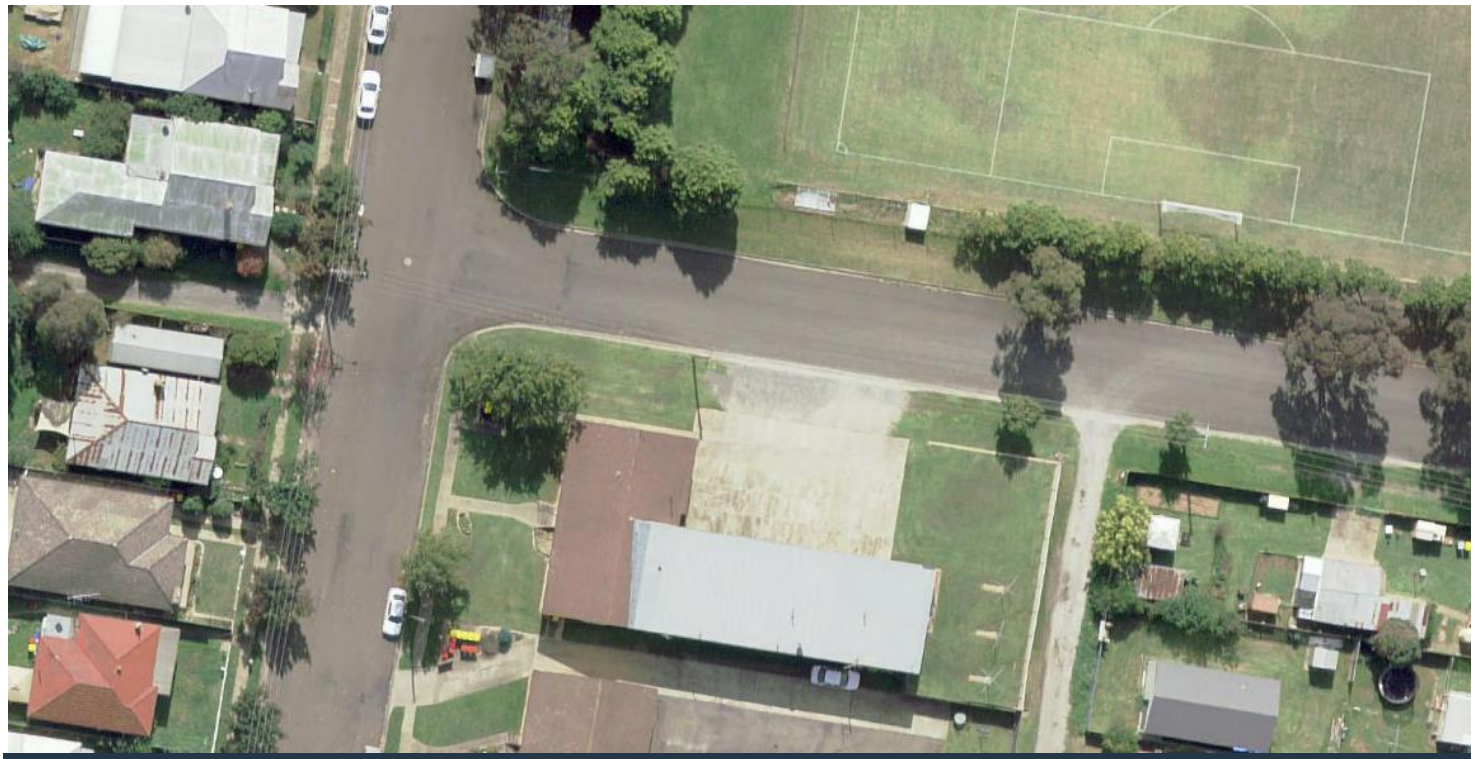

Flood Assessment Letter & Risk Management Plan

PROPOSED ALTERATIONS AND ADDITIONS

15 Avoca Street, Goulburn

ARCHIPLAN Design Studio

JN
Responsive Engineering

CPRT – N0200943.01

Revision History

REVISION	DATE	BY	CHECKED	COMMENTS
A	31.05.2021	DY	BA	FOR INTERNAL REVIEW
B	01.06.2021	DY	BA	UPDATED FOR INTERNAL REVIEW
C	04.06.2021	DY	BA	ISSUED FOR SUBMISSION
D	08.06.2021	NJ	BA	ISSUED FOR SUBMISSION
E	09.06.2021	DY	BA	ISSUED FOR SUBMISSION
F	24.06.2021	DY	BA	RE-ISSUED FOLLOWING COUNCIL FEEDBACK

