

Design Requirements for Block 1 Section 65 MU

Strathnairn

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ACT
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Suburban Land
Agency



RIVERVIEW
GROUP

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Part 1: Introduction

The Ginninderry vision: an inspiring 21st century community

The Ginninderry community will be unique in our region. It extends across the ACT/NSW border to the west of Belconnen and is being developed by a Joint Venture between the ACT Suburban Land Agency (SLA) and Riverview Developments (ACT) Pty Ltd.

From the start, our vision for Ginninderry has been to build a community of international significance, with innovation, diversity and ecological criteria at its core. Now we're bringing this vision to life.

Setting the highest standards

The multi-unit site at Ginninderry will form part of a whole neighbourhood design.

The project team has established high expectations for Ginninderry, perhaps best illustrated by the project's accreditation as Canberra's first 6 Star Green Star Community, through the Green Building Council of Australia. To achieve this certification, we've shown that Ginninderry will be a worldleading community, exhibiting international best practice in urban design and development.

All residents at Ginninderry will benefit from a vast conservation corridor, well connected pedestrian and cycling pathways, tree lined streets and easy access to public transport.

Ginninderry aspires to be recognised as a world leader in sustainable development, delivering a community that is:

- better planned and designed
- more dynamic and vibrant
- a healthy place to live work and play
- productive and prosperous
- flexible, adaptable and resilient.

Innovative ideas and technologies

Like all communities, Ginninderry will evolve and change over time, and so too will building design technologies and materials. It is quite possible that innovative energy, comfort and cost outcomes may be achieved by using new technologies, practices and principles not contemplated in this document.

At the discretion of the Development Manager, mandatory requirements may be varied if better alternatives and solutions are proposed, that do not compromise the overall integrity of Ginninderry's design philosophy.

Part 2:

Design Approval Process

Multi-unit designs at Ginninderry need to comply with the following:

- These Design Requirements
- Plans relating to this block in Part 4 Appendices
- Relevant rules in the Multi Unit Housing Development Code (as applicable)
- Strathnairn Precinct Map and Code

Compliance Bond

An important part of the Contract for Sale of land at Ginninderry is the requirement for the payment of a Compliance Bond at the time of settlement. The Compliance Bond is to ensure the adherence to these Design Requirements.

Minimum Requirements

The conditions for the return of the Compliance Bond are:

- You must attend a pre application meeting with the Design Team prior to design submission. Pre application documents should include:
 - A concept site plan
 - Concept floor plans
 - Concept elevation and open space elevation
- The design(s) has been submitted to and approved by the Development Manager prior to building commencement.
- The multi-unit homes have been built to the approved design in accordance with the Design Requirements

- A letter from your solar installer certifying that the PV system with inverter and Home Energy Management System has been installed to comply with the Sustainability Requirements
- Any damage caused by the construction of the multi-unit site to the surrounding verges, street trees, footpath, services and adjoining land has been rectified to the satisfaction of Transport Canberra and City Services (TCCS) and our Development Manager
- All waste on the public verge and adjoining land has been removed
- The purchaser (builder) may not seek to transfer the compliance bond requirements to the ultimate owner of the dwelling(s)
- If found to be compliant, your full Compliance Bond will be returned



Part 3: Design Requirements

The following information outlines the Design Requirements for Block 1 Section 65 within Strathnairn.

Design Principle	Design Requirements
<p>Public Domain Interface</p> <p>Provide legible and attractive interfaces that achieve passive surveillance to public streets and lane-ways.</p>	<p>Front doors of each dwelling are clearly visible from a public street or lane-way and include a covered entry feature or portico.</p> <p>Windows fronting a public road from habitable rooms, balconies or decks overlook the public domain.</p> <p>Courtyard walls are to be provided to comply with the Precinct Code and are required to be coordinated with all service requirements, including clearance to any water meters and free access to any electrical meter boxes.</p> <p>Where development frontages are adjacent to open spaces, parks, public walkways or located on a corner, the following requirements apply:</p> <ul style="list-style-type: none">• Habitable rooms have windows to provide passive surveillance (i.e. no ‘blank’ facades)• Building entries and pathways are visible and legible from public domain.



Surveillance of Public Domain



Clear entries behind courtyard walls

Design Principle	Design Requirements
Local Character and Context The built form, articulation and scale relates to the local character of the area and its context.	<p>The design should sit comfortably with the Strathnairn Master plan. Block 1 Section 65 is situated on Pro Hart Avenue, the main arterial road through Strathnairn and should provide a high quality, well articulated and active street frontage to the public domain.</p> <p>The design should respond to its northern orientation with private and communal open spaces taking advantage of this orientation and linking to provide connection from the precinct to Pro Hart Avenue and the adjacent public open space to the east.</p> <p>The site has Blocks 8-13 Section 65 to its south via Berents Street with individual residential dwellings. MU Block 2 Section 61 to its West and MU Block 2 Section 65 are located to the East.</p>
Landscape Design The landscape design requires healthy plant and tree growth space for medium and large sized trees.	<p>Planting in open space areas must include either:</p> <ul style="list-style-type: none"> - 1x Medium tree and 7x Large trees, or; - 13x Medium trees and 1x Large tree. <p>Minimum planting area and dimensions - refer to MUHDC.</p> <p>The landscape plan proposes a combination of tree planting, for shade, mid height shrubs, lawn and ground covers.</p> <p>Include a mix of species that are appropriate for scale and shading.</p> <p>Synthetic or artificial grass is not permitted</p> <p>The verge areas between the front boundary of the land and the kerb must be turfed.</p> <p>Refer Appendix B for suggested Landscape Planting Palette.</p>



Courtyard spaces should allow natural light and cross-ventilation to living spaces



An example of a vertical greenwall to help soften small courtyard areas

Design Principle	Design Requirements
<p>Visual Appearance and Façade Articulation</p> <p>To promote well designed buildings of high Architectural quality that contribute to the local character.</p> <p>The facades of the multi-unit homes must be designed as an integrated pack to provide an consistent streetscape.</p>	<p>The development is to incorporate articulation to frontages.</p> <p>The following elements help provide functional articulation. The design must demonstrate how it responds to the following elements:</p> <ul style="list-style-type: none">• Covered entry feature or portico is mandatory• A balcony, deck, pergola, terrace, or veranda• Extruded box window treatments• Bay windows• Awnings, sunhood, and louvres• Eaves• Access ramps as required <p>The overall streetscape must have a light base colour as the prominent wall finish with light weight cladding and include a mix of materials to provide articulation.</p> <p>Double storey designs must incorporate balconies at bookends/ corners with a combination of solid and perforated metal or glass balustrades.</p> <p>Facade glazing to street frontages must be more vertical in proportion with mullion spacing less than 1.0m. Openings of 2.4m wide or more must be a minimum of 3 panels.</p> <p>Metal profile cladding systems or FC style boards with profile widths of a maximum 200mm are encouraged.</p>



Sunhood and Awning



Light filled screened balconies.



Clearly articulated facades add value and character to the streetscape



Passive Surveillance with articulated and screened balconies



Clearly articulated facades add value and character to the streetscape

Design Principle	Design Requirements
Visual Appearance and Articulation to Corners	<p>Refer to the block planning controls.</p> <p>Articulation elements such as balconies, blade walls, pergolas, sunhoods, awnings, façade treatments, material use and expressed structure are required to add visual interest and avoid large blank wall planes to prominent corners.</p> <p>Buildings may need to be stepped back further on corners to permit balconies, glazing and larger eaves without encroachment into secondary front setbacks. All materials must wrap around the corner dwellings by at least 4 metres.</p>
Roof Form	<p>The roof treatments are integrated into the building design and positively respond to open space and laneway and provide for individual expression for each dwelling.</p> <p>The roof form must consider how to integrate the solar panels. Lights and ventilation systems are integrated into the roof design.</p> <ul style="list-style-type: none"> • Gable roof – minimum 25 degrees • Skillion – 10 to 15 degrees minimum
Roofing Materials	Metal profile roof sheeting only. Refer to Approved Colours and Finishes palette Part 4
Eaves, Awnings and Sunhoods	Minimum 450mm eaves required. Any windows that are not protected by an eave, i.e. Parapet walls, require awnings or sunhoods, except south facing windows.
Mailbox	<p>Mailboxes should be incorporated into a courtyard wall (where permitted).</p> <p>Standalone mailboxes must compliment the home and must be constructed of masonry such as smooth face brick, stone faced masonry, rendered or bagged masonry or natural stone.</p> <p>Any pre-fabricated stand alone mailboxes must be of a high quality and may only be approved on merit.</p>
Bush Fire Requirements	There are no bush fire requirements within Strathnairn
Energy Efficiency Rating	A minimum NatHERS rating of 7.0 is required for each dwelling.
Zoning	Zone RZ3
Building Height	Up to 2 storeys permitted
Building Front Setback	Refer to Strathnairn Precinct Map and Code, Multi Unit Housing Development Code and Block Planning Control Plans.
Fencing & Courtyard Walls	Mandatory – refer to Fencing Controls Plan, Strathnairn Precinct Map and Code, Multi Unit Housing Development Code and Block Planning Control Plans.
PPOS Requirements	Refer to Strathnairn Precinct Map and Code, Multi Unit Housing Development Code (as applicable) and Block Planning Control Plans.

Design Principle	Design Requirements
Natural Ventilation	All habitable rooms must be naturally ventilated.
Dwelling Size and Layout	<p>The dwelling has sufficient area to ensure the layout of rooms are functional, well organised and provide a high standard of amenity.</p> <p>Minimum Net Living Areas (NLA's)</p> <ul style="list-style-type: none"> • 1 bed = 65m² (minimum 22.0m² to any upper floor living areas) • 2 bed = 90m² • 3+ bed = 115m² <p>Kitchens are not part of circulation spaces such as hallways.</p>
Garage and Garage Doors	<p>Consider the use of masonry base elements to corners of garages and lightweight elements where appropriate.</p> <p>Provide panel lift or tilt up garage doors. Roller doors are not permitted.</p>
Storage	<p>Multi-unit designs must provide adequate storage and at least 50% of the required storage must be within the dwelling.</p> <p>Minimum Storage Area Provision:</p> <ul style="list-style-type: none"> • 1 bed = 6m³ • 2 bed = 8m³ • 3+ bed = 10m³ <p>Bike storage must be covered and secure whether external or within garages. 10A general power outlet provision for Electric bike charging must be provided.</p>



Garage storage solutions



Bicycle storage solutions



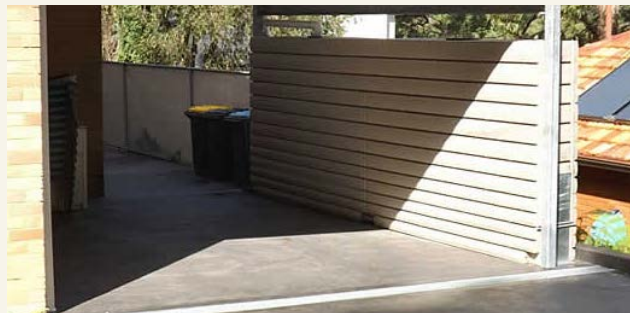
Laundry linen storage

Design Principle	Design Requirements
Bin Locations	<p>Storage for three bins must be provided including general waste, recycling and green waste. Bin locations should be integrated with the dwelling designs and screened from public view.</p> <p>Kitchen design must allow for easy waste separation.</p>
Ceiling Heights	<p>Ceiling heights are to achieve sufficient natural ventilation and provide daylight access and spatial quality.</p> <p>Minimum ceiling heights:</p> <ul style="list-style-type: none"> • 2.7m to ground floor habitable rooms • 2.7m to upper floor living areas • 2.5m to upper level bedrooms
Glazing	<p>uPVC or thermally broken aluminum double glazing is required to all external windows and doors.</p>
Home Energy Systems	<p>Dwellings must be all-electric with no mains or bottled gas connections.</p> <p>A PV System with a Home Energy Systems and compatible inverter must be installed for all dwellings under the following provisions:</p> <ol style="list-style-type: none"> Minimum PV size: <ul style="list-style-type: none"> • 1-2 bedroom 3kW • 3 bedroom+ 4kW Home Energy Systems must be a Reposit Power (battery is required) or Evergen. The solar inverter must be compatible with the chosen Home Energy Systems above. Where PV panels are located on a roof section fronting a street, they must be installed flush with the roof. All hardware components must be installed by a certified Clean Energy Council Installer.
Appliances and Fixtures	<p>Induction cooktops must be provided to all dwellings.</p> <p>All appliances, water fixtures and fittings must have a minimum 4 star rating under the water efficiency labeling and standards (WELS) scheme and (where required) a 4 star energy rating under the energy rating label (Energy Efficiency Rating) scheme.</p> <p>This includes showerheads, tap ware, toilets, fridges, freezers, washing machines, dryers and any other appliance provided with the dwelling.</p>

Design Principle	Design Requirements
Hot Water Systems	<p>All dwellings must have a solar or heat pump hot water system installed. Roof top solar water collectors are not permitted on the roof fronting the street. Consideration must be given to the location of any tank including screening or placement within a cupboard or garage space.</p> <p>Hot water systems must be climate appropriate and have temperature application range down to -5 degrees ambient air temperature.</p>
Heating and Cooling	<p>Passive heating and cooling must be considered for all dwellings including ceiling fans and thermal mass)</p> <p>If Mechanical heating and/ or cooling systems are installed they must be:</p> <ol style="list-style-type: none"> reverse cycle air conditioning with: <ul style="list-style-type: none"> Energy Efficiency Rating of 3.1 or higher for cooling cycle Coefficient of Performance of 3.5 or higher for heating cycle Outdoor unit with sound pressure level of 57dBA or lower for heating and cooling cycle air conditioning with a cooling cycle only that achieves an Energy Efficiency Rating of 3.1 or higher ducted evaporative cooling with self-closing damper ground source heat pump. <p>Considerations must be given to the location of any outdoor fan coil unit including screening and compliance with ACT EPA noise requirements.</p>
Rainwater Tanks	<p>Minimum requirement as per Multi Unit Housing Development Code.</p> <p>Please consider addition Water Sensitive Urban Design and Rainwater tank provisions for soft planting and environmental purposes.</p>



