Application for Planning Approval

Land Use Planning and Approvals Act 1993

APPLICATION NO.

DA2024/029

LOCATION OF AFFECTED AREA

4 SHELDUCK DRIVE, OLD BEACH

DESCRIPTION OF DEVELOPMENT PROPOSAL

DWELLING

A COPY OF THE DEVELOPMENT APPLICATION MAY BE VIEWED AT www.brighton.tas.gov.au AND AT THE COUNCIL OFFICES, 1 TIVOLI ROAD, OLD BEACH, BETWEEN 8:15 A.M. AND 4:45 P.M, MONDAY TO FRIDAY OR VIA THE QR CODE BELOW. ANY PERSON MAY MAKE WRITTEN REPRESENTATIONS IN ACCORDANCE WITH S.57(5) OF THE LAND USE PLANNING AND APPROVALS ACT 1993 CONCERNING THIS APPLICATION UNTIL 4:45 P.M. ON **18/03/2024**. ADDRESSED TO THE GENERAL MANAGER AT 1 TIVOLI ROAD, OLD BEACH, 7017 OR BY EMAIL AT development@brighton.tas.gov.au. REPRESENTATIONS SHOULD INCLUDE A DAYTIME TELEPHONE NUMBER TO ALLOW COUNCIL OFFICERS TO DISCUSS, IF NECESSARY, ANY MATTERS RAISED.

JAMES DRYBURGH
General Manager

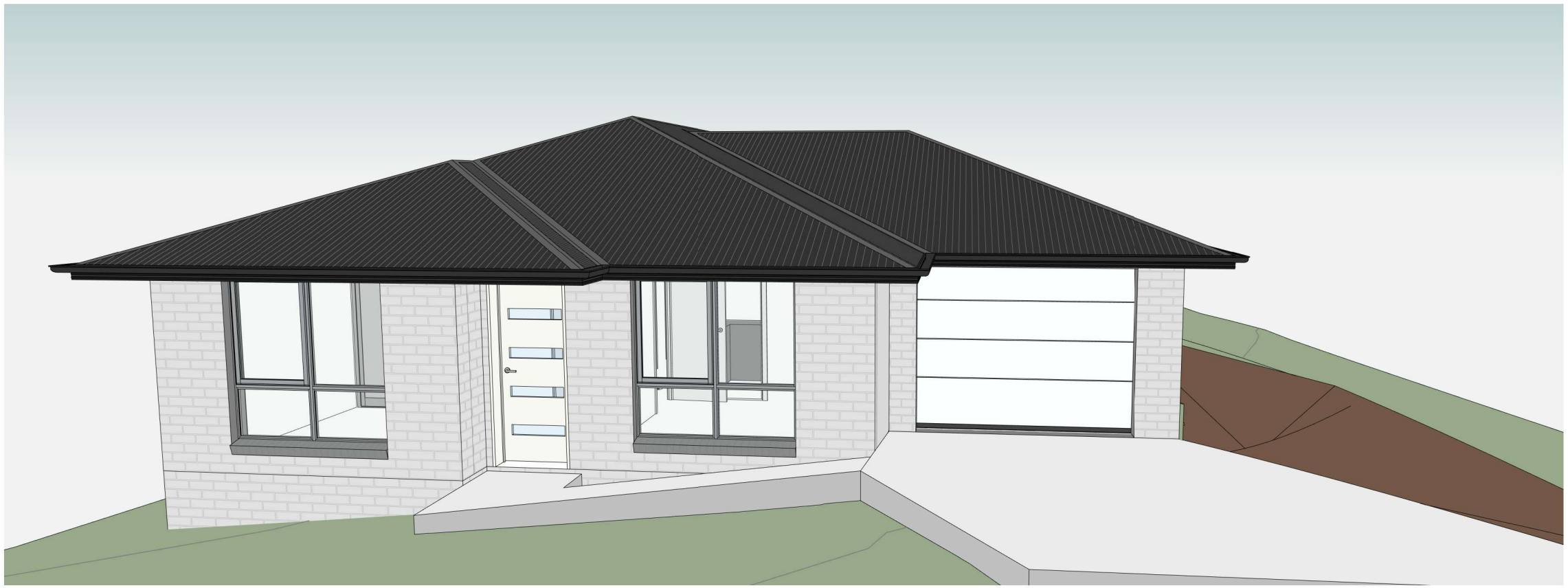
SCAN ME

Brighton
going places

CREATIVE HOMES HOBART

CREATIVE HOMES HOBART, CORNOR OF ELWICK ROAD & BROOKER HIGHWAY, GLENORCHY 7010 PH: 03 6272 3000

Proposed New Dwelling for
GRACE CURTAIN
LOT 471 TIVOLI GREEN ESTATE,OLD BEACH



Land Title Reference: CT
Wind Classification: TBC
Soil Classification: M
Climate Zone: 7
Bushfire Attack Level: TBC
Alpine Area: N/A Less than 900m AHD

DRAWINGS:

01	SITE PLAN
02	FLOOR PLAN
03	ROOF PLAN
04	ELEVATIONS
05A	NOTES & DETAILS
06	3D VIEWS
07	ELECTRICAL LAYOUT
08	WET AREA NOTES
09	BAL NOTES

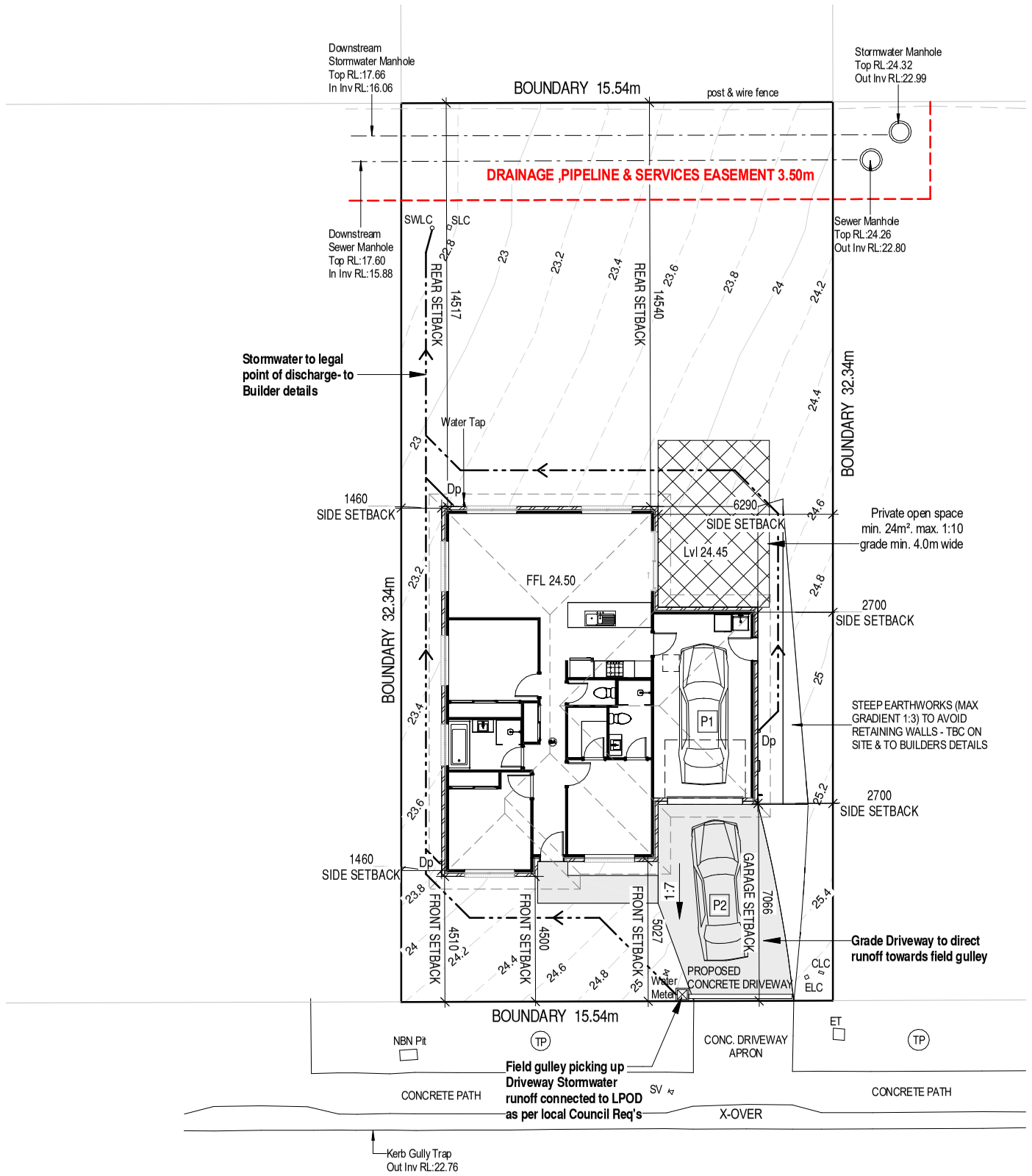
AREA SCHEDULE

FLOOR AREA (DWELLING)	:	99.5 m²
GARAGE AREA	:	27.3 m²
FLOOR AREA:	:	126.8 m²
DECK	:	13.0 m²
TOTAL AREA	:	139.8 m²
DRIVEWAY AREA	:	33.6 m²

GLAZING NOTE:
- ALL EXTERNAL TO BE DOUBLE GLAZED

No.	Date	Description	Drawn
A	03.01.2024	WORKING DRAWINGS	RK
	19.12.2023	CONCEPT PLANS	RK

Ground FL	24.500
CL	26.900



GLAZING NOTE:
- ALL EXTERNAL TO BE DOUBLE GLAZED

AGG DRAIN REQUIRED
(TBC ON SITE & TO BUILDERS DETAILS)

SITE PLAN

GENERAL NOTES:

1. THIS PLAN HAS BEEN PREPARED BY SURVEY PLUS FROM A COMBINATION OF EXISTING RECORDS AND FIELD SURVEY FOR THE PURPOSES OF SHOWING THE PHYSICAL FEATURES OF THE LAND AND SHOULD NOT BE USED FOR ANY OTHER PURPOSE.

2. TITLE BOUNDARIES SHOWN WERE NOT VERIFIED OR MARKED BY SURVEY PLUS AT THE TIME OF THIS SURVEY.

3. SERVICES SHOWN ON THIS PLAN WERE LOCATED WHERE POSSIBLE BY FIELD SURVEY. THEY ARE NOT A COMPLETE PICTURE OF SERVICES ON SITE. ALL SERVICE LOCATIONS ARE TO BE VERIFIED BEFORE COMMENCEMENT OF ANY WORK ON SITE, IN PARTICULAR THOSE SERVICES NOT PREVIOUSLY LOCATED THROUGH FIELD SURVEY.

4. SURVEY PLUS CAN NOT ACCEPT LIABILITY WHATSOEVER FOR LOSS OR DAMAGE CAUSED TO ANY UNDERGROUND SERVICE WHETHER SHOWN BY OUR SURVEY OR NOT.

5. THIS NOTE IS AN INTEGRAL PART OF THIS PLAN/DATA. REPRODUCTION OF THIS PLAN OR ANY PART OF IT WITHOUT THIS NOTE BEING INCLUDED IN FULL WILL RENDER THE INFORMATION SHOWN ON SUCH A REPRODUCTION INVALID AND NOT SUITABLE FOR USE WITHOUT PRIOR AUTHORITY OF SURVEY PLUS.

6. HORIZONTAL DATUM IS MGA (GDA94).

7. VERTICAL DATUM IS AHD.

8. CONTOUR INTERVAL IS 0.2 METRES, INDEX IS 1.0 METRES.

9. SURVEY BY ROBOTIC TOTAL STATION AND GPS.

10. IMPORTED DATA SHOWN ON THIS PLAN WAS OBTAINED FOR PUBLIC AVAILABLE DATA FROM VARIOUS GOVERNMENT AUTHORITIES. THIS INFORMATION IS PROVIDED FOR GUIDANCE ONLY. THE ACCURACY OF ANY IMPORTED DATA IS PER THE ACCURACY QUOTED BY THE SOURCE AND IS IN NO WAY GUARANTEED BY SURVEY PLUS. USERS MUST NOT RELY ON THIS DATA FOR FOR ON-GROUND LOCATION OF BOUNDARIES AND/OR SERVICES.

LIST DATA IMPORT
- TasWater-SewerLateralLine
- TasWater-SewerMain
- TasWater-SewerMaintenanceHole
- TasWater-SewerPressurisedMain
- TasWater-WaterHydrant
- TasWater-WaterLateralLine
- TasWater-WaterMain
- CadastralParcel-OwnerInformation

LOCAL COUNCIL IMPORT
LocalAuthority-StormwaterMain

11. BOUNDARIES ARE COMPILED ONLY FROM PRELIMINARY/DRAFT PLAN OF SURVEY AND ARE CONSIDERED APPROXIMATE ONLY. BOUNDARIES & EASEMENT ARE SUBJECT TO CHANGE ONCE TITLES ARE ISSUED.

12. 3D DATA TURNED OFF IN LAYER CONTROL.
- 3D TIN
- MAJOR CONTOUR 3D
- MINOR CONTOUR 3D

LEGEND

SV = Stop Valve
ET = Electrical Turret
TP = Tree Planter
ELC = Electricity Lot Connection
CLC = Communication Lot Connection

SWLC = Stormwater Lot Connection
Top RL:22.69
Inv RL:22.05

SLC = Sewer Lot Connection
Top RL:22.70
Inv RL:22.02

AREA SCHEDULE

FLOOR AREA (DWELLING)	:	99.5 m²
GARAGE AREA	:	27.3 m²
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01

CONTRACTOR MUST VERIFY ALL DIMENSIONS AND LEVELS AT THE JOB PRIOR TO COMMENCING ANY WORK OR MAKING ANY SHOP DRAWINGS.

