shallow across the site (<0.25m) except for the existing trapped-low points where the flood depths are as high as 0.7m.

Flood velocities are less than 0.5 m/s and of low hazard across the site during the PMF event.

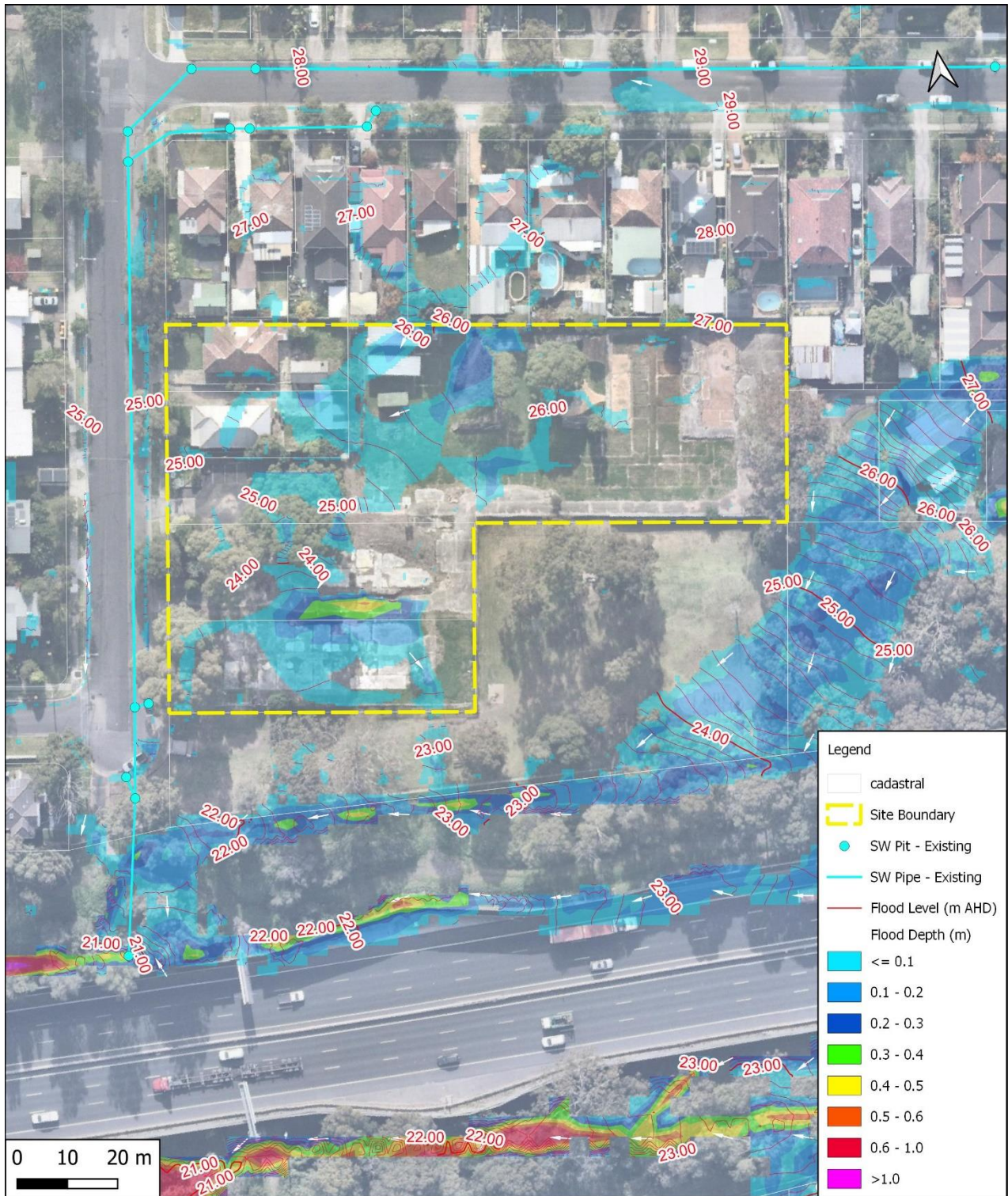


Figure 4 - 1% AEP Overland Flow Level & Depth – Existing Conditions

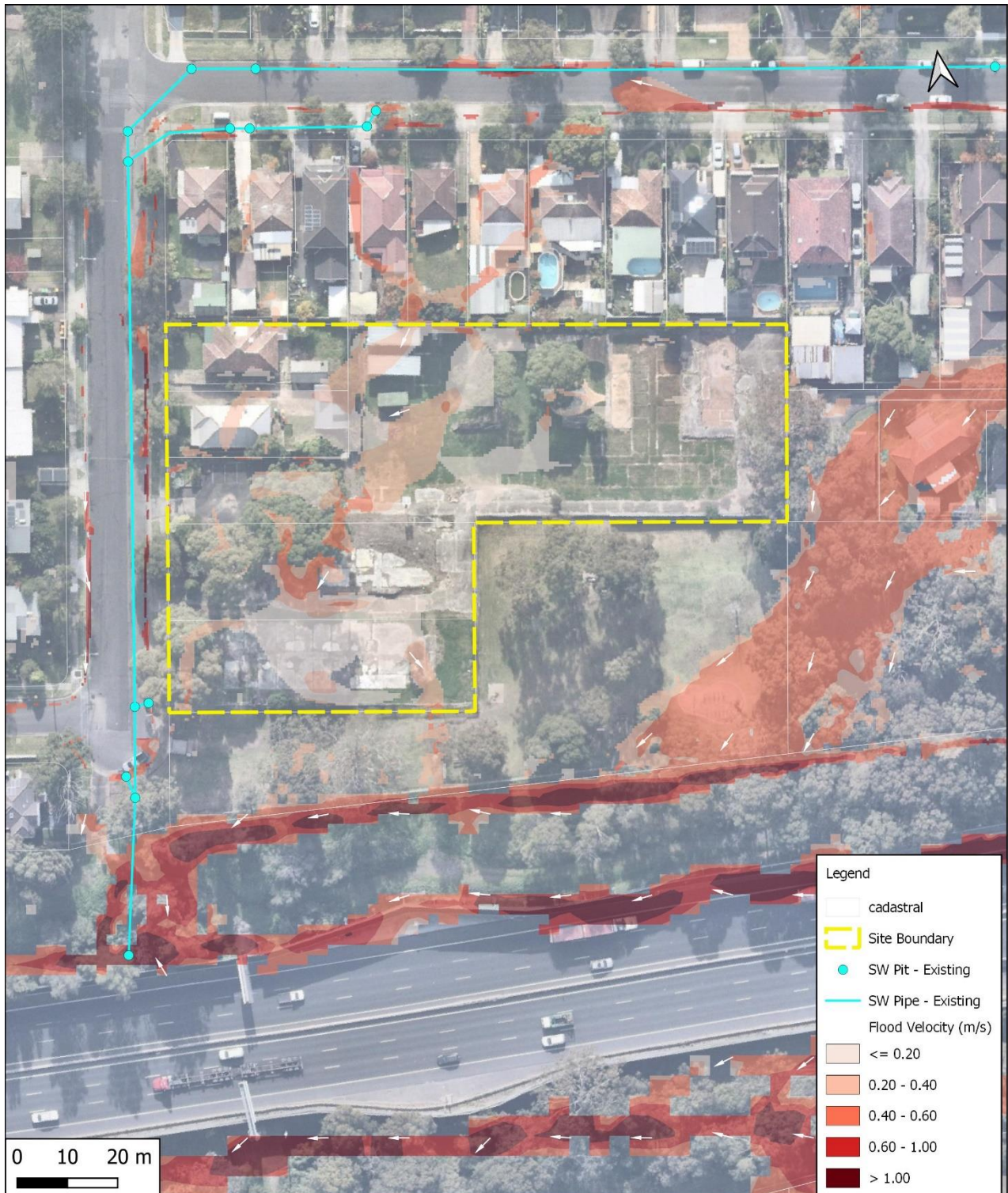


Figure 5 - 1% AEP Overland Flow Velocity – Existing Conditions



Figure 6 - 1% AEP Overland Flow Hazard – Existing Conditions

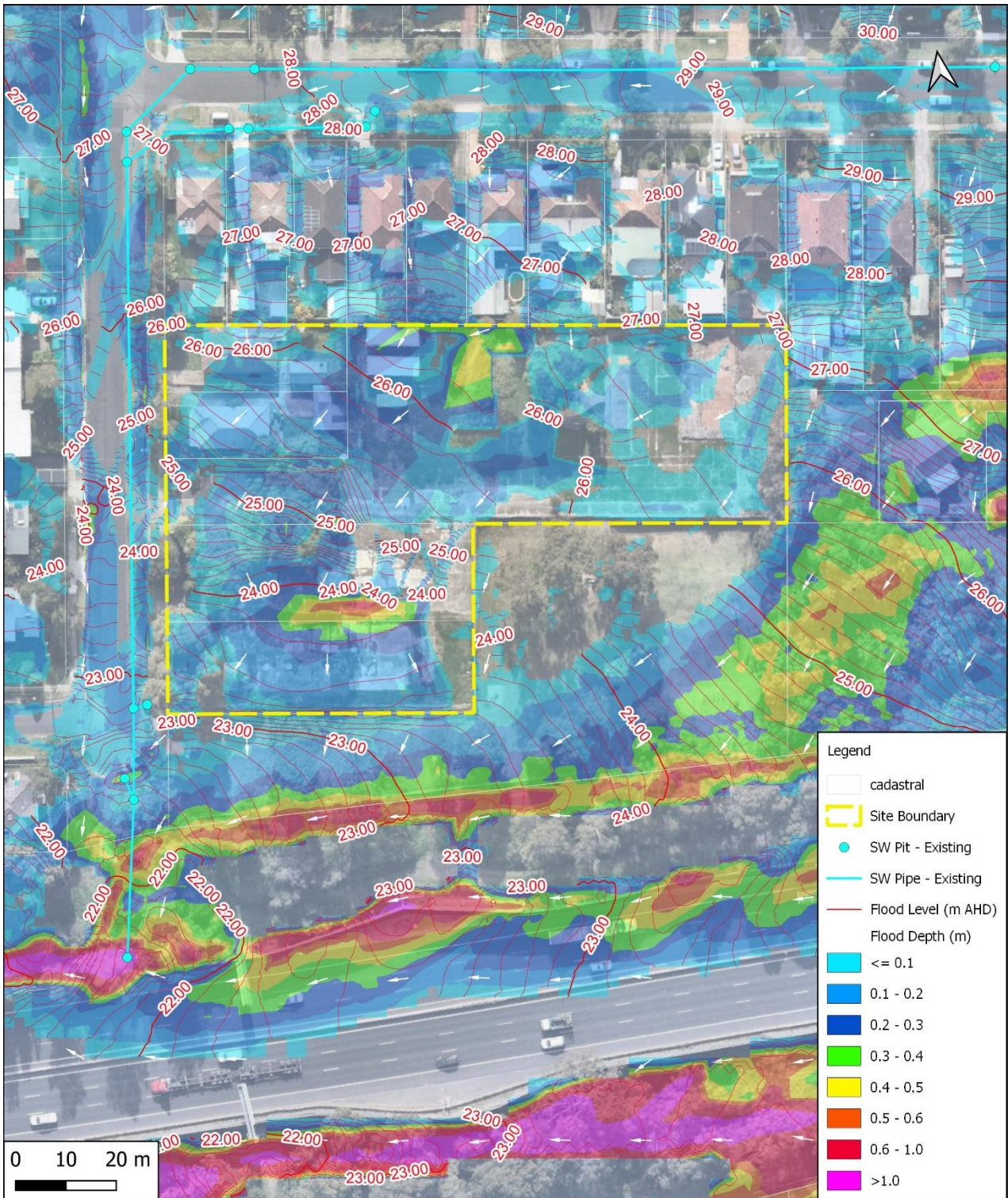


Figure 7 - PMF Level & Depth – Existing Conditions

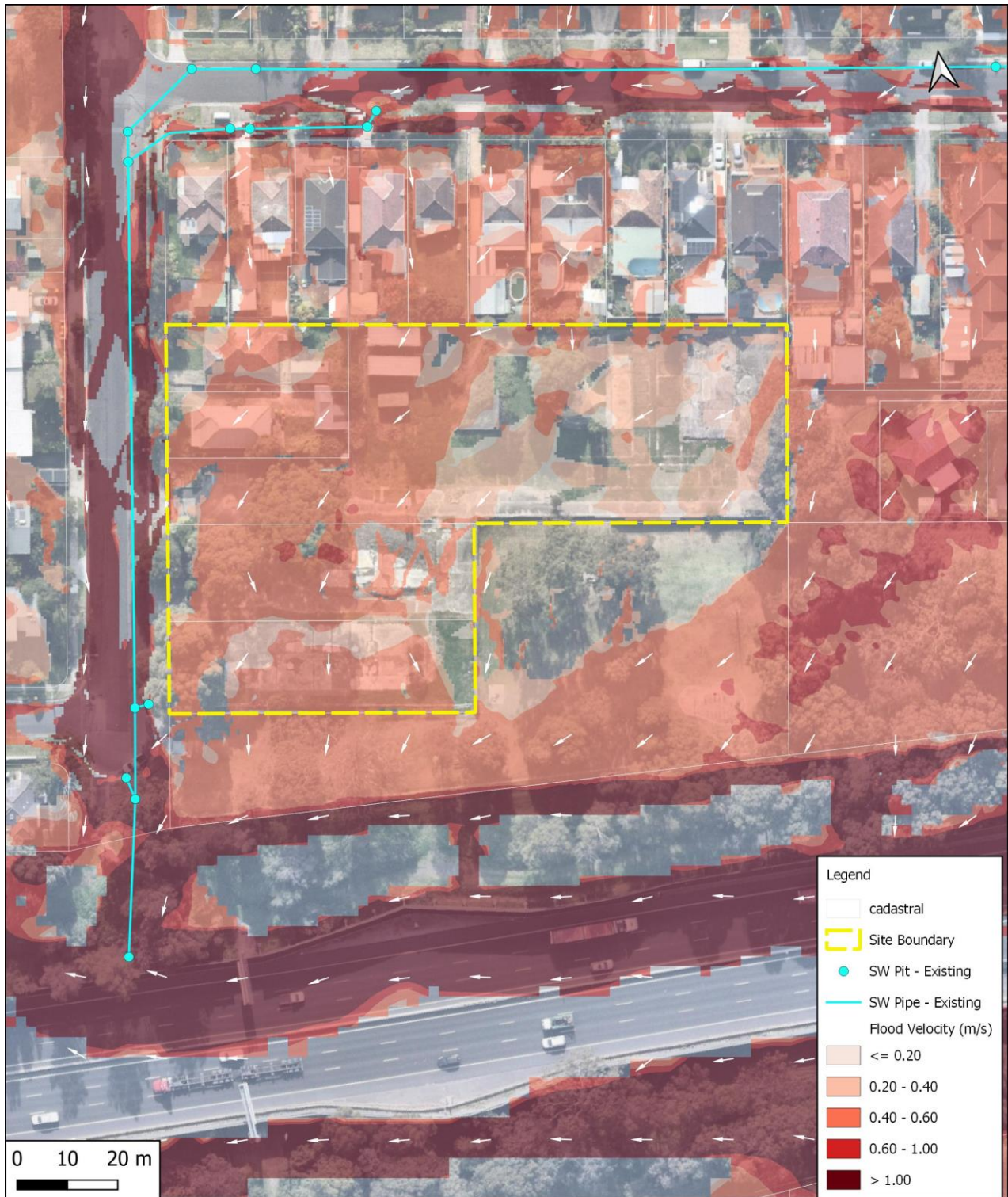


Figure 8 PMF Velocity – Existing Conditions

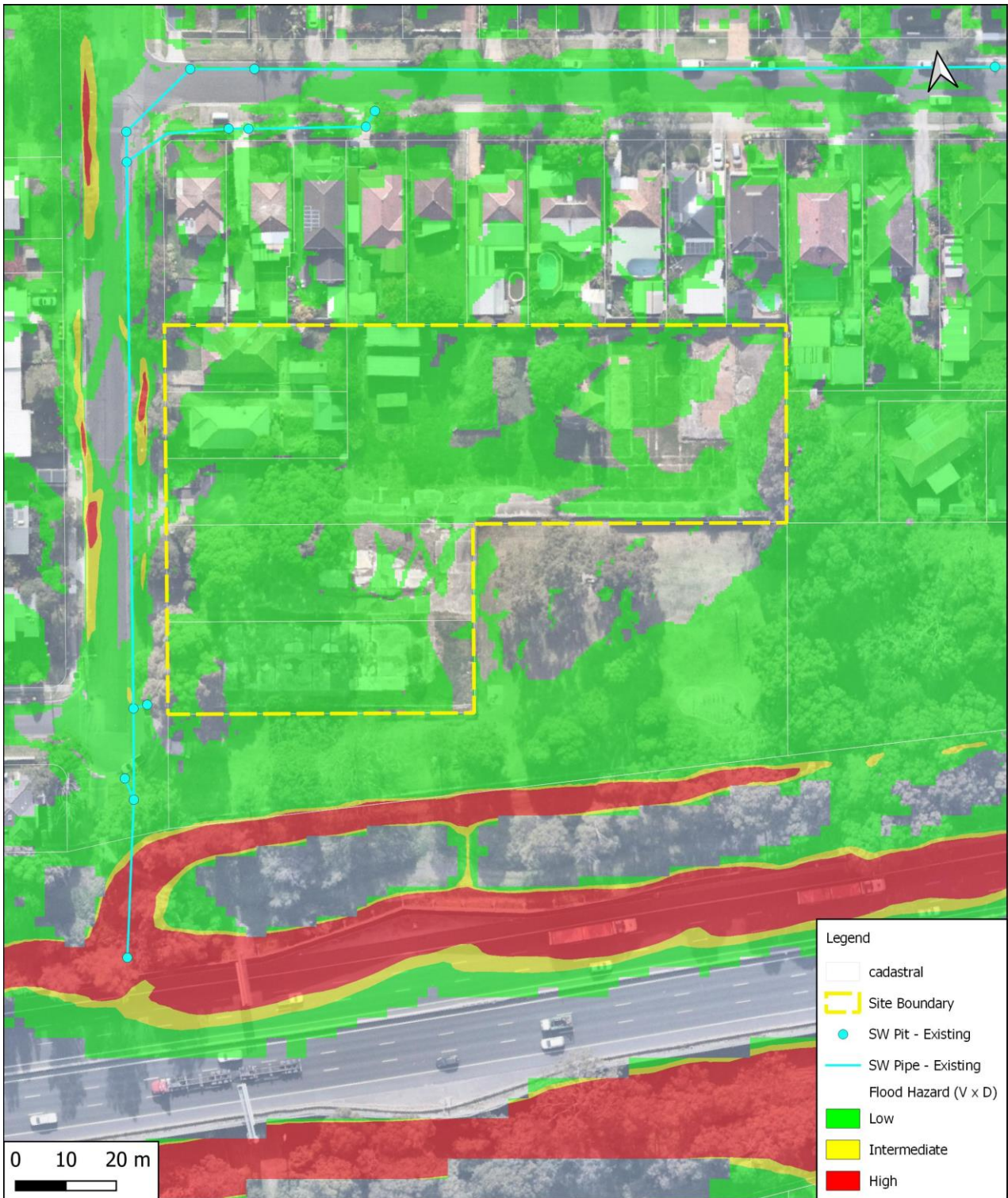


Figure 9 - PMF Hazard – Existing Conditions

5.2 Proposed Conditions

The model was updated through the following steps to enable flood simulation for the proposed site conditions:

- Site elevations were updated by incorporating the proposed surface elevation TIN prepared by Henry & Hymas.
- Existing buildings onsite were removed and replaced with the proposed structures.
- The proposed drainage swale along the northern site boundary was represented in the model.
- The proposed inground drainage pit & pipe system along the northern site boundary was incorporated into the model and a pipe discharge connection was made to the existing 650mm pipe at Karne Avenue based on the stormwater design received from Henry & Hymas.
- Existing roughness Manning's zones were also adjusted to represent the proposed surface in the model.

The flood model was then run for the critical duration 1% AEP and PMF events.

The peak flood levels depths, velocities, and hazards for the critical duration 1% AEP and PMF events for proposed site conditions are shown in Figure 11 to Figure 13 and Figure 14 to Figure 16 respectively.

Flood results for the proposed site conditions confirm that the site is effectively flood free during both 1% AEP and PMF events and overland flows arriving from the northern site boundary are effectively redirected to Karne Avenue through the proposed drainage system. Minor local overland flows on the site are generally shallow and of low hazard.