Narrow style rainwater tanks can be used where space requirements are restrictive

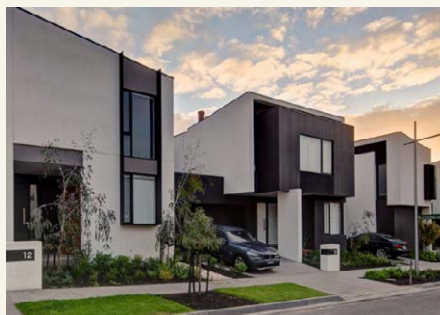


Rainwater tanks incorporated into a carport design shows clever and effective use of small spaces

Design Principle	Design Requirements
Electric Vehicle (EV) Charging Provision	<p>One EV Ready parking space point per dwelling with:</p> <ul style="list-style-type: none"> • 10amp General Power Outlet (GPO) with wiring capacity for 7KW AC charging • Wiring installed from EV Charger position to individual switchboard • Space for double-width circuit breaker in switchboard • Data cabling to be provided next to GPO <p>If any future higher specification requirements are provided by the National Construction Code or ACT Government Territory Plan, the requirements from the National Construction Code or ACT Government Territory Plan take precedence.</p>
Retaining Walls <p>Extensive earthworks should be limited where possible to minimise the extent of retaining wall costs and the visual impacts to the streetscape.</p>	<p>Minimum Requirements:</p> <ul style="list-style-type: none"> • The height of site cuts along the side boundaries with attached neighbouring wall cannot exceed 500mm in height • Retaining wall forward of the front building line must be constructed from the following materials at the discretion of the Ginninderry Development Manager <ul style="list-style-type: none"> - Approved face brick - Approved rendered masonry - Approved brickwork such as split face, honed or shot blast finishes - Approved stone faced masonry - Approved reinforced concrete finishes • Timber, concrete sleepers or prefabricated modular systems are not permitted forward of the building line. • Retaining walls alongside boundaries forward of the building line must be tapered or stepped in line with the finished ground level at the front boundary. • Where there are services such as water, electrical, communications, sewer and storm water, detailed coordination of all courtyard wall locations and associated services must be considered in the initial design process.



Arch split face block



Streetscape

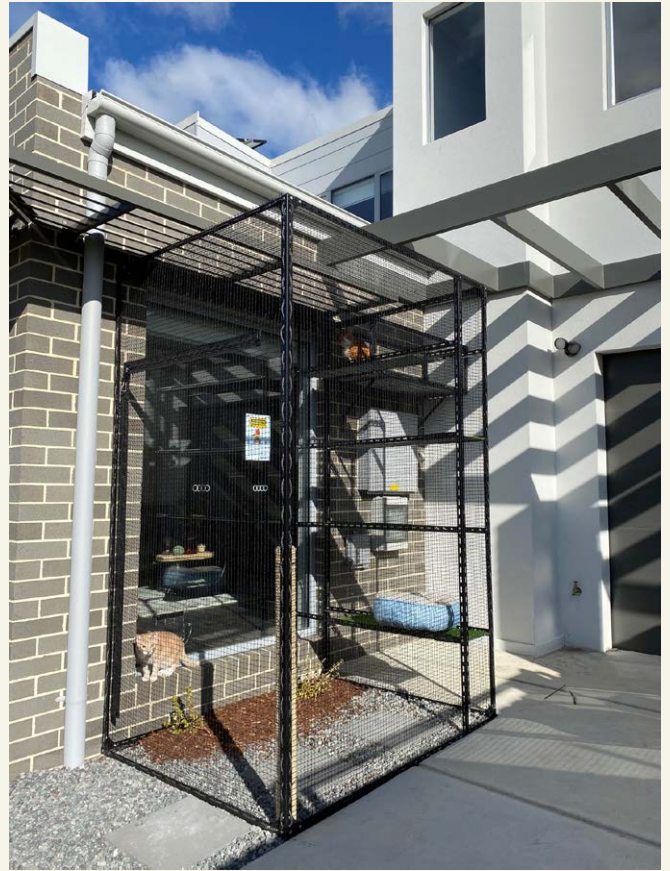


Well articulated dwelling designs provide a functional and more attractive streetscape

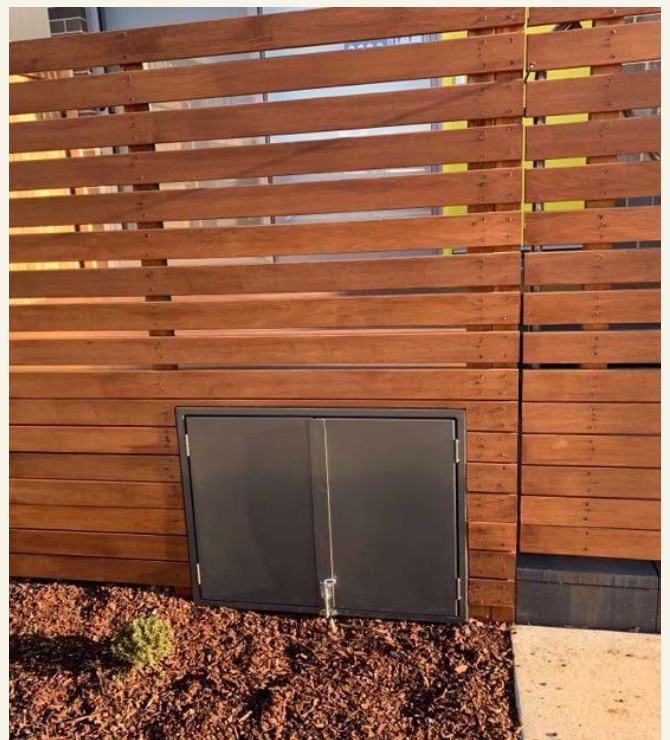
Design Principle	Design Requirements
Vehicle Access	<p>Block 1 Section 65 is to be accessed via Holzheimer Street.</p> <p>Minimum Requirements:</p> <ul style="list-style-type: none"> • Driveways must be constructed from either <ul style="list-style-type: none"> - plain concrete or - maximum 5% Oxide finish
Services and ancillary structures	<p>Services such as water, electricity meter boxes, NBN and home energy system cabinets can have an adverse impact on the overall streetscape if not considered as part of the overall design.</p> <p>The location of the above services will be required to be shown on the site plan as part of the design approval process.</p> <p>Minimum Requirements:</p> <ul style="list-style-type: none"> • Water, electricity meter boxes, NBN and home energy system cabinets must be integrated into the front façade and located away from the front door • Solar panels must sit flush with the roof line if located to the street frontages of the dwellings • Storage tank for solar HWS is not permitted to be mounted on the roof fronting the street • Aerials, satellite dishes, antennae, heat pumps, A/C units and evaporative units are to be located to the rear of the dwellings and must not be visible from the street. • Clothes drying lines and garbage bins are to be located to the rear of the terraces. If they are located to the side of the house within the Primary Building zone, they must be screened from public view. • Sheds, outdoor structures are to be located to the rear of the terraces and away from public view.
Dog and Cat containment	<p>Minimum Requirements:</p> <p>Suburbs within Ginninderry are Cat Containment and Dog on Leash areas. Terrace designs should give consideration to responsible pet ownership principles including the use of enclosures or cat runs. More information can be obtained at: https://www.cityservices.act.gov.au/pets-and-wildlife/domestic-animals/cats/cat-containment</p> <ul style="list-style-type: none"> • Dogs must remain on leash in public areas except within designated un-leashed areas such as dog parks. • Dogs are not permitted in the conservation corridor.



Cat containment



Integrated water meter details within courtyard walls





Site location map



Part 4: Appendix




External Colours and Finishes Schedule

Please tick the boxes below






Roof Tiles – Monier

Atura		<input type="checkbox"/> Mist Grey		<input type="checkbox"/> Saltspray		<input type="checkbox"/> Seashell		<input type="checkbox"/> Wildrice
Horizon		<input type="checkbox"/> Mist Grey		<input type="checkbox"/> Saltspray		<input type="checkbox"/> Seashell		<input type="checkbox"/> Wildrice












Roof Tiles – Boral

Vogue		<input type="checkbox"/> Stonewall
Contour		<input type="checkbox"/> Quartz
Slimline		<input type="checkbox"/> Stonewall

Roof Tiles – Bristle


Prestige		<input type="checkbox"/> Silver Gum		<input type="checkbox"/>		<input type="checkbox"/>
Classic		<input type="checkbox"/> Alabaster		<input type="checkbox"/> Linen		<input type="checkbox"/> Silver Gum

Metal Roof – Colorbond















	<input type="checkbox"/> Basalt		<input type="checkbox"/> Cove		<input type="checkbox"/> Dune		<input type="checkbox"/> Evening Haze		<input type="checkbox"/> Gully		<input type="checkbox"/> Windspray
	<input type="checkbox"/> Jasper		<input type="checkbox"/> Shale Grey		<input type="checkbox"/> Surfmist		<input type="checkbox"/> Wallaby		<input type="checkbox"/> Paperbark		

Fence Colour - Colorbond

Side and Rear Boundary Fencing

	<input type="checkbox"/> Jasper
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








Fence Infill Panel / Street Facing Fencing - Colorbond

	<input type="checkbox"/> Basalt		<input type="checkbox"/> Cove		<input type="checkbox"/> Dune		<input type="checkbox"/> Evening Haze		<input type="checkbox"/> Gully		<input type="checkbox"/> Windspray
	<input type="checkbox"/> Jasper		<input type="checkbox"/> Natural Pearl		<input type="checkbox"/> Shale Grey		<input type="checkbox"/> Surfmist		<input type="checkbox"/> Wallaby		<input type="checkbox"/> Ultra Silver
	<input type="checkbox"/> Precious Silver		<input type="checkbox"/> Silver Medalist								

Garage Doors

	Basalt		Cove		Dune		Evening Haze		Gully		Windspray
	Jasper		Natural Pearl		Shale Grey		Surfmist		Wallaby		Ultra Silver
	Precious Silver		Silver Medalist		Blushed Teak		Classic Cedar		Iron Bark		Kwila
	Merbau		Silky Oak		Weathered Timber		Western Red Cedar				

Façade Colours Walls / Render / Cladding




	Basalt		Cove		Dune		Evening Haze		Gully		Windspray
	Jasper		Natural Pearl		Shale Grey		Surfmist		Wallaby		Ultra Silver
	Precious Silver		Silver Medalist		Beige Royal		Braid		Cru		Lexicon
	Light Rice		Linseed		Natural White		Oyster Linen		Terrace White		Toffee Fingers
	Tuft		Warm Neutral								

Bricks – Austral

La Paloma			Miro			Chiffon			Pepper		
Urban One			Silver			Blue Gum			Blackbutt		
Wilderness Design			Silver Birch			Freedom			Leisure		
Everyday Life			Engage			Orpheus					
Whitsunday Range			Brampton			Cloudy Silver (F.O.)			Opaque Slate (F.O.)		Wild Storm (F.O.)
San Selmo Smoked			Grey Cashmere (F.O.)			Platinum			Titanium		Cuprum
Metallix			Quartz			Gun Metal Blue					
Park Lane			Bronze			Grosvenor			Dorchester		Mayfair
			Biltmore			Chesterfield (F.O.)					
Stratos			Westminster			Coastal Storm					
			Winter Frost			Penrose (F.O.)			Wingello (F.O.)		Jellore
Bowral Highlands			Meryla (F.O.)								
			Tarlo								

F.O. Feature area only

Bricks – PGH

Alfresco		Vino		Chocolatto		Truffle		Espresso
		Urban Blue						
Altitude		Olympus		Apollo		Matterhorn		
Dry Pressed Architectural		Bennelong Blue		Bradfield Bronze		Flinders Red		Gledswood Blend
		Macquarie Blend		Tinto Cream		Mawson White		Silver Shadow
		McKinlay Brown		Monash Grey				
Dark and Stormy		Monsoon		Thunder		Whirlwind		Zephyr
Foundations		Gravel		Stone				
Highlands		Blackheath		Leura (F.O.)				
Manhattan		Chelsea (F.O.)		East Hampton (F.O.)		Tribeca (F.O.)		
Metallic		Nickel Flash		Pewter		Blue Steel Flash		
Morada		Blanco		Ceniza		Nero (F.O.)		Gris
Opaline		Tourmaline		Garnet		Tiger Eye		
Pure Linens		Cinders & Soot		Flannel Grey		Pebble Creek		Whispering White
Smooth		Mineral		Volcanic		Cream		Pearl Grey
		Brown		Terracota		Choc Tan		Copper Glow
		Black & Tan						
Urban Essence		Melbourne Blue (F.O.)		Storm (F.O.)				
Velour		Terracota		Cream		Pearl Grey		Red
		Brown		Choc Tan		Mineral		Volcanic

F.O. Feature area only

Appendix B

Landscape Concept Planting Palette

Edible Plants

Below is a list of edible plants that Ginninderry encourages you to plant when landscaping your garden.

Code	Botanical Name	Common Name	Mature Plant Size	Container Size	Spacing
Small Trees					
Mad	<i>Malus domestica</i>	Apple	3m x 3m	100L	-
Pyc	<i>Prunus cerasifera</i>	Cherry Plum	5m x 5m	100L	-
PrpA	<i>Prunus persica</i> 'Anzac'	Australian Peach	4m x 4m	100L	-
PrsAB	<i>Prunus salicina</i> 'Angelina Burdett'	Plum	4-10m x 2-4m	100L	-
Large Shrubs					
Cil	<i>Citrus limon</i> 'Meyer'	Meyer Lemon	3m x 2m	25L/300mm	1.5/m ²
Fes	<i>Feijoa sellowiana</i>	Pineapple Guava	4m x 2m	25L/300mm	1.5/m ²
Mia	<i>Microcitrus australasica</i>	Finger Lime	4m x 2m	25L/300mm	1.5/m ²
Small Shrubs					
Roo	<i>Rosemarinus officinalis</i>	Rosemary	0.5-1.5m x 1m	5L/200mm	3/m ²
Vac	<i>Vaccinium corymbosum</i>	Blueberry - Blue Rose	1-2m x 1-2m	5L/200mm	3/m ²
Cij	<i>Citrus japonica</i>	Kumquat	2-3m x 3m	5L/200mm	3/m ²
Groundcovers/ Climbers					
Fra	<i>Fragaria ananassa</i>	Strawberry	0.3m H	2.5L/150mm	4/m ²

Small Trees



Malus domestica



Malus domestica – fruit



Prunus cerasifera



Prunus persica



Prunus salicina - fruit

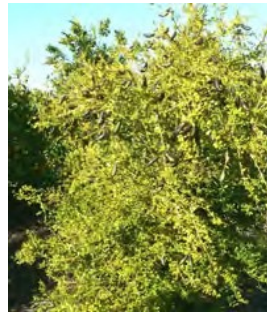
Large Shrubs



Citrus limon



Feijoa sellowiana



Microcitrus australasica

Groundcovers



Fragaria ananassa

Small Shrubs



Rosemarinus officinalis



Vaccinium corymbosum



Citrus japonica

Landscape Concept Planting Palette

Native Plants

Below is a list of native plants that Ginninderry encourages you to plant when landscaping your garden.

