BUILDING CERTIFIERS
form

RECEIVED
18 MAY 2015
PITTWATER COUNCIL

12 May, 2015.

Pittwater Council
P.O. Box 882
Mona Vale NSW 1660

Dear Sir /Madam

Re: Lodgement of CC2015-118 for DA No. N0289/14
Site address: No. 180A Prince Alfred Parade, Newport

Please find attached all required documentation relied upon to issue Construction Certificate and Notice of Commencement for the above development:

- Part 4A Lodgement Fee $36.00 payable to Council.
- Copy of Owner Builder Permit
- Sydney Water approval
- Full set of Council Approved 'Stamped' Plans.
- 1 full set of Construction Certificate Plans and Specifications.
- 1 Structural Engineer's Plans
- Geotechnical Risk Assessment Report dated 6 January, 2015.
- Stormwater Management Plans.
- Receipt for payment of Long Service Levy.
- Revised Shedule of Material & Finishes
- Arborist Report dated 21 December, 2014.
- Vehicle Driveway Gradients.
- Landscape Pan

Yours faithfully

CFormosa

Craig Formosa

$36 REC: 377934 18/5/15.

POSTED

BUILDING CERTIFIERS

form

CONSTRUCTION CERTIFICATE #2015-118

Approved 12/05/15

Issued in accordance with the provisions of the Environmental & Assessment Act 1979 under Sections 109C(1)(b) and 109F

Date Application Received	22-04-15		
Council	Pittwater Council		
Development Consent No.	N0289/14	Date Approved	26-03-15
Certifying Authority	Craig Formosa	Accredited Certifier	Craig Formosa - BPB0124
Accreditation Body	Building Professionals Board	BCA in Force	BCA2014
APPLICANT DETAILS			
Name	Simon Olding	Ph No.	0412 272 699
Address	P.O. Box 375, Wahroonga NSW 2076		
OWNER DETAILS			
Name	Anne Olding		
Address	47 Mirrabooka Street, Bilgola NSW 2016		
DEVELOPMENT DETAILS			
Subject Land	180A Prince Alfred Parade, Newport NSW 2106	Lot No. 201	DP 1191485
Description of Development	Construction of a new garage/shed structure & associated driveway		
Class of Building	10a	Value of Work	$45,000.00
BUILDER DETAILS			
Name	Anne Olding		
Address	47 Mirrabooka Street, Bilgola NSW 2016		
Contact Number	0412 272 699	O/B Permit no.	
APPROVED PLANS & DOCUMENTS			
Plans Prepared By	Anne Olding		
Drawing Numbers	DA01A ,DA02A & DA03A	Dated	27-11-14
Engineer Details Prepared By	Kneebone, Beretta & Hall Pty Ltd - Structural		
Drawing Numbers	101800-1 structural	Dated	13-04-15

CERTIFICATION

I, Craig Formosa, as the certifying authority am satisfied that;

(a) The requirements of the regulations referred to in s81A (5) have been complied with. That is, work completed in accordance with the documentation accompanying the application for this certificate (with such modifications verified by the certifying authority as may be shown on that documentation) will comply with the requirements of the Regulation as referred to in section 81A (5) of the Act, and b)Long Service Levy has been paid where required under s34 of the Building & Construction Industry Long Service Payments Act 1986.

Signed: CFormosa

Date: 12/05/15

BUILDING CERTIFIERS form

NOTICE OF COMMENCEMENT OF BUILDING WORK & APPOINTMENT OF PRINCIPAL CERTIFYING AUTHORITY

Issued under the Environmental Planning & Assessment Act, 1979 – Sections 81A(2)(b)(ii) or (c), or (4)(b)(ii) or (c), 86(1) & (2)

CONSTRUCTION CERTIFICATE					
Certificate No.	2015-118				
Date of Issue	12/05/15	Commencement Date	14/05/15		
APPLICANT DETAILS					
Name	Simon Olding	Ph No.	0412 272 699		
Address	P.O. Box 375, Wahroonga NSW 2076				
DEVELOPMENT DETAILS					
Subject Land	180A Prince Alfred Parade, Newport NSW 2106	Lot No.	201	DP	1191485
Description of Development	Construction of a new garage/shed structure & associated driveway	DA Consent No.	N0289/14		
Issued By	Pittwater Council	Determination Date	26-03-15		
Class of Building	10a	Value of Work	$45,000.00		
OWNER BUILDER DETAILS					
Name	Anne Olding				
Address	47 Mirrabooka Street, Bilgola NSW 2016				
Contact Number	0412 272 699	O/B Permit No.			
PRINCIPAL CERTIFYING AUTHORITY					
Certifying Authority	Craig Formosa	ABN	76 134 030 710		
Accredited Certifier	Craig Formosa	Accreditation No.	BPB0124		
Address	PO Box 1824, Dee Why NSW 2099	Contact Number	0432 097 545		

MANDATORY CRITICAL STAGE INSPECTIONS: Class 1 & 10 Buildings	
Site inspection prior to issue of Construction Certificate	30/04/15
Footings/piers (prior to pouring)	YES
Slab Steel- (prior to pouring)	YES
Frame- floor (prior to lining)	YES
Frame-wall/roof (prior to lining)	YES
Stormwater drainage (prior to backfilling)	YES
Final inspection – issue of Occupation Certificate	YES
PCA to state any additional inspections: NO	

COMPLIANCE WITH DEVELOPMENT CONSENT/COMPLYING DEVELOPMENT CERTIFICATE		
Have all conditions required to be satisfied prior to commencement of work, been met? *(Conditions may include payment of security, S94 contributions, endorsement of building work plans by water supply authority)*	YES	☒
	NO	☐
Signed	Date	12/05/15

IMPORTANT ADVICE

Due to changes in planning laws, (Sect. S81A (2)C of the Act),**the critical stage inspections are mandatory and must** be inspected by the P.C.A or the final certificate (Occupation Certificate) may not be able to be issued (causing complications and delays when selling/refinancing etc). **The critical stage inspections are listed on the Notice of Commencement part of this document.**

Also, **NO CHANGES** to the building, as detailed in the plans, can be made without notification to your PCA (**some changes will need council consent**). **Please take note of any changes made in red to your plans, the builder will have to be provided with a copy of the approved construction certificate plans so that compliance with the Building Code of Australia and Council's DA conditions is achieved first time.**

Unauthorised changes may lead to fines and orders being issued by Council's Compliance Officers and prevent an Occupation Certificate being issued.

To arrange the mandatory inspections please give 48 hours notice by contacting Form Building Certifiers by telephone.

Please do not hesitate to ring me if there are any enquiries in respect of these matters.

Kind regards

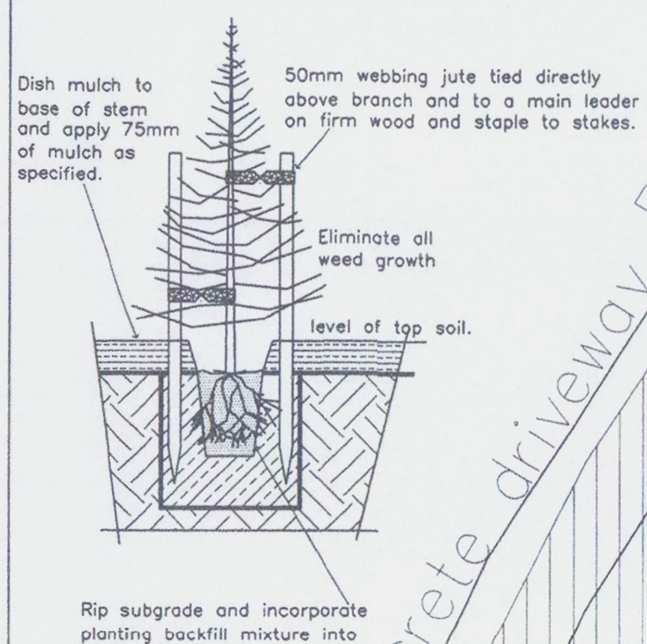
Craig Formosa
Director
Form Building Certifiers

PROPOSED LANDSCAPE SCHEDULE.

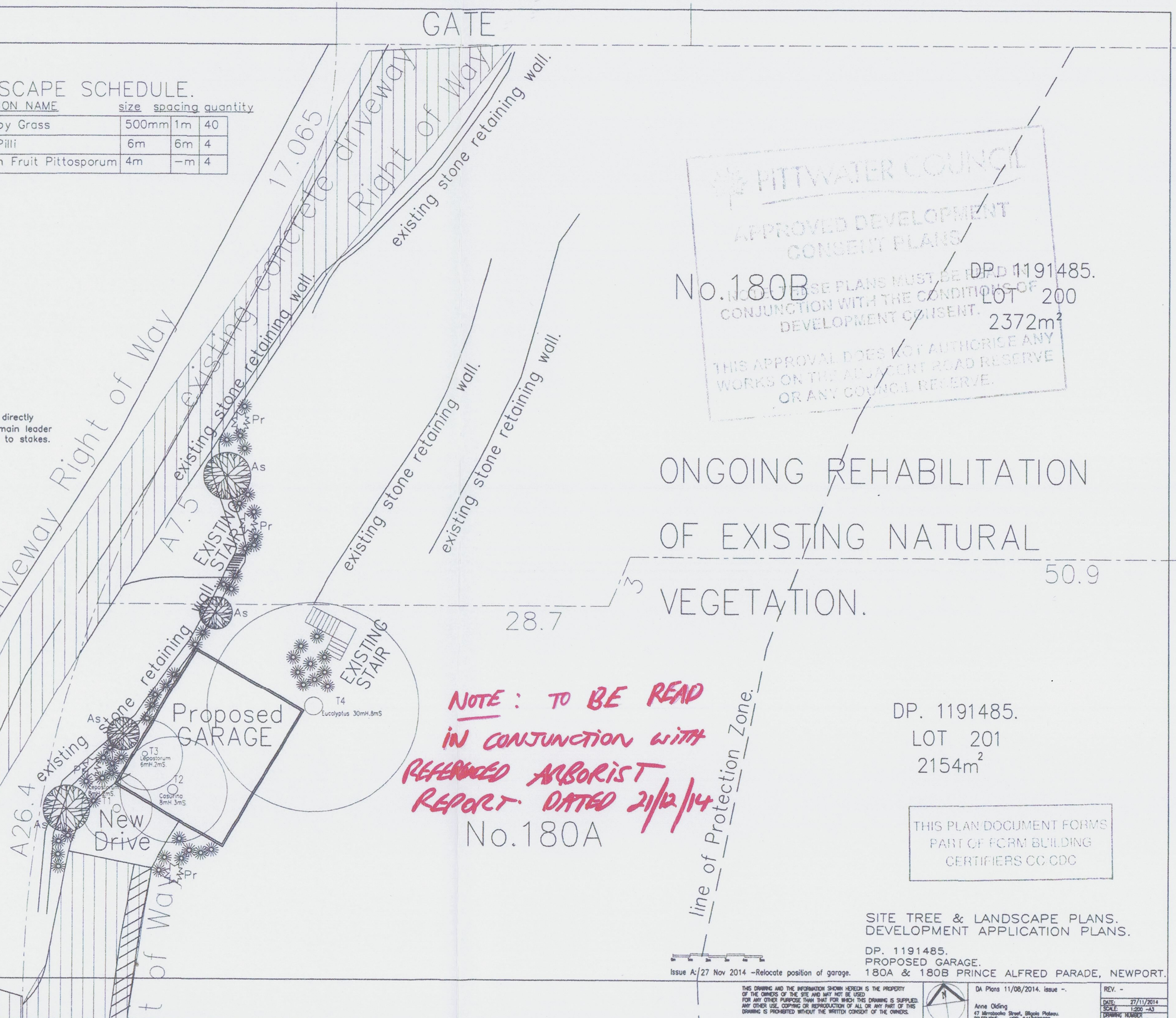
Symbol	BOTAINCAL NAME	COMMON NAME	size	spacing	quantity
D	Danthonia species	Wallaby Grass	500mm	1m	40
As	Acmena smithii	Lilly Pilli	6m	6m	4
Pr	Pittosporum revolutum	Rough Fruit Pittosporum	4m	—m	4