The recipient of the latest issue as noted above will be responsible for superseding/destroying all previous documents.

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1. Overview

As requested by Perry Gribilas of ARCHIPLAN Design Studio, JN have been engaged to undertake a flood assessment, inclusive of structural requirements for the flood affectation of the storage areas at 15 Avoca Street, Goulburn. The site location is provided in Figure 1. below.

Figure 1. Site Location Map (Nearmap Image, dated 10/04/2021)

The following information is the findings of the existing available flood information. JN has undertaken a desktop assessment of the existing flood conditions. The assessment was based on the available flooding information and mapping, namely the Goulburn Flood Study Final Report Merge (Flood Maps etc.), published on Goulburn City Council's website. The subject development is a refurbishment to 2 units at 15 Avoca St. The relevant spaces are storage areas and bathrooms. The assessment determined that the subject site was affected by flooding during the 1% Annual Exceedance Probability (AEP) event at 15 Avoca St, Goulburn NSW, as depicted in in Figure 2. below, has been identified as being flood prone with respect to a 1% Annual Exceedance Probability (AEP) event.

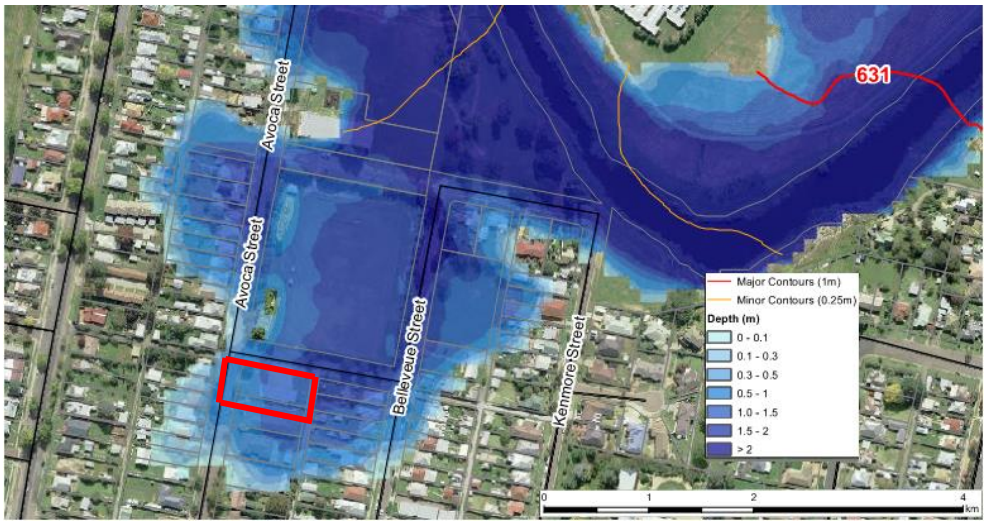

Figure 2. Goulburn Flood Study Final Report Merge (Flood Maps etc) – 1% Annual Exceedance Probability (AEP)

Based on the available information, the flood information provided by Goulburn City Council estimates the 1% AEP flood level as 0.5 – 1 meter above the ground level in the vicinity of the property based on the Combined Catchments of the Wollondilly River and Mulwaree Chain of Ponds, dated March 2011. In accordance with The Wollondilly River and Mulwaree Chain of Ponds Floodplain Risk Management Study & Plan Volume III, the site is classed as Low Hazard.