DO NOT SCALE DRAWINGS. ALWAYS USE WRITTEN DIMENSIONS.

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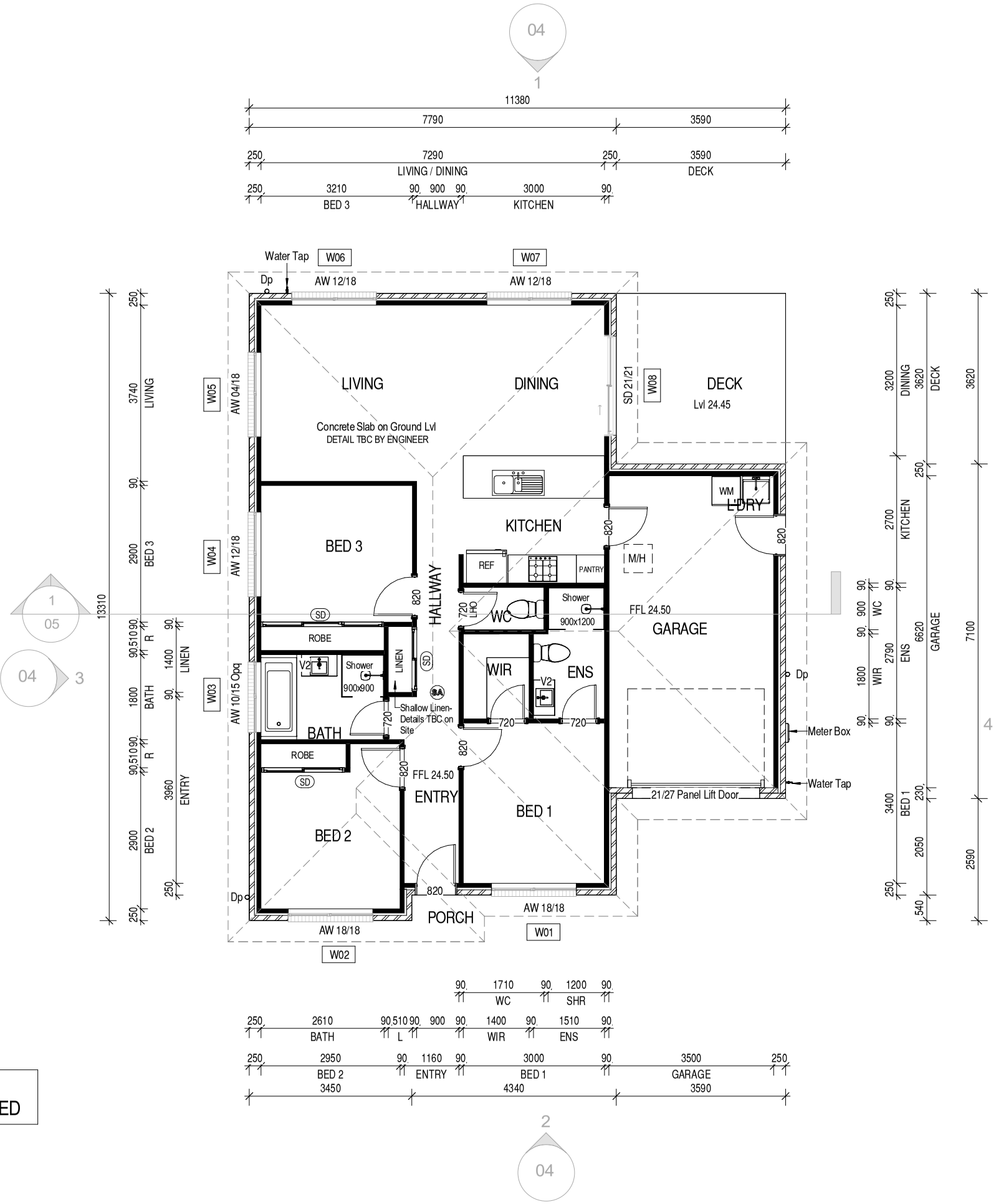
CREATIVE HOMES HOBART
CREATIVE HOMES HOBART, CORNOR OF ELWICK ROAD & BROOKER HIGHWAY,GLENORCHY 7010 PH: 03 6272 3000

JOB ADDRESS : LOT 471 TIVOLI GREEN ESTATE,OLD BEACH			CLIENT : GRACE CURTAIN
APPROVED BY:	STUART CHUGG		
DRAWN :	Ranjot Kaur		SHEET: 01 OF 11
CHECKED: SC	DATE:	03.01.2024	PROJECT NO: CH_90
SCALE: 1 : 200	REVISION:	A	

Ground FL	24.500
CL	26.900



Legend:

AW	Awning window
DH	Double hung window
FW	Fixed window
SD	Sliding door
SW	Sliding window
B/O	Beam over
BRM	Broom cupboard
CSD	Cavity sliding door
CT	Cook top
DP	Downpipe (Location)
DW	Dishwasher
MW	Microwave
MH	Manhole
OHC	Overhead cupboards
OBS	Obscured (Glazing)
REF	Fridge / Refrigerator
RH	Range hood
SHS	Square hollow section (column)
U/M	Under mount
UBO	Under beam oven
V	Vanity basin
WC	Water closet (Toilet)
WM	Washing machine
WT	Wash tub

Note:

1. Tile layout indicative only.
2. Provide lift off hinges to WC doors- to comply with NCC requirements.
3. Confirm level on the site to all external doors if steps are required- to comply with NCC requirement.
4. All smoke alarms to be inter-connected to NCC requirements.

NOTES :

1. ENS TILES, FITTINGS AND FIXTURES AS PER SELECTION
2. BATH TILES, FITTINGS AND FIXTURES AS PER SELECTION
3. DRESS WARDROBE FITOUT AS PER SELECTION
4. KITCHEN JOINERY, SPLASHBACK, FITTINGS AND FIXTURES AS PER SELECTION

NOTE:
Cladding is to be installed using treated pine battens or similar. If the battens are running horizontally, they are to be packed out min 10mm at each stud to allow for airflow and condensation.

Window Schedule

Number	Type	Height	Width	Head Ht.
01	AW 18/18	1800	1800	2160
02	AW 18/18	1800	1800	2160
03	AW 10/15 Opq	1000	1500	2160
04	AW 12/18	1200	1800	2160
05	AW 04/18	400	1800	2160
06	AW 12/18	1200	1800	2160
07	AW 12/18	1200	1800	2160
08	SD 21/21	2100	2100	2100
Grand total: 8				

GLAZING NOTE:
- ALL EXTERNAL TO BE DOUBLE GLAZED

Note:
DP Down Pipe

Vanity Legend	
VB	450 mm
V1	600 mm
V2	750 mm
V3	900 mm
V4	1200 mm
V5	1500 mm

AREA SCHEDULE

FLOOR AREA (DWELLING)	:	99.5 m²
GARAGE AREA	:	27.3 m²
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TOTAL AREA	:	139.8 m²
DRIVEWAY AREA	:	33.6 m²

FLOOR PLAN

02

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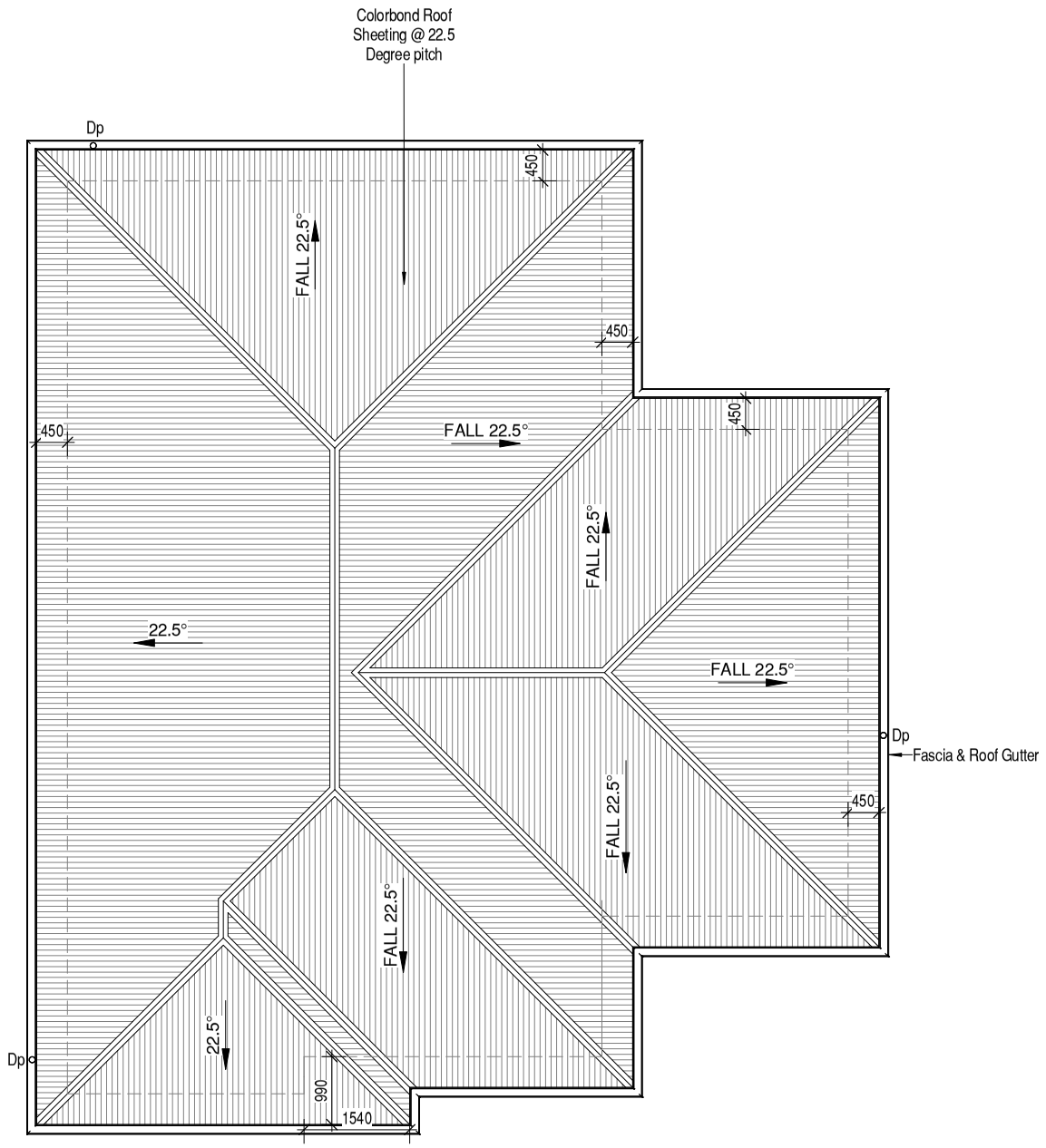
CREATIVE HOMES HOBART, CORNOR OF ELWICK ROAD & BROOKER HIGHWAY,GLENORCHY 7010 PH: 03 6272 3000

JOB ADDRESS :	LOT 471 TIVOLI GREEN ESTATE,OLD BEACH
APPROVED BY:	STUART CHUGG
DRAWN :	Ranjot Kaur
CHECKED:	SC
DATE:	03.01.2024
SCALE:	1 : 100
REVISION:	A
CLIENT :	GRACE CURTAIN
SHEET:	02 OF 11
PROJECT NO:	CH_90

ROOF NOTES:

1. VAPOUR PERMEABLE SARKING UNDER BATTENS (OR EQUIV.) (WITH 25MM AIR GAP TO ROOFING) AND MINIMUM 10MM ROOF VENTILATION (SUPPLY) GAP IN ACCORDANCE WITH NCC.
2. RIDGE TO HAVE CONTINUOUS GAP IN VAPOUR PERMEABLE SARKING (5mm) OR EQUIV.VENTILATION SYSTEM (EXHAUST)IN ACCORDANCE WITH NCC.
3. SELECT COLORBOND CAPPING AND FLASHINGS INSTALLED TO MANUFACTURER'S SPECIFICATION.
4. FC LINING TO EAVE WITH EAVE VENTS FOR VENTILATION (OR EQUIV.)IN ACCORDANCE WITH NCC.



