NOTICE OF PROPOSED DEVELOPMENT

Notice is hereby given that an application has been made for planning approval for the following development:

SITE:
251 GREENS ROAD, ORIELTON

PROPOSED DEVELOPMENT:
OUTBUILDING

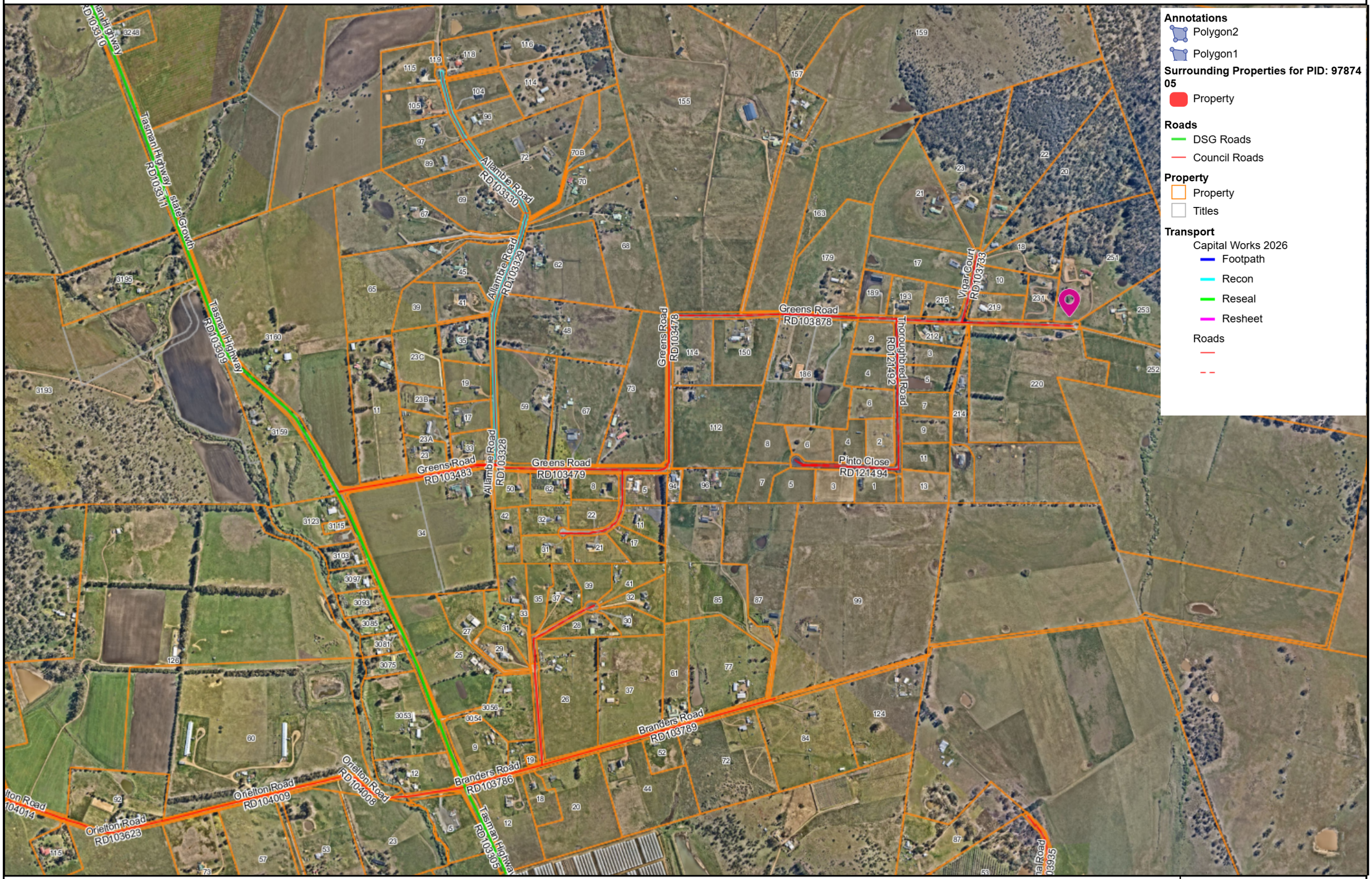
The relevant plans and documents can be inspected at the Council Offices at 47 Cole Street, Sorell during normal office hours, or the plans may be viewed on Council's website at www.sorell.tas.gov.au until **Tuesday 24th February 2026.**

Any person may make representation in relation to the proposal by letter or electronic mail (sorell.council@sorell.tas.gov.au) addressed to the General Manager. Representations must be received no later than **Tuesday 24th February 2026.**

APPLICATION NO: **5.2025-337.1**
DATE: **06 FEBRUARY 2026**

251 Greens Road, Orielton

5-Feb-2026



Annotations
- Polygon2
- Polygon1

Surrounding Properties for PID: 9787405
- Property

Roads
- DSG Roads
- Council Roads

Property
- Property
- Titles

Transport

Capital Works 2026
- Footpath
- Recon
- Reseal
- Resheet

Roads

SORELL COUNCIL

Disclaimer

Any information extracted from this document (from the face of the document or by scale) should be verified on site. Council takes no responsibility for the accuracy of any information contained or presented in the document. While every care has been taken to ensure the accuracy of this information, Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and liability.

200 m

N

Part B: Please note that Part B of this form is publicly exhibited.