2. Flood Risk Reduction

2.1. Flood Mitigation Works

In order to ensure there is no change to existing flooding extents within the site or surrounding areas, it is proposed to provide a louvre in the door/wall framing to allow water to freely enter the dwelling. In this case the stud framing will still need to be brought to a waterproof condition to prevent wood rot and decomposition should flood waters occur.

For the purpose of this report, the Flood Height Level (FHL) and the Defined Flood Level (DFL) are one and the same as the Defined Height Level is the 100-year ARI event.

To ensure this is the case, the following will need to be undertaken in line with the BCA report:

- Any enclosure below the 100-year ARI RL of 631.313 must have openings to allow for automatic entry and exit of floodwater for all floods up to the Flood Height Level (FHL)
- The openings must meet the following criteria
    1. Doors and windows must not be counted as openings, but openings can be installed in doors and windows, and
    2. There must be a minimum of two openings on different sides of each enclosed area, and
    3. The total net area of all openings must be at least 1% of the enclosed area, and
    4. Openings must permit a 75 mm sphere to pass through, and
    5. Any opening covers must not impede the flow of water

Additionally, any electrical and internal wiring will have to be raised above the maximum flood level. The anticipated flood levels from the study above convey the top flood level to be approximately RL631.313. The GPOs and wiring/other electrical equipment shall be raised to minimum RL631.80. As such, the louvre must have an area of no less than:

	Area (m2)	Open area Required (1% of total area) m2
Storage 1	17.60	0.176
Storage 2	19.43	0.194
Storage 4	61.53	0.615
Unit 6	23.99	0.239

2.2. Structural Flood Affectation

Structural advice and assessment have been determined in association with the BCA report, and the findings/determinations are outlined below.

- Footing System in Flood Prone Area – All existing structure and no new building works therefore it is assumed the original structure is compliant. New Grounds keeper shed will be designed to allow for flood loading as required.
- Requirements for structural attachments – Any new works will be designed accordingly to ensure the structural integrity of the existing structure.
- Material Requirements – As the undercroft dividing walls are non-load bearing, and therefore no structural concern however JN Suggest the following materials in order of preference due to the flood risk:
    1. Brick Walls.
    2. Brick walls to above Flood height, steel stud framing to ceiling.
    3. Steel stud framing with submerged waterproof cladding. Wall to also have weep holes to allow water regress.
    4. Fully Waterproof membrane designed by others to all cavity walls.
- All electrical wiring and services within undercroft are to be raised above Flood level.

General Comments:

- New Balcony and stairs can be designed in accordance with all BCA and Australian Standards once Development application has been approved.
- Waterproofing, fire rated, and acoustic linings are generally designed and confirmed by others, but we can provide comment on suitability to existing structural elements.

3. Flood Warnings

3.1. Warning of Impeding Flood

The Bureau of Meteorology provides flood advice, flood forecasting and warnings relevant to the local area which are conveyed to emergency service agencies.

The Bureau of Meteorology will advise on severe weather or thunderstorm warnings for the local area to the SES Local Controller. In addition to this, information will also be made available through media outlets to disseminate evaluation warnings.

3.1.1. Severe Weather Warnings

The Bureau of Meteorology issues Severe Weather Warnings whenever severe weather is occurring in an area or is expected to develop or move into an area. The warnings describe the area under threat and the expected hazards. Warnings are issued with varying lead-times, depending on the weather situation, and range from just an hour or two up to about 24 hours.

Severe Weather Warnings are issued for:

- Sustained winds of gale force (63 km/h) or more

- Wind gusts of 90 km/h or more
- Very heavy rain that may lead to flash flooding
- Abnormally high tides (or storm tides) expected to exceed highest astronomical tide
- Unusually large surf waves expected to cause dangerous conditions on the coast
- Widespread blizzards in Alpine areas

3.1.2. Flood Watch

A Flood Watch is issued by the Bureau of Meteorology if flood producing rain is expected to occur soon and flooding is expected to be above Minor level.