ROOF CATCHMENT AREA CALCULATION		
Ah	157.6 m²	Plan area of roof including115mm Quad gutter (parapet included where applicable)
Ac	190.7 m²	Catchment area of a roof= Ah x slope factor
Gutter	6555	effective cross-sectional area of a gutter (assumed 57x115 quad gutter)
DRI	85	Rainfall intensity (mm/h) - 5 Min - ARI 20 years. (as per Figure E8)
Acdp	70	The maximum catchment area of roof per vertical downpipe
Downpipes required	3	Ac / Acdp
Downpipes provided	3	
NOTE: Roof catcment areas to comply with AS3500.3		

AREA SCHEDULE		
FLOOR AREA (DWELLING)	:	99.5 m²
GARAGE AREA	:	27.3 m²
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DECK	:	13.0 m²
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DRIVEWAY AREA	:	33.6 m²

ROOF PLAN

03

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JOB ADDRESS : LOT 471 TIVOLI GREEN ESTATE,OLD BEACH

APPROVED BY: STUART CHUGG

DRAWN : Ranjot Kaur

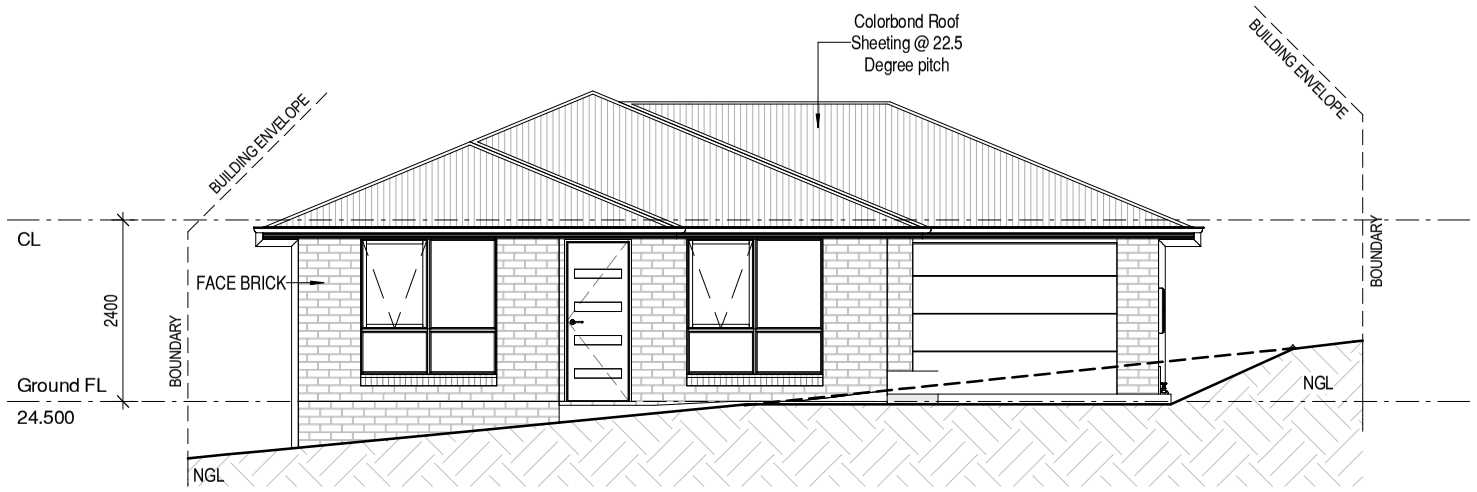
CHECKED: SC DATE: 03.01.2024

SCALE: 1 : 100 REVISION: A

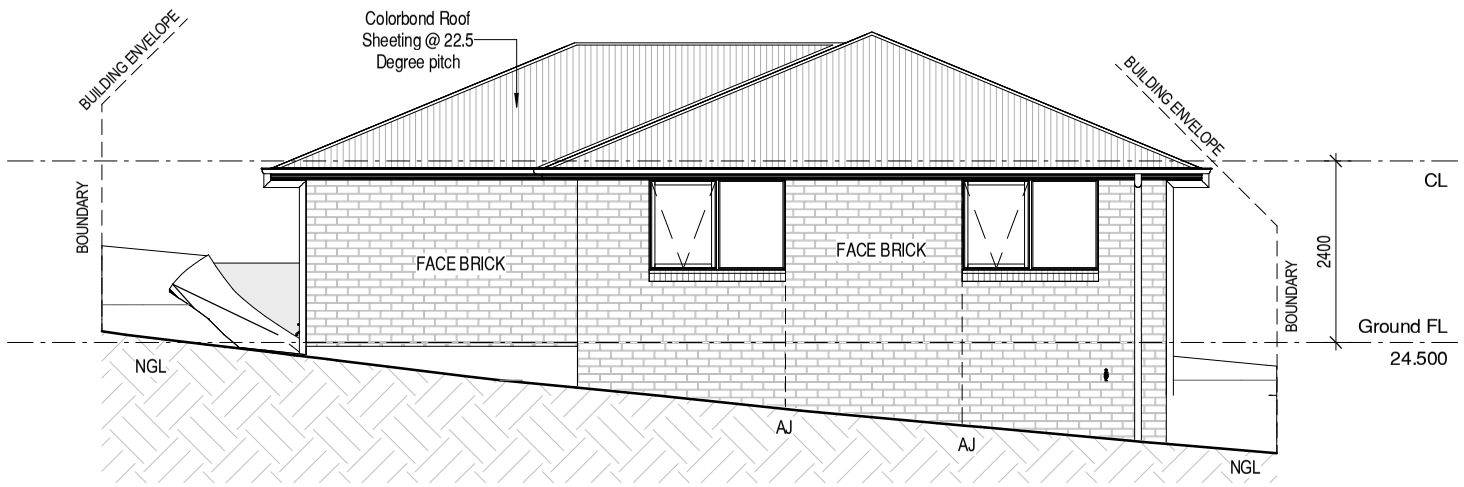
CLIENT : GRACE CURTAIN

SHEET: 03 OF 11

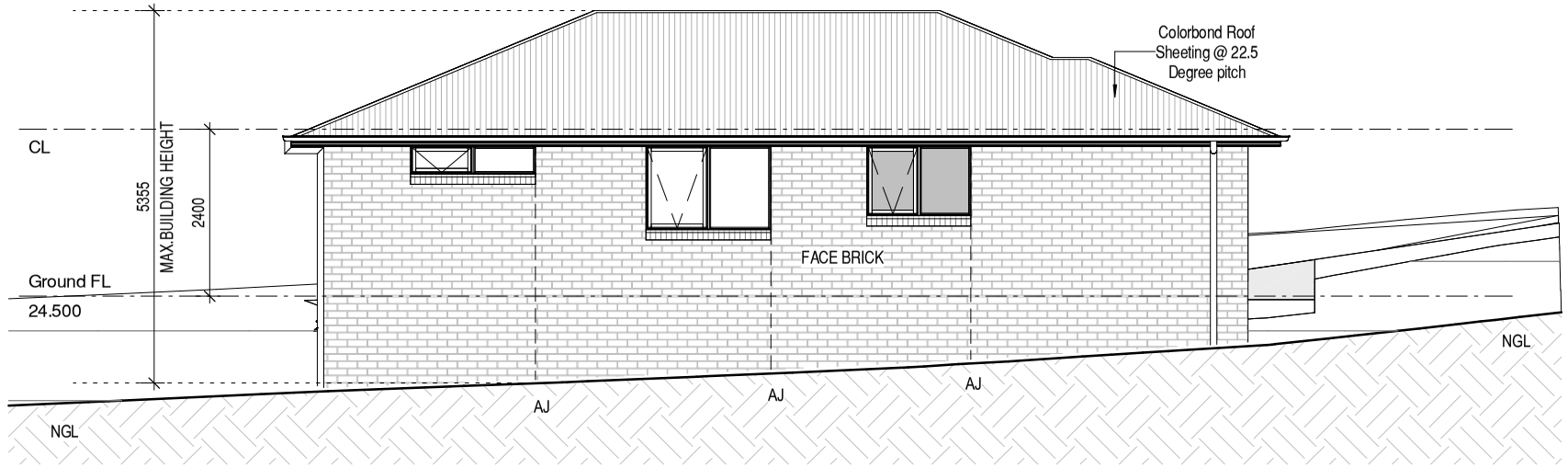
PROJECT NO: CH_90



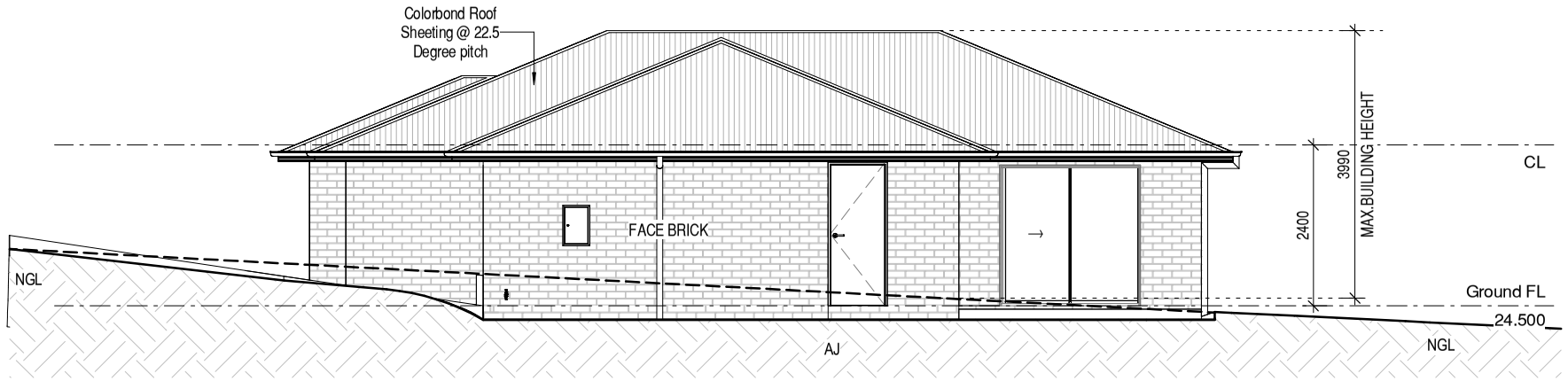
WEST Elevation



EAST Elevation



NORTH Elevation



SOUTH Elevation

ROOF NOTES:

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GLAZING NOTE:
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ELEVATIONS

04

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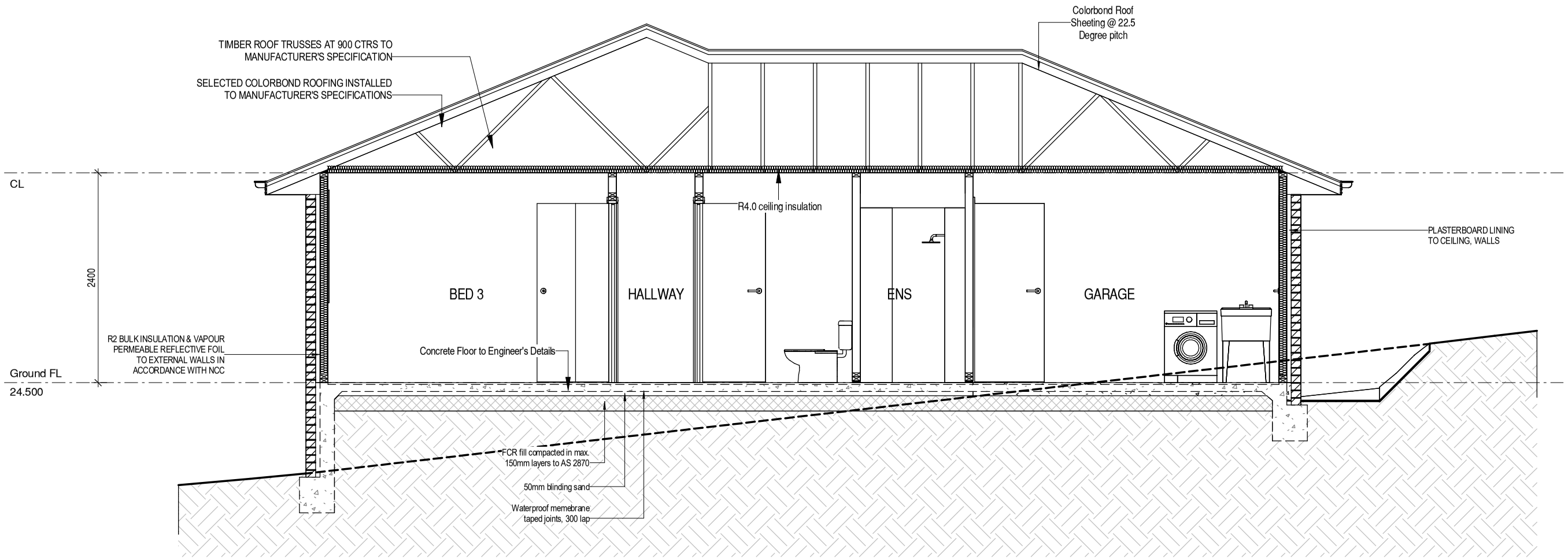
JOB ADDRESS : LOT 471 TIVOLI GREEN ESTATE,OLD BEACH		CLIENT : GRACE CURTAIN	
APPROVED BY:	STUART CHUGG		
DRAWN :	Ranjot Kaur	SHEET:	04 OF 11
CHECKED: SC	DATE: 03.01.2024	PROJECT NO:	CH_90
SCALE: 1 : 100	REVISION: A		



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SECTION

05

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JOB ADDRESS : LOT 471 TIVOLI GREEN ESTATE,OLD BEACH		CLIENT : GRACE CURTAIN	
APPROVED BY:	STUART CHUGG		
DRAWN :	Ranjot Kaur	SHEET:	05 OF 11
CHECKED: SC	DATE: 03.01.2024	PROJECT NO:	CH_90
SCALE: As indicated	REVISION:		

Note:

Builder and subcontractors to verify all dimension and levels prior to the commencement of any work. Give 24 hours mininum notice where ammendments are required to design of working drawings. These drawings are to be read in construction with engineers and surveyors drawings and notes. Do not scale drawings. Dimensions are to take preference over scale. Building specifications and engineers drawings shall override Architectural drawings.

All construction work shall be carried out in accordance with the state building regulations local council by laws and relevent NCC and AS codes.

Important notice for attention of owners:
The owners attention is drawn to the fact that foundations and associated drainage in all sites requires concontinuing maintenance to assist footing performance. Advice for foundations maintenance is contained in the CSIRO building technology file 18 and it is the owners responsibility to maintain the site in accordance with the document.

Energy Efficiency:

Bulk insulation between external studs to be insulated with min R2.0. (Ensure batts fit within cavity without compression, making sure that there is at least 25mm gap from the reflective surface).