It is notable that the local ponding areas across the site during the PMF (shown in Figure 14) are due to application of direct rainfall in the model and are not considered flooding. Internal storm flows will be redirected outside of the site by way of internal drainage system.

A retaining wall is proposed along the southern side of the drainage swale to ensure overland flows arriving from the northern site boundary will be contained within the proposed swale and would not overtop onto the site during all storm events up to and including the PMF.

Maximum PMF levels adjacent to the proposed retaining wall are shown in Figure 10. Please refer to relevant civil/structural drawings (Henry & Hymas) for the proposed retaining wall details.

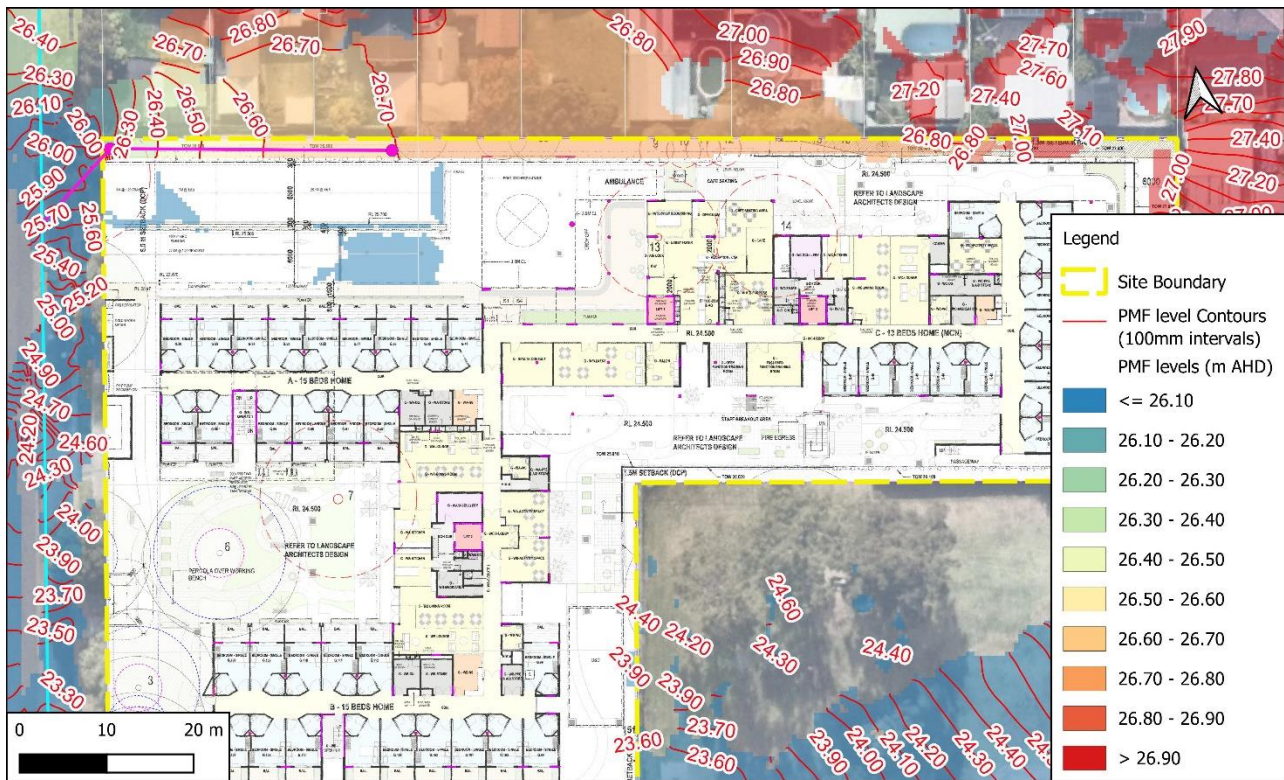


Figure 10 – PMF Levels Adjacent to Proposed Retaining Wall at Northern Site Boundary



Figure 11 - 1% AEP Overland Flow Level & Depth – Proposed Conditions



Figure 12 - 1% AEP Overland Flow Velocity – Proposed Conditions



Figure 13 - 1% AEP Overland Flow Hazard – Proposed Conditions

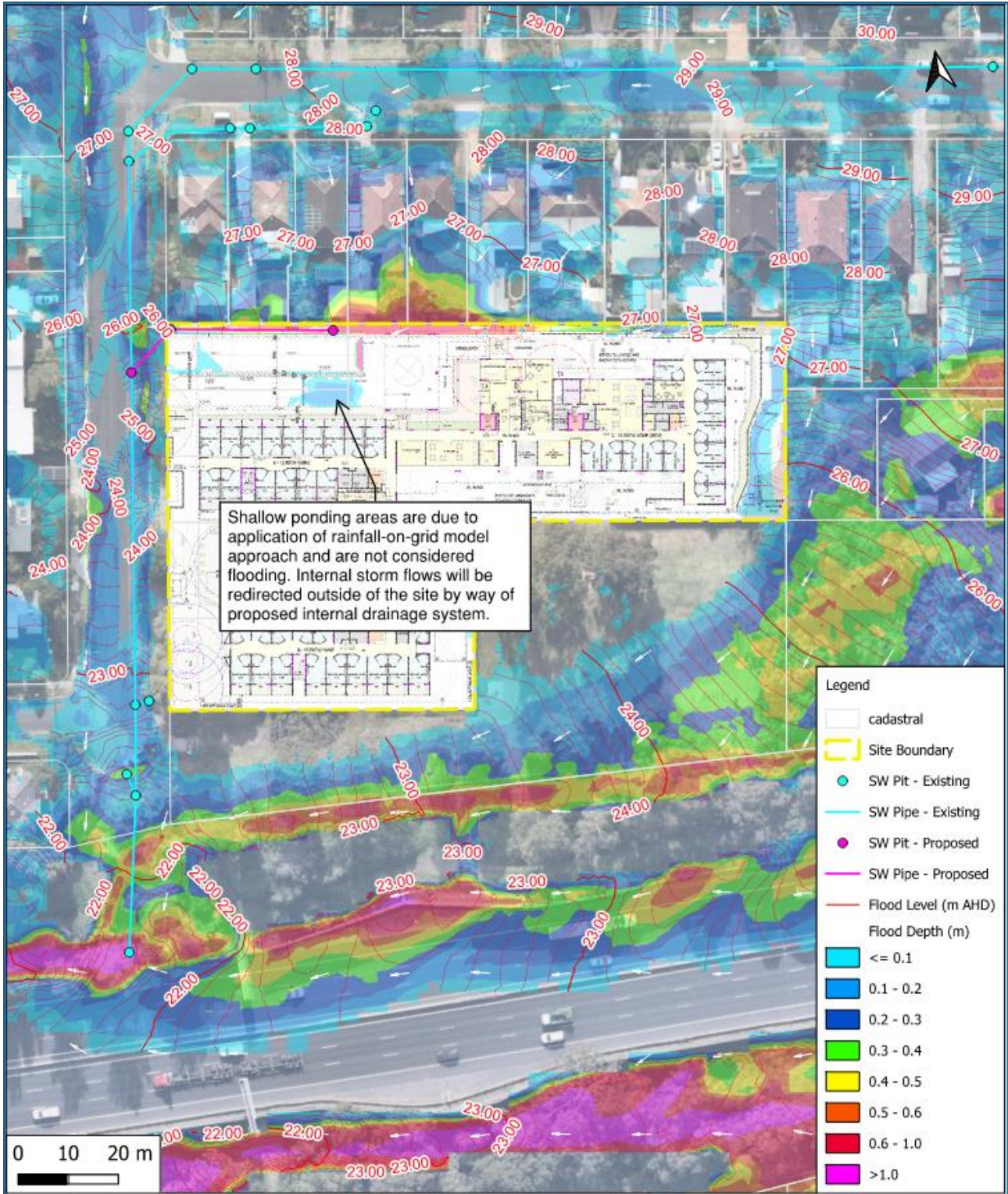


Figure 14 - PMF Level & Depth – Proposed Conditions



Figure 15 PMF Velocity – Proposed Conditions



Figure 16 - PMF Hazard – Proposed Conditions

6.0 Basement Car Park

Based on the civil design package prepared by Henry & Hymas for the proposed development on site, egress to the basement car park has average crest level of 25.75m AHD which is equivalent to the adjacent average PMF level of 25.75m AHD. Therefore, the proposed basement car park would not be inundated with floodwaters in any storm events up to and including the PMF.

Flood model results however, indicate that there is a small volume of overland flow running down the basement ramp in the PMF event. The model estimates that the total volume of water flowing into the basement car park during the PMF event is circa 45 litres and therefore, negligible.

7.0 Offsite Flood Impacts

A flood impact assessment has been carried out to ensure the proposed development would not result in either an unacceptable flood level increase or worsening the flood conditions over the neighbouring properties in the 1% AEP storm event.

The flood level impact map for the proposed development in the 1% AEP event is shown in Figure 17. The flood impact assessment confirms that changes to flood levels over the neighbouring properties are within acceptable tolerance of $\pm 20\text{mm}$ and therefore the proposed development has negligible offsite impacts on the neighbouring properties in the 1% AEP event.



Figure 17 - 1% AEP Flood Level Impacts– Proposed Conditions (Afflux Map)

8.0 Flood Risk Management Plan (FRMP)

This FRMP provides recommendations to ensure that in the event of a flood, risk to personal safety is appropriately managed. The plan provides strategic level advice that needs to be implemented as part of the site's construction and on-going operation.

8.1 Flood Behaviour (Post Development Conditions)

Flood modelling results confirm that the overland flows arriving at the site via the northern boundary are effectively controlled and redirected onto Karne Street by way of the proposed drainage channel and retaining wall at the northern site boundary (refer Section 5.2 for more details).

It is notable that the proposed retaining wall structure at the northern site boundary will be designed to withstand the forces of floodwater, debris and buoyancy up to and including the PMF (details to be provided by structural engineers at the detailed design stage).

General flood behaviour for the proposed development and its vicinity is summarised below:

- The proposed development is flood free during all storm events up to and including the PMF.
- The site is located within a fast-responding catchment. Flood levels around the site are expected to reach up to their peak in 60 minutes after the onset of the 1% AEP event and in 15 minutes after the onset of PMF.
- The site is not subject to isolation during any large flood event including the PMF.
- Flood durations are relatively short, and floodwaters are likely to fully recess in 1-1.5 hours after the onset of a large storm event.
- Flood hazards are generally low over the nearby roads during the 1% AEP event (refer Figure 13).
- Flood hazards are low to high over Karne Street during the PMF (refer Figure 16).