Code	Botanical Name	Common Name	Mature Plant Size	Container Size	Spacing
Large Shrubs (Hedging)					
BNm	<i>Banksia marginata</i>	Silver Banksia	5m x 3m	25L/300mm	1.5/m ²
BNsp	<i>Banksia spinulosa</i>	Hairpin Banksia	3m x 3m	25L/300mm	1.5/m ²
Cbf	<i>Callistemon 'Great Balls of Fire'</i>	Bottlebrush	2m x 2m	25L/300mm	1.5/m ²
Ckp	<i>Callistemon 'King's Park Special'</i>	Bottlebrush	2-4m x 3-4m	25L/300mm	1.5/m ²
Cra	<i>Callistemon viminalis 'Red Alert'</i>	Creek Bottlebrush	4m x 2m	25L/300mm	1.5/m ²
Gpp	<i>Grevillea 'Poorinda Peter'</i>	Poorinda Peter Grevillea	3m x 4m	25L/300mm	1.5/m ²
Gpq	<i>Grevillea 'Poorinda Queen'</i>	Poorinda Queen Grevillea	3m x 4m	25L/300mm	1.5/m ²
Gho	<i>Grevillea 'Red Hooks'</i>	Red Hooks Grevillea	3m x 4m	25L/300mm	1.5/m ²
Small Shrubs					
Anf	<i>Anigozanthus 'Bush Gem'</i>	Kangaroo Paw	0.6m x 1m	5L/200mm	3/m ²
Bkl	<i>Baeckea linifolia</i>	Flax-leaf Heath Myrtle	1-2.5m x 0.5-2m	5L/200mm	3/m ²
Gco	<i>Grevillea confertifolia</i>	Dense-leaf Grevillea	2m x 1-2m	5L/200mm	3/m ²
Gla	<i>Grevillea lanigera</i>	Wooly Grevillea	0.5-1m x 1-2m	5L/200mm	3/m ²
Wab	<i>Westingia</i> sp. 'Aussie Box'	Coast Rosemary	1.5m x 1.5m	5L/200mm	3/m ²
Small Shrubs (Hedging to Frontage)					
Cvc	<i>Callistemon viminalis 'Captain Cook'</i>	Bottlebrush		5L/200mm	3/m ²
Etm	<i>Philotheca myoporoides</i>	Long-leaf Waxflower	1.5-2m x 2m	5L/200mm	3/m ²
Gba	<i>Grevillea baueri</i>	Bauer's Grevillea	0.6-1.5m x 2m	5L/200mm	3/m ²
Wew	<i>Westingia fruticosa 'Grey Box'</i>	Coastal Rosemary	2m x 4m	5L/200mm	3/m ²
Groundcover/Climbers					
Acc	<i>Acacia cognata 'limelight'</i>	Dwarf River Wattle	0.5m x 1m	2.5L/150mm	4/m ²
Asfp	<i>Astartea fascicularis</i>	Winter Pink	0.3m x 1.5m	2.5L/150mm	4/m ²
BNsp	<i>Banksia spinulosa 'Birthday Candle'</i>	Birthday Candle Banksia	0.5m x 1.5m	2.5L/150mm	4/m ²
BRm	<i>Brachyscome multifida</i>	Rock Daisy	0.3m x 1.5m	2.5L/150mm	4/m ²
Coc	<i>Convolvulus cneorum</i>	Bush Morning Glory	0.6m x 1m	2.5L/150mm	4/m ²
Gbr	<i>Grevillea</i> sp. 'Bronze Rambler'	Bronze Rambler Grevillea	0.3m x 2m	2.5L/150mm	4/m ²

Hav	Hardenbergia violacea	Purple Coral Pea	3m x 1m	2.5L/150mm	4/m ²
Myp	Myoporum parvifolium	Creeping Boobialla	0.2m x 2m	2.5L/150mm	4/m ²
RHs	Rhagodia spinescens 'Aussie Flat Bush'	Aussie Flat Bush	0.3-0.5m x 1m	2.5L/150mm	4/m ²
Vih	Viola hederacea	Australian Native Violet	0.1m x 0.5m	2.5L/150mm	4/m ²
Grasses					
Dlc					
Dic	Dianella caerulea 'Cassa Blue'	Cassa Blue Flax Lily	0.7m x 1m	Growtube	6/m ²
DII	Dianella longifolia	Pale Flax Lily	0.6m x 0.4m	Growtube	6/m ²
Dlr	Dianella revoluta	Black Anther Flax Lily	0.5m x 0.5m	Growtube	6/m ²
DIt	Dianella tasmanica	Blue Flax Lily	0.7m x 1m	Growtube	6/m ²
LDIC	Lomandra longifolia 'Cassica'	Cassica Mat Rush	1.2m x 0.8m	Growtube	6/m ²
LDIT	Lomandra longifolia 'Tanika'	Tanika Mat Rush	0.5m x 0.5m	Growtube	6/m ²
POAIE	Poa labillardieri	Tussock Grass	0.6m x 0.4m	Growtube	6/m ²
THt	Themeda triandra	Kangaroo Grass	1m x 0.5m	Growtube	6/m ²

Large Shrubs (Hedging)



Banksia marginata



Banksia spinulosa



Callistemon 'Balls of Fire'



Callistemon 'Kings Park'



Callistemon 'Red Alert'



Grevillea 'Poorinda Peter'



Grevillea 'Poorinda Queen'



Grevillea 'Red Hooks'

Small Shrubs



Angiozanthus 'Bush Gem'



Baeckea linifolia



Grevillea confertifolia



Grevillea lanigerav

Small Shrubs (Hedging to Frontage)



Callistemon viminalis



Philotheca myoproides



Grevillea baueri



Westringia 'Grey Box'

Groundcover/Climbers



Acacia cognata 'Limelight'



Astartea fascicularis



Banksia 'Birthday Candles'



Brachyscome multifida



Convolvulus cneorum



Grevillea 'Bronze Rambler'



Hardenbergia violacea



Myoporum parvifolium



Rhagodia spinescens

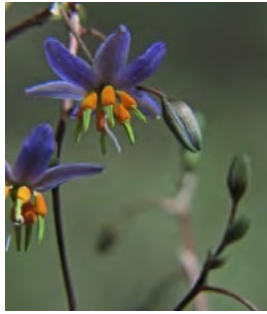


Viola hederacea

Grasses



Camellia sasanqua



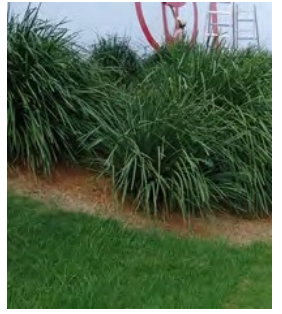
Cupressus sp.



Michelia figo



Thuja sp.



Viburnum tinus



Lomandra 'Tanika'



Poa labillardieri



Themeda triandra

Landscape Concept Planting Palette

Exotic Plants

Below is a list of exotic plants that Ginninderry encourages you to plant when landscaping your garden.

Code	Botanical Name	Common Name	Mature Plant Size	Container Size	Spacing
Small trees/Large Shrubs					
Acb	Acer buergeranum	Trident Maple	5m x 3m	100L	
Acj	Acer japonicum	Japanese Maple	5m x 5m	100L	
Cil	Citrus x Lemon	Lemon	-	25L/300mm	1.5/m2
Cra	Cordyline Australis	Cabbage Tree	2m x 1.5m	5L/200mm	3/m ²
CNc	Cornus capitata	Evergreen Dogwood	3m x 3m	25L/300mm	1.5/m ²
Dyk	Diospyros kaki	Japanese Persimmon	6-8m x 6m	100L	-
Dia	Dicksonia antarctica	Soft Tree Fern	2-4m x 2.5m	25L/300mm	-
Kop	Koelreuteria paniculata	Golden Rain Tree	5m x 8m	100L	-
Lai	Lagerstroemia indica	Crepe Myrtle	3m x 2m	25L/300mm	-
MGI	Magnolia grandiflora 'Little Gem'	-	6m x 3m	100L	-
Mgso	Magnolia soulangeana	Saucer Magnolia	4m (h)	100L	-
Mgst	Magnolia stellata	Star Magnolia	4-6m x 4.5m	100L	-
Pcp	Prunus cerasifera 'Pissardii'	Cherry Plum	5m x 5m	100L	-
Pcs	Prunus cerasifera 'Spire'	Black Cherry Plum	6m x 2m	100L	-
Pyc	Pyrus calleryana	Ornamental Pear	11m x 4m	100L	-
Large Shrubs (Hedging)					
CAMs	Camellia sasanqua	Sasanqua Camellia	4m x 3m	25L/300mm	1.5/m ²
Cup	Cupressus sp.	Cypress Sp.	-	25L/300mm	-
Eiv	Escallonia sp. 'Iveyi'	Escallonia	3m x 3m	25L/300mm	1.5/m ²
MIlf	Michelia figo	Port Wine Magnolia	2m x 2m	25L/300mm	1.5/m ²
Pitt	Pittosporum tenuifolium 'Green Pillar'	Pittosporum	3m x 2m	25L/300mm	1.5/m2
Pla	Prunus laurocerasus	Cherry Laurel	5m x 3m	25L/300mm	-
Plu	Prunus lusitanica	Portugese Laurel	4m x 2m	25L/300mm	-
THj	Thuja Sp.	Cedar Sp.	-	25L/300mm	-
VIO	Viburnum odoratissimum	Sweet Viburnum	4-6m x 4m	25L/300mm	1.5/m ²
VIT	Viburnum tinus	Lauristinus	3m x 3m	25L/300mm	1.5/m ²

Small Shrubs					
Azs	Azalea sp.	Azalea		5L/200mm - 25L/300mm	3/m ²
Bey	Beschorneria yuccoides	Mexican Lily	1-1.5m x 1-2m	25L/300mm	-
Epp	Escallonia sp. 'Pink Pixie'	Escallonia	0.8m x 0.8m	5L/200mm	3/m ²
LVA	Lavandula angustifolia	White English Lavender	0.3m x 0.3m	5L/200mm	3/m ²
LOn	Lonicera nitida	Dwarf Honeysuckle	2m x 3m	25L/300mm	1.5/m ²
NNn	Nandina domestica 'Nana'	Dwarf Screen Bamboo	0.3m x 2m	5L/200mm	3/m ²
Small Shrubs (Hedging to Frontage)					
ABg	Abelia grandiflora	Glossy Abelia	1.5m x 1.2m	5L/200mm	3/m ²
BUs	Buxus sempervirens	English Box	2m x 1m	5L/200mm	3/m ²
CYt	Choisya ternata	Mexican Orange Blossom	1.5m x 1.5m	25L/300mm	1.5/m ²
Erk	Escallonia sp. 'Red Knight'	Escallonia	1.5m x 1.5m	25L/300mm	1.5/m ²
GAf	Gardenia augusta 'Florida'	Gardenia Florida	1-1.5m x 1m	5L/200mm	3/m ²
Groundcovers/Climbers					
AJr	Ajuga reptans	Common Bugle	0.1m x 0.3m	2.5L/150mm	4/m ²
COPk	Coprosma x kirkii	Mirror Plant	0.6m x 1m	2.5L/150mm	4/m ²
HEc	Hedera canariensis (green form only)	Canary Island Ivy	n/a	2.5L/150mm	4/m ²
HYc	Hypericum calycinum	Aaron's Beard	0.3m x 0.5m	2.5L/150mm	4/m ²
RSI	Rosmarinus lavandulaceus	Creeping Rosemary	0.3m x 0.3m	2.5L/150mm	4/m ²
TRj	Trachelospermum jasminoides	Chinese Star Jasmine	n/a	2.5L/150mm	4/m ²
Vla	Vitis amurensis	Ornamental Grape Vine	n/a	2.5L/150mm	-
Grasses					
LIEg	Liriope 'Evergreen Giant'	Evergreen Giant Lily	0.4m x 0.7m	Growtube	6/m ²
Opn	Ophiopogon planiscapus 'Nigrescens'	Black Mondo Grass	0.2m x 0.8m	Growtube	6/m ²

Grasses



Liriope 'Evergreen Giant'



Ophiopogon 'Nigrescens'

Small Trees/ Large Shrubs



Acer buergerianum



Acer japonicum



Citrus x limon



Cordyline australis



Cornus capitata



Diospyros kaki



Koelreuteria paniculata



Lagerstroemia indica



Magnolia grandiflora



Magnolia soulangeana



Magnolia stellata



Prunus cerasifera 'Pissardii'



Prunus cerasifera 'Spire'



Ptrus calleryana

Large Shrubs (Hedging)



Camellia sasanqua



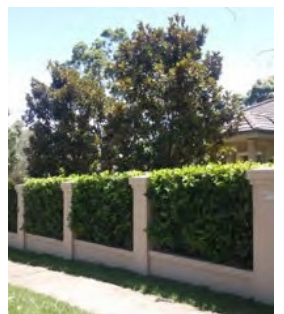
Cupressus sp.



Michelia figo



Thuja sp.



Viburnum tinus

Small Shrubs



Camellia sasanqua



Cupressus sp.



Michelia figo



Thuja sp.