External walls to be clad with peforated reflecive foil over the outside of the timber frame.

Ceiling to be insulated with R4.0 and reflective foil. Seal exhaust fans to ensuite, bathroom, laundry and kitchen. Building to be sealed in accordance with NCC 2022 part 13.4.

Construction of the external walls, floor, and roof compliance of air leakage to comply with NCC2022 part 13.4.6.

General:

All flashings to be in accordance with part 5 of the NCC2022. Weep holes and damp proof coursing in accordance 5.7.5 and 5.7.4 of the NCC2022. Fibre cement sheet in accordance with 7.4.4.

Block construction in accordance with the NCC requirements. Plasterboard to internal wall linings and ceilings with selected cornice. (See further for wet areas).

Health & Amenity part 10 NCC2022:

Showers, bath and wall fixtures to all wet areas shall comply with the requirements of Part 10.2 NCC2022. In all wet areas provide selected ceramic tiles to concrete floors or over 15mm cement sheeting where timber framed are proposed.

Provide waterproof plasterboard sheeting to all walls and ceilings. Provide ceramic tiles, lamipanel or other approved water-resistant lining to a min. height of 1800mm to shower walls and to a height of 150mm behind baths, basins, sinks, troughs, washing machines and wall fixtures. For the required extent of area to be protected refer to the figures 10.2.2
For typical insulation requirements of shower recesses, tap flanges, shower troughs, floors & waterproof memberanes refer to10.2.5, 10.2.6
For typical installation requirements & sealing of wall junctions with benchtops, laundry sinks & bath refer to figures 10.2.4a,10.2.4b,10.2.5. Materials shall comply with the requirements of clauses 10.2.7,10.2.8,10.2.9 and 10.2.10.

Refer to AS 3740-2010 for waterproofing of domestic wet areas as well as appropriative wall & floor treatment when a prefabricated shower unit is not used. (EG. min 1:100 fall to waste).

ARCHITECTURAL NOTES

ARCHITECTURAL PLANS DRAWING NOTE:
All plans shown in this document are architectural only, for structural specification/design refer to engineer drawings. (Engineering plans are documented after DA permit)

ARCHITECTURAL PLANS DRIVEWAY NOTES:
Driveway grades to be in accordance with AS2890.
If noted with "to be designed by Engineer at BA Stage" Engineer design to take precedence over Architectural Driveway.

PLUMBING STACK NOTE:
Plumber to check plumbing stack location with framing plan prior to start of works.

DESIGN RETAINING WALL NOTES:
Extent of any retaining wall design should be assessed on site to determine if unprotected embankment could replace retaining wall.

UNPROTECTED EMBANKMENT :
Any excavation adjacent to boundary shall comply to NCC 2022 H1D3(1) Earthworks. For slope ratio refer to the site plan on the Architectural documentation

KITCHEN NOTES:
Kitchen appliances/design/sizes/location are indicitive only (objects shown as placeholders only). Refer to selection documentation.

BATHROOM NOTES:
Bathroom fixtures/design/sizes/location are indicitive
only (objects shown as placeholders only). Refer to selection documentation.

STAIR NOTES:
All internal/external stairs including concrete or timber timber risers and treads shall comply to NCC2022 H5D2 Part 11.2.2 Stairway construction.

Framing H1D6 NCC2022

All timber framing, fixing and bracing shall comply with AS 1684 and the requirements of NCC2022 H1D6(4) manufactured sizes must not be undersized to those specified. For all timber sizes, stress grades, spacing and wall bracing refer to engineers detail.

Structural steel members shall comply with the requirements of clauses in part 6.3. Refer to engineers details where provided.

GLAZING PART 8 NCC2022 :
All windows to be aluminium awning style, double glazed (obscured safety glass to bathrooms as shown on drawings) all glazing shall comply with the requirements of AS 2047-AS 1288 and NCC2022 clauses in part 8.

Human impact safety requirements shall comply with NCC2022 Part 8.4 pane within 500mm from finished floor level & glazed full height

ROOF NOTES:

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DRAINAGE PLAN STANDARD NOTES

GENERAL:
Ensure that there are inspection openings are installed at all major bends for stormwater and all low points of downpipes.

All plumbing & drainage shall be in accordance with local Council requirements.

Provide surface drain to back of any bulk excavation on site to drain levelled pad prior to commencing footing excavation.

SERVICES:
The heated water system shall be designed and installed with Part B2 of the NCC Volume Three - Plumbing Code of Australia.

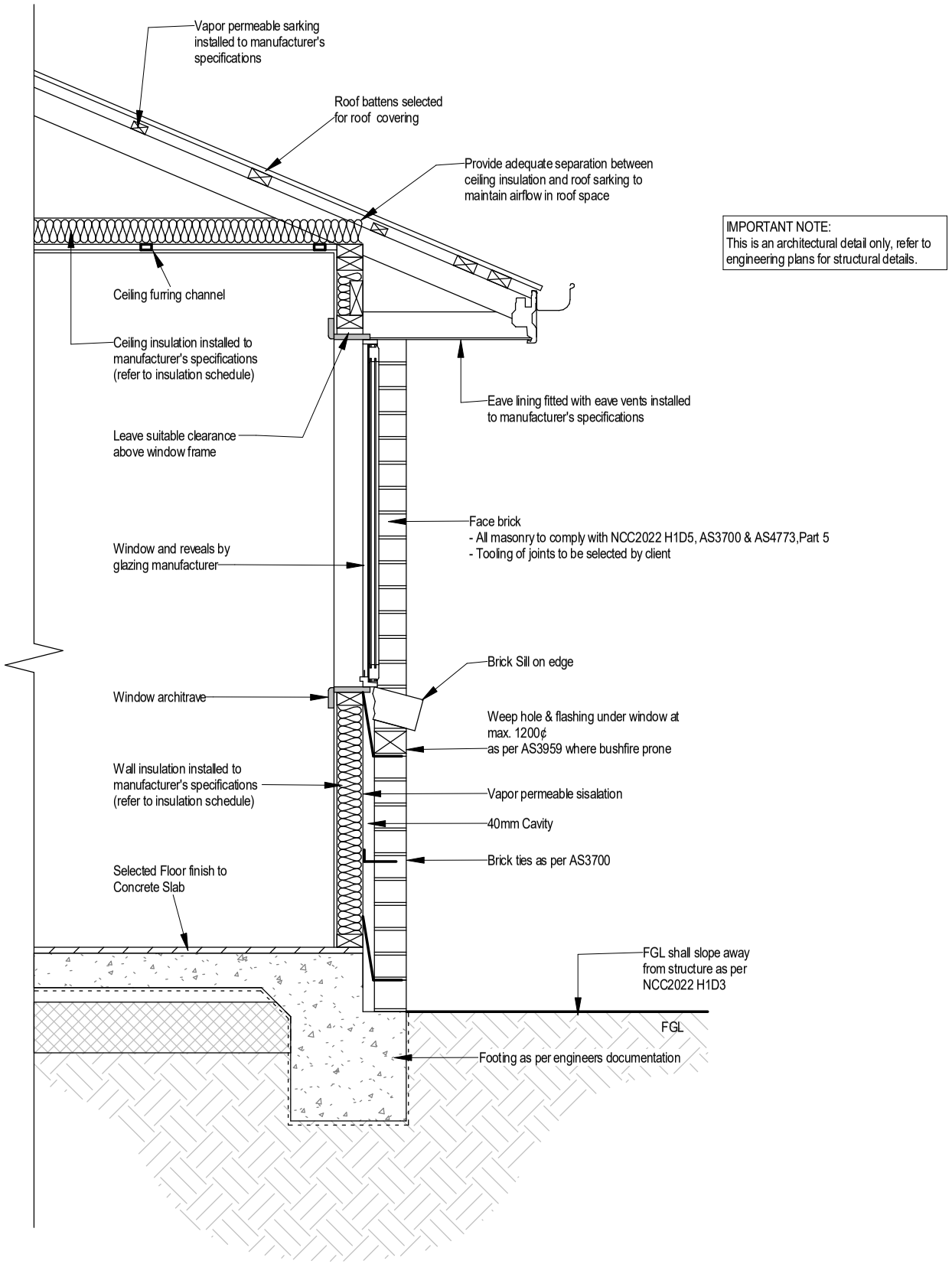
Thermal insulation for heated water piping must:
A) be protected against the effects of weather and sunlight; and
B) be able to withstand the tempretures within the piping; and
C) use thermal insulation in accordance with AS/NZS 4859.1

SOIL & WATER MANAGEMENT STRATEGIES:
Downpipes shall be installed into Council stormwater as soon as the roof has been installed

Ensure that AG drains have been installed prior to footing excavation. Refer to Drainage Plan on the Architectural Drawing Plans

Any excavated materials that are placed up-slope of an Ag drain. Shall be removed when the building works are complete and used as fill on site for any other low points. Ensure a install a sediment fence on the downslope side of material.

All construction vehicles shall be parked on the street only, to prevent transferring debris onto street.



NOTES & DETAILS

TYPICAL WALL DETAIL
(BRICK VENEER)

05A

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APPROVED BY: STUART CHUGG
DRAWN : Ranjot Kaur
CHECKED: SC
DATE: 03.01.2024
SCALE: 1 : 20
REVISION: A

CLIENT :
GRACE CURTAIN

SHEET: 05A OF 11
PROJECT NO: CH_90

GLAZING NOTE:
- ALL EXTERNAL TO BE DOUBLE GLAZED

NOTE:
MATERIAL'S COLOR TO BE CONFIRMED.

3D VIEWS

06

CONTRACTOR MUST VERIFY ALL DIMENSIONS AND LEVELS AT THE JOB PRIOR TO COMMENCING ANY WORK OR MAKING ANY SHOP DRAWINGS.

DO NOT SCALE DRAWINGS. ALWAYS USE WRITTEN DIMENSIONS.

No.	Date	Description	Drawn
A	03.01.2024	WORKING DRAWINGS	RK
	19.12.2023	CONCEPT PLANS	RK

CREATIVE HOMES HOBART

CREATIVE HOMES HOBART, CORNOR OF ELWICK ROAD & BROOKER HIGHWAY,GLENORCHY 7010 PH: 03 6272 3000

JOB ADDRESS : LOT 471 TIVOLI GREEN ESTATE,OLD BEACH

APPROVED BY: STUART CHUGG

DRAWN : Ranjot Kaur

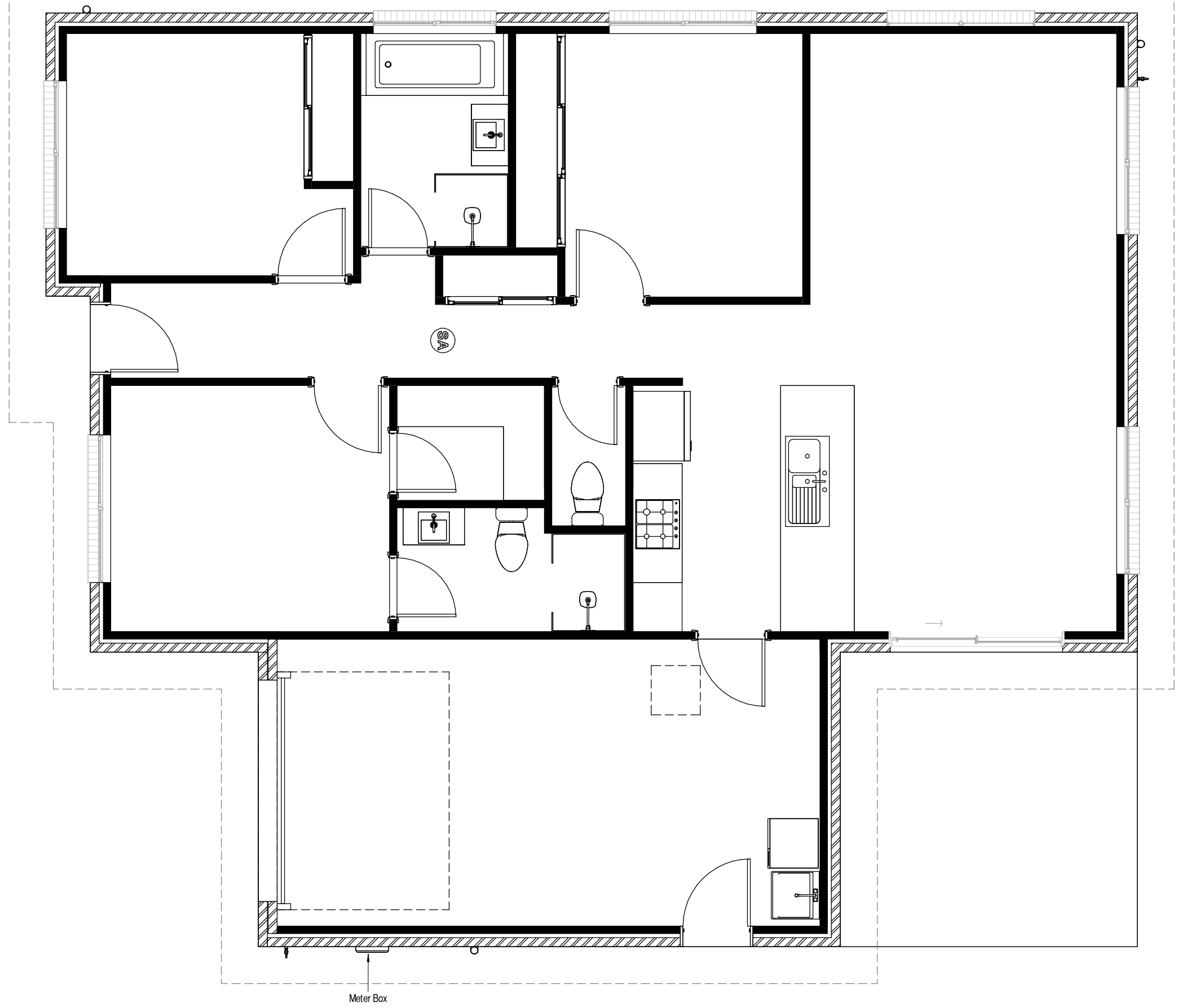
CHECKED: SC | DATE: 03.01.2024

SCALE: | REVISION: A

CLIENT : GRACE CURTAIN

SHEET: 06 OF 11

PROJECT NO: CH_90



ELECTRICAL LAYOUT

07

CONTRACTOR MUST VERIFY ALL DIMENSIONS AND LEVELS AT THE JOB PRIOR TO COMMENCING ANY WORK OR MAKING ANY SHOP DRAWINGS.