8.2 Flood inundation Time

The site is flood free during all flood events up to and including PMF. Nearby roads are also not significantly flood affected during storms up to and including the 1% AEP event.

The critical PMF duration for the site is 15 minutes. Although the site remains flood free during the PMF event, flood hazards over Karne Avenue would become high approximately 15 minutes after the onset of the storm.

Due to the short interval from the onset of a large flood event to hazardous conditions over Karne Avenue, site users must be warned to stay clear of Karne Avenue.

8.3 Flood Emergency Response Plan (FERP)

Considering the following we recommend 'Shelter-in-Place' strategy to be adopted as the main Flood Emergency Response Plan (FERP) for the site. However, in the event that SES issues evacuation orders, these orders should be followed:

- The proposed development is flood free during all flood events up to and including the PMF. Therefore, the proposed development provides safe occupation for residents during all flood events up to and including the PMF.
- There is not sufficient time for self-evacuation given the site is located within a fast-responding catchment.
- The proposed development is a retirement residential. Therefore, vulnerability of occupants and their ability for evacuation should be considered.
- Shelter-in-place is available for residents, staff and visitors at all habitable floors.
- Shelter-in-Place is only required for very rare storm events (greater than the 1% AEP).

- The site is subject to short duration flash floods. Therefore, Shelter-in-Place duration would normally be as long as one hour and would not notably impact the medical requirements and safety of the residents.

8.3.1 Shelter-in-Place

The shelter-in-place duration would be around one hour based on the critical duration PMF. The following should be provided to enable safe shelter-in-place:

- A suitable number of trained staff will remain with the residents during Shelter-in-Place.
- PA systems will be provided to allow management to guide all residents, employees and visitors to a safe Shelter-in-Place and provide them with all necessary warnings and updates.
- Facility management should maintain several emergency kits including torches with spare batteries, portable radio with spare batteries, first aid kits and high visibility vests and proper signage in public areas.
- Facility management should follow the advice of SES and police at all times and provide guidance to staff, residents and visitors on site until the floodwaters recede.

8.3.2 Evacuation

TTW recommend that 'Shelter-in-Place' strategy to be adopted as the basis of the site's Flood Emergency Response Plan (FERP) as there is not sufficient warning time and evacuation time available given the site is located within a fast-responding catchment. Evacuation from the site should only happen if SES determine that this is required and issue evacuation orders.

The evacuation route from the site is via Karne Street to Grove Avenue to Penshurst Road to King Georges Road, as shown in Figure 18.

The evacuation route remains open and safe during flood events up to and including the 1% AEP event. However, flood flows over Karne Street as well as across the intersection of Grove Avenue and Penshurst Road become unsafe in approximately 10 minutes after the onset of the PMF event and remain unsafe for about 20 minutes.

As a result, evacuation route (and consequently, access to the site) would only be interrupted during flood events rarer than 1% AEP. The duration of this interruption would approximately be 20 to 30 minutes.



Figure 18 – Site Evacuation Route

9.0 Conclusions

A detailed hydraulic model has been developed for the site based on the Salt Plan Creek overland flow model (Cardno, 2016). Detailed site survey and proposed design elements were further incorporated into the model to assess local flood characteristics of the site in the 1% AEP and PMF events for both existing and proposed site conditions. Modelling concluded that:

- Flood modelling results confirm that the overland flows arriving to the site via the northern boundary are effectively controlled and redirected onto Karne Street by way of the proposed drainage channel and retaining wall at the northern site boundary.
- The proposed development is flood free in all food events up to an including the PMF.
- Proposed flood characteristics are largely consistent with existing conditions nearby the site and offsite flood impacts of the proposed development are within the acceptable $\pm 20\text{mm}$ tolerance.
- The proposed works render the site flood free in all flood events up to and including the PMF.
- The proposed basement car park would not be inundated with floodwaters in any storm events up to and including the PMF.
- The proposed retaining wall structure at the northern site boundary is to withstand the forces of floodwater, debris and buoyancy up to and including the PMF (details to be provided by structural engineers at the detailed design stage).
- A Flood Risk Management Plan (FRMP) has been prepared for the site to provide recommendations to ensure that in the event of a flood at the site, risk to personal safety is appropriately managed.
- TTW recommend that 'Shelter-in-Place' strategy to be adopted as the basis of the site's Flood Emergency Response Plan (FERP) and evacuation from the site should only happen if SES issues evacuation orders.
- Evacuation from the site is available via Karne Street to Grove Avenue to Penshurst Road to King Georges Road, and this remains operational during all flood events up to and including the 1% AEP.
- Evacuation route would only be interrupted during flood events rarer than 1% AEP. The duration of this interruption is approximately 20 to 30 minutes.

Prepared by
TTW (NSW) PTY LTD



ALI ATTAR
Senior Engineer

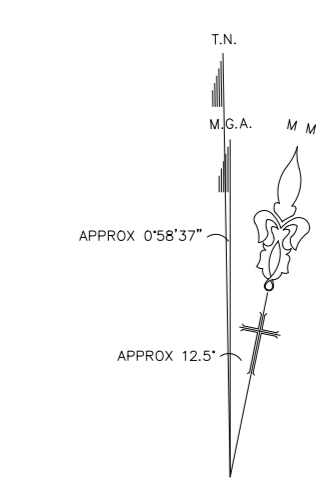
Authorised By
TTW (NSW) PTY LTD



EIRIAN CRABBE
Associate Director

P:\2022\2214\221473\Reports\TTW\Civil\Flood Impact Assessment Report\230701_Flood Impact Assessment Report_RFI v4.docx

Appendix A - Site Survey



NOTES

- BOUNDARIES HAVE BEEN DEFINED BY SURVEY
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- CONTOUR INTERVAL - 0.5 metre - SPOT LEVELS SHOULD BE ADOPTED
- POSITION OF RIDGE LINES ARE DIAGRAMMATIC ONLY (NOT TO SCALE)
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- LEVELS OF SURVEYED OBSERVATIONS ARE AT GROUND LEVEL UNLESS NOTED OTHERWISE
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LINE TYPES

WATERMANN ELECTRICITY	---
OVERHEAD ELECTRICITY	---
TELECOMMUNICATIONS	---
GAS (MPC)	---
GAS (MPC)	---
SEWER	---
STORMWATER	---
RIBN LINE	---
OPTICUS LINE	---
OPTICAL FIBRE LINE	---
NEXT GEN LINE	---
FUEL LINE	---
UNKNOWN	---
TPG	---
FIRE	---
APT	---
COMMS	---
FENCE	---

SYMBOLS

FIRE HOSE REEL	VALVE
FX FIRE EXTINGUISHER	GAS METER
TAP	GAS MARKER
WATER METER	BENCH MARK
HYDRANT	TREE - 812 TO 510 (SPREAD TRUNK HEIGHT)

ANNOTATION

DP - DOWN PIPE	LP - LIGHT POLE
FHT - FENCE HEIGHT	MH - MANHOLE
FL - FLOOR LEVEL	OBV - OBVERT
GL - GROUND LEVEL	PP - POWER POLE
GY - GULLY PIT	RR - ROOF RIDGE
INV - INVERT	SR - SEWER MANHOLE
IO - INSPECTION OPENING (SEWER)	UTL - UNABLE TO LEFT
IOS - INSPECTION OPENING (STORMWATER)	UTL - UNABLE TO TRACE
KB - KERB INVERT	TGUT - TOP OF GUTTER
LH - SEWER LAMPHOLE	WHT - WALL HEIGHT

QL-B
0.85m SERVICE LOCATED TO QUALITY LEVEL B
INV 0.85m DEPTH TO INVERT
QL0.56 GROUND LEVEL 10.56

QUALITY LEVEL RISK MATRIX

CERTAINTY	MEASURED DIRECTLY TO UTILITY
QL-A	ELECTRONIC TRACKING OF UTILITY
QL-B	ALIGNED TO SURFACE FEATURES
QL-C	ESTIMATED FROM EXISTING DRAWINGS
QL-D	

H	CH	POTHOLES	208173	26/06/23
G	CH	SURVEY EXTENDED	207987	5/5/23
F	CH	DETAIL ADDED	207951	18/4/23
E	CH	SEWER EXTENDED	207415	13/12/22
D	DJB	STORMWATER EXTENDED	207288	17/11/22
C	CH	STORMWATER ADDED	207192	13/10/22
B	CH	CONTOURS ADDED	206455	06/07/22
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Rev	Dim	Revision/Issue	Ref No.	Date
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NARREE, NSW 2577
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EMAIL : info@vmarksurvey.com.au
ABN : 12 109 067 950