Full description of Proposal:	*Use:* Residential *Development:* New Farm Shed *Large or complex proposals should be described in a letter or planning report.*
Design and construction cost of proposal:	$ 50,000

Is all, or some the work already constructed:	No: ☑ Yes: ☐

Location of proposed works:	Street address: 251 Greens Road, Suburb: Orielton Postcode: 7172 Certificate of Title(s) Volume: 103907 Folio: 7

Current Use of Site	Residential

Current Owner/s:	Name(s) Justin and Emma Altmann

Is the Property on the Tasmanian Heritage Register?	No: ☑ Yes: ☐	*If yes, please provide written advice from Heritage Tasmania*
Is the proposal to be carried out in more than one stage?	No: ☑ Yes: ☐	*If yes, please clearly describe in plans*
Have any potentially contaminating uses been undertaken on the site?	No: ☑ Yes: ☐	*If yes, please complete the Additional Information for Non-Residential Use*
Is any vegetation proposed to be removed?	No: ☑ Yes: ☐	*If yes, please ensure plans clearly show area to be impacted*
Does the proposal involve land administered or owned by either the Crown or Council?	No: ☑ Yes: ☐	*If yes, please complete the Council or Crown land section on page 3*

If a new or upgraded vehicular crossing is required from Council to the front boundary please complete the Vehicular Crossing (and Associated Works) application form
https://www.sorell.tas.gov.au/services/engineering/

Part B continued: Please note that Part B of this form is publicly exhibited

Declarations and acknowledgements
• I/we confirm that the application does not contradict any easement, covenant or restriction specified in the Certificate of Title, Schedule of Easements or Part 5 Agreement for the land. • I/we consent to Council employees or consultants entering the site and have arranged permission and/or access for Council's representatives to enter the land at any time during normal business hours. • I/we authorise the provision of a copy of any documents relating to this application to any person for the purposes of assessment or public consultation and have permission of the copyright owner for such copies. • I/we declare that, in accordance with s52(1) of the *Land Use Planning and Approvals Act 1993*, that I have notified the owner(s) of the intention to make this application. • I/we declare that the information in this application is true and correct. *Details of how the Council manages personal information and how you can request access or corrections to it is outlined in Council's Privacy Policy available on the Council website.*
• I/we acknowledge that the documentation submitted in support of my application will become a public record held by Council and may be reproduced by Council in both electronic and hard copy format in order to facilitate the assessment process, for display purposes during public exhibition, and to fulfil its statutory obligations. I further acknowledge that following determination of my application, Council will store documentation relating to my application in electronic format only.
• Where the General Manager's consent is also required under s.14 of the *Urban Drainage Act 2013*, by making this application I/we also apply for that consent.

Applicant Signature:	Signature: ..... Date: 03/12/2025

Crown or General Manager Land Owner Consent
If the land that is the subject of this application is owned or administered by either the Crown or Sorell Council, the consent of the relevant Minister or the Council General Manager whichever is applicable, must be included here. This consent should be completed and signed by either the General Manager, the Minister, or a delegate (as specified in s52 (1D-1G) of the *Land Use Planning and Approvals Act 1993*). Please note: • If General Manager consent if required, please first complete the General Manager consent application form available on our website www.sorell.tas.gov.au • If the application involves Crown land you will also need a letter of consent. • Any consent is for the purposes of making this application only and is not consent to undertaken work or take any other action with respect to the proposed use or development.
I _____ being responsible for the administration of land at _____ declare that I have given permission for the making of this application for _____

Sorell Council
Development Application: Development Application - 251 Greens Road, Orielton.pdf
Plans Reference:P1
Date Received:3/12/2025

Signature of General Manager, Minister or Delegate:	Signature: ..... Date: .....

RESULT OF SEARCH

RECORDER OF TITLES

Issued Pursuant to the Land Titles Act 1980

Tasmanian Government

SEARCH OF TORRENS TITLE

VOLUME	FOLIO
103907	7
EDITION	DATE OF ISSUE
6	18-Jan-2016

SEARCH DATE : 03-Dec-2025
SEARCH TIME : 09.48 am

DESCRIPTION OF LAND

Parish of SORELL, Land District of PEMBROKE
Lot 7 on Sealed Plan 103907
Derivation : Part of Lot 30000 Gtd to O.D. Townsend
Prior CT 38902/1

SCHEDULE 1

M546440 TRANSFER to EMMA LEE JONES and JUSTIN KEITH ALTMANN
Registered 18-Jan-2016 at 12.01 pm

SCHEDULE 2

Reservations and conditions in the Crown Grant if any
SP 103907 FENCING PROVISION in Schedule of Easements
SP 103907 COVENANTS in Schedule of Easements
E28800 MORTGAGE to National Australia Bank Limited
Registered 18-Jan-2016 at 12.02 pm