Viburnum tinus

Small Shrubs (Hedging to Frontage)



Abelia grandiflora



Buxus sempervirens



Choisya ternata



Gardenia augusta

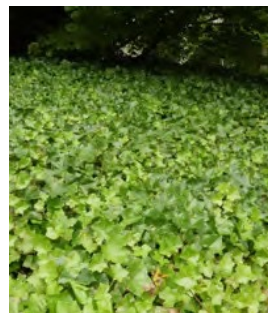
Groundcover/Climbers



Ajuga reptans



Coprosma x 'Kirkii'



Hedera canariensis



Hypericum calycinum



Rosmarinus lavandulaceus



Trachelospermum sp.



Vitis amurensis

Pest Plant List

Not for use at Ginninderry

Botanical Name	Common Name	Reason
<i>Ailanthus altissima</i>	Tree of Heaven	Declared pest plant of the ACT
<i>Alnus glutinosa</i>	Black Alder	Declared pest plant of the ACT
<i>Alternanthera philoxeroides</i>	Alligator Weed	Declared pest plant of the ACT
<i>Andropogon gayanus</i>	Gamba Grass	Declared pest plant of the ACT
<i>Annona glabra</i>	Pond Apple	Declared pest plant of the ACT
<i>Anredera cordifolia</i>	Madeira Vine	Declared pest plant of the ACT
<i>Asparagus aethiopicus</i>	Ground Asparagus Fern	Declared pest plant of the ACT
<i>Asparagus africanus</i>	Climbing Asparagus Fern	Declared pest plant of the ACT
<i>Asparagus asparagoides</i>	Bridal Creeper	Declared pest plant of the ACT
<i>Asparagus asparagoides</i> Western Cape Form	Bridal Creeper – Western Cape Form	Declared pest plant of the ACT
<i>Asparagus declinatus</i>	Bridal Veil	Declared pest plant of the ACT
<i>Asparagus plumosa</i>	Climbing Asparagus Fern	Declared pest plant of the ACT
<i>Asparagus scandens</i>	Asparagus Fern	Declared pest plant of the ACT
<i>Austrocylindropuntia</i> (ALL species)	Coral Cacti	Declared pest plant of the ACT
<i>Cabomba caroliniana</i>	Cabomba	Declared pest plant of the ACT
<i>Carduus nutans</i>	Nodding Thistle	Declared pest plant of the ACT
<i>Carduus pycnocephalus</i>	Slender Thistle	Declared pest plant of the ACT
<i>Carduus tenuiflorus</i>	Slender Thistle	Declared pest plant of the ACT
<i>Carthamus lanatus</i>	Saffron Thistle	Declared pest plant of the ACT
<i>Celtis australis</i>	Nettle Tree	Declared pest plant of the ACT
<i>Centaurea maculosa</i>	Spotted Knapweed	Declared pest plant of the ACT
<i>Chrysanthemoides monilifera</i>	Bitou Bush / Boneseed	Declared pest plant of the ACT
<i>Cortaderia jubata</i>	Pampas Grass	Declared pest plant of the ACT
<i>Cortaderia selloana</i>	Pampas Grass	Declared pest plant of the ACT
<i>Cotoneaster franchettii</i>	Cotoneaster	Declared pest plant of the ACT
<i>Cotoneaster glaucophyllus</i>	Cotoneaster	Declared pest plant of the ACT
<i>Cotoneaster pannosus</i>	Cotoneaster	Declared pest plant of the ACT
<i>Cotoneaster salicifolius</i>	Willow-leaf Cotoneaster	Declared pest plant of the ACT
<i>Cotoneaster simonsii</i>	Cotoneaster	Declared pest plant of the ACT

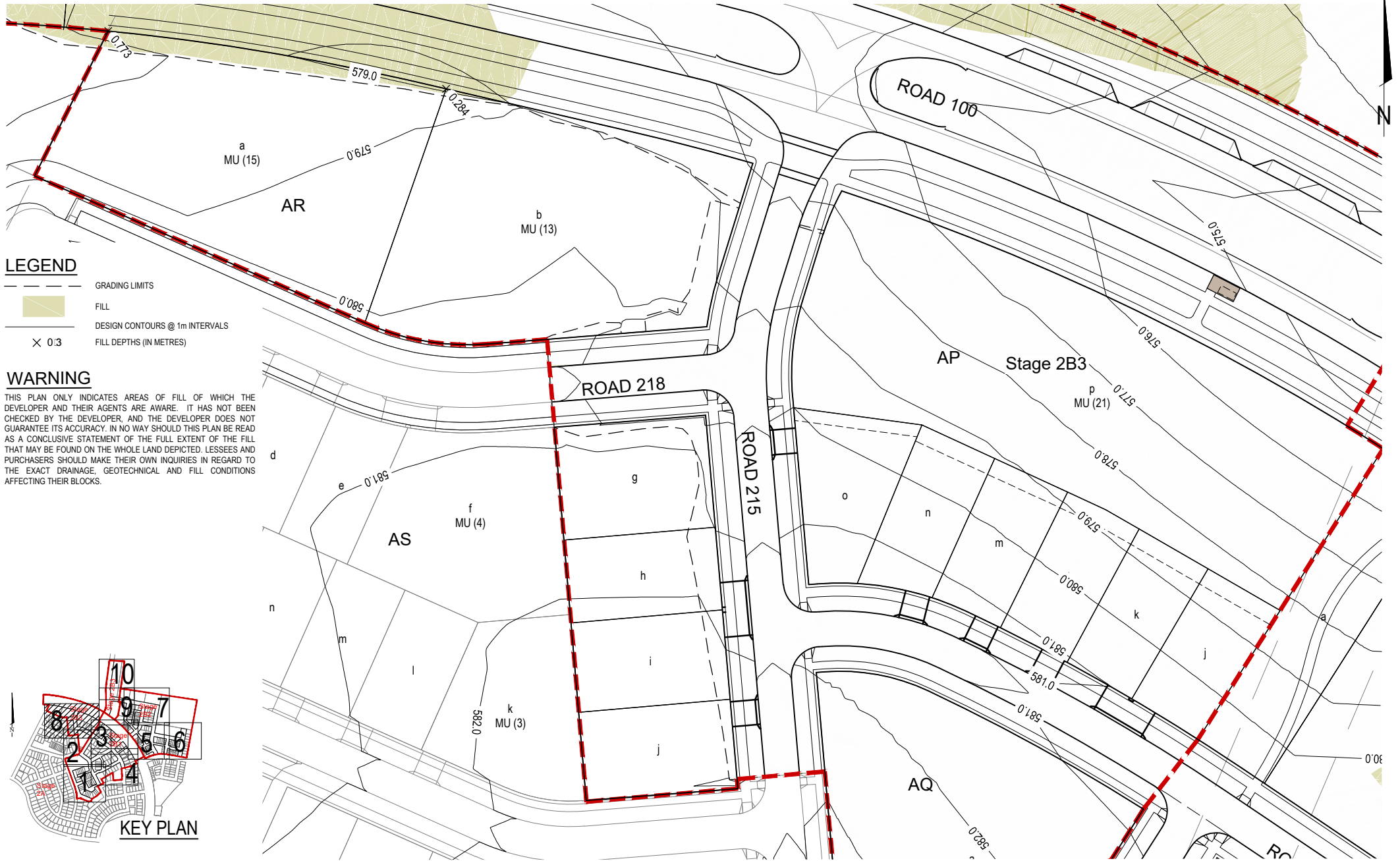
Botanical Name	Common Name	Reason
<i>Crataegus monogyna</i>	Hawthorn	Declared pest plant of the ACT
<i>Cryptostegia grandiflora</i>	Rubber Vine	Declared pest plant of the ACT
<i>Cylindropuntia</i> (ALL species)	Pear Cacti	Declared pest plant of the ACT
<i>Cytisus</i> (ALL species)	Broom species	Declared pest plant of the ACT
<i>Echium plantagineum</i>	Paterson's Curse	Declared pest plant of the ACT
<i>Echium vulgare</i>	Viper's Bugloss	Declared pest plant of the ACT
<i>Eichornia crassipes</i>	Water Hyacinth	Declared pest plant of the ACT
<i>Equisetum</i> species	Horsetail	Declared pest plant of the ACT
<i>Eragrostis curvula</i>	African Love Grass	Declared pest plant of the ACT
<i>Genista</i> (ALL species)	Broom species	Declared pest plant of the ACT
<i>Gymnocoronis spilanthoides</i>	Senegal Tea Plant	Declared pest plant of the ACT
<i>Hedera helix</i>	English Ivy	Declared pest plant of the ACT
<i>Hieracium aurantiacum</i>	Orange Hawkweed	Declared pest plant of the ACT
<i>Hieracium pilosella</i>	Mouse-ear Hawkweed	Declared pest plant of the ACT
<i>Hymenachne amplexicaulis</i>	Hymenachne	Declared pest plant of the ACT
<i>Hypericum perforatum</i>	St John's Wort	Declared pest plant of the ACT
<i>Jatropha gossypifolia</i>	Bellyache Bush	Declared pest plant of the ACT
<i>Kochia scoparia</i>	Kochia	Declared pest plant of the ACT
<i>Lagarosiphon major</i>	Lagarosiphon	Declared pest plant of the ACT
<i>Lantana camara</i>	Lantana	Declared pest plant of the ACT
<i>Ligustrum lucidum</i>	Broad-leaf privet	Declared pest plant of the ACT
<i>Ligustrum sinense</i>	Narrow-leaf privet	Declared pest plant of the ACT
<i>Lonicera japonica</i>	Japanese Honeysuckle	Declared pest plant of the ACT
<i>Lycium ferocissimum</i>	African Boxthorn	Declared pest plant of the ACT
<i>Macfadyena unguis-cati</i>	Cat's Claw Creeper	Declared pest plant of the ACT
<i>Mimosa pigra</i>	Mimosa	Declared pest plant of the ACT
<i>Miscanthus sinensis</i> (ALL varieties)	Chinese Fairy Grass	Declared pest plant of the ACT
<i>Myriophyllum aquaticum</i>	Parrot's Feather	Declared pest plant of the ACT
<i>Nasella tenuissima</i>	Mexican Feather Grass	Declared pest plant of the ACT
<i>Nassella charruana</i>	Lobed Needlegrass	Declared pest plant of the ACT
<i>Nassella neesiana</i>	Chilean Needle Grass	Declared pest plant of the ACT
<i>Nassella trichotoma</i>	Serrated Tussock	Declared pest plant of the ACT
<i>Onopordum acanthium</i>	Scotch Thistle	Declared pest plant of the ACT
<i>Onopordum illyricum</i>	Illyrian Thistle	Declared pest plant of the ACT
<i>Opuntia</i> (ALL species) (excludes <i>O. ficus-indica</i>)		
Prickly Pears	Declared pest plant of the ACT	
<i>Parkinsonia aculeata</i>	Parkinsonia	Declared pest plant of the ACT
<i>Parthenium hysterophorus</i>	Parthenium Weed	Declared pest plant of the ACT
<i>Pennisetum setaceum</i>	African Fountain Grass	Declared pest plant of the ACT

Botanical Name	Common Name	Reason
<i>Phyllostachys aurea</i>	Yellow Bamboo	Declared pest plant of the ACT
<i>Pinus radiata</i>	Radiata Pine	Declared pest plant of the ACT
<i>Pistia stratiotes</i>	Water Lettuce	Declared pest plant of the ACT
<i>Populus alba</i>	White Poplar	Declared pest plant of the ACT
<i>Populus nigra</i> 'Italica'	Lombardy Poplar	Declared pest plant of the ACT
<i>Prosopis</i> spp.	Mesquite	Declared pest plant of the ACT
<i>Pyracantha angustifolia</i>	Firethorn	Declared pest plant of the ACT
<i>Pyracantha coccinea</i>	Scarlet Firethorn	Declared pest plant of the ACT
<i>Pyracantha fortuneana</i>	Firethorn	Declared pest plant of the ACT
<i>Robinia pseudoacacia</i>	False Acacia	Declared pest plant of the ACT
<i>Rosa rubiginosa</i>	Sweet Briar, Briar Rose	Declared pest plant of the ACT
<i>Rubus fruticosus</i> (aggregate) All species except for the permitted cultivars: <i>R. armeniacus</i> and <i>R. ulmifolius</i> species hybrid <i>R. armeniacus</i> species hybrid <i>R. ursinus</i> and <i>R. armeniacus</i> species hybrid	All Blackberry except for the permitted cultivars: Black Satin, Chester Thornless, Dirksen Loch Ne and Chehale.	Declared pest plant of the ACT
<i>Sagittaria platyphylla</i>	Sagittaria	Declared pest plant of the ACT
<i>Salix</i> ALL species of willow, except for the permitted species: <i>Salix babylonica</i> <i>S. babylonica</i> <i>S. caladendron</i> <i>S. reichardtii</i>	All Willows except for the permitted species: Weeping Willow Weeping Willow Pussy Willow Sterile Pussy Willow	Declared pest plant of the ACT
<i>Salvinia molesta</i>	Salvinia	Declared pest plant of the ACT
<i>Senecio madagascariensis</i>	Fireweed	Declared pest plant of the ACT
<i>Solanum elaeagnifolium</i>	Silverleaf Nightshade	Declared pest plant of the ACT
<i>Sorbus</i> sp.	Service Tree, Rowan	Declared pest plant of the ACT
<i>Spartium junceum</i>	Spanish Broom	Declared pest plant of the ACT
<i>Tamarix aphylla</i>	Athel Pine	
<i>Toxicodendron succedaneum</i>	Rhus Tree	Declared pest plant of the ACT
<i>Ulex europaeus</i>	Gorse	Declared pest plant of the ACT
<i>Vinca major</i>	Periwinkle	Declared pest plant of the ACT
<i>Xanthium occidentale</i>	Noogoora Burr	Declared pest plant of the ACT
<i>Xanthium spinosum</i>	Bathurst Burr	Declared pest plant of the ACT
Landscaping Plant Species		
<i>Agapanthus</i> species	Agapanthus	Multiple varieties where the seed is easily distributed and forms dense monocultures in conservation areas

Botanical Name	Common Name	Reason
Nandina domestica	Sacred Bamboo	Berries toxic to birds, seed easily distributed into the conservation zone
Photinia species	Photinia	Seed easily distributed into conservation zone
Wisteria sinensis	Chinese Wisteria	Spread by seed, particularly along established waterways

Appendix C

Appendix D

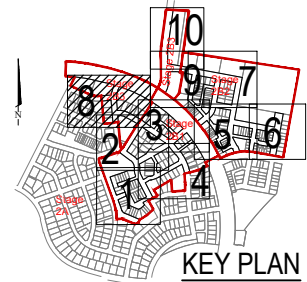


LEGEND

- GRADING LIMITS
- FILL
- DESIGN CONTOURS @ 1m INTERVALS
- FILL DEPTHS (IN METRES)

WARNING

THIS PLAN ONLY INDICATES AREAS OF FILL OF WHICH THE DEVELOPER AND THEIR AGENTS ARE AWARE. IT HAS NOT BEEN CHECKED BY THE DEVELOPER, AND THE DEVELOPER DOES NOT GUARANTEE ITS ACCURACY. IN NO WAY SHOULD THIS PLAN BE READ AS A CONCLUSIVE STATEMENT OF THE FULL EXTENT OF THE FILL THAT MAY BE FOUND ON THE WHOLE LAND DEPICTED. LESSEES AND PURCHASERS SHOULD MAKE THEIR OWN INQUIRIES IN REGARD TO THE EXACT DRAINAGE, GEOTECHNICAL AND FILL CONDITIONS AFFECTING THEIR BLOCKS.