Client Details

CYRE PROJECTS

Project: 59-67 KARNE STREET NARREE

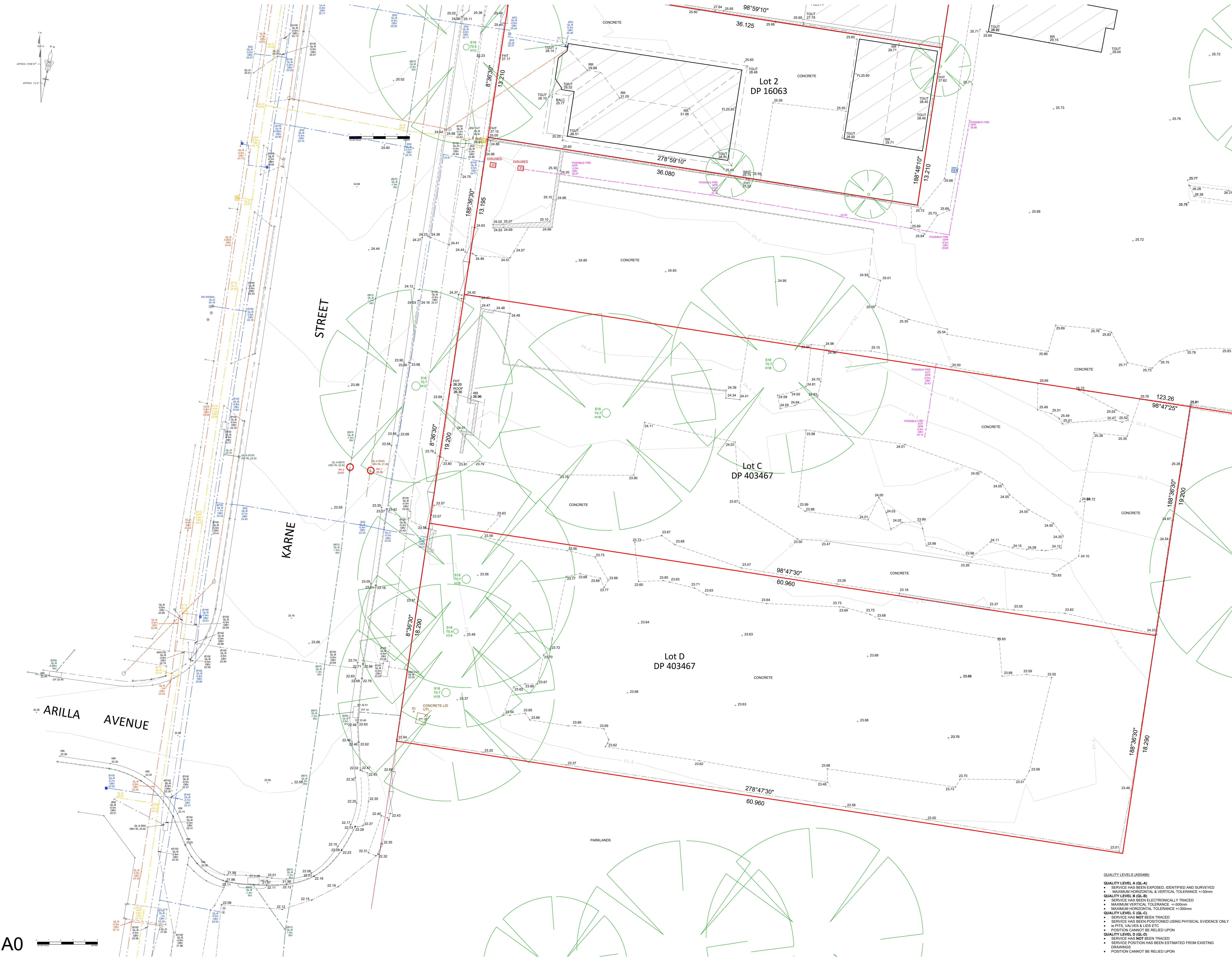
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BM ADOPTED: SSM 108411
RL: 27.054

Date:	MAY 2022	Dim:	CH	CHK:	DJB	Pos:	DJB
Scale:	NOT TO SCALE	Drawn No.:	206455-DL	Rev:	H		



I, Gary Skow, a surveyor registered under the Surveying and Spatial Information Act 2002, certify that:
The boundaries shown in this plan was surveyed in accordance with the Surveying and Spatial Information Regulation 2017, is accurate for the purposes of a development application and the survey was completed on 05/05/22.
Signature:
Dated: 17/05/22
Surveyor Identification No: 1985
Surveyor registered under the Surveying and Spatial Information Act 2002



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LINE TYPES

WATERMANN ELECTRICITY	---
OVERHEAD ELECTRICITY	---
TELECOMMUNICATIONS	---
SEWER	---
GAS (RPO)	---
STORMWATER	---
MINI LINE	---
OPTUS LINE	---
OPTICAL FIBRE LINE	---
NET GEN LINE	---
FUEL LINE	---
UNKNOWN	---
TRP	---
FIRE	---
AAPT	---
COORNS	---
FENCE	---

SYMBOLS

█	FIRE HOSE REEL	□	VALVE
○	FX FIRE EXTINGUISHER	○	GAS METER
+	TAP	○	GAS MARKER
+	WATER METER	▲	BENCH MARK
+	HYDRANT	○	TREE - 812 TO 810 (SPREAD TRUNK HEIGHT)

ANNOTATION

DP	- DOWN PIPE	LP	- LIGHT POLE
FHT	- FENCE HEIGHT	MH	- MANHOLE
FL	- FLOOR LEVEL	OBV	- OBVERT
GL	- GROUND LEVEL	PP	- POWER POLE
GL	- GULLY PIT	RR	- ROOF RIDGE
INV	- INVERT	SMH	- SEWER MANHOLE
IO	- INSPECTION OPENING (SEWER)	UTL	- UNABLE TO LIFT
KOS	- INSPECTION OPENING (STORMWATER)	UTL	- UNABLE TO TRACE
KBI	- KERSI INVERT	TQUT	- TOP OF GUTTER
LH	- SEWER LAMPHOLE	WHT	- WALL HEIGHT

QUALITY LEVELS

QL-B	-0.65m	SERVICE LOCATED TO QUALITY LEVEL B
INV		0.65m DEPTH TO INVERT
QL-0.56		GROUND LEVEL 10.56

QUALITY LEVEL RISK MATRIX

QL-A	MEASURED DIRECTLY TO UTILITY
QL-B	ELECTRONIC TRACING OF UTILITY
QL-C	ALIGNED TO SURFACE FEATURES
QL-D	ESTIMATED FROM EXISTING DRAWINGS

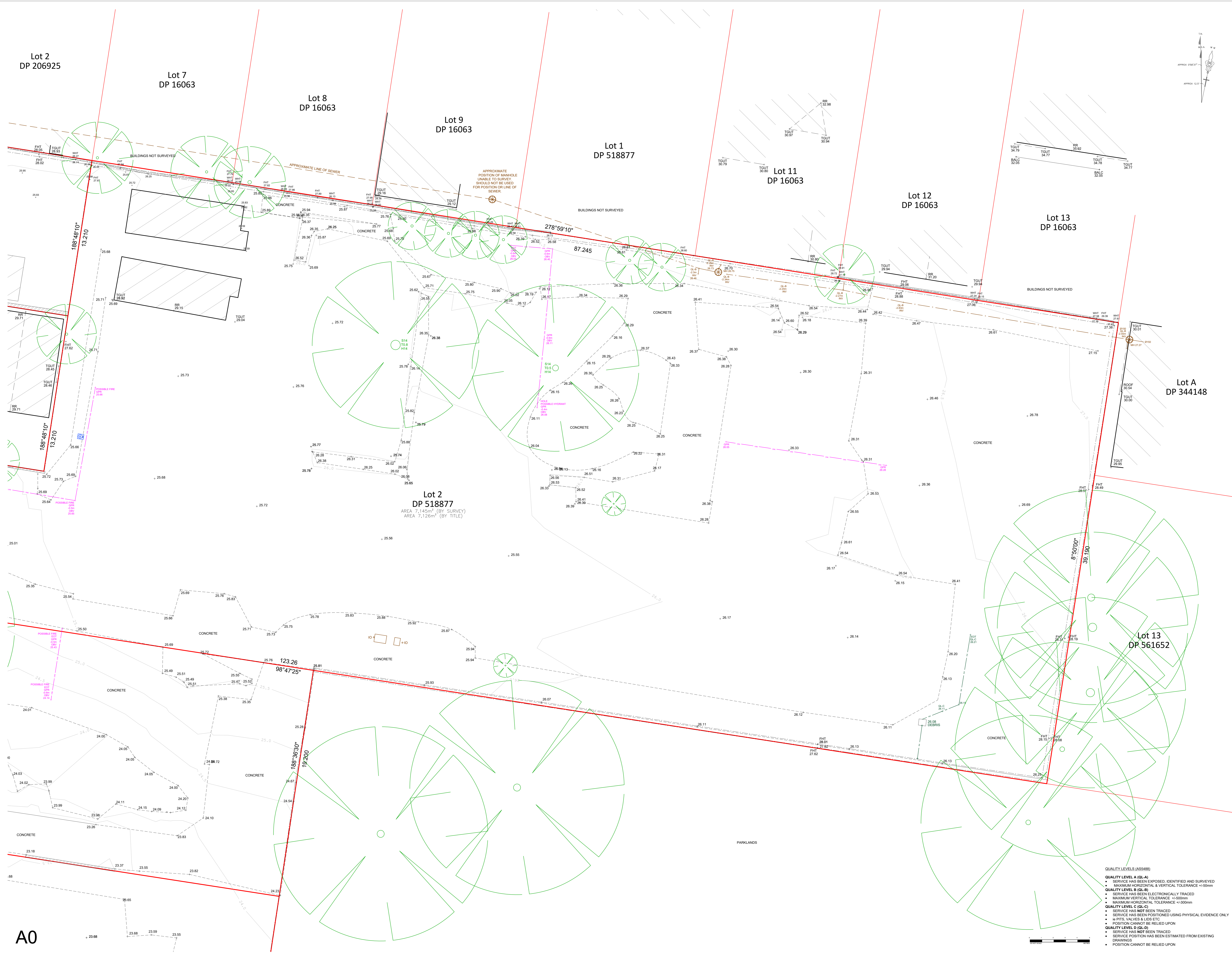
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 ABN : 12 109 067 950

CYRE PROJECTS

Project	Drawing File	Drawing Title	Date
59-67 KARNE STREET NARWEE	DETAIL + LEVEL & UTILITIES SURVEY SHEET 2 OF 8	DATUM: AHD RM: ADOPTEO:SSM 108411 BL: 27.054	

- QUALITY LEVELS (AS5488)**
- QUALITY LEVEL A (QL-A)**
 - SERVICE HAS BEEN EXPOSED, IDENTIFIED AND SURVEYED
 - MAXIMUM HORIZONTAL & VERTICAL TOLERANCE +/-50mm
 - QUALITY LEVEL B (QL-B)**
 - SERVICE HAS NOT BEEN TRACED
 - SERVICE HAS BEEN ELECTRONICALLY TRACED
 - MAXIMUM VERTICAL TOLERANCE +/-500mm
 - MAXIMUM HORIZONTAL TOLERANCE +/-300mm
 - QUALITY LEVEL C (QL-C)**
 - SERVICE HAS NOT BEEN TRACED
 - SERVICE HAS BEEN POSITIONED USING PHYSICAL EVIDENCE ONLY
 - IN PITS, VALVES & LIDS ETC
 - POSITION CANNOT BE RELIED UPON
 - QUALITY LEVEL D (QL-D)**
 - SERVICE HAS NOT BEEN TRACED
 - SERVICE POSITION HAS BEEN ESTIMATED FROM EXISTING DRAWINGS
 - POSITION CANNOT BE RELIED UPON



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LINE TYPES

WATERMAIN	---
ELECTRICITY	---
OVERHEAD ELECTRICITY	---
TELECOMMUNICATIONS	---
SEWER	---
STORMWATER	---
MAN LINE	---
OPTUS LINE	---
OPTICAL FIBRE LINE	---
NEXT GEN LINE	---
FUEL LINE	---
UNKNOWN	---
TRP	---
FENCE	---
MAPT	---
COMMS	---
FENCE	---