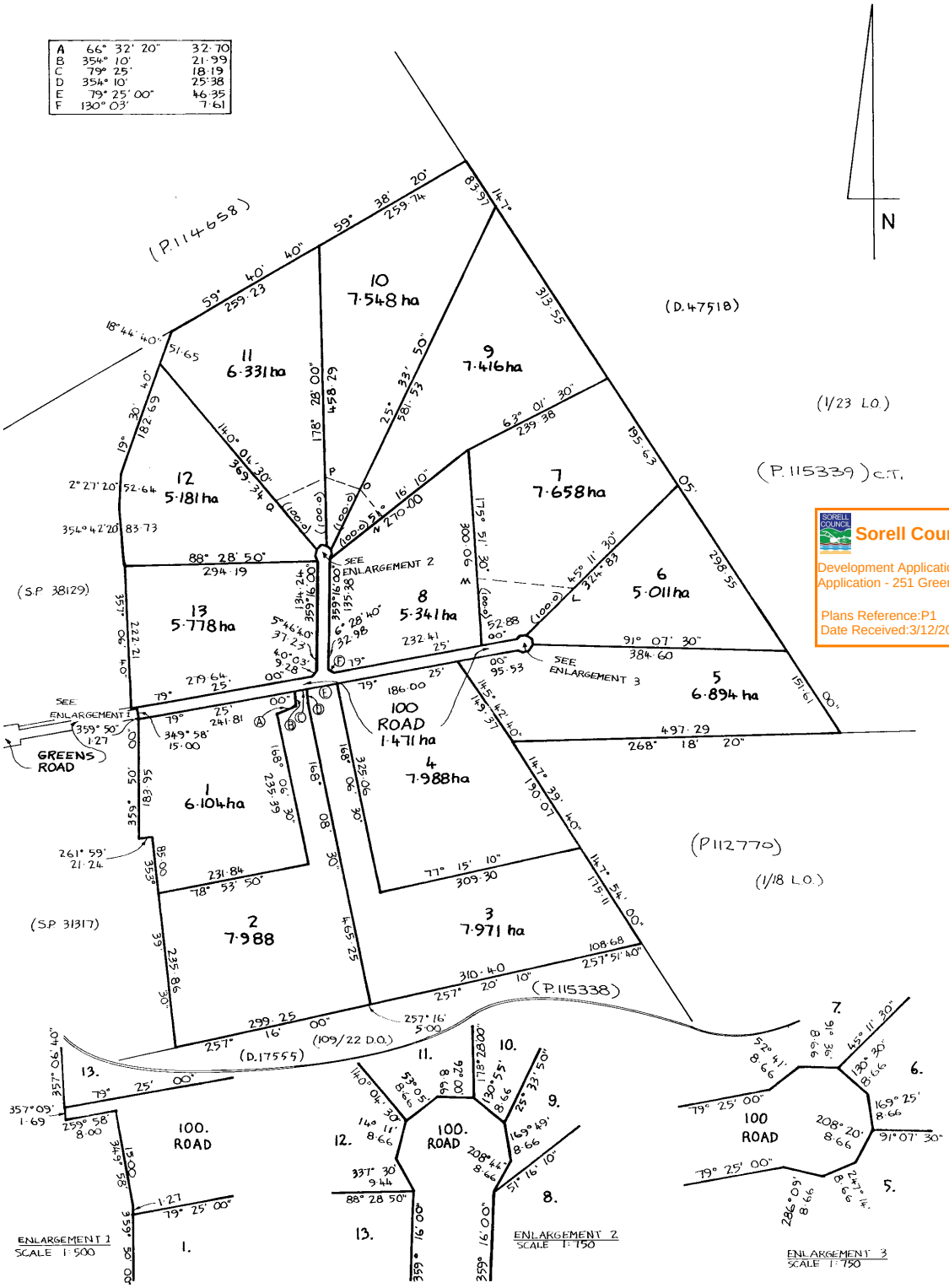
UNREGISTERED DEALINGS AND NOTATIONS

No unregistered dealings or other notations

Owner: DAVID MURRAY SKINNER & CYNTHIA SKINNER	**PLAN OF SURVEY** by Surveyor JOHN L. CERUTTY of land situated in the CROMER & CERUTTY P/L. 7 BAYFIELD ST. ROSNY PARK	REGISTERED NUMBER 103907
Title Reference C.T. ~~4537-15~~ 38902-1	LAND DISTRICT OF PEMBROKE PARISH OF SORELL	Approved 12 MAR 1993 Effective from
Grantee PART OF LOT 30000 A GTD. TO QUEEN DOUGLAS TOWNSEND (276-1-25)	SCALE 1:5000 MEASUREMENTS IN METRES	Recorder of Titles

(2/24 L.O.) 29 1085 1086 D.38902

A	66° 32' 20"	32.70
B	354° 10'	21.99
C	79° 25'	18.19
D	354° 10'	25.38
E	79° 25' 00"	46.35
F	130° 03'	7.61



Sorell Council

Development Application: Development Application - 251 Greens Road, Orielton.pdf

Plans Reference:P1
Date Received:3/12/2025

REGISTERED NUMBER

SP103907

SCHEDULE OF EASEMENTS

NOTE:—The Town Clerk or Council Clerk must sign the certificate on the back page for the purpose of identification.

The Schedule must be signed by the owners and mortgagees of the land affected. Signatures should be attested.

EASEMENTS AND PROFITS

Each lot on the plan is together with:—

(1) such rights of drainage over the drainage easements shewn on the plan (if any) as may be necessary to drain the stormwater and other surplus water from such lot; and

(2) any easements or profits à prendre described hereunder.

Each lot on the plan is subject to:—

(1) such rights of drainage over the drainage easements shewn on the plan (if any) as passing through such lot as may be necessary to drain the stormwater and other surplus water from any other lot on the plan; and

(2) any easements or profits à prendre described hereunder.

The direction of the flow of water through the drainage easements shewn on the plan is indicated by arrows.

The Owners of each lot shown on the plan (except Lots 1,2,3,4,5,6,8,12,13 & 100) covenant with the owners (David Murray Skinner and Cynthia Skinner) and the owners for the time being of every other lot shown on the plan to the intent that the burden of these covenants may run with and bind the covenantors lot and every part thereof and that the benefit thereof shall be annexed to every other part of every lot shown on the plan (except Lots 1,2,3,4,5,6,8,12,13 & 100) to observe the following stipulations:

(a) Not to construct a dwelling on Lot 7 on the Northern side of a line marked LM on the plan.

(b) Not to construct a dwelling on Lot 9 on the Northern side of a line marked NO on the plan.

(c) Not to construct a dwelling on Lot 10 on the Northern side of a line marked OP on the plan.

(d) Not to construct a dwelling on Lot 11 on the Northern side of a line marked PQ on the plan.

FENCING ~~COVENANT~~ Provision In respect of each lot shown on the plan the Vendors (David Murray Skinner and Cynthia Skinner) shall not be required to fence.