Trees for removal.

Tree No	Height.	Spread.	Name
T1	8mH.	2mS.	Lepostorum
T2	8mH.	3mS.	Casurina
T3	6mH.	2mS.	Lepostorum
T4	30mH.	8mS	Eucalyptus gummifera



Planting Detail.



NOTE: TO BE READ IN CONJUNCTION WITH REFERENCED ARBORIST REPORT. DATED 21/12/14

THIS PLAN DOCUMENT FORMS PART OF FCRM BUILDING CERTIFIERS CC CDC

SITE TREE & LANDSCAPE PLANS.
DEVELOPMENT APPLICATION PLANS.

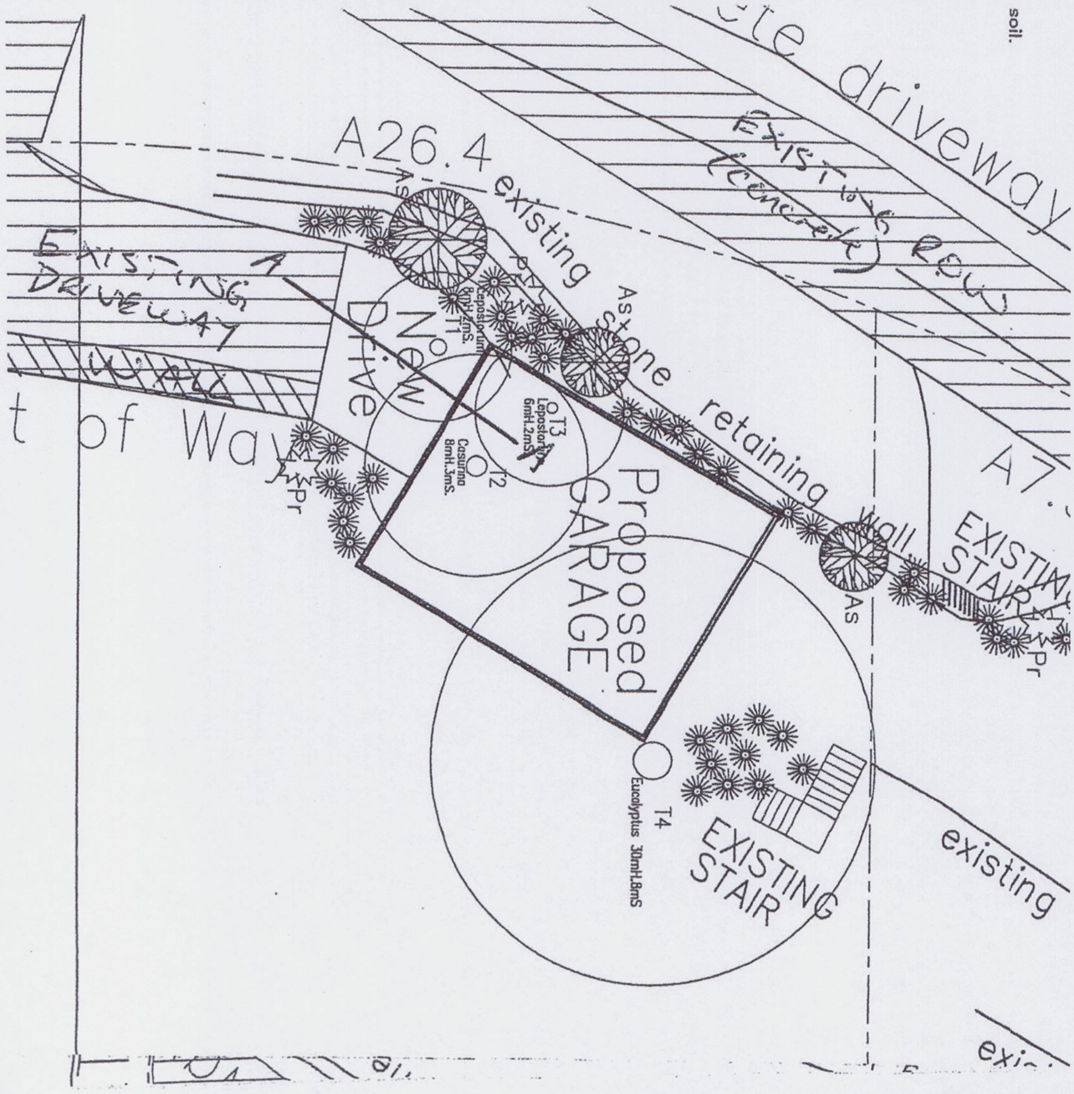
DP. 1191485.
PROPOSED GARAGE.
180A & 180B PRINCE ALFRED PARADE, NEWPORT.

Issue A/27 Nov 2014 –Relocate position of garage.

DA Plans 11/08/2014. Issue –.

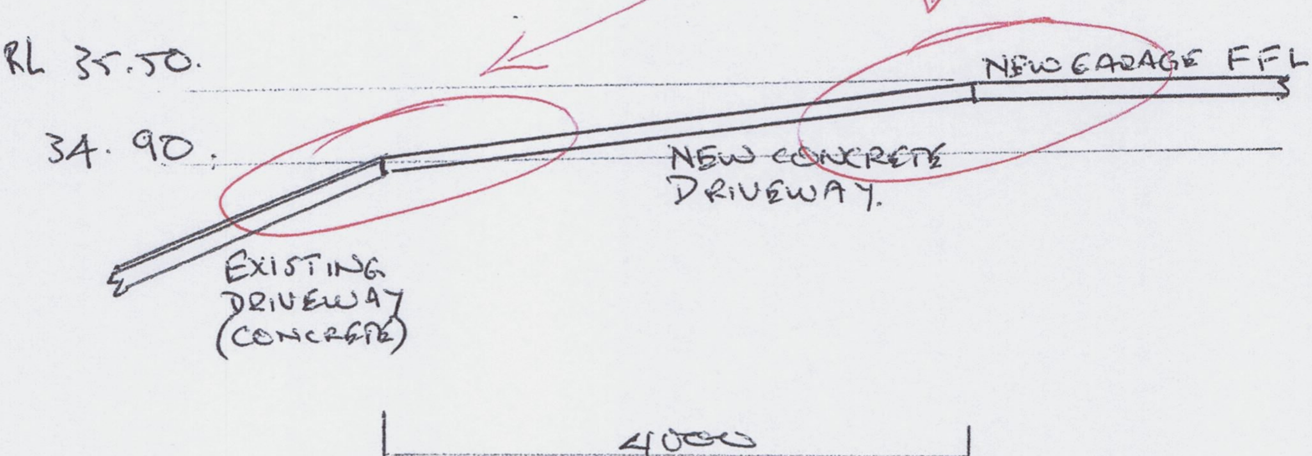
Anne Olding
47 Mirrabooka Street, Bilgola Plateau.
TELEPHONE: . MOB: 0412272899

REV. –
DATE: 27/11/2014
SCALE: 1:200 –A3
DRAWING NUMBER
2014OLDING–DA04A



MAXIMUM TRANSITION GRADIENTS 1:10 for 1·5 metres (minimum)