3.1.3. Preliminary Flood Warnings

These warnings usually predict which class of flooding (minor, moderate or major) will occur rather than providing quantitative forecasts. They are the first in a series of warnings and will typically be followed by more detailed flood warnings. These products are disseminated directly to media outlets by the BoM and are published on the BoM website.

3.1.4. Flood Warnings

These normally predict flood heights (in metres and centimetres at a gauge) which will be reached at a location at a specified time in the future. After the issuing of a Preliminary Flood Warning, Flood Warnings are renewed at frequent intervals until the relevant stream drops to below the minor flood level. The local SES is responsible in covering operations for all levels of flooding within the council area and caters for both SES control of operations and where appropriate, the handover to the Local Emergency Controller (LECON).

Local Emergency Operations Controller (LECON)

- Mentor flood response operations
- Coordinate support to the SES local Controller if requested to do so
- As required by the SES Local Controller, evacuate persons at threat of inundation
- Control emergency operations
- Issue the 'all clear' when Emergency operations have been completed

NSW Police Service

- Assist with the distribution of evacuation warnings
- Assist with the conduct of evacuations
- Conduct road control operations in conjunction with the Roads and Maritime Service (RMS) and City of Ryde Council
- Ensure all evacuees are registered
- Secure evacuated area

NSW Fire Brigades

- Assist with the distribution of evacuation warnings
- Assist with the conduct of evacuations
- Carry out clean up operations, including the hosing down of flood affected premises

4. Flood Emergency Response Plan

4.1. Preparedness

In preparation for any flood event, the following items should be addressed:

Education and training to occupants and staff on flood awareness and plan implementation is intrinsic to its successful operation. All staff members and building management are to be familiarised with this document.

The building manager will be designated as the Site Flood Coordinator and is entrusted with the responsibility of monitoring flood activities and dissemination of evacuation warning as and when required.

The Site Flood Coordinator should attend the flood events and seminar held for the community in the local area to meet the local SES members and learn about flood safety. The event dates area found on the following website, https://www.ses.nsw.gov.au/disaster-tabs-header/flood/.

The FloodSafe Guide for the local area is required to be distributed to every staff member and occupant electronically. The FloodSafe Guide is a customised brochure addressing flooding in the local context.

Building occupants should regularly monitor Radio and Television alerts and warnings, as well as SES advice in the event of large rainfall events.

All new building occupants are to be introduced to this plan as part of their induction and made aware of the protocols to be employed during a flood event.

All medical supplies should be located above the PMF flood level where possible.

4.2. Alert

The building manager, staff and occupants shall be vigilant at all times of severe thunderstorms, weather warning and continual rain, and are encouraged to check with warning from local radio, television, or the SES Local Controller.

For flood help: SES 132 500

In the event of an alert by any of the channels outlined previously in this report, the Site Flood Coordinator is to communicate the alert to all staff members and occupants and initiate the Flood Emergency Response Plan.

4.3. Emergency Contacts

The list below should be updated regularly.

Parties to Contact	**Phone Number**
Building Manager's Office	(TBC)
SES	132 500 (Emergency Help)
Bureau of Meteorology NSW Flood Warning Centre	1300 659 218 9296 1555 http://www.bom.gov.au/nsw/warnings/
Local Fire Brigade	000 (Emergency)
Police	000 (Emergency)
City of Ryde Council	(02) 9952 8222
Sydney Water (Water and Sewer)	132 090
Endeavour Energy	131 033
RMS Traffic Enquiry	132 701

4.4. Evacuation

Evacuation is the temporary movement (relocation) of people from a dangerous or potentially dangerous place to a safe location, and their eventual return. It is a proactive emergency management strategy that uses distance to separate people from danger created by a hazard.

In this case as the flood extent is away from the building, occupants are advised to remain indoor during extreme storm events.

If Emergency Services advise that the occupants and others are to leave the site, then they should follow their directions and advice in moving to an appropriate evacuation/assembly point, if it is deemed safe to do so.