SIGNED by the said DAVID MURRAY SKINNER and CYNTHIA SKINNER as the registered proprietor of the land comprised in the Folio of the Register Volume 4537 folio 15 in the presence of:

THE COMMON SEAL of MURDOS NOMINEES PTY LTD (A.C.N. 009 584 543) was hereto affixed in the presence of:)

DIRECTOR

DIRECTOR/SECRETARY

MURDOS NOMINEES PTY. LTD. A.C.N. 009 584 543 The Common Seal Of

Sorell Council

Development Application: Development Application - 251 Greens Road, Orielton.pdf

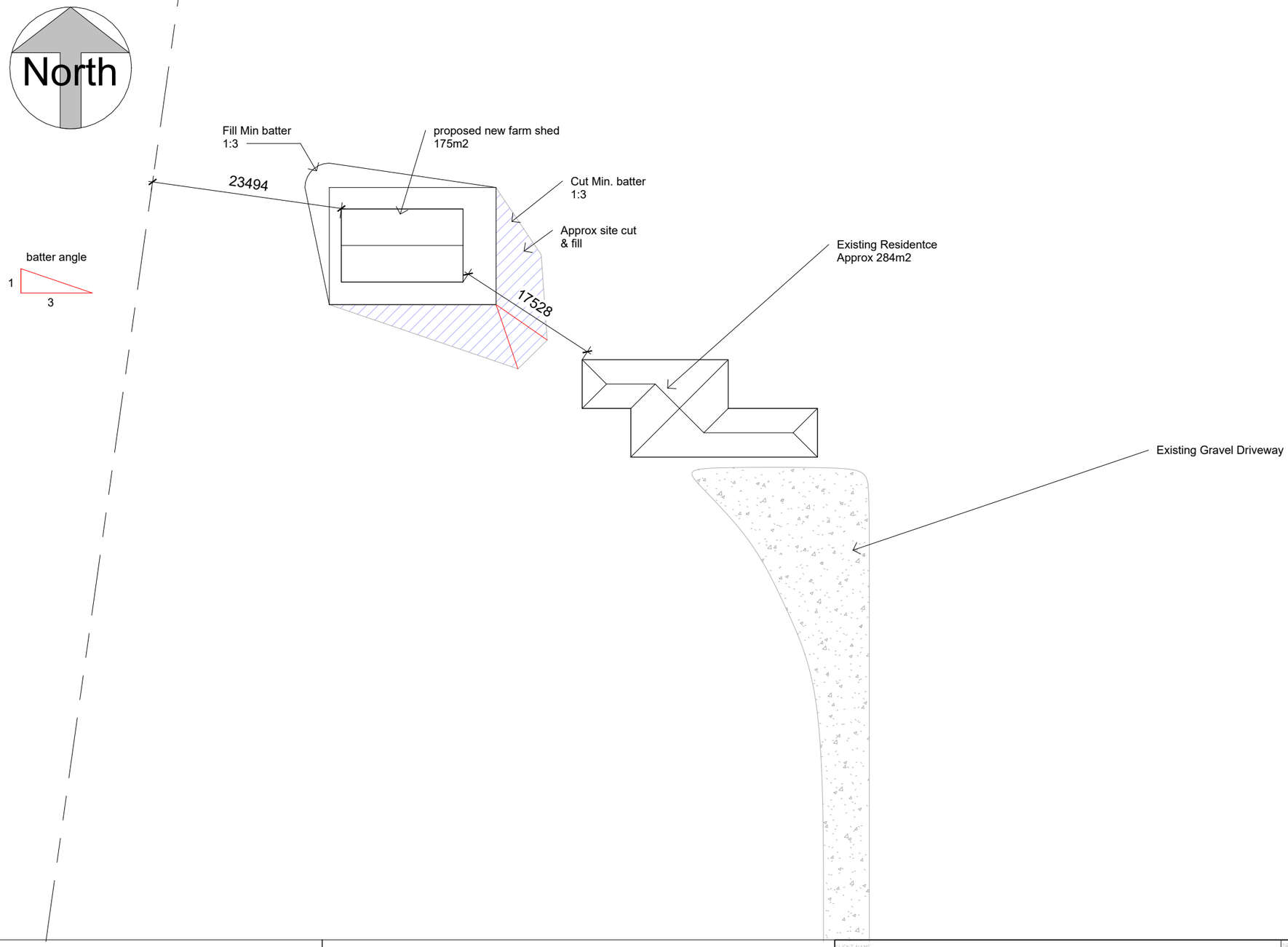
Plans Reference:P1
Date Received:3/12/2025

This is the schedule of easements attached to the plan of .....
(Insert Subdivider's Full Name)
David Murray Skinner & Cynthia Skinner affecting land in
C.T. 4537-15
(Insert Title Reference)
Sealed by Municipality of Sorell on 23rd February 1993

Solicitor's Reference .....