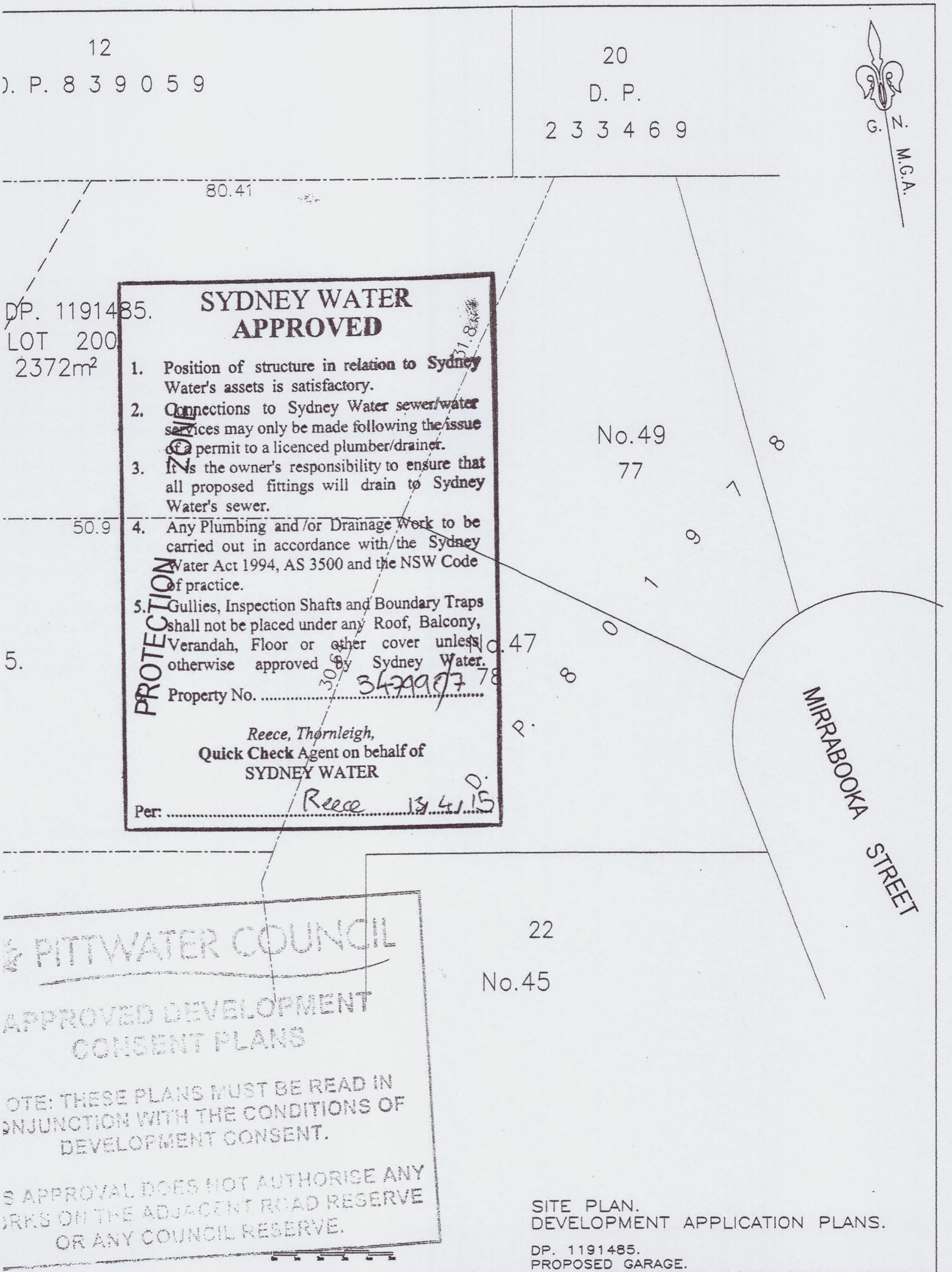
SECTION A - A.



7.4.2015

PROPOSED GARAGE AT 180A PRINCE ALFRED PDE NEWPORT. S&A OLDING. CC DWG. DRIVEWAY GRADIENT.

THIS PLAN/DOCUMENT FORMS PART OF FORM BUILDING CERTIFIERS CC/CDC



SYDNEY WATER APPROVED

1. Position of structure in relation to Sydney Water's assets is satisfactory.
2. Connections to Sydney Water sewer/water services may only be made following the issue of a permit to a licenced plumber/drainer.
3. It is the owner's responsibility to ensure that all proposed fittings will drain to Sydney Water's sewer.
4. Any Plumbing and /or Drainage Work to be carried out in accordance with the Sydney Water Act 1994, AS 3500 and the NSW Code of practice.
5. Gullies, Inspection Shafts and Boundary Traps shall not be placed under any Roof, Balcony, Verandah, Floor or other cover unless otherwise approved by Sydney Water.

Property No. 3479917

Reece, Thornleigh,
Quick Check Agent on behalf of
SYDNEY WATER

Per: Reece 13.4.15

PITTWATER COUNCIL

APPROVED DEVELOPMENT CONSENT PLANS

NOTE: THESE PLANS MUST BE READ IN CONJUNCTION WITH THE CONDITIONS OF DEVELOPMENT CONSENT.

THIS APPROVAL DOES NOT AUTHORISE ANY WORKS ON THE ADJACENT ROAD RESERVE OR ANY COUNCIL RESERVE.

SITE PLAN.
DEVELOPMENT APPLICATION PLANS.

DP. 1191485.
PROPOSED GARAGE.
180A & 180B PRINCE ALFRED PARADE, NEWPORT.

Issue A: 27 Nov 2014 –Relocate position of garage.

DA Plans 11/08/2014. issue –.

Anne Olding
47 Mirrabooka Street, Bilgola Plateau.
TELEPHONE: . MOB: 0412272699

REV. –
DATE: 27/11/2014
SCALE: 1:400 –A3
DRAWING NUMBER
2014OLDING–DA01A

Levy Online Payment Receipt
Building and Construction

Long Service Corporation

ANNE OLDING
PO BOX 375
WAHROONGA NSW 2076

Application Details:

Applicant Name:	**ANNE OLDING**
Levy Number:	**5091116**
Application Type:	**DA**
Application Number:	**NO289-2014**
Approving Authority:	**PITTWATER COUNCIL**

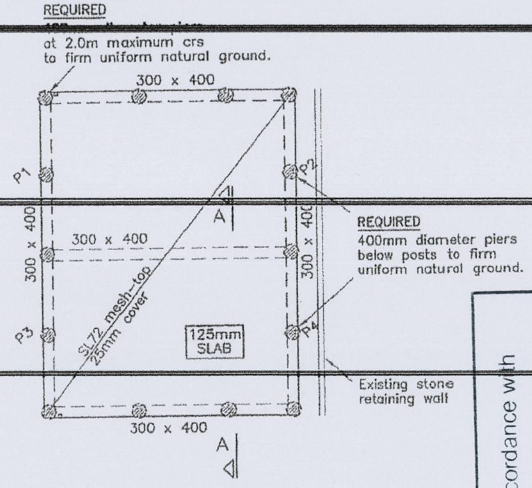
Work Details:

Site Address:	**PRINCE ALFRED PDE NEWPORT NSW 2106**
Value of work:	**$45,000**
Levy Due:	**$157.00**

Payment Details:

LSC Receipt Number:	**196996**
Payment Date:	**13/04/2015 2:24:11 PM**
Bank Payment Reference:	**797861726**
Levy Paid:	**$157.00**
Credit card surcharge:	**$0.63**
Total Payment Received:	**$157.63**

THIS PLAN/DOCUMENT FORMS
PART OF FORM BUILDING
CERTIFIERS CC/CDC



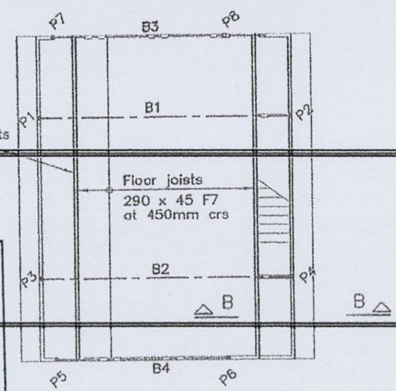
PLAN – FOUNDATION SLABS

Overlap fabric one whole uncut wire panel plus 25mm minimum at splices.

Slab edge beams to bear directly onto firm uniform natural ground or be supported by 400mm diameter piers at 2.0m max centres. Edge beams and piers to be excavated to an allowable bearing capacity of at least 300KPa.

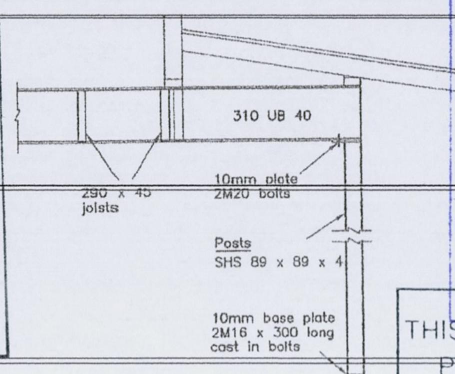
If rock is encountered in trenches or pier holes the entire edge beam must be piered to it but the diameter of the piers may be

NOTE:
Location of Sydney Water's sewer main, sewer connection lines, water pipes, stormwater drains, underground electricity lines and other services must be obtained prior to commencement of any work on site.
DIAL BEFORE YOU DIG 1100

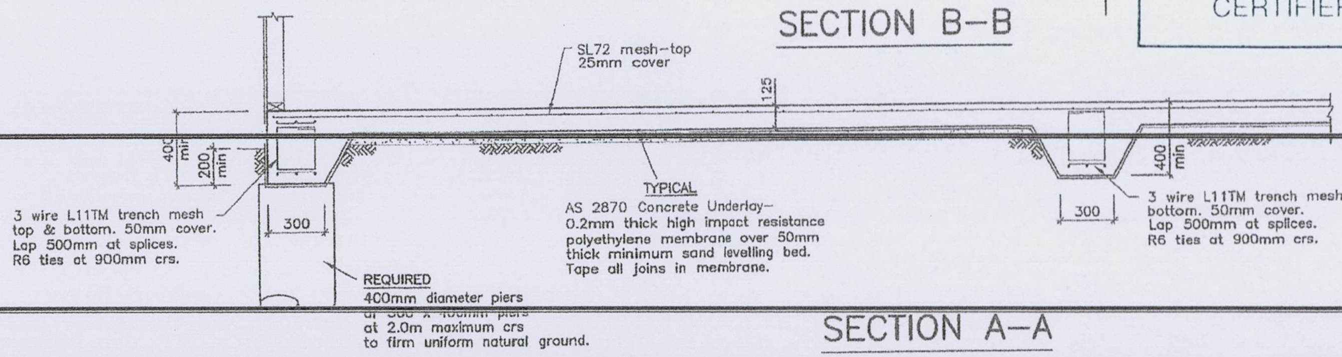


PLAN – FIRST FLOOR FRAMING

I certify that work completed in accordance with these plans and specifications will comply with the regulations referred to in Section 81A(5) of the Environment Planning and Assessment Act 1979



SECTION B–B



SECTION A–A

SCHEDULE OF MEMBERS

Beams

B1, B2 ..... 310 UB 40
B3, B4 ..... Double 290 x 42 LVLs

Posts

P1 to P8 ..... 89 x 89 x 4.0 SHS

This is the plan/spec. referred to in Form Building Certifiers Certificate
Certificate No. 2015 - 118
Plan Nos. DWG 101800-1
Craig Formosa BPB0124 DATED

THIS PLAN/DOCUMENT FORMS PART OF FORM BUILDING CERTIFIERS CC/CDC

NOTES:

1. This drawing is to be read in conjunction with the Architectural drawing and specifications.
2. Workmanship and materials to comply with AS3600 and associated Australian Standards.
3. Concrete properties:

	PIERS	SLABS
Characteristic Strength	20MPa	25MPa
Slump	100mm	80mm
Maximum Aggregate Size	20mm	20mm

4. Concrete slabs to be mechanically vibrated during placing.
5. Cure concrete by keeping constantly damp for at least 5 days after placing.
6. Reinforcement to be supported on bar chairs spaced at every 5th wire in both directions.
7. Maximum depth of filling to be 900mm.
8. Filling to be thoroughly compacted in shallow layers by multiple passes of earth moving equipment.
9. Grade finished ground surface to divert water away from slab and to prevent ponding.
10. Termite protection to be in accordance with AS3660.1–1995 and Council's requirements.
11. Construction requirements and site maintenance outlined in AS2870–1996 are to be followed. Performance expectations set out in AS2870–1996 Appendix B are acceptable. Refer also to CSIRO Information Sheet 10–91 "Guide to house owners on foundation maintenance and footing performance".