DO NOT SCALE DRAWINGS. ALWAYS USE WRITTEN DIMENSIONS.

No.	Date	Description	Drawn
A	03.01.2024	WORKING DRAWINGS	RK

CREATIVE HOMES HOBART

CREATIVE HOMES HOBART, CORNOR OF ELWICK ROAD & BROOKER HIGHWAY,GLENORCHY 7010 PH: 03 6272 3000

JOB ADDRESS : LOT 471 TIVOLI GREEN ESTATE,OLD BEACH

APPROVED BY: STUART CHUGG

DRAWN : Ranjot Kaur

CHECKED: SC | DATE: 03.01.2024

SCALE: 1 : 52 | REVISION: A

CLIENT : GRACE CURTAIN

SHEET: 07 OF 11

PROJECT NO: CH_90

WATER PROOFING

WET AREAS
Waterproofing: To AS3740 and NCC H4D2

MEMBRANES
Standard: To AS/NZS4858

MEMBRANE SYSTEMS
Requirement: Provide a proprietary membrane system certified as suitable for the intended external waterproofing.

SEALANTS
Requirement: Waterproof, flexible, mould- resistant and compatible with host materials.

SUBSTRATES
General: Provide substrates as follows:
Clean and free of any deposit or finish which may impair adhesion of membranes. If walls are plastered, remove loose sand. If walls or floors are framed or discontinuous, support members in full lengths without splicing. If floors are solid or continuous: Remove excessive projections.
Fill voids and hollows greater than 10mm with abrupt edges with a cement: sand mix not stronger than the substrate nor weaker than the bedding.
Fill depressions less than 10mm with a latex modified cementitious product with feathering eliminated by scabbling the edges.
Fill cracks in substrates wider than 1.5mm with a filler compatible with the membrane system.
External corners: Round or arris edges.

FALLS
Substrate: If the membrane is directly under the floor finish, make sure the fall in the substrate conforms to the fall documented for the finish.

WATER STOP ANGLES
Requirement: Provide water stop angles at door thresholds and shower enclosures to support the waterproof membrane at junctions between waterproofed and non-waterproofed areas. Sealant fillet bond breakers:
Application: Form a triangular fillet or cove of sealant to internal corners within the period recommended by the membrane manufacturer after the application of the primer.
Widths : 8mm minimum to vertical corners. 10-12mm to horizontal corners.
Backing rod bond breakers: Retain in position with continuous
length of tape pressed firmly in place against the surfaces on each side of the rod.

BOND BREAKERS
Requirement: After the priming of surfaces, provide bond breakers at all wall/floor, hob/wall junctions and at control joints where the membrane is bonded to the substrate.
Sealant fillet bond breakers:
Application: Form a triangular fillet or cove of sealant to internal corners within the period recommended by the membrane manufacturer after the application of the primer.
Widths: 8mm minimum to vertical corners. 10-12 mm to horizontal corners.

PROTECTION
General: Protect membrane from damage during installation and for the period after installation until the membrane achieves its service characteristics that resist damage

EXTENT OF WATERPROOFING
Waterproof or water resistant surfaces: To requirements of NCC H4D2

VERTICAL MEMBRANE TERMINATIONS
Upstands: At least 150mm above the finished tile level of the floor or 25mm above the maximum retained water level, whichever is the greater.
Anchoring: Secure sheet membranes along the top edge. Edge protection: Protect edges of the membrane.
Waterproofing above terminations: Waterproof the structure above the termination to prevent moisture entry behind the membrane using tiler's angle and finish over laps.

DOOR JAMBS AND ARCHITRAVES
Requirement: If the bottom of doorjambs and architraves do not finish above the floor tiling, waterproof their surfaces below tile level to provide a continuous seal between the perimeter flashing at the wall/floor junction and the water stop angle.

DRAINAGE CONNECTIONS
Floor wastes: Turn membrane down 50mm minimum into the floor waste drainage flanges and adhere to form a waterproof connection.

ENCLOSED SHOWERS WITH HOBS
Internal membranes: Extend membrane over the hob and into the room at least 50mm.

UNENCLOSED SHOWERS
Requirement: Extend membrane at least 1500mm into the room from the shower rose outlet on the wall.

MEMBRANE VERTICAL PENETRATIONS
Pipes, ducts, and vents: Provide separate sleeves for all pipes, ducts, and vents and have fixed to the substrate.

MEMBRANE HORIZONTAL PENETRATIONS
Sleeves: Provide a flexible flange for all penetrations, bonded to the penetration and to the membrane.

CURING OF LIQUID APPLIED SYSTEMS
General: To the manufacturer's instructions.
Curing: Allow membrane to fully cure before tiling.

OVERLAYING FINISHES ON MEMBRANES
Requirement: Protect waterproof membranes with compatible water-resistant surface materials that do not cause damage to the membrane.
Bonded or partially bonded systems: If the topping or bedding mortar is required to be bonded to the membrane, provide sufficient control joints in the topping or bedding mortar to reduce the movement over the membrane.

WET AREA NOTES

Wet Areas (to comply with BCA H4D2 and AS 3740)

H4D2 Part 10.2.1 Wet Areas
Building elements in *wet areas* within a building must
(a) be *waterproof* or *water resistant* in accordance with Table 10.2.2; and
(b) comply with AS 3740.

Table 10.2.2 Waterproofing and water resistance requirements for building elements in wet areas

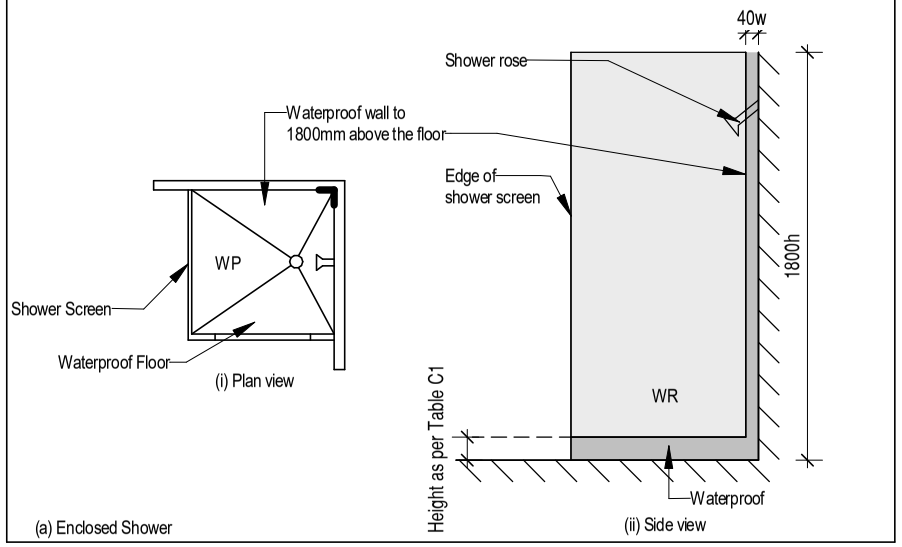
***Vessels* or area where the fixture is installed**	**Floors and horizontal surfaces**	**Walls**	**Wall junctions and joints**	**Wall / floor junctions**	**Penetrations**
Shower area (enclosed and unenclosed)					
With hob	*Waterproof* floor in *shower area* (including any hob or step-down)	The walls of the shower area must be waterproof not less than 1800 mm above the floor substrate	*Wall junctions and joints within the shower area must be waterproof not less than 40 mm either side of the junction*	*Wall/floor junctions within the shower area must be waterproof*	*Waterproof* penetrations in *shower area.*
With step-down					
Without hob or step-down					
Vessels or area where the fixture is installed					
Area outside shower area					
For concrete and compressed fibre-cement sheet flooring	*Water resistant* floor of the room.	*N/A*	*N/A*	*a) Waterproof* wall / floor junctions b) where a flashing is used, the horizontal leg must be not less than 40 mm	*N/A*
For timber floors including particleboard, plywood and other timber based flooring materials	*Waterproof* floor of the room				
Areas adjacent to baths and spas					
For concrete and compressed fibre-cement sheet flooring	*Water resistant* floor of the room.	(a) *Water resistant* to a height of not less than 150 mm above the *vessel*, for the extent of the *vessel*, where the *vessel* is within 75 mm of a wall. (b) *Water resistant* all exposed surfaces below *vessel* lip.	*Water resistant* junctions within 150 mm above a *vessel* for the extent of the *vessel.*	*Water proof* wall / floor junctions for the extent of the *vessel.*	*Waterproof* tap and spout penetrations where they occur in horizontal surfaces.
For timber floors including particleboard, plywood and other timber based flooring materials	*Waterproof* floor of the room.	(a) *Water resistant* to a height of not less than 150 mm above the *vessel*, for the extent of the *vessel*, where the *vessel* is within 75 mm of a wall. (b) *Water resistant* all exposed surfaces below *vessel* lip.	*Water resistant* junctions within 150 mm above a *vessel* for the extent of the *vessel.*	*Water proof* wall / floor junctions for the extent of the *vessel.*	*Waterproof* tap and spout penetrations where they occur in horizontal surfaces.
Inserted baths and spas	(a) *Waterproof* shelf area, incorporating waterstop under the vessel lip. (b) No requirement under bath.	(a) *Waterproof* to not less than 150 mm above the lip of the bath or spa; and (b) No requirement under bath.	(a)*Waterproof* junctions within 150 mm above bath or spa; and (b)No requirement under bath.	*N/A*	*Waterproof* tap and spout penetrations where they occur in horizontal surfaces.

NOTE: User of this Standard should refer to the current edition of the NCC for any changes to the tables.

***Vessels* or area where the fixture is installed**	**Floors and horizontal surfaces**	**Walls**	**Wall junctions and joints**	**Wall / floor junctions**	**Penetrations**
Other areas					
Laundries and WCs	*Water resistant* floor of the room	*N/A*	*N/A*	*Water resistant* wall / floor junctions. and where a flashing is used, the horizontal leg must not be less than 40 mm.	N/A
Walls adjoining other *vessels* (e.g. sink, basin or laundry tub	*N/A*	*Water resistant* to a height of not less than 150 mm above the *vessel*, for the extent of the *vessel*, where the *vessel* is within 75 mm of a wall.	*Waterproof* wall junctions where a *vessel* is fixed to a wall.	N/A	*Waterproof* tap and spout penetrations where they occur in surfaces *required* to be *waterproof* or *water resistant.*
N/A means not applicable. Where a shower is above a bath or spa, use requirements for shower.					

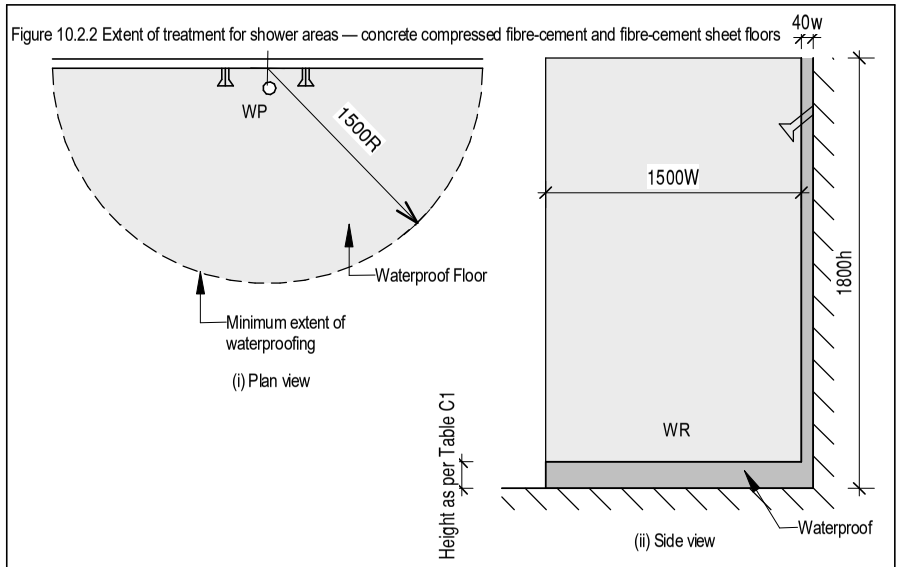
Extent of Waterproofing
Where the shower shown in the Figures is not enclosed, the wet area is to be taken as 1500 mm from the shower connection.