.....
Council Clerk/Town Clerk

OS-K 3134

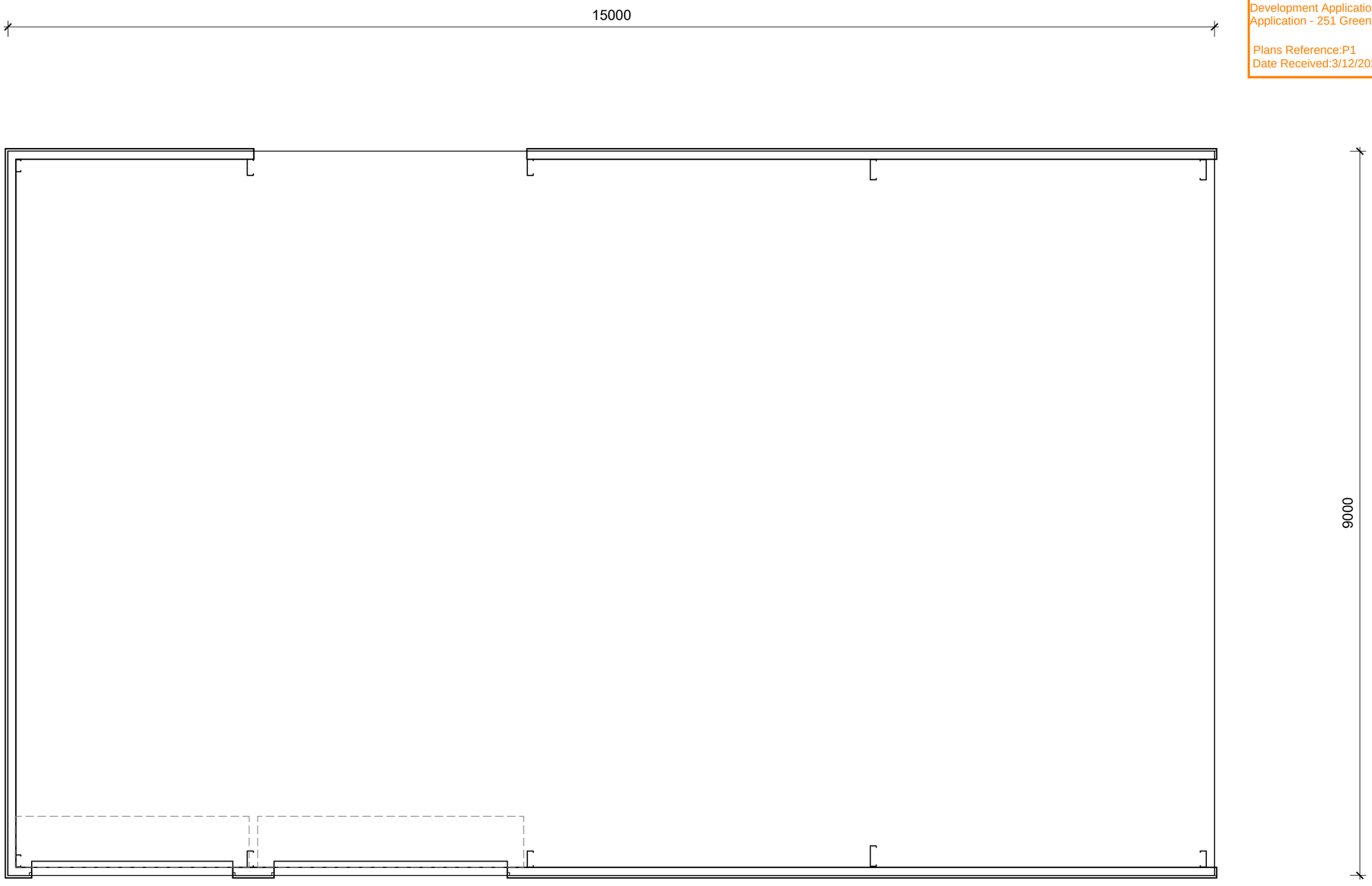


DIMENSION NOTE:
Use written diemtnions only. Do no scale from drawings. All figured dimensions are to be used as a guide only. It is imperative that all dimensions, setouts and levels be confirmed onsite by the builder, Surveyor or Sub Contractor prior to the commencement of work, manufacture or installaion; and the Builder, Sub Contractor and/or manufacturer ensures a full set of plans are on hand and reference has been made to the general notes

DRAWING NOTE:

SHEDS n HOMES
SHEDS. MADE. TOUGH.
57 Cove Hill Road
Bridgewater TAS 7030
(03) 6263 6545
hobart@shedsnhomes.com.au
BLST Pty Ltd
ABN 52 660 422 159

CLIENT NAME: Justin and Emma Altmann		DRAWING TITLE: SITEPLAN			
PROJECT ADDRESS: 251 Greens Road, Orielton		DATE: 27/01/2026	SCALE: 1 : 500		DRAWN BY: SH
PROJECT: NEW FARM SHED	REVISION No: R2	SHEET SIZE: A3	JOB No: SNH25-044		SHEET No: A2.1



DIMENSION NOTE:
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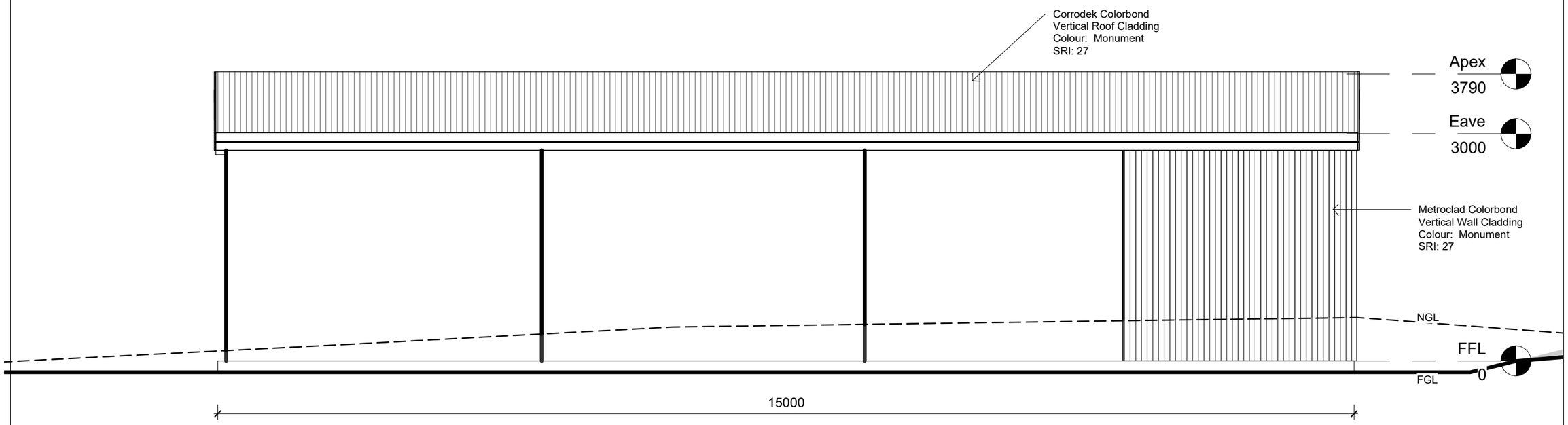
SHEDS n HOMES
SHEDS. MADE. TOUGH.