SYMBOLS

○	FIRE HOSE REEL	○	VALVE
○	FIRE EXTINGUISHER	○	GAS METER
○	TAP	○	GAS MARKER
○	WATER METER	○	BENCH MARK
○	HYDRANT	○	TREE - S12 TO S110 (SPREAD TRUNK HEIGHT)

ANNOTATION

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GL	- GROUND LEVEL	PP	- POWER POLE
GY	- GULLY PIT	RR	- ROOF RIDGE
INV	- INVERT	SMH	- SEWER MANHOLE
IO	- INSPECTION OPENING (SEWER)	UTL	- UNABLE TO LEFT
IOS	- INSPECTION OPENING (STORMWATER)	UTL	- UNABLE TO TRACE
KB	- KEBB INVERT	TGUT	- TOP OF GUTTER
LH	- SEWER LAMPHOLE	WHT	- WALL HEIGHT

QUALITY LEVEL A (Q.L.A)

- SERVICE HAS BEEN EXPOSED, IDENTIFIED AND SURVEYED
- MAXIMUM HORIZONTAL & VERTICAL TOLERANCE +/-50mm

QUALITY LEVEL B (Q.L.B)

- SERVICE HAS BEEN ELECTRONICALLY TRACED
- MAXIMUM VERTICAL TOLERANCE +/-500mm
- MAXIMUM HORIZONTAL TOLERANCE +/-300mm

QUALITY LEVEL C (Q.L.C)

- SERVICE HAS NOT BEEN TRACED
- SERVICE HAS NOT BEEN POSITIONED USING PHYSICAL EVIDENCE ONLY
- IN PITS, VALVES & LIDS ETC.
- POSITION CANNOT BE RELIED UPON

QUALITY LEVEL D (Q.L.D)

- SERVICE HAS NOT BEEN TRACED
- SERVICE POSITION HAS BEEN ESTIMATED FROM EXISTING DRAWINGS
- POSITION CANNOT BE RELIED UPON

QUALITY LEVEL RISK MATRIX

Q.L.A	MEASURED DIRECTLY TO UTILITY
Q.L.B	ELECTRONIC TRACING OF UTILITY
Q.L.C	ALIGNED TO SURFACE FEATURES
Q.L.D	ESTIMATED FROM EXISTING DRAWINGS

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 EMAIL : info@v-mark-survey.com.au
 ABN : 12 109 067 950

CYRE PROJECTS

Project: 59-67 KARNE STREET NARWEE

Drawing File: DETAIL + LEVEL & UTILITIES SURVEY SHEET 3 OF 8

Vertical Datum: DATUM: AHD
 BM ADOPTED: SSM 108411
 RL: 27.054

Date: MAY 2022
 Drawn By: CH
 Checked: DJB
 Project: DJB

Scale: 1:100@A0
 Drawing No: 206455-DL
 Rev: H

A0

QUALITY LEVELS (AS4688)

QUALITY LEVEL A (Q.L.A)

- SERVICE HAS BEEN EXPOSED, IDENTIFIED AND SURVEYED
- MAXIMUM HORIZONTAL & VERTICAL TOLERANCE +/-50mm

QUALITY LEVEL B (Q.L.B)

- SERVICE HAS BEEN ELECTRONICALLY TRACED
- MAXIMUM VERTICAL TOLERANCE +/-500mm
- MAXIMUM HORIZONTAL TOLERANCE +/-300mm

QUALITY LEVEL C (Q.L.C)

- SERVICE HAS NOT BEEN TRACED
- SERVICE HAS NOT BEEN POSITIONED USING PHYSICAL EVIDENCE ONLY
- IN PITS, VALVES & LIDS ETC.
- POSITION CANNOT BE RELIED UPON

QUALITY LEVEL D (Q.L.D)

- SERVICE HAS NOT BEEN TRACED
- SERVICE POSITION HAS BEEN ESTIMATED FROM EXISTING DRAWINGS
- POSITION CANNOT BE RELIED UPON



NOTES

- BOUNDARIES HAVE BEEN DEFINED BY SURVEY
- WALL TO BOUNDARY DIMENSIONS MUST NOT BE USED FOR CONSTRUCTION
- IF CONSTRUCTION ON OR NEAR BOUNDARIES IS REQUIRED IT IS RECOMMENDED THAT THE BOUNDARIES OF THE LAND BE MARKED
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LINE TYPES

WATERMAIN	---
ELECTRICITY	---
OVERHEAD ELECTRICITY	---
TELECOMMUNICATIONS	---
SEWER	---
GAS (RIG)	---
STORMWATER	---
MINI LINE	---
OPTUS LINE	---
OPTICAL FIBRE LINE	---
NEXT GEN LINE	---
FUEL LINE	---
UNKNOWN	---
TRP	---
JAPT	---
COMMS	---
FENCE	---

SYMBOLS

⊠	FIRE HOSE REEL	⊠	VALVE
⊠	FIRE EXTINGUISHER	⊠	GAS METER
⊠	TAP	⊠	GAS MARKER
⊠	WATER METER	⊠	BENCH MARK
⊠	HYDRANT	⊠	TRIE - 812 TO 5 H10 (SPREAD TRUNK HEIGHT)

ANNOTATION

DP	- DOWN PIPE	LP	- LIGHT POLE
FHT	- FENCE HEIGHT	MH	- MANHOLE
FL	- FLOOR LEVEL	OBV	- OBVERT
GL	- GROUND LEVEL	OP	- POWER POLE
GY	- GULLY PIT	PP	- ROOF RIDGE
INV	- INVERT	RR	- ROOF RISE
IO	- INSPECTION OPENING (SEWER)	UTL	- UNABLE TO LIFT
IOS	- INSPECTION OPENING (STORMWATER)	UTL	- UNABLE TO TRACE
KBI	- KERB INVERT	TOUT	- TOP OF GUTTER
LH	- SEWER LAMPPIECE	WHT	- WALL HEIGHT

QUALITY LEVEL RISK MATRIX

Q.L.A	MEASURED DIRECTLY TO UTILITY
Q.L.B	ELECTRONIC TRACING OF UTILITY
Q.L.C	ALIGNED TO SURFACE FEATURES
Q.L.D	ESTIMATED FROM EXISTING DRAWINGS

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REVISIONS

Rev	Desc	Revision/Issue	Ref No.	Date
H	CH	POTHOLES	208173	26/06/23
G	CH	SURVEY EXTENDED	207987	5/5/23
F	CH	DETAIL ADDED	207951	18/4/23
E	CH	SEWER EXTENDED	207415	14/12/22
D	CH	STORMWATER EXTENDED	207288	17/11/22
C	CH	STORMWATER ADDED	207192	13/10/22
B	CH	CONTOURS ADDED	206455	06/07/22
A	CH	GENERAL ISSUE	206455	17/05/22
-	CH	PRELIMINARY ISSUE	206455	12/05/22

CLIENT DETAILS

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 NARREE VIC 3717
 PH : 02 9016 4235
 EMAIL : dev@v-marksurvey.com.au
 ABN : 12 109 067 950

CYRE PROJECTS

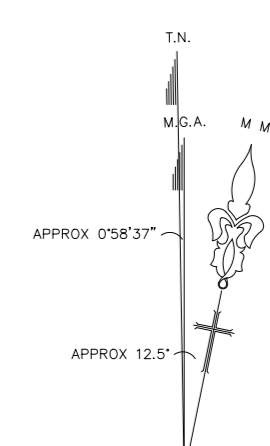
Project: 59-67 KARNE STREET NARWEE

Drawing File: DETAIL + LEVEL & UTILITIES SURVEY SHEET 4 OF 8

Vertical Datum: DATUM: AHD
 BM ADOPTED: SSM 108411
 RL: 27.054

Date: MAY 2022
 Scale: 1:100@A0

Drawn By: CH
 Checked: DUB
 Project No: 206455-DL
 Revision: H



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LINE TYPES

WATERMAIN	---	---	---	---	---	---	---	---	---
ELECTRICITY	---	---	---	---	---	---	---	---	---
OVERHEAD ELECTRICITY	---	---	---	---	---	---	---	---	---
TELECOMMUNICATIONS	---	---	---	---	---	---	---	---	---
GAS (DPO)	---	---	---	---	---	---	---	---	---
SEWER	---	---	---	---	---	---	---	---	---
STORMWATER	---	---	---	---	---	---	---	---	---
MIN LINE	---	---	---	---	---	---	---	---	---
OPTUS LINE	---	---	---	---	---	---	---	---	---
OPTICAL FIBRE LINE	---	---	---	---	---	---	---	---	---
NET GEN LINE	---	---	---	---	---	---	---	---	---
FUEL LINE	---	---	---	---	---	---	---	---	---
UNKNOWNS	---	---	---	---	---	---	---	---	---
AAPT	---	---	---	---	---	---	---	---	---
COMMS	---	---	---	---	---	---	---	---	---
FENCE	---	---	---	---	---	---	---	---	---

SYMBOLS

█	FIRE HOSE REEL	⊕	VALVE
⊗	FIRE EXTINGUISHER	⊙	GAS METER
⊥	TAP	⊕	GAS MARKER
⊕	WATER METER	⊕	BENCH MARK
⊕	HYDRANT	⊕	TREE - 512 TO 5110 (SPREAD TRUNK HEIGHT)

ANNOTATION

DP	DOWN PIPE	LP	LIGHT POLE
FHT	FENCE HEIGHT	MH	MANHOLE
FL	FLOOR LEVEL	OBV	OBVIOUS
GL	GROUND LEVEL	PP	POWER POLE
GY	GULLY PIT	RR	ROOF RIDGE
INV	INVERT	SMH	SEWER MANHOLE
IO	INSPECTION OPENING (SEWER)	UTL	UNABLE TO LIFT
IOS	INSPECTION OPENING (STORMWATER)	UTL	UNABLE TO TRACE
KB	KEYS INVERT	TGUT	TOP OF GUTTER
LH	SEWER LAMPHOLE	WHT	WALL HEIGHT

QL-B
 0.65m INV
 0.65m DEPTH TO INVERT
 0.10.56
 SERVICE LOCATED TO QUALITY LEVEL B
 0.65m DEPTH TO INVERT
 GROUND LEVEL 10.56