Appendix E

SITE CLASSIFICATION REPORT SUMMARY

BLOCK:	1 (p)	SECTION:	65 (AP)	SUBURB:	Strathnairn
JOB No:	77356.39			DATE:	Oct 2021
CLIENT:	Calibre Professional Services Pty Ltd			REV:	0

Classification Procedures:

Existing Subsurface Conditions: Refer attached test pit log(s) – Pit(s) 26,27,28,29,30 and Drawing 1.

Laboratory Results: Previous laboratory testing results indicated liquid limit ranging from 22 - 84%, plasticity index ranging from 2 - 60% and linear shrinkage ranging from 0.5 - 15.0%.

Site Classification: Site classification in accordance with AS2870:2011 provides guidance on the patterns and magnitude of moisture related seasonal ground movements that must be considered in design. Based on the current soil profile / state, on limited subsurface information, soil reactivity and allowing for variation in the subsoil profile, the natural soil profile would be equivalent to Class H2 (highly reactive) conditions. The site classification must be reassessed should the subsurface profile change by either cutting or filling and/or if the presence of service trenches, retaining walls or submerged structures are within the zone of influence of the proposed footings. Reference must be made to the comments provided below.

Footing Systems: Reference must be made to AS2870:2011 which indicates footing systems that are appropriate for each site classification. All footings must found within a uniform bearing stratum of suitable strength/material, below the zone of influence of any service trenches, backfill zones, retaining walls or underground structures. Masonry walls should be articulated in accordance with current best practice. Dwelling design must ensure suitable drainage and uniform moisture conditions are maintained in the vicinity of footings. Footing systems must be confirmed by a structural engineer taking into consideration any onsite or offsite constraints.

Maintenance Guidelines: Reference should be made to the attached CSIRO Sheet BTF 18 'Foundation Maintenance & Footing Performance' to comments about gardens, landscaping and trees on the performance of foundation soils and in particular in respect to maintaining good surface drainage. It notes that minor cracking in most structures is inevitable, and it describes site maintenance practices aimed at minimising foundation movements that can lead to cracking damage.

Comments/ Limitations:

The successful purchaser must make their own interpretations, deductions and conclusions from the information made available and will need to accept full responsibility for such interpretations, deductions and conclusions.

Development specific geotechnical investigations must be undertaken.

Additional topsoils / fill may have been spread subsequent to the investigation.

Site preparation prior to the construction should include removal of all vegetation, topsoil and any uncontrolled fill.

All new fill must be placed under controlled conditions (AS 3798:2007), otherwise Class P conditions would be warranted in those fill areas.

Some variability in subsurface conditions must be anticipated.

Moisture condition of site soils and/or the presence of groundwater may vary considerably from time of investigation compared to at the time of construction. Groundwater seepages are highly likely after heavy or prolonged rain.

Depending on the depth of site cut and trenches, hard rock excavation may be required.

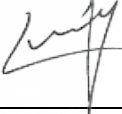

The above site classification is provided on the basis that all building materials/waste and stockpiles are removed from site and have not been spread across the site.

It is recommended that footing excavations be inspected by a geotechnical engineer.

This report must be read in conjunction with the attached "Limitations" and notes "About this Report".

References: AS 2870:2011, Residential Slabs and Footings, Standards Australia.

Attachments: Limitations & About this Report
Explanatory Notes
Test Pit Log(s) Pit(s) 26,27,28,29,30
Drawing 1

Douglas Partners
Geotechnics | Environment | Groundwater

Limitations

Douglas Partners (DP) has prepared this report for this project at Stage 2B3, Strathnairn in accordance with DP's proposal CAN190130.P.001.Rev0 dated 31 May 2019 and acceptance received from Calibre Professional Services Pty Ltd dated 30 April 2020. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Calibre Professional Services Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The scope for work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of filling of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such filling may contain contaminants and hazardous building materials.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the geotechnical components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

About this Report

Douglas Partners



Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;

- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.



Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low

reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:
4,6,7
N=13
- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:
15, 30/40 mm

Sampling Methods

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.



Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are generally based on Australian Standard AS1726:2017, Geotechnical Site Investigations. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	19 - 63
Medium gravel	6.7 - 19
Fine gravel	2.36 - 6.7
Coarse sand	0.6 - 2.36
Medium sand	0.21 - 0.6
Fine sand	0.075 - 0.21

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

The proportions of secondary constituents of soils are described as follows:

In fine grained soils (>35% fines)

Term	Proportion of sand or gravel	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	>30%	Sandy Clay
With	15 - 30%	Clay with sand
Trace	0 - 15%	Clay with trace sand

In coarse grained soils (>65% coarse)

- with clays or silts

Term	Proportion of fines	Example
And	Specify	Sand (70%) and Clay (30%)
Adjective	>12%	Clayey Sand
With	5 - 12%	Sand with clay
Trace	0 - 5%	Sand with trace clay

In coarse grained soils (>65% coarse)

- with coarser fraction

Term	Proportion of coarser fraction	Example
And	Specify	Sand (60%) and Gravel (40%)
Adjective	>30%	Gravelly Sand
With	15 - 30%	Sand with gravel
Trace	0 - 15%	Sand with trace gravel

The presence of cobbles and boulders shall be specifically noted by beginning the description with 'Mix of Soil and Cobbles/Boulders' with the word order indicating the dominant first and the proportion of cobbles and boulders described together.

Soil Descriptions

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	VS	<12
Soft	S	12 - 25
Firm	F	25 - 50
Stiff	St	50 - 100
Very stiff	VSt	100 - 200
Hard	H	>200
Friable	Fr	-

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	Density Index (%)
Very loose	VL	<15
Loose	L	15-35
Medium dense	MD	35-65
Dense	D	65-85
Very dense	VD	>85

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Extremely weathered material – formed from in-situ weathering of geological formations. Has soil strength but retains the structure or fabric of the parent rock;
- Alluvial soil – deposited by streams and rivers;

- Estuarine soil – deposited in coastal estuaries;
- Marine soil – deposited in a marine environment;
- Lacustrine soil – deposited in freshwater lakes;
- Aeolian soil – carried and deposited by wind;
- Colluvial soil – soil and rock debris transported down slopes by gravity;
- Topsoil – mantle of surface soil, often with high levels of organic material.
- Fill – any material which has been moved by man.

Moisture Condition – Coarse Grained Soils

For coarse grained soils the moisture condition should be described by appearance and feel using the following terms:

- Dry (D) Non-cohesive and free-running.
- Moist (M) Soil feels cool, darkened in colour.
Soil tends to stick together.
Sand forms weak ball but breaks easily.
- Wet (W) Soil feels cool, darkened in colour.
Soil tends to stick together, free water forms when handling.

Moisture Condition – Fine Grained Soils

For fine grained soils the assessment of moisture content is relative to their plastic limit or liquid limit, as follows:

- 'Moist, dry of plastic limit' or 'w < PL' (i.e. hard and friable or powdery).
- 'Moist, near plastic limit' or 'w ≈ PL' (i.e. soil can be moulded at moisture content approximately equal to the plastic limit).
- 'Moist, wet of plastic limit' or 'w > PL' (i.e. soils usually weakened and free water forms on the hands when handling).
- 'Wet' or 'w ≈ LL' (i.e. near the liquid limit).
- 'Wet' or 'w > LL' (i.e. wet of the liquid limit).



Rock Strength

Rock strength is defined by the Unconfined Compressive Strength and it refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects.

The Point Load Strength Index $Is_{(50)}$ is commonly used to provide an estimate of the rock strength and site specific correlations should be developed to allow UCS values to be determined. The point load strength test procedure is described by Australian Standard AS4133.4.1-2007. The terms used to describe rock strength are as follows:

Strength Term	Abbreviation	Unconfined Compressive Strength MPa	Point Load Index * $Is_{(50)}$ MPa
Very low	VL	0.6 - 2	0.03 - 0.1
Low	L	2 - 6	0.1 - 0.3
Medium	M	6 - 20	0.3 - 1.0
High	H	20 - 60	1 - 3
Very high	VH	60 - 200	3 - 10
Extremely high	EH	>200	>10

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$. It should be noted that the UCS to $Is_{(50)}$ ratio varies significantly for different rock types and specific ratios should be determined for each site.

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Residual Soil	RS	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely weathered	XW	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible
Highly weathered	HW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately weathered	MW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly weathered	SW	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh	FR	No signs of decomposition or staining.
<i>Note: If HW and MW cannot be differentiated use DW (see below)</i>		
Distinctly weathered	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathered products in pores.

Rock Descriptions

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with occasional fragments
Fractured	Core lengths of 30-100 mm with occasional shorter and longer sections
Slightly Fractured	Core lengths of 300 mm or longer with occasional sections of 100-300 mm
Unbroken	Core contains very few fractures

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq 100 \text{ mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or stronger. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Symbols & Abbreviations

Douglas Partners



Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U ₅₀	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

General



Asphalt



Road base



Concrete



Filling

Soils



Topsoil



Peat



Clay



Silty clay



Sandy clay



Gravelly clay



Shaly clay



Silt



Clayey silt



Sandy silt



Sand



Clayey sand



Silty sand



Gravel



Sandy gravel



Cobbles, boulders

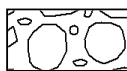


Talus

Sedimentary Rocks



Boulder conglomerate



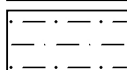
Conglomerate



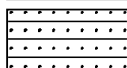
Conglomeratic sandstone



Sandstone



Siltstone



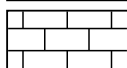
Laminite



Mudstone, claystone, shale

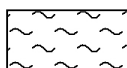


Coal

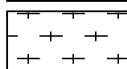


Limestone

Metamorphic Rocks



Slate, phyllite, schist

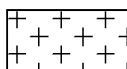


Gneiss

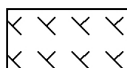


Quartzite

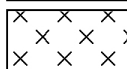
Igneous Rocks



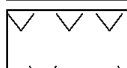
Granite



Dolerite, basalt, andesite



Dacite, epidote



Tuff, breccia



Porphyry

Foundation Maintenance and Footing Performance: A Homeowner's Guide



PUBLISHING

BTF 18-2011
replaces
Information
Sheet 10/91

Buildings can and often do move. This movement can be up, down, lateral or rotational. The fundamental cause of movement in buildings can usually be related to one or more problems in the foundation soil. It is important for the homeowner to identify the soil type in order to ascertain the measures that should be put in place in order to ensure that problems in the foundation soil can be prevented, thus protecting against building movement.

This Building Technology File is designed to identify causes of soil-related building movement, and to suggest methods of prevention of resultant cracking in buildings.

Soil Types

The types of soils usually present under the topsoil in land zoned for residential buildings can be split into two approximate groups – granular and clay. Quite often, foundation soil is a mixture of both types. The general problems associated with soils having granular content are usually caused by erosion. Clay soils are subject to saturation and swell/shrink problems.

Classifications for a given area can generally be obtained by application to the local authority, but these are sometimes unreliable and if there is doubt, a geotechnical report should be commissioned. As most buildings suffering movement problems are founded on clay soils, there is an emphasis on classification of soils according to the amount of swell and shrinkage they experience with variations of water content. The table below is Table 2.1 from AS 2870-2011, the Residential Slab and Footing Code.

Causes of Movement

Settlement due to construction

There are two types of settlement that occur as a result of construction:

- Immediate settlement occurs when a building is first placed on its foundation soil, as a result of compaction of the soil under the weight of the structure. The cohesive quality of clay soil mitigates against this, but granular (particularly sandy) soil is susceptible.
- Consolidation settlement is a feature of clay soil and may take place because of the expulsion of moisture from the soil or because of the soil's lack of resistance to local compressive or shear stresses. This will usually take place during the first few months after construction, but has been known to take many years in exceptional cases.

These problems are the province of the builder and should be taken into consideration as part of the preparation of the site for construction. Building Technology File 19 (BTF 19) deals with these problems.

Erosion

All soils are prone to erosion, but sandy soil is particularly susceptible to being washed away. Even clay with a sand component of say 10% or more can suffer from erosion.

Saturation

This is particularly a problem in clay soils. Saturation creates a bog-like suspension of the soil that causes it to lose virtually all of its bearing capacity. To a lesser degree, sand is affected by saturation because saturated sand may undergo a reduction in volume, particularly imported sand fill for bedding and blinding layers. However, this usually occurs as immediate settlement and should normally be the province of the builder.

Seasonal swelling and shrinkage of soil

All clays react to the presence of water by slowly absorbing it, making the soil increase in volume (see table below). The degree of increase varies considerably between different clays, as does the degree of decrease during the subsequent drying out caused by fair weather periods. Because of the low absorption and expulsion rate, this phenomenon will not usually be noticeable unless there are prolonged rainy or dry periods, usually of weeks or months, depending on the land and soil characteristics.