The slab shown on this drawing has been designed for a class "M" site in accordance with the requirements of AS2870 & AS3600 and if constructed in accordance with the details shown will be structurally adequate for a single storey clad framed garage on this site.

STRUCTURAL STEELWORK NOTES:

1. Steelwork is to be thoroughly cleaned of dirt, grease and rust. Cleaned surfaces above ground to be given at least one coat of primer followed by two coats of approved enamel on exposed surfaces.

   All paintwork including shop priming damaged during transport and erection to be made good after recleaning steel surfaces.
2. The contractor shall provide all cleats and drill all holes for fixing steel to steel and timber to steel as required whether or not detailed on the structural drawings.

REINFORCING STEEL

Rebar

'N' indicates 500N grade reinforcing steel
'L' indicates grade 500MPa low ductility steel in accordance with AS4671. All reinforcing bars to be 'D' shape (deformed rib) unless noted otherwise.

Number following 'N' & 'L' is the bar diameter in millimetres.

Example: N16 bar is 16mm diameter deformed bar, 500N grade steel.

Mesh

All mesh to be of deformed ribbed bar, grade 500N MPa low ductility steel in accordance with AS/NZS 4671.
"S" indicates square configuration.

Issue	Date	App'd	DESCRIPTION

REVISIONS

KNEEBONE, BERETTA & HALL PTY LTD
CONSULTING STRUCTURAL & CIVIL ENGINEERS
A.C.N 002 419 797 A.B.N 38 622 442 293
4 MACQUARIE AVENUE, PENRITH NSW 2750
PHONE: (02) 4731 3833 FACSIMILE: (02) 4721 6442
WEBSITE: www.kneeboneandberetta.com
E-MAIL ADDRESS: kneebone@pnc.com.au
Directors:
Trevor B HALL BSc (Eng) FIE Aust, CP Eng
Peter R. ANDRESEN, BE, MIE Aust, CP Eng
Member of: CONSULT AUSTRALIA