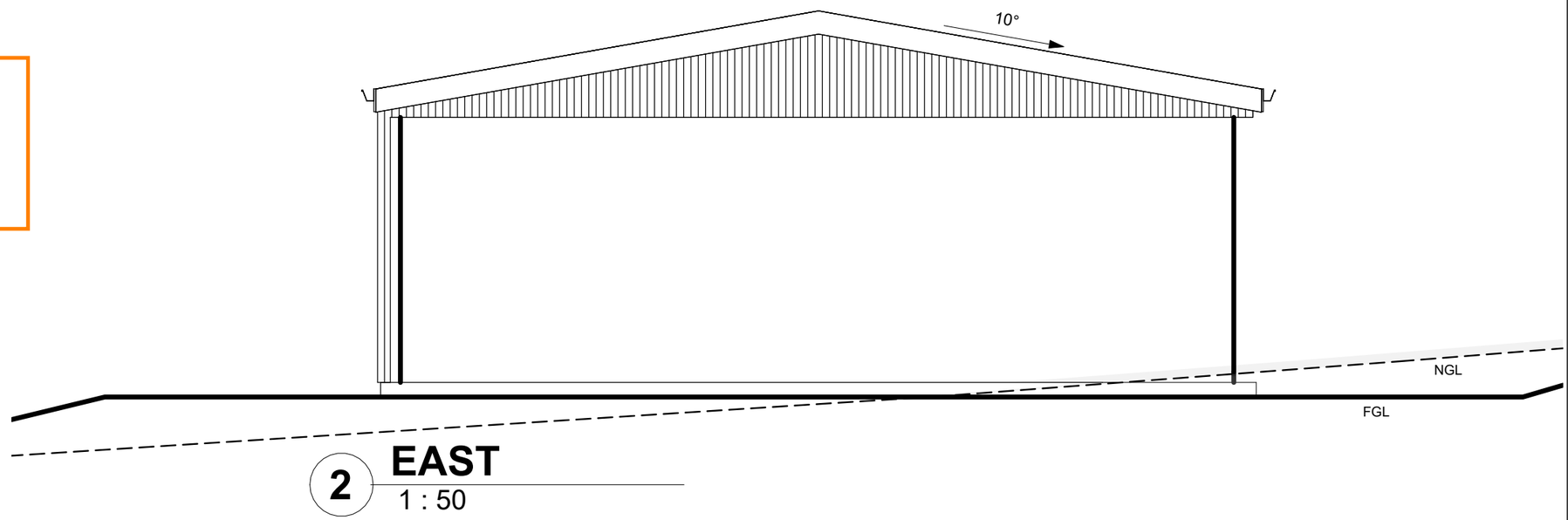
57 Cove Hill Road
Bridgewater TAS 7030
(03) 6263 6545
hobart@shedsnhomes.com.au

BLST Pty Ltd
ABN 52 660 422 159

CLIENT NAME: Justin and Emma Altmann			DRAWING TITLE: FLOORPLAN		
PROJECT ADDRESS: 251 Greens Road, Orielton		DATE: 02/12/2025	SCALE: 1 : 50		DRAWN BY: BH
PROJECT: NEW FARM SHED	REVISION No:	SHEET SIZE: A3	JOB No: SNH25-044		SHEET No: A3.0



1 NORTH
1 : 50

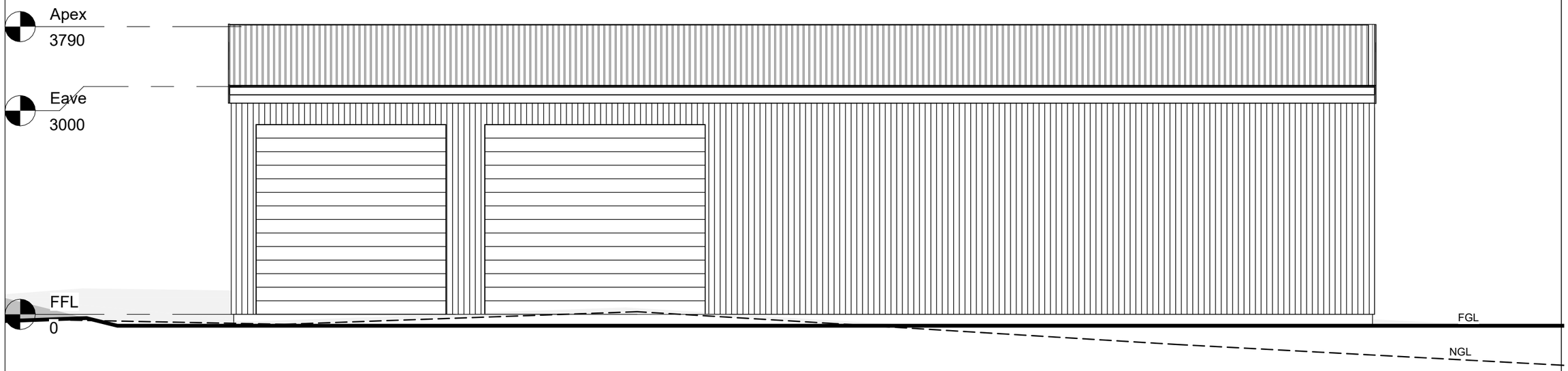


2 EAST
1 : 50

DIMENSION NOTE:
Use written diemtnions only. Do no scale from drawings. All figured dimensions are to be used as a guide only. It is imperative that all dimensions, setouts and levels be confirmed onsite by the builder, Surveyor or Sub Contractor prior to the commencement of work, manufacture or installaion; and the Builder, Sub Contractor and/or manufacturer ensures a full set of plans are on hand and reference has been made to the general notes

SHEDS n HOMES
SHEDS MADE TOUGH
57 Cove Hill Road
Bridgewater TAS 7030
(03) 6263 6545
hobart@shedsnhomes.com.au
BLST Pty Ltd
ABN 52 660 422 159