The swelling of soil creates an upward force on the footings of the building, and shrinkage creates subsidence that takes away the support needed by the footing to retain equilibrium.

Shear failure

This phenomenon occurs when the foundation soil does not have sufficient strength to support the weight of the footing. There are two major post-construction causes:

- Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.

In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

GENERAL DEFINITIONS OF SITE CLASSES

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites, which may experience only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which may experience moderate ground movement from moisture changes
H1	Highly reactive clay sites, which may experience high ground movement from moisture changes
H2	Highly reactive clay sites, which may experience very high ground movement from moisture changes
E	Extremely reactive sites, which may experience extreme ground movement from moisture changes

Notes

1. Where controlled fill has been used, the site may be classified A to E according to the type of fill used.
2. Filled sites. Class P is used for sites which include soft fills, such as clay or silt or loose sands; landslide; mine subsidence; collapsing soils; soil subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise.
3. Where deep-seated moisture changes exist on sites at depths of 3 m or greater, further classification is needed for Classes M to E (M-D, H1-D, H2-D and E-D).

Tree root growth

Trees and shrubs that are allowed to grow in the vicinity of footings can cause foundation soil movement in two ways:

- Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.
- Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.

Unevenness of Movement

The types of ground movement described above usually occur unevenly throughout the building's foundation soil. Settlement due to construction tends to be uneven because of:

- Differing compaction of foundation soil prior to construction.
- Differing moisture content of foundation soil prior to construction.

Movement due to non-construction causes is usually more uneven still. Erosion can undermine a footing that traverses the flow or can create the conditions for shear failure by eroding soil adjacent to a footing that runs in the same direction as the flow.

Saturation of clay foundation soil may occur where subfloor walls create a dam that makes water pond. It can also occur wherever there is a source of water near footings in clay soil. This leads to a severe reduction in the strength of the soil which may create local shear failure.

Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, then gradually spreads to the interior. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Swelling gradually reaches the interior soil as absorption continues. Shrinkage usually begins where the sun's heat is greatest.

Effects of Uneven Soil Movement on Structures

Erosion and saturation

Erosion removes the support from under footings, tending to create subsidence of the part of the structure under which it occurs. Brickwork walls will resist the stress created by this removal of support by bridging the gap or cantilevering until the bricks or the mortar bedding fail. Older masonry has little resistance. Evidence of failure varies according to circumstances and symptoms may include:

- Step cracking in the mortar beds in the body of the wall or above/below openings such as doors or windows.
- Vertical cracking in the bricks (usually but not necessarily in line with the vertical beds or perpend).

Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

Seasonal swelling/shrinkage in clay

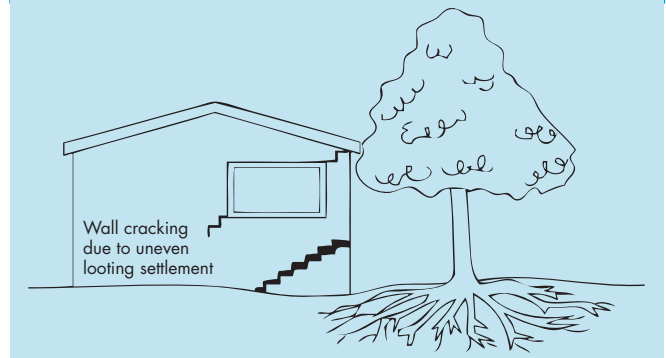
Swelling foundation soil due to rainy periods first lifts the most exposed extremities of the footing system, then the remainder of the perimeter footings while gradually permeating inside the building footprint to lift internal footings. This swelling first tends to create a dish effect, because the external footings are pushed higher than the internal ones.

The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally there may be visible dishing of the hip or ridge lines.

As the moisture absorption process completes its journey to the innermost areas of the building, the internal footings will rise. If the spread of moisture is roughly even, it may be that the symptoms will temporarily disappear, but it is more likely that swelling will be uneven, creating a difference rather than a disappearance in symptoms. In buildings with timber flooring supported by bearers and joists, the isolated piers will rise more easily than the strip footings or piers under walls, creating noticeable doming of flooring.

As the weather pattern changes and the soil begins to dry out, the external footings will be first affected, beginning with the locations where the sun's effect is strongest. This has the effect of lowering the

Trees can cause shrinkage and damage



external footings. The doming is accentuated and cracking reduces or disappears where it occurred because of dishing, but other cracks open up. The roof lines may become convex.

Doming and dishing are also affected by weather in other ways. In areas where warm, wet summers and cooler dry winters prevail, water migration tends to be toward the interior and doming will be accentuated, whereas where summers are dry and winters are cold and wet, migration tends to be toward the exterior and the underlying propensity is toward dishing.

Movement caused by tree roots

In general, growing roots will exert an upward pressure on footings, whereas soil subject to drying because of tree or shrub roots will tend to remove support from under footings by inducing shrinkage.

Complications caused by the structure itself

Most forces that the soil causes to be exerted on structures are vertical – i.e. either up or down. However, because these forces are seldom spread evenly around the footings, and because the building resists uneven movement because of its rigidity, forces are exerted from one part of the building to another. The net result of all these forces is usually rotational. This resultant force often complicates the diagnosis because the visible symptoms do not simply reflect the original cause. A common symptom is binding of doors on the vertical member of the frame.

Effects on full masonry structures

Brickwork will resist cracking where it can. It will attempt to span areas that lose support because of subsided foundations or raised points. It is therefore usual to see cracking at weak points, such as openings for windows or doors.

In the event of construction settlement, cracking will usually remain unchanged after the process of settlement has ceased.

With local shear or erosion, cracking will usually continue to develop until the original cause has been remedied, or until the subsidence has completely neutralised the affected portion of footing and the structure has stabilised on other footings that remain effective.

In the case of swell/shrink effects, the brickwork will in some cases return to its original position after completion of a cycle, however it is more likely that the rotational effect will not be exactly reversed, and it is also usual that brickwork will settle in its new position and will resist the forces trying to return it to its original position. This means that in a case where swelling takes place after construction and cracking occurs, the cracking is likely to at least partly remain after the shrink segment of the cycle is complete. Thus, each time the cycle is repeated, the likelihood is that the cracking will become wider until the sections of brickwork become virtually independent.

With repeated cycles, once the cracking is established, if there is no other complication, it is normal for the incidence of cracking to stabilise, as the building has the articulation it needs to cope with the problem. This is by no means always the case, however, and monitoring of cracks in walls and floors should always be treated seriously.

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

The normal structural arrangement is that the inner leaf of brickwork in the external walls and at least some of the internal walls (depending on the roof type) comprise the load-bearing structure on which any upper floors, ceilings and the roof are supported. In these cases, it is internally visible cracking that should be the main focus of attention, however there are a few examples of dwellings whose external leaf of masonry plays some supporting role, so this should be checked if there is any doubt. In any case, externally visible cracking is important as a guide to stresses on the structure generally, and it should also be remembered that the external walls must be capable of supporting themselves.

Effects on framed structures

Timber or steel framed buildings are less likely to exhibit cracking due to swell/shrink than masonry buildings because of their flexibility. Also, the doming/dishing effects tend to be lower because of the lighter weight of walls. The main risks to framed buildings are encountered because of the isolated pier footings used under walls. Where erosion or saturation causes a footing to fall away, this can double the span which a wall must bridge. This additional stress can create cracking in wall linings, particularly where there is a weak point in the structure caused by a door or window opening. It is, however, unlikely that framed structures will be so stressed as to suffer serious damage without first exhibiting some or all of the above symptoms for a considerable period. The same warning period should apply in the case of upheaval. It should be noted, however, that where framed buildings are supported by strip footings there is only one leaf of brickwork and therefore the externally visible walls are the supporting structure for the building. In this case, the subfloor masonry walls can be expected to behave as full brickwork walls.

Effects on brick veneer structures

Because the load-bearing structure of a brick veneer building is the frame that makes up the interior leaf of the external walls plus perhaps the internal walls, depending on the type of roof, the building can be expected to behave as a framed structure, except that the external masonry will behave in a similar way to the external leaf of a full masonry structure.

Water Service and Drainage

Where a water service pipe, a sewer or stormwater drainage pipe is in the vicinity of a building, a water leak can cause erosion, swelling or saturation of susceptible soil. Even a minuscule leak can be enough to saturate a clay foundation. A leaking tap near a building can have the same effect. In addition, trenches containing pipes can become watercourses even though backfilled, particularly where broken rubble is used as fill. Water that runs along these trenches can be responsible for serious erosion, interstrata seepage into subfloor areas and saturation.

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem. Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

- Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.

- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

Seriousness of Cracking

In general, most cracking found in masonry walls is a cosmetic nuisance only and can be kept in repair or even ignored. The table below is a reproduction of Table C1 of AS 2870-2011.

AS 2870-2011 also publishes figures relating to cracking in concrete floors, however because wall cracking will usually reach the critical point significantly earlier than cracking in slabs, this table is not reproduced here.

Prevention/Cure

Plumbing

Where building movement is caused by water service, roof plumbing, sewer or stormwater failure, the remedy is to repair the problem. It is prudent, however, to consider also rerouting pipes away from the building where possible, and relocating taps to positions where any leakage will not direct water to the building vicinity. Even where gully traps are present, there is sometimes sufficient spill to create erosion or saturation, particularly in modern installations using smaller diameter PVC fixtures. Indeed, some gully traps are not situated directly under the taps that are installed to charge them, with the result that water from the tap may enter the backfilled trench that houses the sewer piping. If the trench has been poorly backfilled, the water will either pond or flow along the bottom of the trench. As these trenches usually run alongside the footings and can be at a similar depth, it is not hard to see how any water that is thus directed into a trench can easily affect the foundation's ability to support footings or even gain entry to the subfloor area.

Ground drainage

In all soils there is the capacity for water to travel on the surface and below it. Surface water flows can be established by inspection during and after heavy or prolonged rain. If necessary, a grated drain system connected to the stormwater collection system is usually an easy solution.

It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

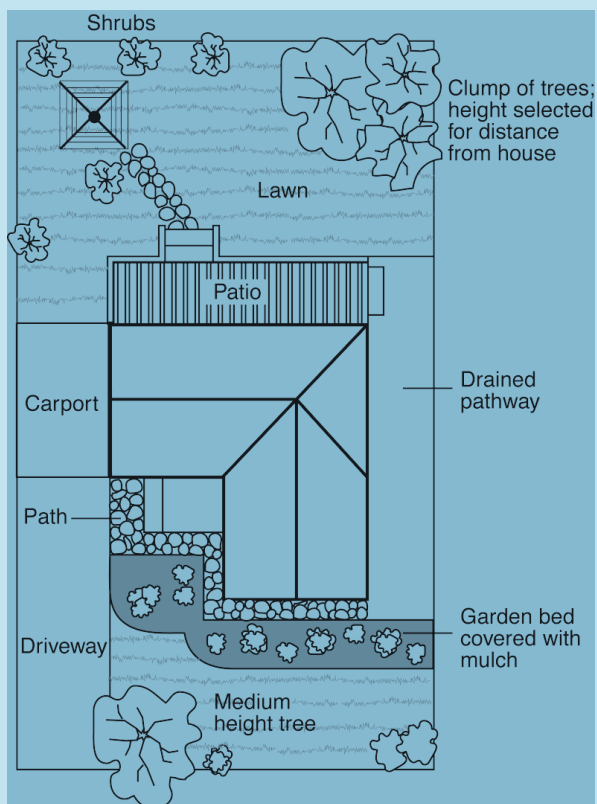
Protection of the building perimeter

It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving should

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS		
Description of typical damage and required repair	Approximate crack width limit (see Note 3)	Damage category
Hairline cracks	<0.1 mm	0
Fine cracks which do not need repair	<1 mm	1
Cracks noticeable but easily filled. Doors and windows stick slightly.	<5 mm	2
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weathertightness often impaired.	5–15 mm (or a number of cracks 3 mm or more in one group)	3
Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted.	15–25 mm but also depends on number of cracks	4

Gardens for a reactive site



extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. The finished paving should be no less than 100 mm below brick vent bases.

It is prudent to relocate drainage pipes away from this paving, if possible, to avoid complications from future leakage. If this is not practical, earthenware pipes should be replaced by PVC and backfilling should be of the same soil type as the surrounding soil and compacted to the same density.

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill from it (see BTF 19).

It may be desirable to install a grated drain at the outside edge of the paving on the uphill side of the building. If subsoil drainage is needed this can be installed under the surface drain.

Condensation

In buildings with a subfloor void such as where bearers and joists support flooring, insufficient ventilation creates ideal conditions for condensation, particularly where there is little clearance between the floor and the ground. Condensation adds to the moisture already present in the subfloor and significantly slows the process of drying out. Installation of an adequate subfloor ventilation system, either natural or mechanical, is desirable.

Warning: Although this Building Technology File deals with cracking in buildings, it should be said that subfloor moisture can result in the development of other problems, notably:

- Water that is transmitted into masonry, metal or timber building elements causes damage and/or decay to those elements.
- High subfloor humidity and moisture content create an ideal environment for various pests, including termites and spiders.
- Where high moisture levels are transmitted to the flooring and walls, an increase in the dust mite count can ensue within the living areas. Dust mites, as well as dampness in general, can be a health hazard to inhabitants, particularly those who are abnormally susceptible to respiratory ailments.

The garden

The ideal vegetation layout is to have lawn or plants that require only light watering immediately adjacent to the drainage or paving edge, then more demanding plants, shrubs and trees spread out in that order.

Overwatering due to misuse of automatic watering systems is a common cause of saturation and water migration under footings. If it is necessary to use these systems, it is important to remove garden beds to a completely safe distance from buildings.

Existing trees

Where a tree is causing a problem of soil drying or there is the existence or threat of upheaval of footings, if the offending roots are subsidiary and their removal will not significantly damage the tree, they should be severed and a concrete or metal barrier placed vertically in the soil to prevent future root growth in the direction of the building. If it is not possible to remove the relevant roots without damage to the tree, an application to remove the tree should be made to the local authority. A prudent plan is to transplant likely offenders before they become a problem.