Figure 10.2.2 Extent of treatment for shower areas — concrete compressed fibre-cement and fibre-cement sheet floors



(a) Enclosed Shower

Figure 10.2.2 Extent of treatment for shower areas — concrete compressed fibre-cement and fibre-cement sheet floors



(b) Unenclosed Shower

Dimensions in Millimetres

For further wet area notes not shown on this document, refer to AS3740

AS3740 to take precedence of this document

08		CONTRACTOR MUST VERIFY ALL DIMENSIONS AND LEVELS AT THE JOB PRIOR TO COMMENCING ANY WORK OR MAKING ANY SHOP DRAWINGS. DO NOT SCALE DRAWINGS. ALWAYS USE WRITTEN DIMENSIONS.	A	03.01.2024	WORKING DRAWINGS	RK	JOB ADDRESS : LOT 471 TIVOLI GREEN ESTATE,OLD BEACH APPROVED BY: STUART CHUGG DRAWN : Ranjot Kaur CHECKED: SC DATE: 03.01.2024 SCALE: REVISION: A
			No.	Date	Description	Drawn	CLIENT : GRACE CURTAIN SHEET: 08 OF 11 PROJECT NO: CH_90

CREATIVE HOMES HOBART
CREATIVE HOMES HOBART, CORNOR OF ELWICK ROAD & BROOKER HIGHWAY,GLENORCHY 7010 PH: 03 6272 3000

BAL LOW:

GENERAL
This Standard does not provide construction requirements for buildings assessed in bushfire-prone areas in accordance with Section 2 as being BAL-LOW.
The Bushfire Attack Level BAL-LOW is based on insufficient risk to warrant specific bushfire construction requirements. It is predicated on low threat vegetation and non vegetated areas (see AS3959 Clause 2.2.3.2).

SUB-FLOOR
This standard does not provide construction requirements for subfloor supports, poles, piers, stumps and columns.

CONCRETE SLABS ON GROUND
This standard does not provide construction requirements for concrete slabs on the ground.

ELEVATED FLOORS
This standard does not provide construction requirements for elevated floors, including bearers, joists and flooring.

WALL
This standard does not provide construction requirements for the exposed components of an external wall.

JOINT
This standard does not provide construction requiments for joints.

VENTS AND WEEPHOLES
This standard does not provide construction requiments for vents and weepholes.

BUSHFIRE SHUTTERS
This standard does not provide construction requiments for bushfire shutters.

SCREENS FOR WIDOWS AND DOORS
This Standard does not provide construction requirements for window and door screens.

WINDOWS
This standard does not provide construction requiments for windows.

SIDE-HUNG EXTERNAL DOORS (INCLUDING FRENCH DOORS, PANEL FOLD AND BIFOLD)
This standard does not provide construction requiments for side-hung external doors (including french doors, panel fold and bifold).

SLIDING DOORS
This standard does not provide construction requiments for sliding doors.

VEHICLE ACCESS DOORS
This standard does not provide construction requiments for vehicle access doors.

ROOFS
This standard does not provide construction requiments for roofs.

VERANDA, CARPORT AND AWNING
This standard does not provide construction requiments for veranda, carport and awning.

ROOF PENETRATIONS
This standard does not provide construction requiments for roof penetrations.

EAVES LININGS, FASCIAS AND GABLES
This standard does not provide construction requiments for eaves linings, fascias and gables.

GUTTERS AND DOWNPIPES
This standard does not provide construction requiments for gutters and downpipes.

VERANDAS, DECKS, STEPS AND LANDINGS - GENERAL
Decking may be spaced.
There is no requirement to enclose the subfloor spaces of verandas, decks, steps, ramps or landings.

ENCLOSED SUBFLOOR SPACES OF VERANDAS, DECKS, STEPS, RAMPS AND LANDINGS
This standard does not provide construction requiments for enclosed subfloor spaces of verandas, decks, steps, ramps and landings.

UNENCLOSED SUBFLOOR SPACES OF VERANDAS, DECKS, STEPS, RAMPS AND LANDINGS
This standard does not provide construction requiments for unenclosed subfloor spaces of verandas, decks, steps, ramps and landings.

BALUSTRADES, HANDRAILS OR OTHER
This standard does not provide material requirements for unenclosed subfloor spaces of verandas, decks, steps, ramps and landings

WATER AND GAS SUPPLY
This standard does not provide construction requirements for water and gas supply pipes.

AS3500.1(2003)
(Amend 2 2010)

5.23 BUSHFIRE ZONES
Pipes of other materials shall be buried with a minimum depth of cover 300mm, measured from the proposed finished surface level and should be identified generally in accordance with AS1345-1995

BAL 12.5:

Construction shall be in accordance with Bushfire Attack Level 12.5 BAL-125) specified in AS 7955-2018 Construction of Buildings in Bushfire Prone Areas, Sections 3 and 5.

SUBFLOOR shall be either stab-on-ground or timber on isolated piers with brick perimeter. The standard does not provide construction requirements for either of these subfloor construction methods.

EXTERNAL WALLS shall be timber framing, externally lined with sarking and clad with brick veneer or Weathertex cladding respectively Weathertex is stated as having a density of 990kg/m^3 Any exposed timber shall bushfire resistant timber (AS 3999-2018 Appendix E1 or Appendix F compliant). Compliant timbers include Tas Oak (as Messmate, Peppermint & Manna Gum) or Southern Blue Gum as long as the density Is 750 kg/m^3 or greater.

JOINTS IN EXTERNAL WALLS are to be covered, sealed, overlapped, backed or butt-jointed to prevent gaps greater than 3mm.

VENTS, WEEPHOLES AND GAPS IN EXTERNAL WALLS greater than 3mm are to be fitted with 2mm minimum aperture, corrosion resistant steel, bronze, or aluminium mesh.

BUSHFIRE SHUTTERS when used, shall protect the whole window/door assembly and shall be fixed to the building and be non-removable with gaps no greater than 3mm between the shutter and the wall, sill, or head.
They must be manually openable from either inside or outside. They shall be made of non-combustible material or bushfire resistant timber AS 3959-2018 Appendix F compliant). Perforations must have an area no greater than 20% of the shutter and be uniformly distributed with gaps no greater than 3mm (or no greater than 2mm when the openable portion of the window is not screened).

SCREENS shall be fitted internally or externally to openable portions of windows. Screens shall be aluminium framed with 2mm minimum aperture, corrosion resistant steel, bronze, or aluminium mesh. No gaps between the perimeter of the screen assembly and the building are to be greater than 3mm. Alternatively, compliant bushfire shutters may be installed.

WINDOWS AND GLAZED SLIDING DOORS and their frames, joinery and architraves can be aluminium framed but can also be PVC which is shown to be bushfire resistant or bushfire resistant timber (AS 3959-2018 Appendix E2 or Appendix F compliant). Compliant timbers include Celery Top, Blackwood, Myrtle, Southern Blue Gum, some Tas Oak (as Messmate.Alpine Ash, Mountain Ash, Silvertop Ash, Peppermint & Manna Gum) or Plantation Ash (as Shining Gum) as long as the density is 650 kg/m^3 or greater.

Windows less than 400mm from the ground or less than 400mm above decks, carport roofs, veranda roofs and awnings which have an angle less than 18 degrees shall be a minimum of 4mm Grade A safety glass. When using double glazing this requirement applies to the external face only. Windows above 400mm (when specific glazing is not required by other relevant standards) may use annealed glass. Sliding doors shall be glazed with a minimum of Grade A safety glass. Alternatively, compliant bushfire shutters may be installed. Care should be taken to ensure that the energy assessor for this project is aware of the minimum glazing requirements for this BAL classification so as to avoid conflict with glazing specifications.

SIDE HUNG EXTERNAL DOORS can be either non-combustible or solid timber with a minimum thickness of 35mm or hollow core with a non-combustible kick plate on the outside for the first 400mm above the threshold Glazed doors including French doors and bi-fold must have glazing that complies with the glazing requirements for windows and the frame can be aluminium framed or PVC which is shown to be bushfire resistant or bushfire resistant timber (AS 3959-2018 Appendix E2 or Appendix F compliant). Compliant timbers include Celery Top, Blackwood, Myrtle, Southern Blue Gum, some Tas Oak (as Messmate, Alpine Ash, Mountain Ash, Silvertop Ash, Peppermint & Manna Gum) or Plantation Ash (as Shining Gum) as long as the density is 650 kg/m^3 or greater

DOOR JAMBS AND ARCHITRAVES can be aluminium framed or PVC which is shown to be bushfire resistant or bushfire resistant timbe (AS 3959-2018 Appendix E2 or Appendix F compliant). Compliant timbers include Celery Top, Blackwood, Myrtle, Southern Blue Gum, some Tas Oak (as Messmate, Alpine Ash, Mountain Ash, Silvertop Ash Peppermint & Manna Gum) or Plantation Ash (as Shining Gum) as long as the density is 650kg/m^3 or greater. Doors must be tight-fitting to the door jamb (and to the abutting door where applicable). Weather strips or draught excluders shall be installed to all side-hung external doors.

GARAGE DOORS must be fully non-combustible or have the lower portion of the door which is within 400mm of the ground be non-combustible.Panel lift, tilt or side hung doors shall be fitted with weather strips, draught excluders or guide tracks as appropriate to the door type with gaps no greater than 3mm. Roller doors shall have guide tracks with gaps no greater than 3mm or fitted with a nylon brush that is in contact with the door.

ROOF shall be timber framing, lined with sarking on the outside of the frame and clad with corrugated Colourbond cladding. Any gaps under ribs or roof components such as roof eave, fascia and wall junctions are to be sealed with 2mm aperture corrosion resistant, steel, bronze or aluminium mesh, or filled with mineral wool to prevent openings greater than 3mm.

VERANDAH, CARPORT OR AWNING ROOFS forming part of the main roof shall meet the requirements of the main roof..

ROOF PENETRATIONS such as skylights, vent pipes and aerials that penetrate the roof shall be sealed to prevent openings greater than 3mm Openable and vented skylights or vent pipes shall be fitted with 2mm aperture corrosion resistant, steel, bronze, or aluminium mesh ember guards. All overhead glazing shall be Grade A safety glass. PVC vent pipes are permitted.

EAVES LINING, FASCIA AND GABLES shall be cement sheet or equivalent non-combustible material and sealed to prevent openings greater than 3mm.

GUTTERS AND DOWNPIPE materials and requirements are not specified in the standard for BAL-12.5 with the exception of box gutters which shall be non-combustible. Gutter and valley leaf guards are not a requirement of the standard but they are strongly recommended. If installed, they must be non-combustible.

VERANDAH AND DECK SUPPORTS AND FRAMING can be timber construction as there are no construction requirements in the standard for BAL-12.5. Decking may be spaced or un-spaced and the sub-floor either enclosed or unenclosed. If the decking is spaced, it is assumed that the spacing shall be 3mm nominal spacing with an allowance of between 0-5mm due to seasonal changes. If the deck sub-floor is enclosed, then all materials less than 400mm from the ground shall be non-combustible.

VERANDAHS, DECKS, STEPS, LANDINGS AND RAMPS and their elements can be timber construction as there are no construction requirements for BAL-12.5 except for elements less than 300mm horizontally and 400mm vertically from glazed elements which must be bushfire resistant timber (AS 3959-2018 Appendix EI or Appendix F compliant) or equivalent non- combustible material. Compliant timbers include Tas Oak (as Messmate, Peppermint & Manna Cum) or Southern Blue Gum as long as the density of 750kg/m^3 or greater. An acceptable solution would be to line the area with cement sheet with ceramic tiles over.

BALUSTRADES AND HANDRAILS can be timber construction as there are no construction requirements in the standard for BAL 12.5.

WATER AND GAS SUPPLY PIPING where it is above ground and exposed shall be metal.

BAL 19:

Construction shall be in accordance with Bushfire Attack Level 19 (BAL-19) as specified in AS 3959-2009 Construction of Buildings in Bushfire Prone Areas, Sections 3 and 6.

SUBFLOOR shall be either slab-on-ground or timber on isolated piers with brick perimeter. The standard does not provide construction requirements for either of these subfloor construction methods.

EXTERNAL WALLS shall be timber framing, externally lined with sarking and clad with brick veneer or Weathertex cladding respectively. (Weathertex is stated as having a density of 990kg/m^3. Any exposed timber shall bushfire resistant timber (AS 3959-2018 Appendix EI or Appendix F compliant). Compliant timbers include Tas Oak (as Messmate, Peppermint & Manna Gum) or Southern Blue Gum as long as the density is 750 kg/m3 or greater.

JOINTS IN EXTERNAL WALLS are to be covered, sealed, overlapped, backed or butt-jointed to prevent gaps greater than 3mm.

VENTS WEEPHOLES AND GAPS IN EXTERNAL WALLS greater than 3mm are to be fitted with 2mm minimum aperture, corrosion resistant steel or bronze mesh. Aluminium mesh or perforated sheet cannot be used for the ember guards.

BUSHFIRE SHUTTERS when used, shall protect the whole window/door assembly and shall be fixed to the building and be non-removable with gaps no greater than 3mm between the shutter and the wall, sill, or head. They must be manually openable from either inside or outside. They shall be made of non-combustible material or bushfire resistant timber (AS 3959-2018 Appendix F compliant). Perforations must have an area no greater than 20% of the shutter and be uniformly distributed with gaps no greater than 3mm (or no greater than 2mm when the openable portion of the window is not screened).

SCREENS shall be fitted internally or externally to openable portions of windows, Screens shall be aluminium framed with 2mm minimum aperture, corrosion resistant steel or bronze mesh. No gaps between the perimeter of the screen assembly and the building are to be greater than 3mm. Refer section 6.5.2 for detail. Alternatively, compliant bushfire shutters may be installed.