QUALITY LEVEL RISK MATRIX

█	CERTAINTY	█	MEASURED DIRECTLY TO UTILITY
█	QL-A	█	ELECTRONIC TRACING OF UTILITY
█	QL-B	█	ALIGNED TO SURFACE FEATURES
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 WATKINS NSW 2177
 PH : 02 9016 4235
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 ABN : 12 109 067 950

CYRE PROJECTS

Project: 59-67 KARNE STREET NARWEE

Drawing File: DETAIL + LEVEL & UTILITIES SURVEY SHEET 5 OF 8

Vertical Datum: DATUM: AHD
 BM ADOPTED: SSM 108411
 RL: 27.054

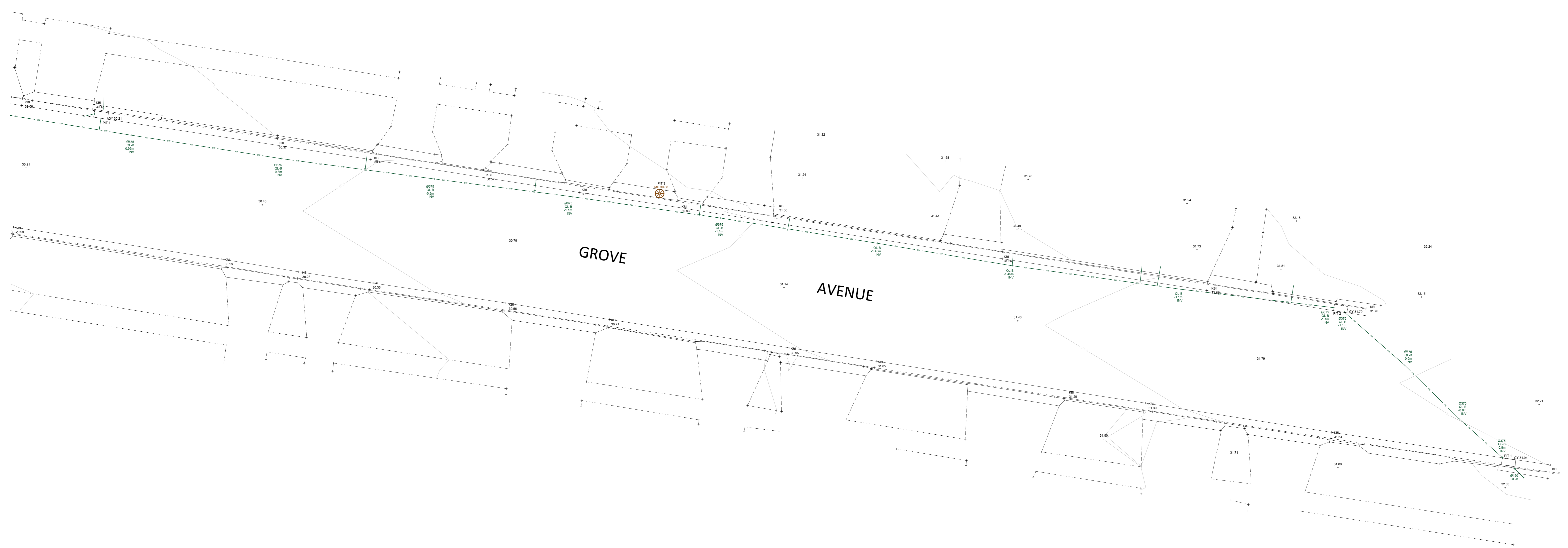
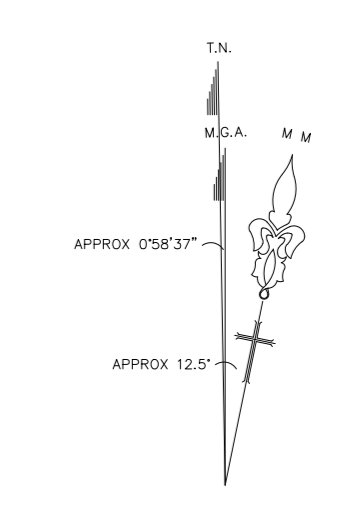
Date: MAY 2022
 Scale: 1:100@A0

Drawn By: CH
 Checked: DJB
 Project: H

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A0
CONCRETE





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OVERHEAD ELECTRICITY	---	---	---	---
TELECOMMUNICATIONS	---	---	---	---
CLASSIFIED	---	---	---	---
SEWER	---	---	---	---
STORMWATER	---	---	---	---
RAIN LINE	---	---	---	---
OPTUS LINE	---	---	---	---
OPTICAL FIBRE LINE	---	---	---	---
NEXT GEN LINE	---	---	---	---
FUEL LINE	---	---	---	---
UNKNOWN	---	---	---	---
TPO	---	---	---	---
FIRE	---	---	---	---
AFT	---	---	---	---
COMMS	---	---	---	---
FENCE	---	---	---	---

SYMBOLS

Fire hose reel	Valve
FX Fire extinguisher	Gas meter
TAP	Gas marker
Water meter	Bench mark
Hydrant	Tree - 0.12 to 1.10 (spread trunk height)

ANNOTATION

DP - DOWN PIPE	LP - LIGHT POLE
FHT - FENCE HEIGHT	MH - MANHOLE
FL - FLOOR LEVEL	OBV - OBVERT
GL - GROUND LEVEL	OP - POWER POLE
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QUALITY LEVEL RISK MATRIX

QL-A	HEARDED DIRECTLY TO UTILITY
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CYRE PROJECTS

Client Details

Project: 59-67 KARNE STREET NARWEE

Drawing File: DETAIL + LEVEL & UTILITIES SURVEY SHEET 6 OF 8

Vertical Datum: DATUM: AHD
BM ADOPTED: SSM 108411
RL: 27.054

Date:	MAY 2022	Dim:	CH	Dim:	DJB	Dim:	DJB
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- THIS DRAWING IS ONLY VALID FOR 28 DAYS AFTER THE DATE OF LOCATING
- UTILITIES HAVE BEEN LOCATED USING ELECTROMAGNETIC LOCATING AND GPR EQUIPMENT
- AS-S488-2022 QUALITY LEVELS HAVE BEEN ADOPTED
- ALL UTILITIES NEED TO BE POTHOLED TO VERIFY LOCATION AND DEPTH BEFORE CARRYING OUT ANY CONSTRUCTION WORKS
- LEVELS OF SURVEYED OBSERVATIONS ARE AT GROUND LEVEL UNLESS NOTED OTHERWISE
- NOTATION "0.85m INV QL-B" REPRESENTS A QUALITY LEVEL B DEPTH TO THE INVERT OF A SERVICE AS PER AS-S488-2022 AND APPLIES TO THE POINT AND NOT THE LINE
- ALL DEPTHS A QUALITY LEVELS APPLY TO THE POINT AND NOT THE LINE - ACTUAL POSITION OF SERVICES MAY VARY SUBSTANTIALLY BETWEEN SURVEYED POINTS
- DIAMETERS AND MATERIALS HAVE BEEN OBTAINED FROM BYDA DRAWINGS UNLESS QLA
- UTILITIES HAVE BEEN SURVEYED USING TOTAL STATIONS
- PLEASE REFER TO CIVILS REPORT FOR FURTHER DETAILS ABOUT SERVICE LOCATION
- THIS SURVEY IS RELATED TO GDA2020 56 HORIZONTAL AND AHD71 HEIGHT DATUM
- THERE MAY BE SOME UNCERTAINTY AROUND SOME OF THE LOCATING AND WE RECOMMEND NON DESTRUCTIVE EXCAVATION
- THIS DRAWING IS DESIGNED TO REDUCE RISK NOT ELIMINATE RISK
- THIS DRAWING DOES NOT REPLACE BYDA INFORMATION AND EACH UTILITY OWNERS DUTY OF CARE NEEDS TO BE CONSULTED BEFORE EXCAVATION
- THESE NOTES MUST NOT BE REMOVED

LINE TYPES

WATERMAIN	---
ELECTRICITY	---
OVERHEAD ELECTRICITY	---
TELECOMMUNICATIONS	---
GAS (DPO)	---
SEWER	---
STORMWATER	---
MIN LINE	---
OPTUS LINE	---
OPTICAL FIBRE LINE	---
NET GEN LINE	---
FUEL LINE	---
UNIDENTIFIED	---
APRT	---
COMMS	---
FENCE	---

SYMBOLS

⊞	FIRE HOSE REEL	⊞	VALVE
⊞	FIRE EXTINGUISHER	⊞	GAS METER
⊞	TAP	⊞	GAS MARKER
⊞	WATER METER	⊞	BENCH MARK
⊞	HYDRANT	⊞	TREE - 512 TO 510 (SPREAD TRUNK HEIGHT)

ANNOTATION

DP	DOWN PIPE	LP	LIGHT POLE
FH	FENCE HEIGHT	MM	MANHOLE
FL	FLOOR LEVEL	OBV	OBVERT
GL	GROUND LEVEL	PP	POWER POLE
GY	GULLY PIT	RR	ROOF RIDGE
INV	INVERT	SMH	SEWER MANHOLE
IO	INSPECTION OPENING (SEWER)	UTL	UNABLE TO TRACE (STORMWATER)
IOS	INSPECTION OPENING (STORMWATER)	UTL	UNABLE TO TRACE (SEWER)
KBI	KERB INVERT	TOUT	TOP OF TOUT
LH	SEWER LAMP PILE	WHT	WALL HEIGHT

QUALITY LEVEL RISK MATRIX

CERTAINTY	RISK	MEASURED DIRECTLY TO UTILITY	ELECTRONIC TRACKING OF UTILITY	ALIGNED TO SURFACE FEATURES	ESTIMATED FROM EXISTING DRAWINGS
QLA	High	Green	Yellow	Orange	Red
QLB	Medium	Green	Yellow	Orange	Red
QLC	Low	Green	Yellow	Orange	Red

Rev	Dim	Revision/Issue	Ref No.	Date
G	CH	POTHOLES	208173	26/06/23
H	CH	SURVEY EXTENDED	207987	5/5/23
F	CH	DETAIL ADDED	207951	18/4/23
E	CH	SEWER EXTENDED	207415	13/12/22
D	DB	STORMWATER EXTENDED	207288	17/11/22
C	CH	STORMWATER ADDED	207192	13/10/22
B	CH	CONTOURS ADDED	206455	06/07/22
A	CH	GENERAL ISSUE	206455	17/05/22
-	CH	PRELIMINARY ISSUE	206455	12/05/22