Information on trees, plants and shrubs

State departments overseeing agriculture can give information regarding root patterns, volume of water needed and safe distance from buildings of most species. Botanic gardens are also sources of information. For information on plant roots and drains, see Building Technology File 17.

Excavation

Excavation around footings must be properly engineered. Soil supporting footings can only be safely excavated at an angle that allows the soil under the footing to remain stable. This angle is called the angle of repose (or friction) and varies significantly between soil types and conditions. Removal of soil within the angle of repose will cause subsidence.

Remediation

Where erosion has occurred that has washed away soil adjacent to footings, soil of the same classification should be introduced and compacted to the same density. Where footings have been undermined, augmentation or other specialist work may be required. Remediation of footings and foundations is generally the realm of a specialist consultant.

Where isolated footings rise and fall because of swell/shrink effect, the homeowner may be tempted to alleviate floor bounce by filling the gap that has appeared between the bearer and the pier with blocking. The danger here is that when the next swell segment of the cycle occurs, the extra blocking will push the floor up into an accentuated dome and may also cause local shear failure in the soil. If it is necessary to use blocking, it should be by a pair of fine wedges and monitoring should be carried out fortnightly.

This BTF was prepared by John Lewer FAIB, MIAMA, Partner, Construction Diagnosis.

The information in this and other issues in the series was derived from various sources and was believed to be correct when published.

The information is advisory. It is provided in good faith and not claimed to be an exhaustive treatment of the relevant subject.

Further professional advice needs to be obtained before taking any action based on the information provided.

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TEST PIT LOG

CLIENT: Calibre Professional Services Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: Stage 2B3, Strathnairn

SURFACE LEVEL: 580 AHD
EASTING: 198255
NORTHING: 610334

PIT No: 26
PROJECT No: 77356.39
DATE: 10/9/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
580	0.1	TOPSOIL FILL/Sandy SILT (ML): low plasticity, grey, fine to coarse grained sand, dry to moist, w<PL, inferred stiff, FILL										
		FILL/Silty CLAY (CI): medium plasticity, brown, with fine to coarse grained sand, trace fine gravel, moist to dry, w<PL, inferred very stiff to hard, regrade FILL										
	0.3	CLAY (CH): high plasticity, yellow brown, trace fine to coarse grained sand, dry to moist, w<PL, hard										
				D	0.7		pp >400					
579	1			D	1.1		pp >400					
	1.3	GRANODIORITE: fine to coarse grained, brown, speckled white, dry to moist, very low to low strength, highly weathered, highly fractured										
				D	1.5							
	1.6	Pit discontinued at 1.6m -limit of investigation										
578	2											

RIG: CAT 304C CR mini excavator fitted with a 300mm wide bucket

LOGGED: LSDJ

SURVEY DATUM: ACT Stromlo

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface levels and coordinates are approximate only and must not be relied upon

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A Auger sample	G Gas sample	PID Photo ionisation detector (ppm)	
B Bulk sample	P Piston sample	PL(A) Point load axial test Is(50) (MPa)	
BLK Block sample	U Tube sample (x mm dia.)	PL(D) Point load diametral test Is(50) (MPa)	
C Core drilling	W Water sample	pp Pocket penetrometer (kPa)	
D Disturbed sample	> Water seep	S Standard penetration test	
E Environmental sample	≡ Water level	V Shear vane (kPa)	

TEST PIT LOG

CLIENT: Calibre Professional Services Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: Stage 2B3, Strathnairn

SURFACE LEVEL: 577.7 AHD
EASTING: 198263
NORTHING: 610372

PIT No: 27
PROJECT No: 77356.39
DATE: 10/9/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
577	0.1	FILL/Gravelly CLAY (CL/CI): low to medium plasticity, brown, fine gravel, with fine to coarse grained sand, moist, w=PL, stiff, FILL Silty CLAY (CI/CH): medium to high plasticity, yellow brown, mottled grey, trace fine to coarse grained sand, dry to moist, w<PL, hard			0.05		pp = 250					
				D	0.5		pp >400					
				D	0.8		pp >400					
	1			D	1.0		pp >400	1				
576	1.6	Pit discontinued at 1.6m -limit of investigation		D	1.5		pp >400					
	2							2				

RIG: CAT 304C CR mini excavator fitted with a 300mm wide bucket

LOGGED: LSDJ

SURVEY DATUM: ACT Stromlo

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface levels and coordinates are approximate only and must not be relied upon

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2


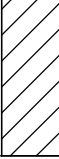
SAMPLING & IN SITU TESTING LEGEND					
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

TEST PIT LOG

CLIENT: Calibre Professional Services Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: Stage 2B3, Strathnairn

SURFACE LEVEL: 577.5 AHD
EASTING: 198312
NORTHING: 610337

PIT No: 28
PROJECT No: 77356.39
DATE: 10/9/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
577	0.1	TOPSOIL FILL/Sandy SILT (ML): low plasticity, dark grey, fine to coarse grained sand, dry to moist, w<PL, very stiff, FILL										
		CLAY (CH): high plasticity, grey mottled yellow brown, trace fine to coarse grained sand, dry to moist, w<PL, hard		D	0.3		pp >400					
				D	0.7		pp >400					
	1			D	1.0		pp >400	1				
576	1.5	Pit discontinued at 1.5m -limit of investigation		D	1.4		pp >400					
	2							2				

RIG: CAT 304C CR mini excavator fitted with a 300mm wide bucket

LOGGED: LSDJ

SURVEY DATUM: ACT Stromlo

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface levels and coordinates are approximate only and must not be relied upon

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2





SAMPLING & IN SITU TESTING LEGEND					
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	Sp	Standard penetration test
E	Environmental sample	≡	Water level	S	Shear vane (kPa)
		V		V	Shear vane (kPa)

TEST PIT LOG

CLIENT: Calibre Professional Services Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: Stage 2B3, Strathnairn

SURFACE LEVEL: 578 AHD
EASTING: 198346
NORTHING: 610299

PIT No: 29
PROJECT No: 77356.39
DATE: 10/9/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
578	0.1	FILL/Gravelly CLAY (CI): medium plasticity, brown, fine gravel, with fine to coarse grained sand, dry to moist, w<PL, inferred hard, FILL										
		CLAY (CH): high plasticity, yellow brown, trace fine to coarse grained sand, moist, w<PL, hard										
				D	0.3		pp >400					
				D	0.9		pp >400					
577	1.1	Silty CLAY (CL/CI): low to medium plasticity, yellow brown, speckled white grey, trace fine to coarse grained sand, dry to moist, w<PL, residual		D	1.2		pp >400					
	1.4	GRANODIORITE: fine to coarse grained, brown speckled white, dry to moist, very low to low strength, highly weathered, highly fractured		D	1.5							
	1.6	Pit discontinued at 1.6m -limit of investigation										
576	2											

RIG: CAT 304C CR mini excavator fitted with a 300mm wide bucket

LOGGED: LSDJ

SURVEY DATUM: ACT Stromlo

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface levels and coordinates are approximate only and must not be relied upon

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2




SAMPLING & IN SITU TESTING LEGEND			
A Auger sample	G Gas sample	PID Photo ionisation detector (ppm)	
B Bulk sample	P Piston sample	PL(A) Point load axial test Is(50) (MPa)	
BLK Block sample	U Tube sample (x mm dia.)	PL(D) Point load diametral test Is(50) (MPa)	
C Core drilling	W Water sample	pp Pocket penetrometer (kPa)	
D Disturbed sample	> Water seep	S Standard penetration test	
E Environmental sample	= Water level	V Shear vane (kPa)	

TEST PIT LOG

CLIENT: Calibre Professional Services Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: Stage 2B3, Strathnairn

SURFACE LEVEL: 575.5 AHD
EASTING: 198362
NORTHING: 610326

PIT No: 30
PROJECT No: 77356.39
DATE: 10/9/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
575	0.1	TOPSOIL FILL/Silty CLAY (CL): low plasticity, grey, trace fine to coarse grained sand and fine gravel, moist, w=PL, FILL		D	0.3		pp = 300					
		CLAY (CI/CH): medium to high plasticity, grey, mottled yellow brown, moist, w=PL										
	0.55	Clayey SAND (SC): fine to medium grained, grey orange brown, dry to moist, dense, weakly cemented										
574	1			D	1.0							
				D	1.5							
	1.7	Pit discontinued at 1.7m -limit of investigation										
	2											

RIG: CAT 304C CR mini excavator fitted with a 300mm wide bucket

LOGGED: LSDJ

SURVEY DATUM: ACT Stromlo

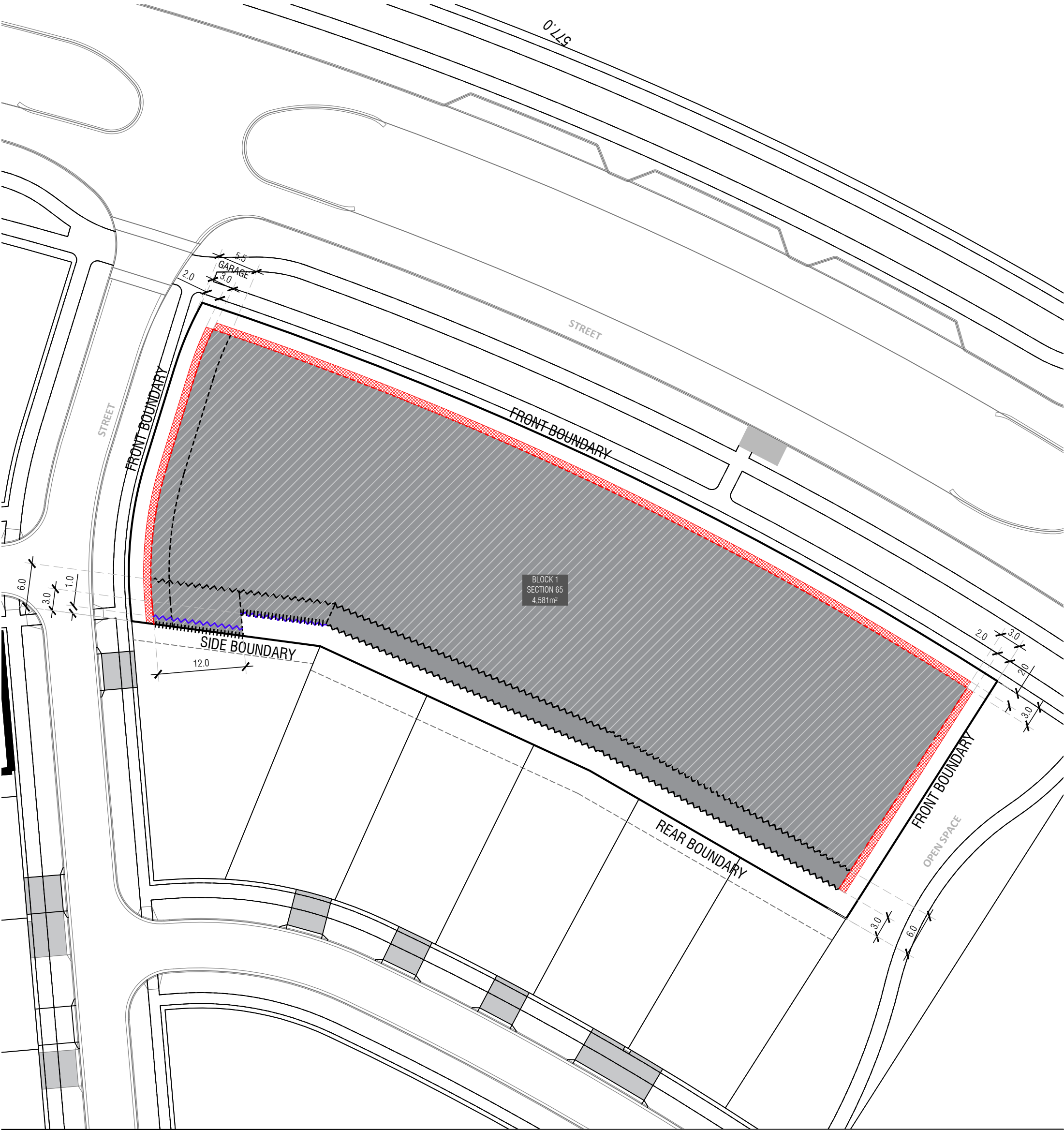
WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface levels and coordinates are approximate only and must not be relied upon

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND					
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)

Appendix F



KEY MAP

SITE LOCATION



LEGEND

- Block Boundary
- BOUNDARY Boundary Defined by MUHDC

INDICATIVE BUILDING FOOTPRINTS
(based on min. building setbacks **only** This does not take into account easements, plot ratio or building envelopes)

- Lower Floor Level
- Upper Floor Levels

MINIMUM BOUNDARY SETBACKS

- Multi Unit Housing Development Code (MUHDC)
front setbacks: refer to Rule 29 Table A5
side and rear setbacks: refer to Rule 30 Table A7
- Side and Rear Boundary - External Wall (Screened)
- Ground Floor - Unscreened
- Upper Floor - Unscreened

- Strathnairn Stage 2 EDP
refer to the Strathnairn Precinct Code
Lower floor level - external wall or unscreened element
(Excluding Garages/Carports)
Upper floor level (front setbacks) - external wall or unscreened element
- Articulation Elements (Articulation Zone)
refer to Strathnairn Precinct Code

BLOCK INFORMATION

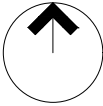
STAGE	2B3
ZONE	RZ 3
SECTION	65
BLOCK	1
PLOT RATIO	65%
HOUSING TYPE	MULTI UNIT SITE (21)