WINDOWS AND GLAZED SLIDING DOORS and their frames, joinery and architraves can be aluminium framed but can also be PVC which is shown to be bushfire resistant or bushfire resistant timber (AS 3959-2018 Appendix E2 or Appendix F compliant). Compliant timbers include Celery Top, Blackwood, Myrtle, Southern Blue Gum, some Tas Oak (as Messmate, Alpine Ash, Mountain Ash, Silvertop Ash, Peppermint & Manna Gum) or Plantation Ash (as Shining Gum) as long as the density is 650 kg/m^3 or greater.

All windows to be minimum 5mm toughened glass. When using double glazing this requirement applies to the external face only. Openable parts of windows to be fitted with compliant screened either internally or externally. Sliding doors shall be glazed with a minimum of Grade A safety glass. Refer to section 6.5.3 for detail. Alternatively, compliant bushfire shutters may be installed. Care should be taken to ensure that the energy assessor for this project is aware of the minimum glazing requirements for this BAL classification so as to avoid conflict with glazing specifications.

SIDE HUNG EXTERNAL DOORS can be either non-combustible or solid timber with a minimum thickness of 35mm, or hollow core with combustible kick plate on the outside for the first 400mm above the threshold. Glazed doors including French doors and Bi-fold must have 5mm toughened glazing that complies with the glazing requirements for windows and the frame can be aluminium framed or PVC which is shown to be bushfire resistant or bushfire resistant timber (AS 3959-2018 Appendix E2 or Appendix F compliant). Compliant timbers include Celery Top, Blackwood, Myrtle, Southern Blue Gum, some Tas Oak (as Messmate, Alpine Ash, Mountain Ash, Silvertop Ash, Peppermint & Manna Gum) or Plantation Ash (as Shining Gum) as long as the density is 650 kg/m^3 or greater.

DOOR JAMBS AND ARCHITRAVES can be aluminium framed or PVC which is shown to be bushfire resistant or bushfire resistant timber (AS 3959-2018 Appendix E2 or Appendix F compliant), Compliant timbers include Celery Top, Blackwood, Myrtle. Southern Blue Gum, some Tas Oak (as Messmate, Alpine Ash, Mountain Ash, Silvertop Ash, Peppermint & Manna Cum) or Plantation Ash (as Shining Gum) as long as the density is 650 kg/m^3 or greater. Doors must be tight-fitting to the door jamb (and to the abutting door where applicable). Weather strips or draught excluders shall be installed to all side-hung external doors.

GARAGE DOORS must be fully non-combustible or have the lower portion of the door which is within 400mm of the ground be non-combustible. Panel lift, tilt or side hung doors shall be fitted with weather strips, draught excluders or guide tracks as appropriate to the door type with gaps no greater than 3mm. Roller doors shall have guide tracks with gaps no greater than 3mm or fitted with a nylon brush that is in contact with the door

ROOF shall be timber framing, lined with sarking on the outside of the frame and clad with corrugated Colourbond cladding. Any gaps under ribs or roof components such as roof eave, fascia and wall junctions are to be sealed with 2mm aperture corrosion resistant steel or bronze mesh, or filled with mineral wool to prevent openings greater than 3mm.

VERANDAH, CARPORT AND AWNING ROOFS forming part of the main roof shall meet the requirements of the main roof.

ROOF PENETRATIONS such as skylights, vent pipes and aerials that penetrate the roof shall be sealed to prevent openings greater than 3mm. Openable and vented skylights or vent pipes shall be fitted with 2mm aperture corrosion resistant, steel, or bronze mesh ember guards. All overhead glazing shall be Grade A safety glass. PVC vent pipes are permitted.

EAVES LINING, FASCIA AND GABLES shall be 4.5mm cement sheet or equivalent non-combustible material and sealed to prevent openings greater than 3mm. .

GUTTERS AND DOWNPIPE materials and requirements are not specified in the standard for BAL-19 with the exception of box gutters which shall be non-combustible. Gutter and valley leaf guards are not a requirement of the standard but they are strongly recommended. If installed, they must be non-combustible.

VERANDAH AND DECK SUPPORTS AND FRAMING can be timber construction as there are no construction requirements in the standard for BAL-19. Decking may be spaced or un-spaced and the sub-floor either enclosed or unenclosed. If the decking is spaced, it is assumed that the spacing shall be 3mm nominal spacing with an allowance of between 0-5mm due to seasonal changes. If the deck sub-floor is enclosed then all materials less than 400mm from the ground shall be non-combustible.

VERANDAHS, DECKS, STEPS, LANDINGS AND RAMPS and their elements can be timber construction as there are no construction requirements for BAL-19 except for elements less than 300mm horizontally and 400mm vertically from glazed elements which must be bushfire resistant timber (AS 3959-2018 Appendix EI or Appendix F compliant) or equivalent non-combustible material. Compliant timbers include Tas Oak (as Messmate,Peppermint & Manna Gum) or Southern Blue Gum as long as the density of 750 kg/m^3 or greater. An acceptable solution would be to line the area with cement sheet with ceramic tiles over. Refer section 6.7.2.4 for detail. Where spaced timber deck flooring is used, bushfire resisting timber must be used for the decking material.

BALUSTRADES AND HANDRAILS may be timber construction as there are no construction requirements in the standard for BAL-19.
WATER AND GAS SUPPLY PIPING where it is above ground and exposed shall be metal. .

BAL NOTES

AS3959:2018 to take precedence over this document

All information on this sheet has been extracted from AS3959:2018

09

CONTRACTOR MUST VERIFY ALL DIMENSIONS AND LEVELS AT THE JOB PRIOR TO COMMENCING ANY WORK OR MAKING ANY SHOP DRAWINGS.

DO NOT SCALE DRAWINGS. ALWAYS USE WRITTEN DIMENSIONS.

No.	Date	Description	Drawn
A	03.01.2024	WORKING DRAWINGS	RK

CREATIVE HOMES HOBART
CREATIVE HOMES HOBART, CORNOR OF ELWICK ROAD & BROOKER HIGHWAY,GLENORCHY 7010 PH: 03 6272 3000

JOB ADDRESS : LOT 471 TIVOLI GREEN ESTATE,OLD BEACH
APPROVED BY: STUART CHUGG
DRAWN : Ranjot Kaur
CHECKED: SC DATE: 03.01.2024
SCALE: 1 : 20 REVISION: A

CLIENT : GRACE CURTAIN
SHEET: 09 OF 11
PROJECT NO: CH_90

DOYLE SOIL CONSULTING

SITE AND SOIL EVALUATION REPORT

FOUNDATION AND WINDLOADING ASSESSMENT

Lot 471 Tivoli Green Estate

Old Beach

July 2023

Doyle Soil Consulting: 6/76 Auburn Rd Kingston Beach 7050 – 0488 080 455 – robyn@doylesoilconsulting.com.au

SITE INFORMATION

Client: Creative Homes Hobart

Address: Lot 471 Tivoli Green Estate, Old Beach (CT part of 183730/4)

Site Area: Approximately 500 m^2

Date of inspection: 12/7/2023

Building type: New house

Services: Mains water and sewer

Planning Overlays: Bushfire prone area

Mapped Geology - Mineral Resources Tasmania 1:25 000 Richmond sheet:
Rv= Undifferentiated Triassic sandstone, siltstone, and mudstone

TQhb = Quaternary clayey cobble deposits dominantly of dolerite and Parmeener rocks

Soil Depth: 1.7 – 2.0 m

Subsoil Drainage: Moderately-well drained

Drainage lines / water courses: None within 200 m

Vegetation: Pasture

Rainfall in previous 7 days: Approximately 24 mm

Slope: Approximately 4° to the south

SITE ASSESSMENT AND SAMPLE TESTING

Site investigation and soil classification in accordance with AS 2870-2011 *Residential slabs and footings* and in accordance with AS 4055-2021 *Wind load for Housing.* Test holes were dug using a Christie Post Driver Soil Sampling Kit, comprising CHPD78 Christie Post Driver with Soil Sampling Tube (50 mm OD x 1600/2100 mm). For test hole and DCP locations, see Appendix 1.

- Two test hole (TH) cores:
    - TH1 with no refusal at 2.0 m
    - TH2 with refusal at 1.7 m
- One Dynamic Cone Penetrometer (DCP) test:
    - DCP1 with refusal at 2.3 m
- Emerson Dispersion test on subsoils and linear shrinkage tests on all likely founding layers.

SOIL PROFILES – Test Hole 1

Depth (m)	Horizon	Description and field texture grade	USCS Class
0 – 0.3	A1	Very dark brown (10YR 2/2), **Clay Loam**, moderate medium compacted polyhedral structure, slightly moist compacted/friable	**MH**
0.3 – 0.7	$B2_1$	Very dark brown (10YR 2/2), **Medium Clay** massive, slightly moist stiff consistency	**CH**
0.7 – 1.0	$B2_2$	Brown (7.5YR 4/3), **Light Medium Clay**, moderate medium angular blocky structure, slightly moist firm consistency	**CH**
1.0 – 2.0	$B2_3$	Yellowish red (5YR 4/6) grading to olive grey (5Y 5/2), **Medium Clay**, weak coarse lenticular structure, slightly moist firm consistency, slickensides. No refusal	**CH**

SOIL PROFILES – Test Hole 2

Depth (m)	Horizon	Description and field texture grade	USCS Class
0 – 0.2	A1	Very dark brown (10YR 2/2), **Clay Loam**, strong coarse compacted structure, slightly moist stiff consistency	**MH**
0.2 – 0.5	A2	Dark brown (10YR 3/3), **Fine Sandy Loam**, single grain, dry loose consistency	**ML**
0.5 – 0.7	$B2_1$	Very dark brown (10YR 2/2), **Medium Clay** massive, slightly moist stiff consistency	**CH**
0.7 – 0.9	$B2_2$	Brown (7.5YR 4/3), **Light Medium Clay**, moderate medium angular blocky structure, slightly moist firm consistency	**CH**
0.9 – 1.3	$B2_3$	Yellowish brown (10YR 5/4), **Fine Sandy Light Medium Clay**, weak coarse angular blocky structure, slightly moist firm consistency	**CL**
1.3 – 1.7	R_w	Light olive brown (2.5Y 5/4), **Fine Sandy Clay Loam**, weak fine to medium platy structure, dry loose consistency. Refusal on weathered sandstone bedrock	**ML**

SITE AND SOIL COMMENTS

The natural soil profiles are formed from clayey colluvium derived from upslope Tertiary basalt and underlying Triassic sandstone. The profiles are moderately deep, to deep, with refusal occurring at approximately 1.7 to 2.3 m. The field textures of the soil profile are dominated by clay, which is highly reactive, weakly to moderately structured and with slight dispersion characteristics. The DCP indicates a low bearing capacity to at least 1.5 m (at TH1). We recommend founding on the competent weathered sandstone bedrock at approximately 1.7 to 2.1 m.

LINEAR SHRINKAGE AND SOIL REACTIVITY

Samples of the clayey subsoils were tested for reactivity using the linear shrinkage test. Linear shrinkage provides an approximate guide to aid soil classification of reactivity of clays for foundations. The tests suggest the clays are moderately to highly reactive (refer to tables below and *AS2870-2011 clause 2.1.2 table 2.1*).

TH #	Depth (m)	Length of mould (mm)	Longitudinal Shrinkage (LS) in mm	LS (%)	Soil Class
1	0.3 - 0.6	125	19.0	15.2	H – 1
1	0.7 - 1.1	125	20.0	16.0	H – 1
1	1.3 - 2.0	125	22.0	17.6	H – 1
2	0.9 - 1.3	125	16.0	12.8	M

DCP TESTS AND ESTIMATED BEARING CAPACITY

A minimum bearing capacity of 100 kPa is required for strip and pad footings and under the edge footings and associated slab foundations (refer to tables below and *AS2870-2011 clause 2.4.5*). We provide estimated soil bearing strengths along with a variance range (+/-) based on a review of published literature relating field Dynamic Cone Penetrometer (DCP) readings to triaxial soil strength tests.

DCP testing is a method of estimating likely soil bearing capacity. However, surface layers (approx. upper 0.7 m) are subject to seasonal variation in soil moisture content leading to possible higher DCP values in summer/drought. Moisture-related discrepancies in soil bearing

capacity are most pronounced in clays - which may be very stiff to hard when dry, while only soft to firm in wetter conditions. When estimating the suitable foundation depth, we take in to account this interplay between soil baring capacity, soil depth and seasonally related soil moisture conditions. DCP values below approximately 0.7 m are likely to be more typical of year–to–year soil bearing conditions in clayey and silty soils.

The subsoils were slightly moist when tested (July ’23).

The field DCP1 data indicates that the bearing capacity of the soil is at a *suitable* strength below 1.5 m. However, the competent sandstone bedrock at approximately 2.1 m would be the *recommended* foundation material.

Based on the DCP data and core depths, the recommended foundation depth is at or below approximately 1.7 to 2.1 m.

DCP 1				
Depth (mm)	**DCP n-number (Blows/100 mm)**	**DCP Penetration Index (mm/Blow)**	**Estimated Bearing Capabity (kPa = n x 30)**	**Likely Variance (+/-)**
0 - 100	1	100.0	30	10
100 - 200	6	16.7	180	60
200 - 300	12	8.3	360	120
300 - 400	9	11.1	270	90
400 - 500	8	12.5	240	80
500 - 600	9	11.1	270	90
600 - 700	8	12.5	240	80
700 - 800	7	14.3	210	70
800 - 900	8	12.5	240	80
900 - 1000	8	12.5	240	80
1000 - 1100	6	16.7	180	60
1100 - 1200	7	14.3	210	70
1200 - 1300	6	16.7	180	60
1300 - 1400	5	20.0	150	50
1400 - 1500	7	14.3	210	70
1500 - 1600	6	16.7	180	60
1600 - 1700	6	16.7	180	60
1700 - 1800	6	16.7	180	60
1800 - 1900	6	16.7	180	60
1900 - 2000	9	11.1	270	90
2000 - 2100	17	5.9	510	170
2100 - 2200	28	3.6	840	280
2200 - 2300	30	3.3	900	300

EMERSON AGGREGATE DISPERSION TEST

Soils with an excess of exchangeable sodium ions on the cation exchange complex (clays), can cause clay dispersion. Under some circumstances the presence of dispersive soils can also lead to significant erosion, and in particular tunnels leading to eventual gully erosion. Dispersive clay subsoil materials can also cause sealing of the soil surface – if left out in wet weather, they then dry and set very hard in dry weather. Based upon field survey of the property and the surrounding area, no erosion was identified at the site.