It is advisable that council shall provide adequate warning to pedestrian using the proposed link between Bayfield Street and Giffnock Avenue.

4.5. Actions, Responsibilities and Procedures

Evacuation actions, responsibilities and procedures are outlined below:

Action	When	Who
Monitor local radio and TV for flood warning	During heavy rain and prior to predicted heavy ran	Site Flood Coordinator, occupants, and staff
Monitor BOM and SES website	During heavy rain and prior to predicted heavy ran	Site Flood Coordinator, occupants, and staff
Review Site Evacuation Plan	Monthly	Site Flood Coordinator, occupants, and staff
Evacuation Drills	Bi-Annually	Site Flood Coordinator, occupants, and staff
Evacuation of occupants, visitors, and staff	After warning of flash flooding is made by BoM, in liaison with SES	Site Flood Coordinator, occupants, and staff
Designated flood combat agency Development of state and local flood plans and FloodSafe community guides	Continuous	NSW State Emergency Service
Familiarity with local flood risk and FloodSafe guides	Continuous	Building Occupants
Management of evacuation centres	During Evacuation Events	NSW Department of Community Services
Liaison with SES local and regional controllers Lead agency for floodplain risk management	Continuous	City of Ryde Council

4.5.1. Steps to Follow During the PMF Event

- Obtain information from BOM, SES, radio stations and local observations to ensure occurrence of event.
- Warn other occupants and staff and immediately start to vacate the affected areas.
- Lock rooms after each room is emptied.
- Designate an individual (if available) to activate back-up power supply if required.
- Turn off unnecessary electrical, gas and water on site.
- Coordinate all occupants, visitors, and staff to the assembly location (See Appendix A).

4.5.2. Recovery

Recovering from a disaster will be easier if you are prepared. To help people recover, the NSW SES, NSWRFS and Fire & Rescue NSW have Recovery Kits available on their websites and in hard copy.

Disaster Recovery Centers may be established following some disasters. These can provide a range of welfare services including financial assistance, personal support, organising temporary accommodation and providing information and referrals.

4.5.3. SES Assistance with Recovery Functions

Concurrently with response operations, the SES is responsible for ensuring that the evacuation and immediate welfare of affected persons is coordinated.

The SES will:

a) Provide information to flood-affected people on safety matters and the restoration of belongings which have been in contact with flood waters

b) Provide impact information to recovery agencies

c) Assist with clean-up operations after floods (if sufficient volunteers are available); and

d) Assist with the return of evacuees to their homes (if sufficient volunteers are available).

SES Controllers should brief the following on details of the flood operations:

a) Any Recovery Coordinating Committee

b) The Welfare Services Functional Area; and

c) Relevant Emergency Management Committees

SES Controllers should participate in recovery committees as required.

Disaster Welfare Services - 1800 018 444

4.6. After the Flood Event

After the flood event, the Site Flood Coordinator is required to check with the relevant authority that it is safe to re-enter into the flooded area. Residents, visitors, and staff should not re-enter the flooded area unless advised by emergency services authorities to do so. Flooded areas pose health risks to individuals and the following procedures should be followed entering the facility:

- Have electrics and gas fixtures been checked by qualified personnel prior to use
- Beware of snakes and spiders
- Beware of health risks from wading through muddy water
- Do not use food or drinks which have been in contact with floodwater
- Boil all water until supplies are declared safe to drink
- Report damaged utility lines to appropriate authorities
- Plan which items and areas should be cleaned first
- Use disinfectant for cleaning
- Wear shoes and gloves in any area which has been flooded.

5. Conclusion

In conclusion, the outcomes of this Flood Risk Management Report are:

- The subject site is affected by 100-year ARI flooding at the eastern corner
- Flood compatible material shall be utilised for constructions within the flood extent
- During extreme storm events, occupants shall remain indoor unless advised by the authority or a qualified person.

It is the responsibility of all staff and the Site Flood Coordinator to ensure this plan is readily available and followed during flood events.