REV	DRAWN	CHECKED	APPROVED	DATE
A	AK	AK	CS	26/05/20
B	AK	AK	CS	01/10/20
C	DZ	CS	CS	14/03/23

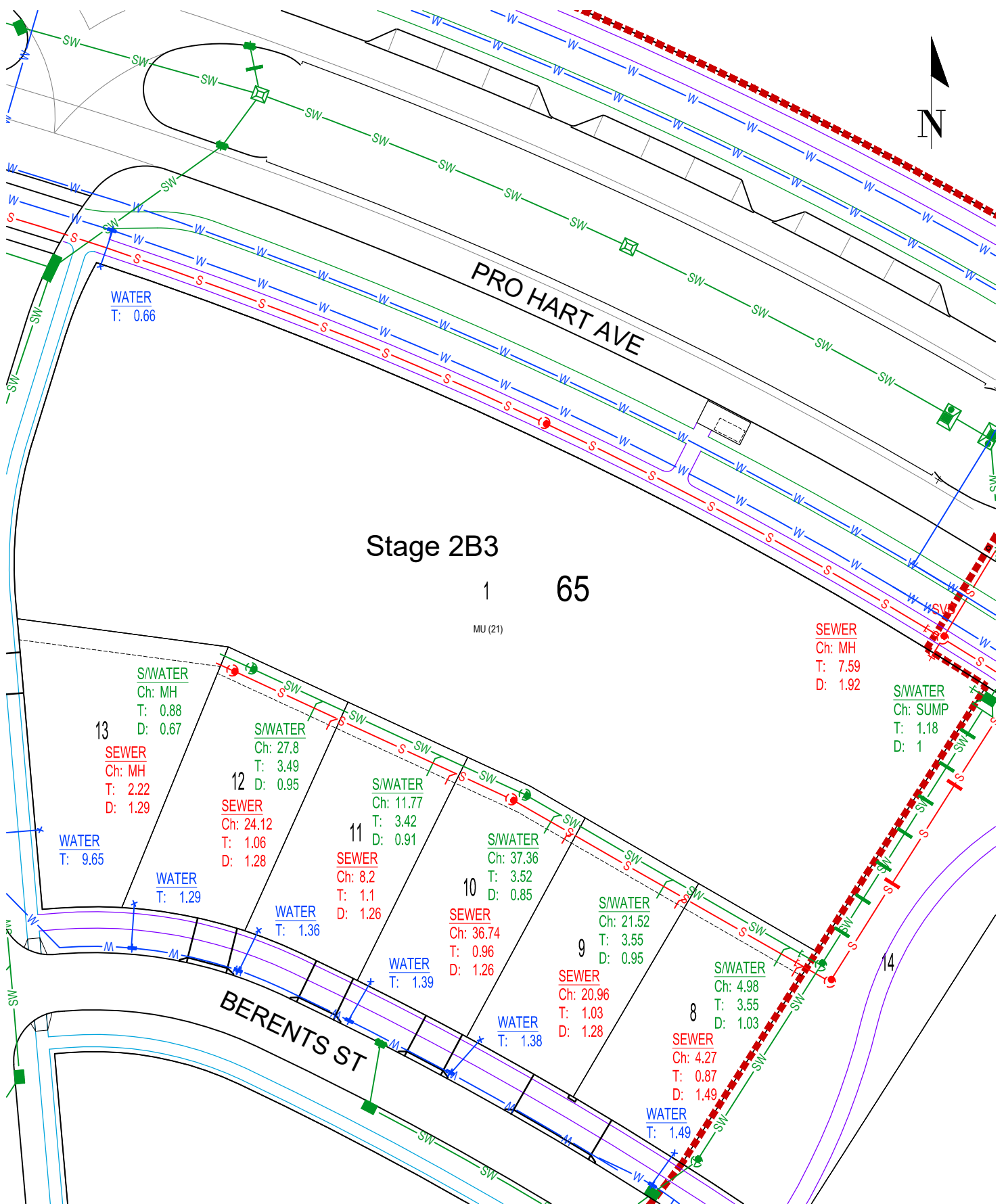
DO NOT SCALE OFF DRAWINGS. DIMENSIONS ARE IN METRES.

INFORMATION ON THIS PLAN IS TO BE USED AS A GUIDE ONLY FOR THE DESIGN PROCESS. APPROVED EDP PLANNING CONTROLS NEED TO BE CHECKED AGAINST PRECINCT CODE UPLIFTS. PLANS TO BE READ IN CONJUNCTION WITH THE TERRITORY PLAN ALONG WITH BLOCK DISCLOSURE PLANS AND THE GINNINDERRY DESIGN REQUIREMENTS TO CONFIRM ALL CURRENT CONTROLS PERTAINING TO YOUR BLOCK.

SCALE
1:500 @A3



Appendix G



Strathnairn Housing Development Requirements Application Form

Ginninderry Housing Development Requirements Application Form



Ginninderry

Property details

Block	
Section	
Block size	
Suburb	

Purchaser details

Name	
Phone	
Mobile	
Email	

Architect/designer details

Name	
Company	
Phone	
Mobile	
Email	

Builder details

Name	
Company	
Phone	
Mobile	
Email	

Required documents

1. 1:200 site plan with the following details:

- Overall building envelope with setback dimensions
- Extent of any retaining walls
- Location and size of Principal Private Open Space (PPOS)
- Location and clearance of all easements
- Services locations such as electrical and NBN meter boxes, water and gas meter, water tank, condenser units, HWS, clothes line
- Finished floor levels for the house and garage as well as gradient of driveway
- Extent of driveway and location of letterbox

2. Provide a fencing plan show all precinct code fencing requirements.

- Include location of letter box incorporated in wall on as a masonry pier.

3. 1:200 erosion sediment controls plan.

4. 1:100 floor plan and roof plan(s) with dimensions and size of dwelling area.

5. 1:100 elevations with the following details:

- Natural and proposed ground level with proposed FFL from boundary to boundary
- Extent of cut and/or fill and any retaining walls, including details of the height and materials
- Roof pitch

6. Energy efficiency rating certificate for the dwelling.

8. Water fixture list.

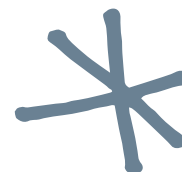
Contact us:

E: designs@ginninderry.com

P: 1800 316 900 (Wednesday to Friday)

Ginninderry is a joint venture between the Suburban Land Agency and Riverview Developments, with Riverview Projects (ACT) Pty Ltd ABN 30 165 870 539 acting as development manager. Correct as at 26/10/2020

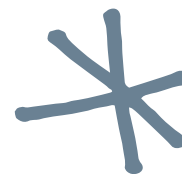
Ginninderry Housing Development Requirements



Ginninderry

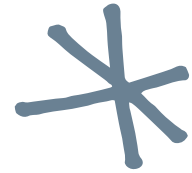
	Minimum requirements	Record for your home
Star rating as shown on your energy efficiency rating certificate	6 Star	<div>Certificate Provided</div>
Solar PV array size (kW)	Block size <250m ² : 2kW Block size 251m ² < 350m ² : 3kW Block size 351m ² < 500m ² : 4kW Block size > 500m ² : 5kW	Panel Array Size: <div></div>
Home energy management system	Reposit Power, Combined Energy and Evergen home energy management systems have been pre-approved. If an alternative system is installed, please provide a copy of a signed Alternative Home Energy System Assessment.	Brand: <div></div>
Inverter	Inverter compatible with an approved home energy management system above.	Brand: <div></div> Model: <div></div>
Hot water system	Solar or Heat Pump Systems Only Temperature range to -5°C.	Brand: <div></div> Model: <div></div>

Ginninderry Housing Development Requirements



Ginninderry

Minimum requirements		Record for your home
Heating and cooling systems		Brand:
Please select:		
Reverse cycle air conditioning		Model:
Air conditioning – cooling only		
Ducted evaporative cooling		EER: SPL:
Ground source heat pump	Cooling Cycle: EER ≥ 3 SPL < 57 Temp. Range -5°C to 43°C	
Other (please specify)		Temp Range:
	Heating Cycle: COP ≥ 3.5 SPL < 57 Temp. Range -10°C to 15°C	COP: SPL:
	<small>EER = Energy Efficiency Ratio SPL = Sound Pressure Level of outdoor unit measured at 1m. Why is this important? Read more here COP = Coefficient of Performance</small>	Temp Range:
Water fixtures and fittings		All fixtures comply
	Showerheads 3 star ($< 9\text{L}/\text{min}$) Tapware 4 star Toilets 4 star	Fixture List Provided
Rain water tank	Block Size $< 250\text{m}^2$: N/A Block Size $251\text{m}^2 < 350\text{m}^2$: 2,000L Block Size $351\text{m}^2 < 600\text{m}^2$: 4,000L Block Size $601\text{m}^2 < 800\text{m}^2$: 8,000L Block Size $> 800\text{m}^2$: 10,000L	Tank Size:
		Connected to Laundry, toilets and all external taps



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External colours and finishes schedule (Please tick the boxes below)

Roof Tiles – Monier

Atura

	Babylon		Barramundi		Caraway		Mist Grey		Saltspray		Seashell
	Silver Pearch		Wildrice		Wollemi		Aniseed				

Horizon

	Babylon		Barramundi		Camelot		Caraway		Mist Grey		Saltspray
	Seashell		Silver Perch		Wildrice		Wollemi		Aniseed		

Roof Tiles – Boral

Artline

	Earth		Fossil		Basalt		Night Quartz		Eclipse		Asphalt
--	-------	--	--------	--	--------	--	--------------	--	---------	--	---------

Wave

	Earth		Fossil		Basalt		Night Quartz		Eclipse		Asphalt
--	-------	--	--------	--	--------	--	--------------	--	---------	--	---------

Vogue

	Shale		Gunmetal		Charcoal Grey		Stonewall		Taupe
--	-------	--	----------	--	---------------	--	-----------	--	-------

Contour

	Quartz		Taupe		Walnut		Shale		Gunmetal		Peat
	Charcoal Grey										

Striata

	Gunmetal		Taupe		Walnut		Charcoal Grey
--	----------	--	-------	--	--------	--	---------------

Slimline

	Gunmetal		Stonewall		Taupe
--	----------	--	-----------	--	-------

Roof Tiles – Bristile

Prestige

	Lithium		Palladium		Titanium		Mercury		Tungsten
--	---------	--	-----------	--	----------	--	---------	--	----------



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Roof Tiles – Bristle (cont.)

Classic

	Pearl		Sand		Steel		Pebble		Mica		Savannah
	Bark		Gun Metal								

Metal Roof – Colorbond

Contemporary Colours

	Basalt		Cove		Dune		Evening Haze		Gully		Ironstone
	Jasper		Mangrove		Shale Grey		Surfmist		Wallaby		Windspray
	Monument										

Classic Colours

	Classic Cream		Deep Ocean		Pale Eucalypt		Paperbark		Woodland Grey
--	---------------	--	------------	--	---------------	--	-----------	--	---------------

Matt Colours

	Basalt		Dune		Shale Grey		Surfmist
--	--------	--	------	--	------------	--	----------

Fence Colour

Side and Rear Boundary Fencing

	Basalt
--	--------

Window Frame Colour

Contemporary Colours

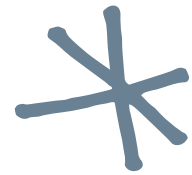
	Basalt		Cove		Dune		Evening Haze		Gully		Monument
	Jasper		Mangrove		Shale Grey		Surfmist		Wallaby		Windspray

Standard Colours

	Natural Pearl
--	---------------

Selected Pearls

	Ultra Silver		Precious Silver		Silver Medalist
--	--------------	--	-----------------	--	-----------------



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Bricks – Austral

Ultra Smooth		Tempo		Chill		Jazz		Rhythm
La Paloma		Miro		Azul				
Urban One		Silver		Latte		Chiffon		Pepper

Wilderness Design

	Grey Gum		Silver Birch		Blue Gum		Blackberry		Blackbutt
	Rosewood								

Everyday Life

	Engage		Freedom		Leisure		Stimulate		Unwind
	Escape								

Whitsunday Range

	Brampton		Orpheus		Alabaster		Marcasite		Topaz
--	----------	--	---------	--	-----------	--	-----------	--	-------

Metropolis

San Selmo Smoked

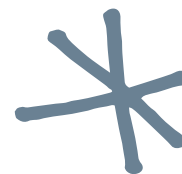
	Grey Cashmere (feature only or arch merit)		Cloudy Silver (feature only or arch merit)		Opaque Slate (feature only or arch merit)		Wild Storm (feature only or arch merit)
--	---	--	---	--	--	--	--

Metallix

	Quartz		Platinum		Titanium		Cuprum		Bronze
	Gun Metal Blue								

Bricks – PGH

Alfresco		Vino		Chocolatto		Truffle		Cocoa
		Espresso						
Altitude		Olympus		Apollo		Matterhorn		
Academy		Quantum		Alumni		Oscar		Nobel
		Juilliard						
		Quantum		Alumni		Oscar		Nobel
		Juilliard						
Composite		Pebble		Aluminium		Urban Blue		Charcoal
Dry Pressed Architectural		Hawkesbury Bronze		Livingston Gold		Mowbray Blue		Macarthur Mix
		Balmerino Blend		Tinto Cream		Red Rum		Silver Shadow
		Black Beauty						



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Bricks – PGH (cont.)

Dark and Stormy		Monsoon		Thunder		Whirlwind		Zephyr	
Foundations		Gravel		Stone					
Highlands		Blackheath		Leura (feature only)					
Manhattan		Chelsea (feature only or arch merit)		East Hampton (feature only or arch merit)		Tribeca (feature only or arch merit)			
Metallic		Nickel Flash		Pewter		Blue Steel Flash			
Morada		Blanco		Ceniza		Nero (feature only)		Gris	
Opaline		Tourmaline		Garnet		Tiger Eye			
Palazzo		Sorbetto							
Pure Linens		Cinders & Soot		Flannel Grey		Pebble Creek		Whispering White	
Smooth		Harvest Cream		Cashmere		Cream		Pearl Grey	
		Mineral		Volcanic		Rustic Harvest Cream		Copper Glow	
		Black & Tan		Brown		Choc Tan		Terracota	
Foundations		Granite		Red					
Urban Essence		Melbourne Blue (feature only)		Storm (feature only)					
Velour		Crevole		Cream		Pearl Grey		Red	
		Brown		Choc Tan		Mineral		Volcanic	
		Terracota		Granite					

Additional colour and finishes information

Driveway finish colour: _____

Retaining wall material finish and colour: _____

Courtyard wall material and finish: _____

Feature materials or colours: _____

Rendered wall colours: _____

Light weight cladding: _____

Fencing along street frontage: _____

Side gate & fencing parallel to street frontage: _____

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