SCALE	1:100,1:20
DATE	13.04.15
DRAWN	C Liu
DESIGNED	TB HALL
APPROVED	

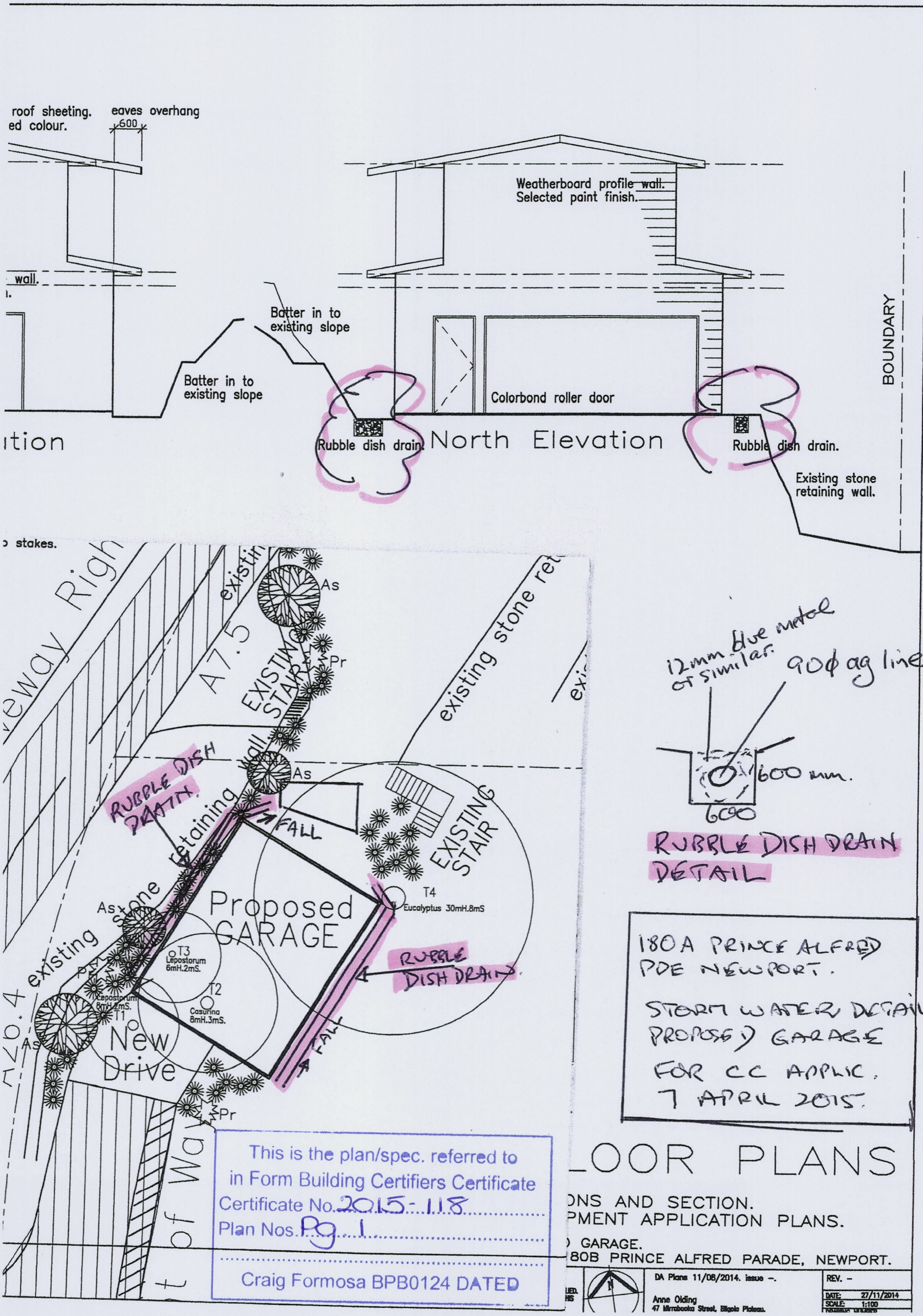
CLIENT: SIMON OLDING

PROPOSED GARAGE AT
180A & 180B PRINCE ALFRED PARADE
NEWPORT

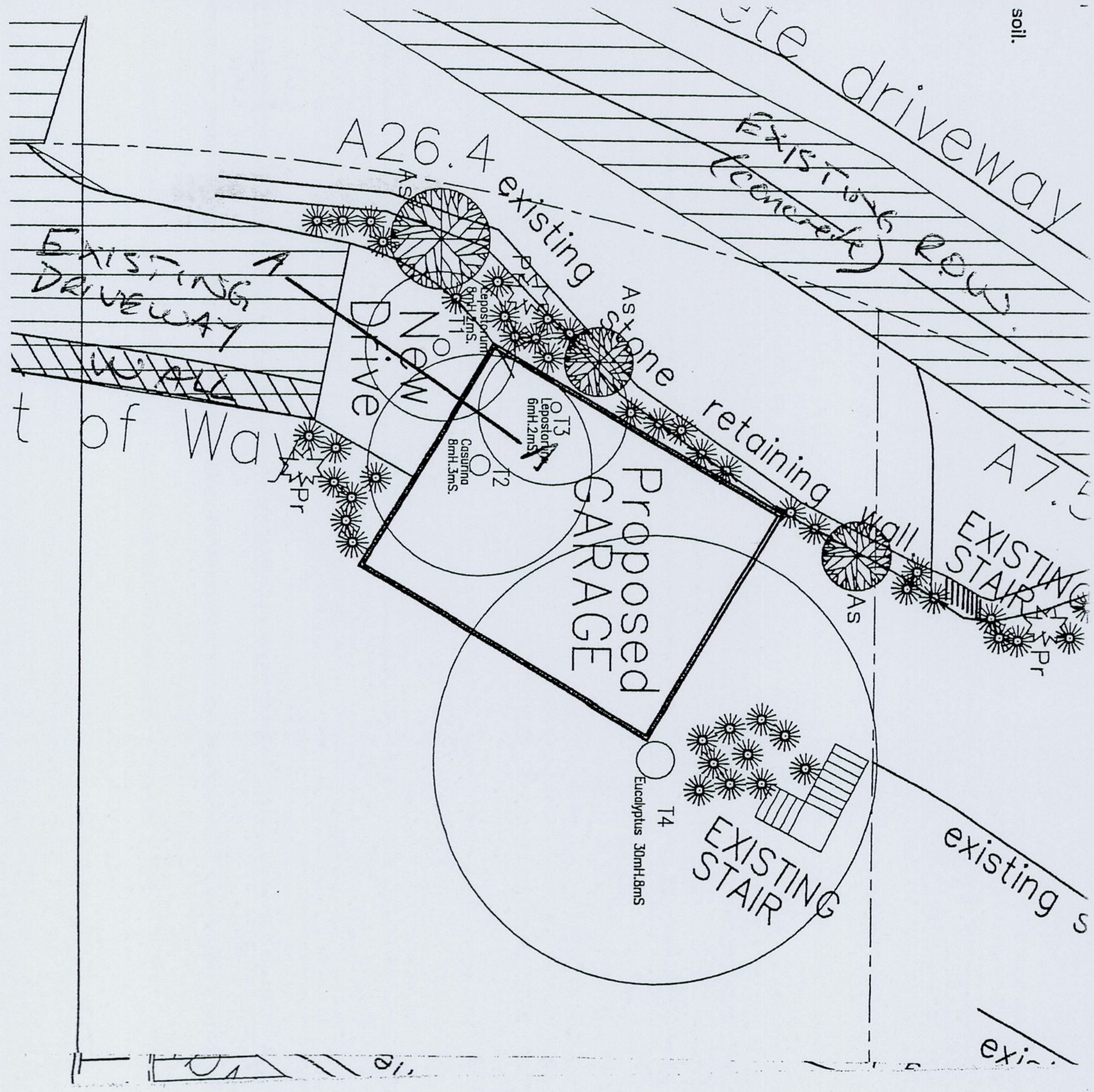
FOUNDATION SLAB AND FRAMING DETAILS

DRAWING NUMBER 101800-1

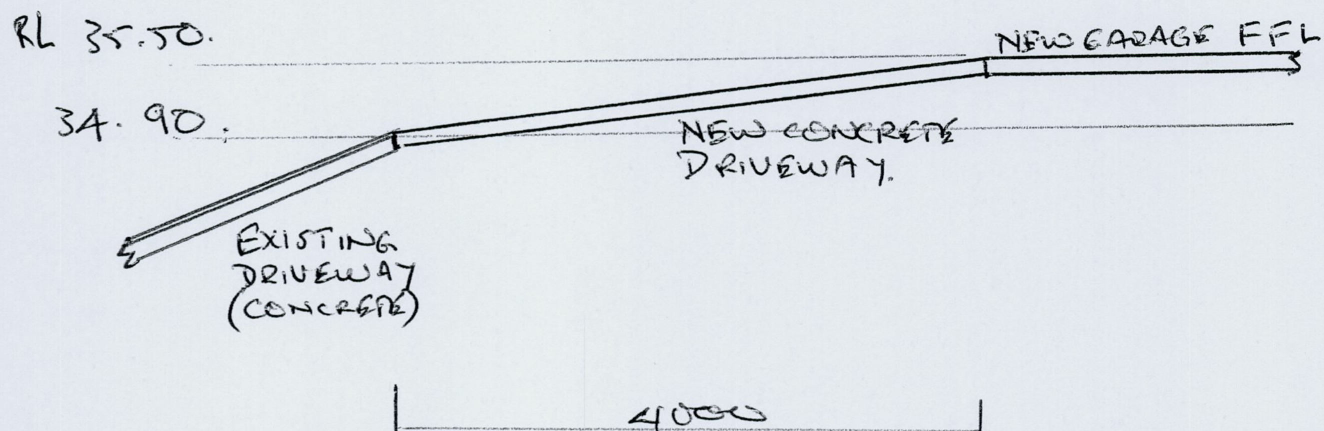
ISSUE



This is the plan/spec. referred to
in Form Building Certifiers Certificate
Certificate No. 2015-118
Plan Nos. Pg. 1
Craig Formosa BPB0124 DATED



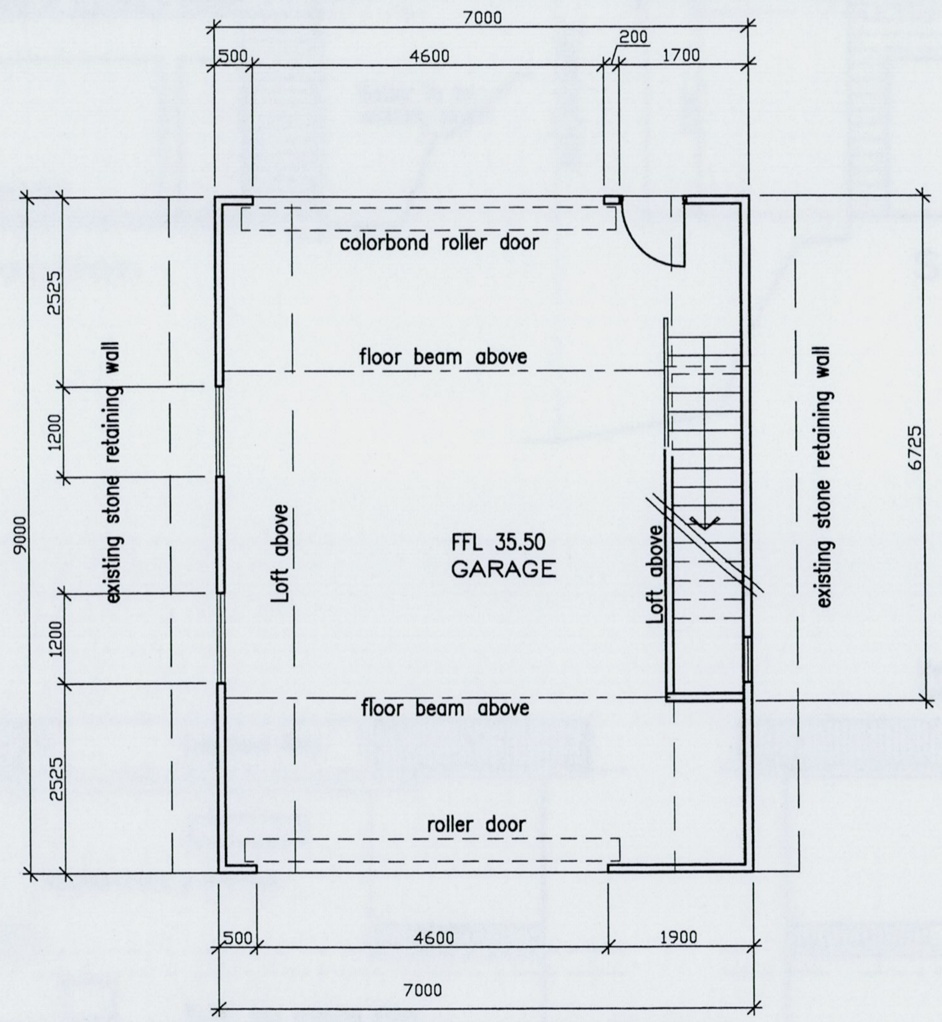
SECTION A - A.



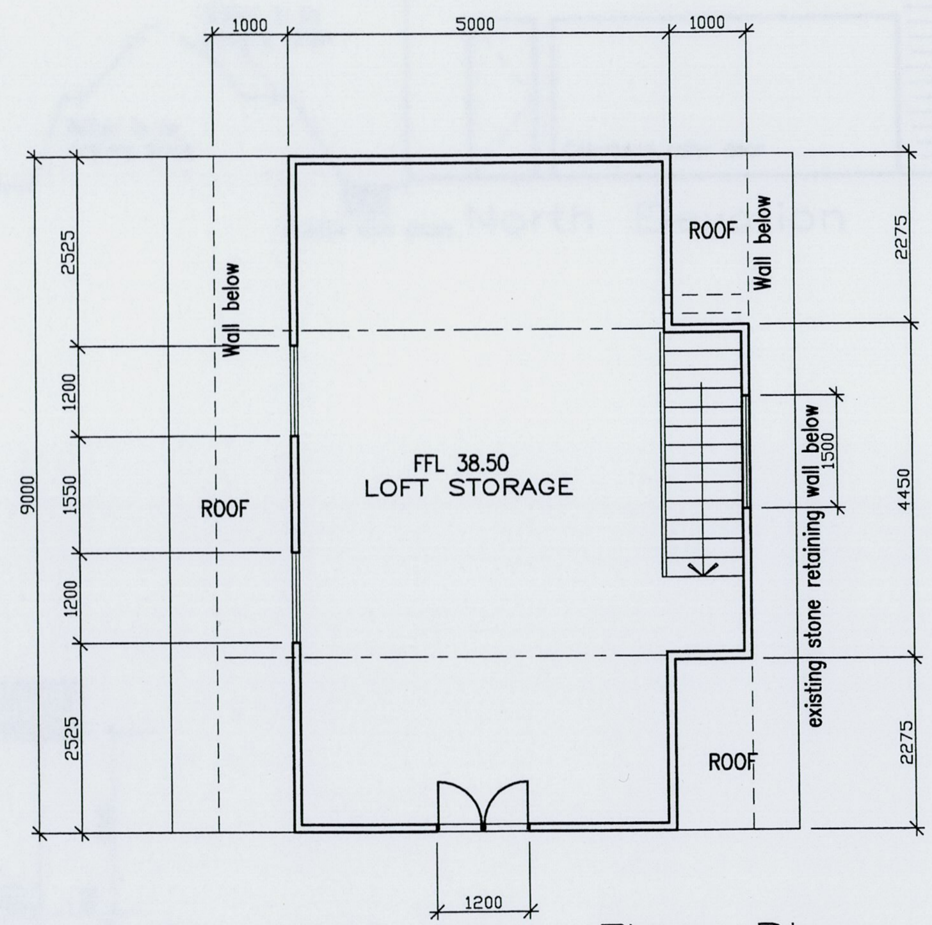
THIS PLAN/DOCUMENT FORMS PART OF FORM BUILDING CERTIFIERS CC/CDC

7.4.2015

PROPOSED GARAGE AT 180A PRINCE ALFRED PDE NEWPORT. S&A OLDING CC DWG. DRIVEWAY GRADIENT.



Proposed Ground Floor Plan



Proposed Upper Floor Plan

I certify that work completed in accordance with these plans and specifications will comply with the regulations referred to in Section 81A(5) of the Environment Planning and Assessment Act 1979

This is the plan/spec. referred to in Form Building Certifiers Certificate
Certificate No. 2015-118
Plan Nos. DA02A & DA03A
Craig Formosa BPB0124 DATED

PROPOSED FLOOR PLANS

0m 1m 2m 3m 4m 5m

Issue A: 27 Nov 2014 –Relocate position of garage.