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CYRE PROJECTS

Project: **59-67 KARNE STREET NARWEE**

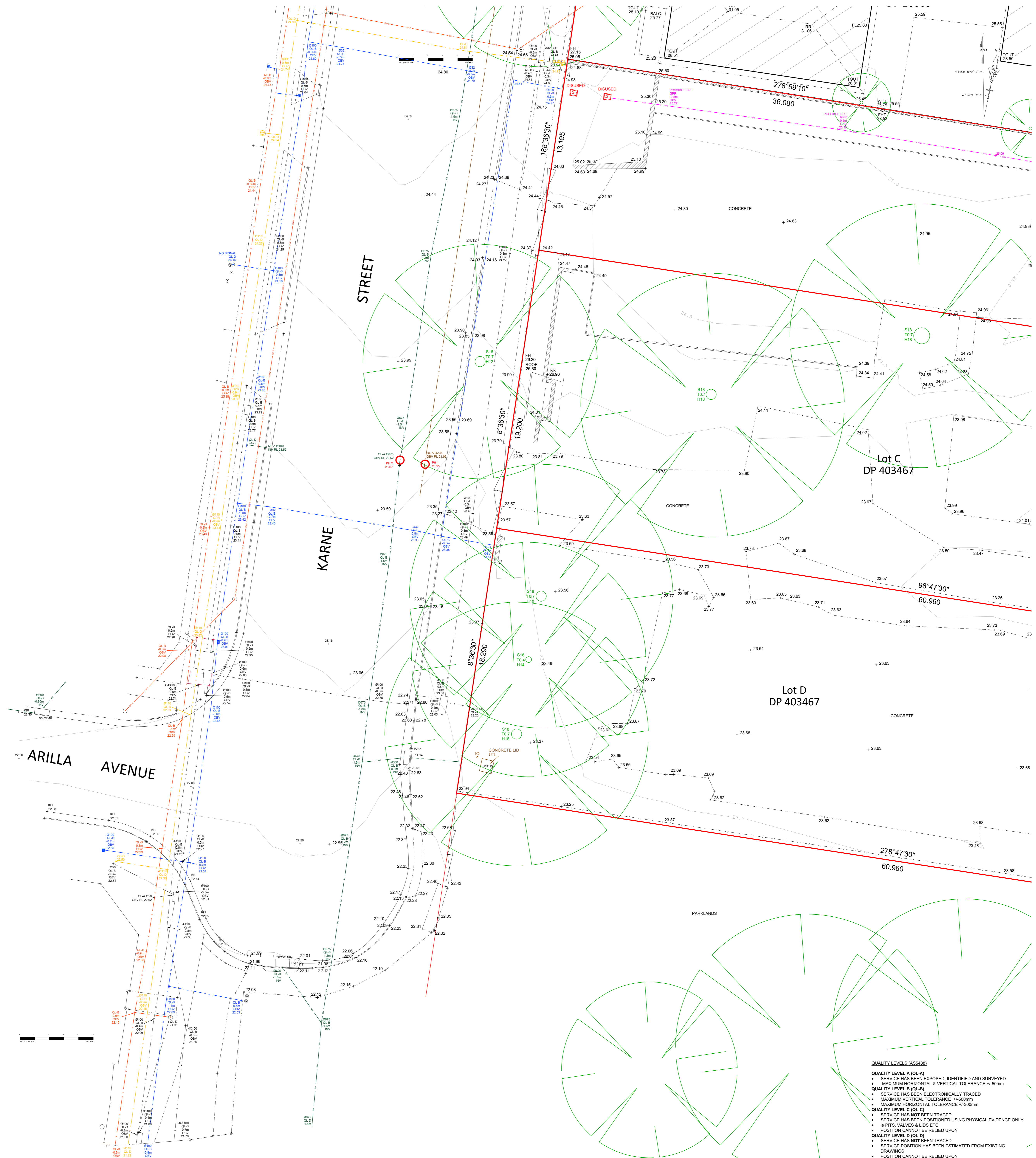
Drawing File: **DETAIL + LEVEL & UTILITIES SURVEY SHEET 7 OF 8**

Vertical Datum: **DATUM: AHD
BM ADOPTED: SSM 108411
RL: 27.054**

Date: **MAY 2022** Drawn By: **CH** Checked: **DJB** Plot: **DJB**

Scale: **1:100@A0** Drawing No: **206455-DL** Rev: **H**

A0



- NOTES**
- BOUNDARIES HAVE BEEN DEFINED BY SURVEY
 - WALL TO BOUNDARY DIMENSIONS MUST NOT BE USED FOR CONSTRUCTION
 - IF CONSTRUCTION ON OR NEAR BOUNDARIES IS REQUIRED IT IS RECOMMENDED THAT THE BOUNDARIES OF THE LAND BE MARKED
 - TREE SIZES ARE ESTIMATES ONLY
 - THIS PLAN HAS BEEN PREPARED FOR THE EXCLUSIVE USE OF CYRE PROJECTS
 - RELATIONSHIP OF IMPROVEMENTS TO BOUNDARIES IS DIAGRAMMATIC ONLY. WHERE OFFSETS ARE CRITICAL THEY SHOULD BE CONFIRMED BY FURTHER SURVEY
 - EXCEPT WHERE SHOWN BY DIMENSION LOCATION OF DETAIL WITH RESPECT TO BOUNDARIES IS INDICATIVE ONLY
 - THIS SURVEY IS RELATED TO MGA2020 56 HORIZONTAL GRID AND AHD71 HEIGHT DATUM
 - CRITICAL SPOT LEVELS SHOULD BE CONFIRMED WITH SURVEYOR
 - THIS PLAN IS ONLY TO BE USED FOR THE PURPOSE OF PLANNING A DEVELOPMENT
 - CONTOURS SHOWN DEPICT THE TOPOGRAPHY. THEY DO NOT REPRESENT THE EXACT LEVEL AT ANY PARTICULAR POINT ONLY SPOT LEVELS SHOULD BE USED FOR CALCULATIONS OF QUANTITIES WITH CAUTION
 - CONTOUR INTERVAL - 0.5 metre - SPOT LEVELS SHOULD BE ADOPTED
 - POSITION OF RIDGE LINES ARE DIAGRAMMATIC ONLY (NOT TO SCALE)
 - THE INFORMATION IS ONLY TO BE USED AT A SCALE ACCURACY OF 1:100
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 - NOTATION "Q.L.B" INV. @ "B" REPRESENTS A QUALITY LEVEL B DEPTH TO THE INVERT OF A SERVICE AS PER AS-4488:2022 AND APPLIES TO THE POINT AND NOT THE LINE
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LINE TYPES

WATERMAIN	---
ELECTRICITY	---
OVERHEAD ELECTRICITY	---
TELECOMMUNICATIONS	---
GAS (H.P.G.)	---
SEWER	---
STORMWATER	---
MINI LINE	---
OPTUS LINE	---
OPTICAL FIBRE LINE	---
NEXT GEN LINE	---
FUEL LINE	---
UNKNOWN	---
TRP	---
FENCE	---
GAFT	---
CONCRETE	---
FENCE	---

SYMBOLS

☐	FIRE HOSE REEL	⊕	VALVE
☒	FIRE EXTINGUISHER	⊙	GAS METER
⊥	TAP	⊙	GAS MARKER
⊕	WATER METER	⊕	BENCH MARK
⊕	HYDRANT	⊕	TREE - S12 TO S10 (SPREAD TRUNK HEIGHT)

ANNOTATION

DP	DOWN PIPE	LP	LIGHT POLE
FHT	FENCE HEIGHT	MH	MANHOLE
FL	FLOOR LEVEL	OBV	OBVERT
GL	GROUND LEVEL	PP	POWER POLE
GY	GULLY PIT	RR	ROOF RIDGE
INV	INVERT	SM	SEWER MANHOLE
IO	INSPECTION OPENING (SEWER)	UTL	UNABLE TO LIFT
IOS	INSPECTION OPENING (STORMWATER)	UTL	UNABLE TO TRACE
KBI	KERB INVERT	TGUT	TOP OF GUTTER
LH	SEWER LAMPHOLE	WHT	WALL HEIGHT

Q.L.B
Q.L.B 0.60m SERVICE LOCATED TO QUALITY LEVEL B
INV 0.60m DEPTH TO INVERT
Q.L.0.56 GROUND LEVEL 19.96

QUALITY LEVEL RISK MATRIX

CERTAINTY	RISK
Q.A	MEASURED DIRECTLY TO UTILITY
Q.B	ELECTRONIC TRACKING OF UTILITY
Q.C	ALIGNED TO SURFACE FEATURES
Q.D	ESTIMATED FROM EXISTING DRAWINGS

Rev	Desc	Revision/Issue	Ref No.	Date
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ABN : 12 109 067 950

CYRE PROJECTS

Client Details

Project: **59-67 KARNE STREET NARWEE**

Drawing Title: **DETAIL + LEVEL & UTILITIES SURVEY SHEET 8 OF 8**

Vertical Datum: **DATUM: AHD
BM ADOPTED: SSM 108411
RL: 27.054**

Date	By	CHK	CHK	Rev
MAY 2022	CH	DJB	DJB	H

Scale: 1:100@A0

A0

- QUALITY LEVELS (AS4488)**
- QUALITY LEVEL A (Q.L.A)**
 - SERVICE HAS BEEN EXPOSED, IDENTIFIED AND SURVEYED
 - SERVICE HAS NOT BEEN TRACED
 - MAXIMUM HORIZONTAL & VERTICAL TOLERANCE +/-50mm
 - QUALITY LEVEL B (Q.L.B)**
 - SERVICE HAS BEEN ELECTRONICALLY TRACED
 - SERVICE HAS NOT BEEN TRACED
 - MAXIMUM VERTICAL TOLERANCE +/-500mm
 - MAXIMUM HORIZONTAL TOLERANCE +/-300mm
 - QUALITY LEVEL C (Q.L.C)**
 - SERVICE HAS BEEN POSITIONED USING PHYSICAL EVIDENCE ONLY
 - SERVICE HAS NOT BEEN TRACED
 - POSITION CANNOT BE RELIED UPON
 - QUALITY LEVEL D (Q.L.D)**
 - SERVICE HAS NOT BEEN TRACED
 - SERVICE POSITION HAS BEEN ESTIMATED FROM EXISTING DRAWINGS
 - POSITION CANNOT BE RELIED UPON