The subsoil was tested for dispersion using the Emerson Aggregate Test (EAT). Testing resulted in (worst-case) Emerson class 2(1), indicating presence of soils with slight dispersion characteristics. As such, exposure to rainfall may lead to spontaneous clay dispersion.

To minimise this, we recommend coverage of exposed subsoil with topsoil or regular treatment with gypsum at 0.5 Kg/m^2 along with minimising subsoil disturbance whenever possible.

TH #	Depth (m)	Visual sign	Class
1	0.3 - 0.6	Some dispersion (Slight milkiness immediately adjacent to aggregate)	2(1)
1	0.7 - 1.1	Some dispersion (Slight milkiness immediately adjacent to aggregate)	2(1)
1	1.3 - 2.0	No slaking and no dispersion	8
2	0.9 - 1.2	Some dispersion (Slight milkiness immediately adjacent to aggregate)	2(1)

WIND CLASSIFICATION

The AS 4055-2021 *Wind load for Housing* classification of the site is:

Region:	**A**
Terrain Category:	**TC3**
Shielding Classification:	**FS**
Topographic Classification:	**T2**
Wind Classification:	**N2**
Design Wind Gust Speed ($V_{h,u}$):	**40 m/sec**

SITE CLASSIFICATION AND RECOMMENDATIONS

According to AS2870-2011 (construction) the site is **Class H-1** or highly reactive, with 40 – 60 mm the dominant reactivity of expected surface movement under normal soil moisture ranges for the location. We recommend founding at or below approximately 1.7 - 2.1 m, due to the presence of higher bearing capacity weathered bedrock at these depths.

Note 1 – If founded entirely on underlying competent weathered sandstone bedrock below approximately 1.7 to 2.1 m (recommended) and no part of the foundations, be it a slab, pier or footing, is in contact with/or is supported by the clayey subsoils, then **Class M** would become an appropriate site classification.

Note 2 – All foundations require ongoing adequate drainage and vegetation management – please refer to CSIRO foundation management BTF 18 sheet attached.

Note 3 – If any foundations are placed on FILL that is > 0.5 m in depth then **Class P** is applicable.

Note 4 – Based on the upper 0.6 m of soil, all plumbing fixtures and fittings should be installed using **Class H-1** as per *Appendix G AS/NZS 3500.2.2021*.

General Notes – Important points pertinent to maintenance of foundation soil conditions

This report relates to the soil and site conditions on the property at the time of the site assessment. The satisfactory long-term performance of footings is dependent upon on- going site maintenance by the owner.

Examples of abnormal moisture conditions developing after construction include the following:

A) The effect of trees too close to the footings.
B) Excessive or irregular watering of gardens adjacent to the footings.
C) Failure to maintain site drainage affecting footings.
D) Failure to repair plumbing leaks affecting footings.
E) Loss of vegetation from near the building.

All earthworks on site must comply with AS 3798-2007 Guidelines on Earthworks for commercial and residential developments.

REPORT LIMITATIONS

Whilst every attempt is made to describe sub-surface conditions, natural variation will occur that cannot be determined by limited investigative soil testing. Therefore, discrepancies are possible between test results and observations during construction. It is our intention to accurately indicate the most probable soil type(s) and conditions for the area assessed. However, due to the nature of sampling an area, variations in soil type, soil depth and site conditions may occur.

We accept no responsibility for any differences between what we have reported and actual site and soil conditions for particular regions we could not directly assess at the time of inspection.

It is recommended that during construction, Doyle Soil Consulting and/or the design engineer be notified of any major variation to the foundation conditions as predicted in this report. Any changes to the site through excavations may alter the site classification.

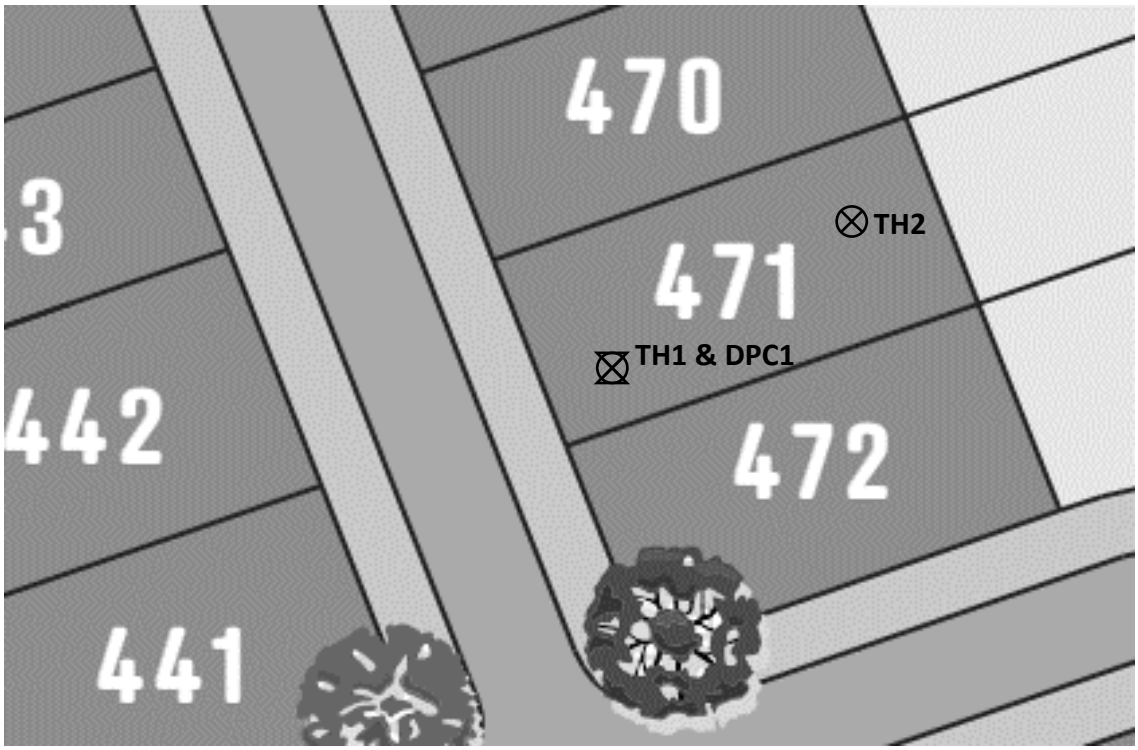
In these cases, it is expected that the owner consult the author for a reclassification. This report requires certification via a form 55 certificate from Doyle Soil Consulting to validate its contents.

Because site discrepancies may occur between this report and actual site conditions, it is a condition of certification of this report that the builder be provided with a copy of this report.

Rowan Mason
B.Agr.Sc.(Hons).
Soil Scientist

Dr Richard Doyle
B.Sc.(Hons), M.Sc.(Geol), Ph.D. (Soil Sci.), CPSS (Certified Prof Soil Scientist)
Geologist and Soil Scientist

APPENDIX 1 – Approximate test hole and DCP locations



APPENDIX 2 – Definitions of Soil Horizons

Horizon name	Meaning
A1	Dark topsoils, zone of maximum organic activity
A2 or E	Leached, light/pale washed-out sandy layer
A3 or AB	Transition from A to B, more like A
B1 or BA	Transition from A to B, more like B
B2	Main subsoils layer with brown colouration, accumulations of clay, humus, iron oxide, etc
B3	Transitional from B2 to C
C	Weakly weathered soil parent materials

Subscript	Meaning
r	Reducing conditions (anaerobic)
t	Enriched in translocated clay
s	Iron/aluminium oxide accumulations
g	Mottled, suggesting periodic/seasonal wetness
m	Cemented layer (oxides, carbonates, humus, silica etc)
k	Calcium carbonate (lime) accumulation
h	Humus accumulation a subsoil

CERTIFICATE OF QUALIFIED PERSON – ASSESSABLE ITEM

Section 321

Form **55**

To: Creative Homes Hobart *Owner /Agent*

PO Box 4 *Address*

New Town 7008 *Suburb/postcode*

Qualified person details:

Qualified person: Richard Doyle

Address: 6/76 Auburn Rd

Kingston Beach 7050

Phone No: 0488 080 455

Fax No:

Licence No: N/A

Email address: robyn@doylesoilconsulting.com.au

Qualifications and Insurance details: Geologist and Soil Scientist
Certified Professional Soil Scientist (CPSS)
Professional Indemnity cover –

Lloyd's of London
ENG 19 000305

(description from Column 3 of the Director's Determination - Certificates by Qualified Persons for Assessable Items

Speciality area of expertise: AS 2870-2011 Site and Soil Classification

(description from Column 4 of the Director's Determination - Certificates by Qualified Persons for Assessable Items)

Details of work:

Address: Lot 471 Tivoli Green Estate

Old Beach 7017

Lot No: 471

Certificate of title No: part of 251254/1

1000

The assessable item related to this certificate: Classification of soil according to AS2870-2011

(description of the assessable item being certified)
Assessable item includes –
- *a material;*
- *a design*
- *a form of construction*
- *a document*
- *testing of a component, building system or plumbing system*
- *an inspection, or assessment, performed*

Certificate details:

Certificate type: Soil Classification

(description from Column 1 of Schedule 1 of the Director's Determination - Certificates by Qualified Persons for Assessable Items n)

This certificate is in relation to the above assessable item, at any stage, as part of - *(tick one)*

building work, plumbing work or plumbing installation or demolition work: X

or

a building, temporary structure or plumbing installation:

In issuing this certificate the following matters are relevant –

Documents:	The attached Site and Soil Assessment Report for the address detailed above in, 'Details of Work'.
Relevant calculations:	Refer to above report.
References:	AS2870-2011 Residential slabs and footings AS1726-2017 Geotechnical site investigations CSIRO Building Technology File -18

Substance of Certificate: (what it is that is being certified)

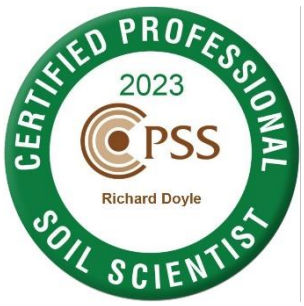
Site classification consistent with AS2870-2011.

Scope and/or Limitations

The classification applies to the site as inspected and does not account for future alteration to foundation conditions as a result of earthworks, drainage condition changes or variations in site maintenance.

I certify the matters described in this certificate.

	Signed:	*Certificate No:*	*Date:*
Qualified person:		1363	22/07/2023



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; landslip; 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 perpends).

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.

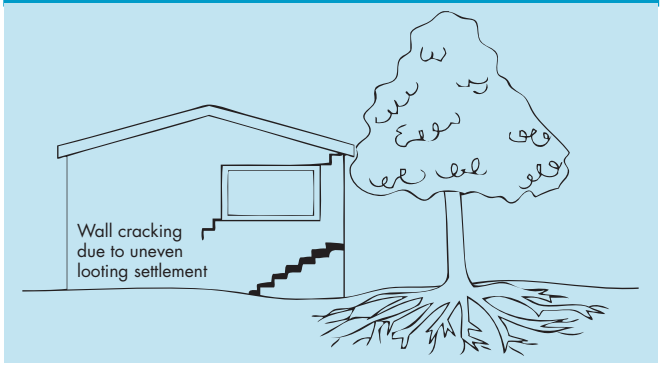
The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally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

Trees can cause shrinkage and damage



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.

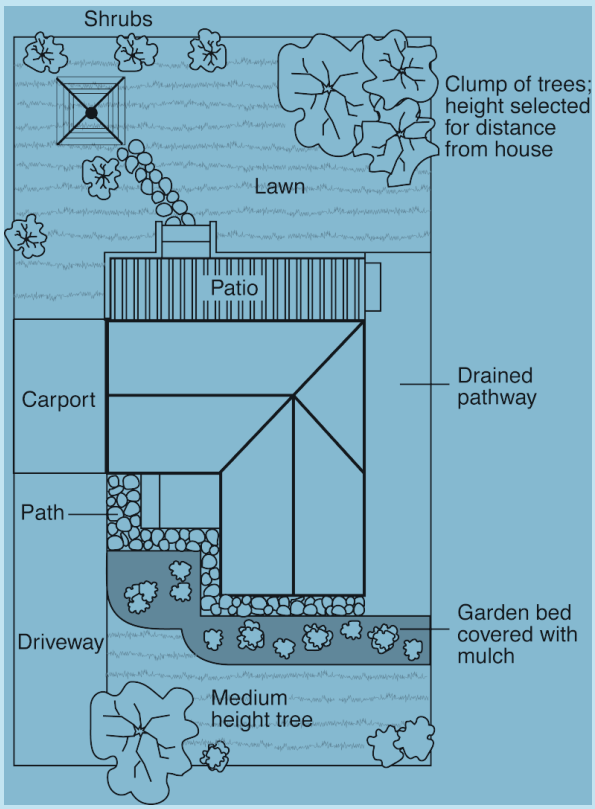
Protection of the building perimeter
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

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.

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