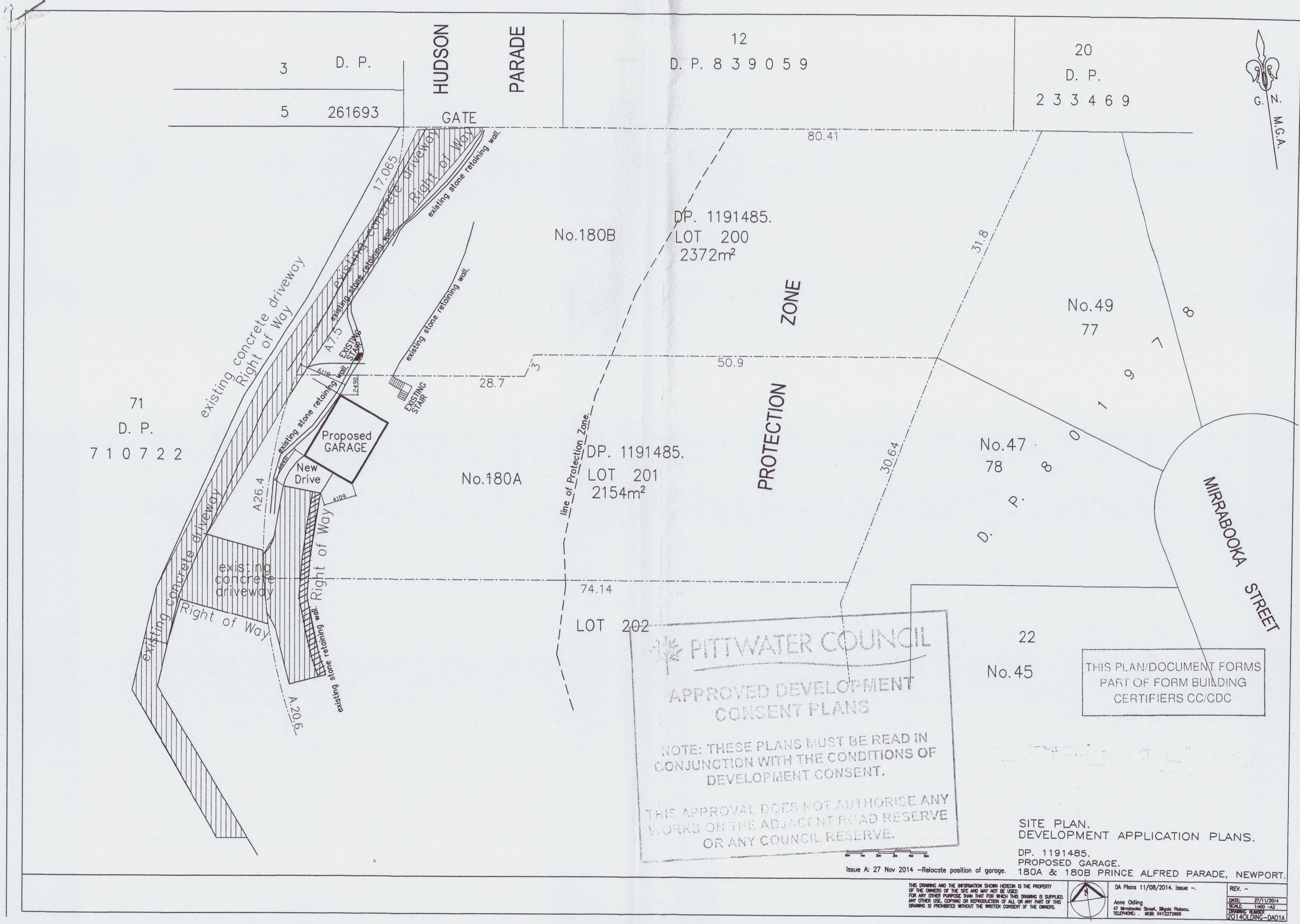
PLANS
DEVELOPMENT APPLICATION PLANS.
PROPOSED GARAGE.
180A & 180B PRINCE ALFRED PARADE, NEWPORT.

N

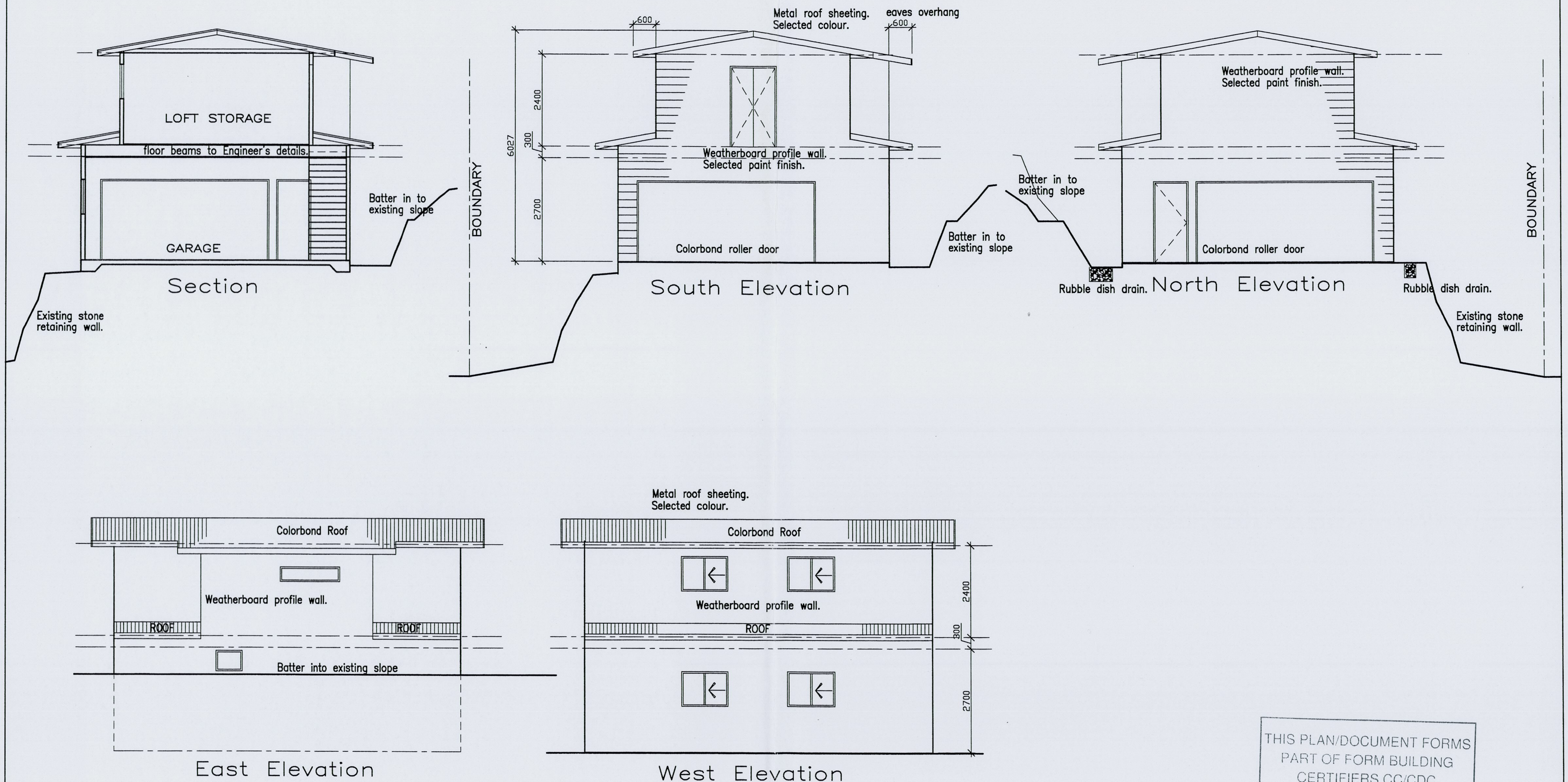
DA Plans 11/08/2014. issue –.

Anne Olding
47 Mirrabooka Street, Bilgola Plateau.
TELEPHONE: . MOB: 0412272699

REV.–A
DATE: 27/11/2014
SCALE: 1:100
DRAWING NUMBER 2014OLDING–DA02A



G. N.
M.G.A.
3
D. P.
5
261693
HUDSON
PARADE
GATE
12
D. P. 8 3 9 0 5 9
20
D. P.
2 3 3 4 6 9
80.41
17.065
existing concrete driveway
Right of Way
existing stone retaining wall.
No.180B
DP. 1191485.
LOT 200
2372m²
ZONE
PROTECTION
31.8
No.49
77
8 7 9 1 0 8
D. P.
A7.5
EXISTING STAIR
50.9
28.7
3
71
D. P.
7 1 0 7 2 2
Proposed GARAGE
New Drive
A26.4
No.180A
line of Protection Zone.
DP. 1191485.
LOT 201
2154m²
30.64
No.47
78
MIRRABOOKA STREET
existing concrete driveway
74.14
LOT 202
A.20.6
22
No.45
PITTWATER COUNCIL
APPROVED DEVELOPMENT
CONSENT PLANS
NOTE: THESE PLANS MUST BE READ IN
CONJUNCTION WITH THE CONDITIONS OF
DEVELOPMENT CONSENT.
THIS APPROVAL DOES NOT AUTHORISE ANY
WORKS ON THE ADJACENT ROAD RESERVE
OR ANY COUNCIL RESERVE.
THIS PLAN/DOCUMENT FORMS
PART OF FORM BUILDING
CERTIFIERS CC/CDC
SITE PLAN.
DEVELOPMENT APPLICATION PLANS.
DP. 1191485.
PROPOSED GARAGE.
180A & 180B PRINCE ALFRED PARADE, NEWPORT.
Issue A: 27 Nov 2014 –Relocate position of garage.
THIS DRAWING AND THE INFORMATION SHOWN HEREON IS THE PROPERTY OF THE OWNERS OF THE SITE AND MAY NOT BE USED FOR ANY OTHER PURPOSE THAN THAT FOR WHICH THIS DRAWING IS SUPPLIED. ANY OTHER USE, COPYING OR REPRODUCTION OF ALL OR ANY PART OF THIS DRAWING IS PROHIBITED WITHOUT THE WRITTEN CONSENT OF THE OWNERS.
DA Plans 11/08/2014. issue –.
Anne Olding
47 Mirrabooka Street, Bilgola Plateau.
TELEPHONE: . MOB: 0412272699
REV. –
DATE: 27/11/2014
SCALE: 1:400 –A3
DRAWING NUMBER
2014OLDING–DA01A



THIS PLAN/DOCUMENT FORMS PART OF FORM BUILDING CERTIFIERS CC/CDC

PROPOSED FLOOR PLANS

0m 1m 2m 3m 4m 5m

ELEVATIONS AND SECTION.
DEVELOPMENT APPLICATION PLANS.

Issue A: 27 Nov 2014 –Relocate position of garage.

PROPOSED GARAGE.
180A & 180B PRINCE ALFRED PARADE, NEWPORT.

DA Plans 11/08/2014. issue –.