CLIENT NAME: Justin and Emma Altmann			DRAWING TITLE: ELEVATIONS		
PROJECT ADDRESS: 251 Greens Road, Orielton		DATE: 13/01/2026	SCALE: 1 : 50		DRAWN BY: SH
PROJECT: NEW FARM SHED	REVISION No: R1	SHEET SIZE: A3	JOB No: SNH25-044	SHEET No: A4.0	



3 SOUTH
1 : 50

Corrodek Colorbond
Roof Cladding
Colour: Monument
SRI: 27

2 WEST
1 : 50

Sorell Council
Development Application: 5.2025.337.1 - Response to Request For Information - 251 Green Road, Orielton - P2.pdf
Plans Reference: P3
Date Received: 13/01/2026

DIMENSION NOTE:
Use written diemtnions only. Do no scale from drawings. All figured dimensions are to be used as a guide only. It is imperative that all dimensions, setouts and levels be confirmed onsite by the builder, Surveyor or Sub Contractor prior to the commencement of work, manufacture or installaion; and the Builder, Sub Contractor and/or manufacturer ensures a full set of plans are on hand and reference has been made to the general notes

DRAWING NOTE:

SHEDS n HOMES
SHEDS. MADE. TOUGH.
57 Cove Hill Road
Bridgewater TAS 7030
(03) 6263 6545
hobart@shedsnhomes.com.au
BLST Pty Ltd
ABN 52 660 422 159

CLIENT NAME: Justin and Emma Altmann			DRAWING TITLE: ELEVATIONS	
PROJECT ADDRESS: 251 Greens Road, Orielton		DATE: 13/01/2026	SCALE: 1 : 50	DRAWN BY: SH
PROJECT: NEW FARM SHED	REVISION No: R1	SHEET SIZE: A3	JOB No: SNH25-044	SHEET No: A4.1

GEOTECH 25-022a

ROCK SOLID GEOTECHNICS PTY LTD
Peter Hofto
163 Orielton Road
Orielton
TAS 7172

0417 960 769
peter@rocksolidgeotechnics.com.au

20/2/2025

Geotechnical Assessment / Classification for Proposed Residential Development

251 Greens Road, Orielton

CLIENT: Justin Altmann [redacted] [redacted]

CONTENTS

SUMMARY 2
INVESTIGATION 2
CONDITIONS OF INVESTIGATION 4

FIGURE 1 Site Plan

APPENDIX 1 Certificate of Others (Building) – Form 55
APPENDIX 2 CSIRO 'Guide to home-owners on foundation maintenance and footing performance'

SUMMARY

A shed development is proposed by Justin Altmann at 251 Greens Road, Orielton (Figure 1). Clay subsoils and shallow dolerite bedrock underlies the site.

The site is classified as Class 'S' in accordance with AS2870-2011. The shed should be founded directly onto the dolerite bedrock.

Suitable upslope site drainage should be installed prior to the commencement of construction.

The following Wind Load Classifications (AS4055-2012: Wind Loads for Housing) are appropriate.

• Terrain Category Classification	TC2.5	Terrain with a few obstructions
• Shielding Classification	PS	Partial Shielding
• Topographic Classification	T2	
• Wind Load Classification	N3	

INVESTIGATION

The Tasmanian Geological Survey 1:63360 Geological Atlas – 'Buckland' indicates that the site is underlain by Jurassic dolerite. A site investigation was completed on Friday 14 February, 2025. This included the augering of a test hole to assess the site for foundation conditions (4WD mounted SAMPLA25 mechanical auger with 100mm solid flight augers). The location of the hole is marked on Figure 1.

The site for the proposed shed lies to the northwest and upslope from the residence. The site slopes at 2-4 degrees to the south/southeast. No seepages or springs were observed on the site. The site is covered in grass, and is devoid trees. Surface cracking was observed over the site. A significant amount of uncontrolled fill has been placed to the immediate south of the proposed shed site. The shed should NOT be constructed on this fill.

The profile displayed in Test Hole #1 consisted of:

0.00 – 0.15m	sandy CLAY: high plasticity, dark brown, to 20% fine to medium grained sand trace rootlets – TOPSOIL
0.15 – 0.55m	CLAY: high plasticity, olive brown, trace fine to medium grained sand, moist,
0.55 – 0.65m	gravelly SAND: fine to coarse grained, greyish brown, 20% fine to medium angular dolerite gravel, dry – EXTREMELY WEATHERED DOLERITE
0.65m+	Mechanical auger refusal on presumed dolerite bedrock

Groundwater was not encountered in the hole.

Plate 1 – Test Hole #1 – shed site – looking to the southeast.

CONDITIONS OF INVESTIGATION

This report remains the property of Rock Solid Geotechnics Pty. Ltd. (RSG). It must not be reproduced in part or full, or used for any other purpose without written permission of this company. The investigations have been conducted, & the report prepared, for the sole use of the client or agent mentioned on the cover page. Where the report is to be used for any other purpose RSG accepts no responsibility for such other use. The Form 55 is not transferable to another body without consultation (reissue) from RSG. The information in this report is current and suitable for use for a period of two years from the date of production of the report, after which time it cannot be used for Building or Development Application.

This report should not be used for submission for Building or Development Application until RSG has been paid in full for its production. RSG accepts no liability for the contents of this report until full payment has been received.

The results & interpretation of conditions presented in this report are current at the time of the investigation only. The investigation has been conducted in accordance with the specific client's requirements &/or with their servants or agent's instructions.

This report contains observations & interpretations based often on limited subsurface evaluation. Where interpretative information or evaluation has been reported, this information has been identified accordingly & is presented based on professional judgement. RSG does not accept responsibility for variations between interpreted conditions & those that may be subsequently revealed by whatever means.

Due to the possibility of variation in subsurface conditions & materials, the characteristics of materials can vary between sample & observation sites. RSG takes no responsibility for changed or unexpected variations in ground conditions that may affect any aspect of the project. The classifications in this report are based on samples taken from specific sites. The information is not transferable to different sites, no matter how close (ie. if the development site is moved from the original assessment site an additional assessment will be required).