For and on behalf of JN,

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Civil Design Engineer

BE Civil MIEAust NER

Reviewed by:

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Appendix C – Flood Compatible Materials

ORDER OF PREFERENCE				
COMPONENT	**MOST SUITABLE**	**SECOND PREFERENCE**	**THIRD PREFERENCE**	**TO BE AVOIDED**
1. Flooring and sub-floor structure	Concrete slab on ground (clay fill is not permitted beneath slab on ground construction which may be inundated) Suspended concrete slab	Timber floor (T & G boarding, marine plywood) full epoxy sealed on joints	Timber floor (T & G boarding, marine plywood) with ends only epoxy sealed on joints and provision of side clearance for board swelling	Timber floor close to ground with surrounding base Timber flooring with ceilings or soffit linings Timber flooring with seal on top only
2. Floor covering	Clay tile Concrete, precast or in situ Concrete tiles Epoxy, formed-in-place Mastic flooring formed-in-place Rubber sheets with chemical-set adhesives Silicone floors formed-in-place Vinyl sheets with chemical- set adhesive	Cement/bituminous formed-in-place Cement/latex formed-in place Rubber tiles, with chemical-set adhesive Terrazzo Vinyl tile with chemical-set adhesive Vinyl-asbestos tiles asphaltic adhesives Loose rugs Ceramic tiles with acid and alkali-resistant grout.	Asphalt tiles with asphaltic adhesive Loose fit nylon or acrylic carpet with closed cell rubber underlay	Asphalt tiles Carpeting, glue-down type or fixed with smooth-edge or jute felts. Ceramic tiles Chipboard (particle board) Cork Linoleum. PVA emulsion cement Rubber sheets or tiles Vinyl sheets or tiles Vinyl sheets or tiles coated on cork or wood backings fiber

				matting (sea-grass matting)
3. Wall Structure (Up to the Design Flood Level)	Solid brickwork, blockwork, reinforced, concrete or mass concrete	Two skins of brickwork or blockwork with inspection openings	Brick or blockwork veneer construction with inspection openings and H4 treated timber	Inaccessible cavities Large window openings
4. Roofing structure (For situations where Design Flood Level is above the ceiling).	Reinforced concrete construction Galvanised metal construction	Timber trusses with galvanised fittings	Traditional timber roof construction	Inaccessible flat roof construction Ungalvanised steelwork e.g., lintels, arch bay tie rods, beams etc. Unsecured roof tiles
5. Doors	Solid panel with waterproof adhesives Flush door with marine ply filled with closed cell foam Painted metal construction Aluminium or galvanised steel frame	Flush panel or single panel with marine plywood and waterproof adhesive T&G lined door, framed ledged and braced Painted steel Timber frame fully epoxy sealed before assembly	Fly-wire doors Standard timber frame	Hollow core ply with PVA adhesive and honeycomb paper core
6. Wall and ceiling linings.	Brick, face or glazed in waterproof mortar Concrete Concrete block Steel with waterproof applications	Brick, common Plastic wall tiles Metals, non-ferrous Rubber mouldings & trim Wood, solid, or exterior grade plywood fully sealed	Chipboard exterior grade Hardboard exterior grade Wood, solid (boards or trim) with allowance for swelling Wood, plywood exterior grade	Chipboard Fibreboard panels Mineral fibreboard Paperboard Plasterboard, gypsum plaster

	Stone, natural solid or veneer, waterproof grout Glass/Glass blocks Plastic sheeting or wall with waterproof adhesive		Fibrous plaster board	Wall coverings (paper, burlap cloth types) Wood, standard plywood strawboard
7. Insulation	Foam or closed cell types	Reflective insulation	Bat or blanket types	Open cell fibre types
8. Windows	Aluminium frame with stainless steel or brass rollers	Epoxy sealed timber waterproof glues with stainless steel or brass fittings Galvanised or painted steel		Timber with PVA glues mild steel fittings
9. Nails, bolts, hinges, and fittings.	Brass, nylon, or stainless steel. Removable pin hinges		Mild steel	

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