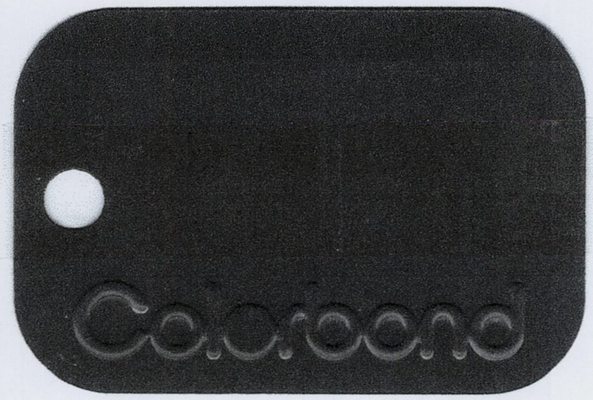
Anne Olding
47 Mirrabooka Street, Bilgola Plateau.
TELEPHONE: . MOB: 0412272899

REV. –	
DATE:	27/11/2014
SCALE:	1:100
DRAWING NUMBER	2014OLDING–DA03A

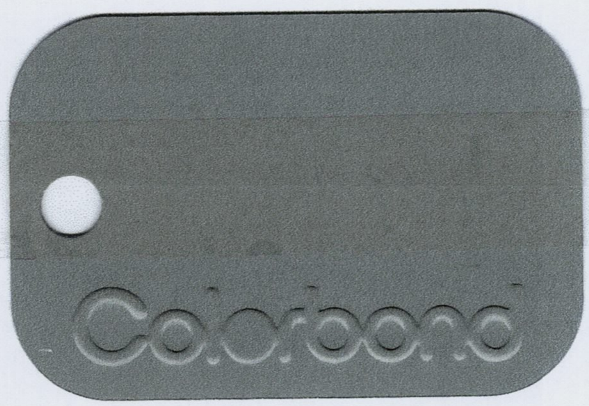
Revised colours and finishes. **7 April 2015 FOR CC**
180A Prince Alfred Parade, Newport

Schedule:
Walls – hardi-plank primed weather board - Windspray (mid grey); painted low sheen acrylic
Roof – colorbond steel, corrugated profile – Woodland Grey (dark grey/brown)
Windows – aluminium framed - Woodland Grey (dark grey/brown); powder coated
Doors - Woodland Grey (dark grey/brown); painted low sheen enamel

Colorbond Woodland Grey (dark grey/brown)



Colorbond Windspray (mid grey)



THIS PLAN/DOCUMENT FORMS
PART OF FORM BUILDING
CERTIFIERS CC/CDC

THIS PLAN/DOCUMENT FORMS
PART OF FORM BUILDING
CERTIFIERS CC/CDC

NSW GOVERNMENT | Fair Trading

Tel 13 32 20
TTY 02 9338 4943
ABN 81 913 830 179
www.fairtrading.nsw.gov.au

OWNER BUILDER PERMIT

HOME BUILDING ACT 1989

Anne Olding
47 Mirrabooka St
BILGOLA PLATEAU NSW 2107

Permit: 420625P
Issued: 01/05/2015

Receipt: 10000284037-01
Amount: $168.00

BUILDING SITE: 180a Prince Alfred Pde, NEWPORT, NSW 2106
AUSTRALIA

AUTHORISED BUILDING WORK Construction of a new garage/shed structure and associated driveway.

AUTHORITY NUMBER: DA-no289-2014

COUNCIL AREA: PITTWATER (S) COUNCIL

PERSONS WITH A PRESCRIBED INTEREST IN THE LAND:

Rod Stowe
Commissioner for Fair Trading

Issuing officer

CAUTION: AS THE HOLDER OF AN OWNER-BUILDER PERMIT YOU MUST NOW ADVISE YOUR CERTIFYING AUTHORITY (COUNCIL OR PRIVATE CERTIFIER) OF YOUR OWNER-BUILDER PERMIT NUMBER AND DATE OF ISSUE.

This permit is only valid when an official receipt has been imprinted.
If payment is made by cheque, the permit is conditional on the cheque being met on presentation.
*GST amount included in total fee: $0.00

PERMIT CONDITIONS

Network Geotechnics

Report

Geotechnical Assessment

Proposed Garage, 180A and 180B Prince Alfred Parade, Newport, NSW

Prepared for:

Simon Olding

PO Box 375
WAHROONGA NSW 2076

Prepared by:

Network Geotechnics Pty Ltd

6 January 2015

Ref: G09/1593-A

Network Geotechnics Pty Ltd

Mt Kuring-Gai
12/9-15 Gundah Road
Mt Kuring-Gai NSW 2080
T: +61 2 8438 0300
F: +61 2 8438 0310

Wollongong
1/140 Industrial Road
Oak Flats NSW 2529
T: +61 2 4257 4458
F: +61 2 4257 4463

E: admin@netgeo.com.au
W: www.netgeo.com.au
ABN: 35 069 211 561

Document Status

Rev No.	Version	Author	Reviewer	Approved for Issue		
				Name	Signature	Date
0	Final	V de Silva	V De Silva	V De Silva	[signature]	06.01.2015

Document Distribution

Rev No.	Copies	Format	Issued to	Date
0	1	Electronic	Simon Olding	06.01.2015

Document delivery

NG provides this document in either printed format, electronic format or both. The electronic format is provided for the client's convenience and NG requests that the client ensures the integrity of this electronic information is maintained.

Where an electronic only version is provided to the client, a signed hard copy of this document is held on file by NG and a copy will be provided if requested.

Table of Contents

Appendices

1.0 Introduction

As requested, Network Geotechnics Pty Ltd (NG) have carried out a limited geotechnical walk over assessment in order to provide recommendations on footing design for a proposed garage at 180A and 180B Prince Alfred Parade Newport.

It is understood that a garage is proposed within an approved building envelope. The site has been a subject of geotechnical assessment by others to assess the risk of slope instability for a proposed four lot subdivision. It is understood that the site has been subjected to stabilisation measures to reduce the risk of rock fall hazards and land slips.

The proposed garage is to be located adjoining the crest of a sandstone boulder retaining wall about 1.5m high. Building footprint for the proposed garage would involve minor cut up to about 1.5m at the north east corner and some filling.

2.0 Fieldwork

Fieldwork included a walk over assessment by the Director/ Principal Geotechnical Engineer during which site features were noted. The inspection was carried out with the owner of the site.

3.0 Surface and Subsurface

The site is located on a west facing 15° slope and has been investigated by GHD-Longmac over a number of years in relation to a four lot subdivision.

The information available from Pittwater Council Development Application Portal indicates the site has been assessed to contain colluvial soils overlying sandstone bedrock. Geotechnical constraints affecting the site have been identified as rock falls and soil creep. The documents available indicated that the site has been remediated by construction of a series of retaining walls to address stability concerns and further risk of landslide has been assessed as Low.

4.0 Discussion and Recommendations

Based on the site conditions and the geotechnical constraints affecting the site the following recommendations are made:

- The proposed garage is located within the zone of influence of the retaining wall located on the low side. We recommend that the building loads be supported by piers taken below the base of the retaining wall in order not to exert additional load on the wall.
- Garage walls adjoining the excavation should be constructed as a retaining wall to resist earth pressure based on coefficient of earth pressure at rest of 0.65 for sloping site.

- We recommend that excavations deeper than 1.0m be provided with lateral support prior to excavation by constructing 450mm diameter reinforced concrete piers at 1.5m centres taken down to minimum 2m below the excavation level or 600mm embedded in rock whichever is shallower. Reinforcement detailing should be designed by a structural engineer to resist bending stresses caused by earth pressure of overburden soils assuming a coefficient of earth pressure of 0.45 for sloping land.
- Due to the assessed risk of slope instability identified in previous geotechnical assessments and following recommendations made by others for excavations for retaining wall construction we recommend that excavations up to about 1.0m height be battered to 1H: 1V. The excavation should be fully supported by the garage block wall without delay
- The ground slab should be designed based on soil reactivity similar to Class M site in accordance with AS2870-2011.
- All surface water should be directed away from the excavation during and after construction.
- Subsoil drains should be provided behind the retaining wall.
- The allowable end bearing pressure for piers in colluvial clay and weathered rock may be taken as 300kPa and 1000kPa for the design of piers.
- The excavation should be inspected by a geotechnical consultant during construction in order to assess the adequacy of the design.
- All piers also should be inspected by a geotechnical/ structural professional before concreting

5.0 Limitations

This report has been prepared for Simon Olding in accordance with verbal instructions and email thread during December 2014.

The report is provided for the exclusive use Simon Olding for the specific development and purpose as described in the report. The report may not contain sufficient information for developments or purposes other than that described in the report or for parties other than Simon Olding.

The information in this report is considered accurate at the date of issue with regard to the current conditions of the site. The conclusions drawn in the report are based on interpolation between boreholes or test pits. Conditions can vary between test locations that cannot be explicitly defined or inferred by investigation.

The report, or sections of the report, should not be used as part of a specification for a project, without review and agreement by NG, as the report has been written as advice and opinion rather than instructions for construction.

The report must be read in conjunction with the attached Information Sheets and any other explanatory notes and should be kept in its entirety without separation of individual pages or sections. NG cannot be held responsible for interpretations or conclusions from review by others of this report or test data, which are not otherwise supported by an expressed statement, interpretation, outcome or conclusion stated in this report. In preparing the report NG has necessarily relied upon information provided by the client and/or their agents.

Network Geotechnics Pty Ltd

Appendix A

Information Sheets

General Notes About This Report

Network Geotechnics

INTRODUCTION

These notes have been prepared by Network Geotechnics Pty Ltd (NG) to help our Clients interpret and understand the limitations of this report. Not all sections below are necessarily relevant to all reports.

SCOPE OF SERVICES

This report has been prepared in accordance with the scope of services set out in NG's proposal under NG's Terms of Engagement, or as otherwise agreed with the Client. The scope of work may have been limited by a range of factors including time, budget, access and/or site constraints.

RELIANCE ON DATA

In preparing the report NG has necessarily relied upon information provided by the Client and/or their Agents. Such data may include surveys, analyses, designs, maps and plans. NG has not verified the accuracy or completeness of the data except as stated in this report.