It is recommended to notify the author should it be revealed that the sub-surface conditions differ from those presented in this report, so additional assessment & advice may be provided.

Investigations are conducted to standards outlined in Australian Standards:

- AS1726-1993: Geotechnical Site Investigations
- AS2870-2011: Residential Slabs and Footings
- AS4055-2012: Wind Loads for Housing

& as specified in 'Guidelines for Geotechnical Assessment of Subdivisions and Recommended Code of Practise for Site Classification to AS2870 in Tasmania' - Institute of Engineers, Tasmanian Division.

All new developments should subject to strict site maintenance. Attention is drawn to the enclosed information reproduced with the permission from Standards Australia:

- CSIRO Information Sheet No. BTF18 – 'Guide to home-owners on foundation maintenance & footing performance'.

PETER HOFTO
ROCK SOLID GEOTECHNICS PTY LTD

LOCALITY MAP
251 GREENS RD. ORIELTON

GDA94 MGA55 : 545134E, 5269713N 1:1,693 **Disclaimer and Copyright Notice**

CERTIFICATE OF QUALIFIED PERSON – ASSESSABLE ITEM

Section 321

Form 55

To: Justin Altmann [redacted] *Owner /Agent*

[redacted] *Address*

Suburb/postcode

Qualified person details:

Qualified person: Peter Hofto - Rock Solid Geotechnics P/L

Address: 163 Orielton Road

Orielton 7172

Phone No: 0417960769

Fax No:

Licence No:

Email address: peter@rocksolidgeotechnics.com.au

Qualifications and Insurance details: BSc (Hons) – Geology / Geophysics
PI Insurance – Lloyds Underwriting
PL Insurance – CGU Insurance Lt

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

Speciality area of expertise: Geotechnical Assessments

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

Details of work:

Address: 251 Greens Road, Orielton

Lot No:

Certificate of title No:

The assessable item related to this certificate: Geotechnical Assessment

(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: Geotechnical Assessment

(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 items, at any stage, as part of – *(tick one)*

☑ building work, plumbing work or plumbing installation or demolition work

OR

☐ a building, temporary structure or plumbing installation

In issuing this certificate the following matters are relevant –

Documents:	
Relevant calculations:	AS2870
References:	

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

Scope and/or Limitations

I certify the matters described in this certificate.

	Signed:	*Certificate No:*	*Date:*
Qualified person:		GEOTECH 25-022	20/2/2025

Foundation Maintenance and Footing Performance:
A Homeowner's Guide

CSIRO

BTF 18
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, 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
1	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites with only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes
H	Highly reactive clay sites, which can experience high ground movement from moisture changes
E	Extremely reactive sites, which can experience extreme ground movement from moisture changes
A to P	Filled sites
P	Sites which include soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise

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.

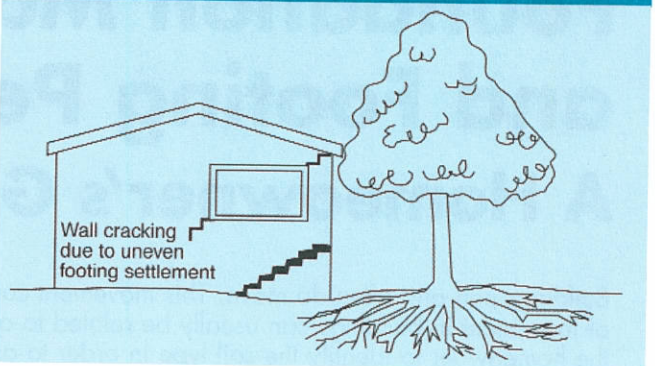
Seasonal swelling/shrinkage in clay

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.

Trees can cause shrinkage and damage



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.

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 cause 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.

AS 2870 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.

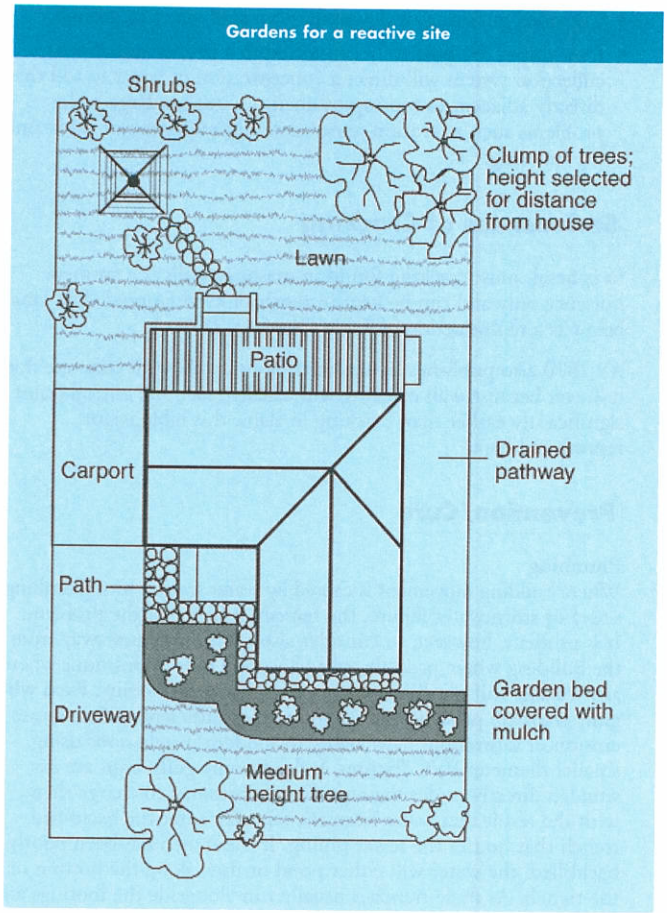
It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

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

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 depend on number of cracks	4



should 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.

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