GEOTECHNICAL ENGINEERING

Geotechnical engineering relies on interpretation of factual information based on judgment and opinion and is far less exact than other engineering disciplines. Geotechnical engineering reports present the results of investigations carried out for a specific project and usually for a specific phase of the project (e.g. preliminary design). Therefore, this report may not be relevant for other phases of the project (e.g. construction), or where the project scope changes.

SUBSURFACE CONDITIONS

Subsurface conditions can change with time and can vary between test locations. The actual interface between the materials may be far more gradual or abrupt than indicated. Also, actual conditions in areas not sampled may differ from those predicted since no subsurface investigation, no matter how comprehensive, can reveal all subsurface details and anomalies.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations can also affect subsurface conditions and thus the continuing adequacy of a geotechnical report. NG should be kept informed of any such events and should be retained to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

GROUNDWATER

Groundwater levels indicated on borehole and test pit logs are recorded at specific times. Depending on ground permeability, measured levels may or may not reflect actual levels if measured over a longer time period. Also, groundwater levels and seepage inflows may fluctuate with seasonal and environmental variations and construction activities.

INTERPRETATION OF DATA

The discussion and recommendations in this report are based on extrapolation / interpolation from data obtained at the nominated discrete locations. Data derived from empirical and external data source review, sampling and subsequent laboratory testing are interpreted by trained professionals to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions.

SOIL AND ROCK DESCRIPTIONS

Soil and rock descriptions are based on AS 1726 – 1993, using visual and tactile assessment except at discrete locations where field and / or laboratory tests have been carried out. Refer to the accompanying soil and rock terms sheet for further information.

COPYRIGHT AND REPRODUCTION

The contents of this document are and remain the intellectual property of NG. This document should only be used for the purpose for which it was commissioned and should not be used for other projects or by a third party.

This report shall not be reproduced either totally or in part without the permission of NG. Where information from this report is to be included in contract documents or engineering specification for the project, the entire report should be included in order to minimise the likelihood of misinterpretation.

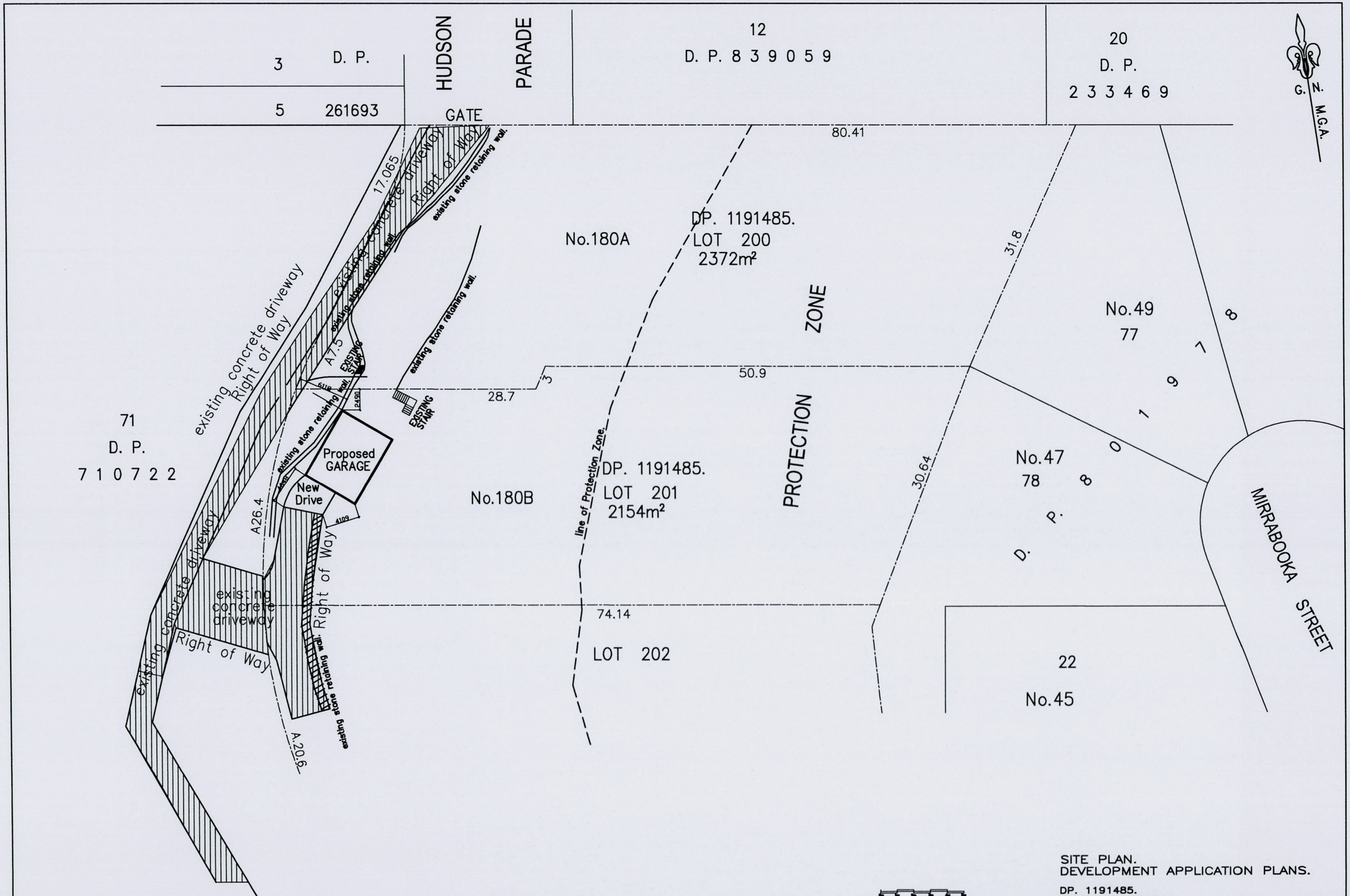
FURTHER ADVICE

NG would be pleased to further discuss how any of the above issues could affect a specific project. We would also be pleased to provide further advice or assistance including:

- Assessment of suitability of designs and construction techniques;
- Contract documentation and specification;
- Construction control testing (earthworks, pavement materials, concrete);
- Construction advice (foundation assessments, excavation support).

Appendix B

Site Plan



Issue A: 27 Nov 2014 –Relocate position of garage.

SITE PLAN.
DEVELOPMENT APPLICATION PLANS.

DP. 1191485.
PROPOSED GARAGE.
180A & 180B PRINCE ALFRED PARADE, NEWPORT.

DA Plans 11/08/2014. Issue –.

Anne Olding
47 Mirrabooka Street, Bilgola Plateau.
TELEPHONE: . MOB: 0412272000

REV. –
DATE: 27/11/2014
SCALE: 1:400 –A3
DRAWING NUMBER
2014OLDING–DA01A

Appendix C

Foundation Maintenance and Footing Performance

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
A	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).

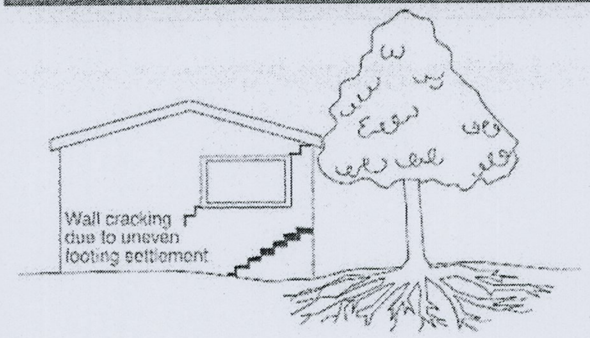
Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

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

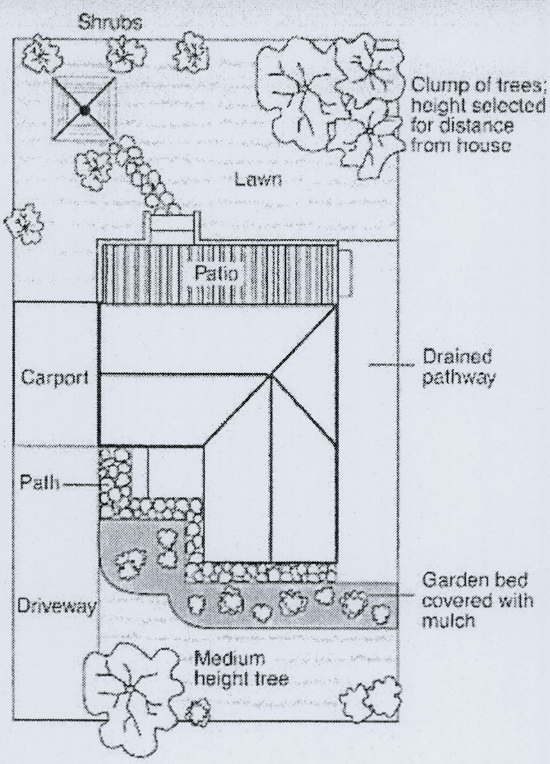
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

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

Gardens for a reactive site



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.

Distributed by

CSIRO PUBLISHING PO Box 1139, Collingwood 3066, Australia

Freecall 1800 645 051 Tel (03) 9662 7666 Fax (03) 9662 7555 www.publish.csiro.au

Email: publishing.sales@csiro.au

Arboricultural Impact Assessment Report

180A & 180B Prince Alfred Parade Newport NSW

Prepared for: Simon Olding

Prepared by: Jack Williams
Priority Tree Services
21 December 2014
Ref: 14/12/21/180APAPN

THIS PLAN/DOCUMENT FORMS
PART OF FORM BUILDING
CERTIFIERS CC/CDC

Table of Contents

1. SUMMARY

1.1 Twelve trees have been identified for removal, as they are located inside the building footprint or in poor condition. These include trees 1, 2, 3, 4, 6, 8, 9, 10, 11, 14, 16, 17.

1.2 Tree 5 has not been identified on the proposed site plans and I was unable to provide an assessment of the potential impact to the tree based on the information available. This tree must be accurately plotted for the construction impact to be assessed.

1.3 Tree 15 will have to be removed in the current development proposal. The tree will be subject to an unacceptable loss of root mass that will be detrimental to the condition of the tree and is likely cause the tree to be structurally unstable. If the tree is to be retained significant design modifications are required.

1.4 Tree 7, 12, and 13 can be retained in the development proposal with minimal impact to their condition. These trees must be protected during the development in accordance with the AMS (section 8.7).

2. INTRODUCTION

2.1 I have been instructed by Simon Olding to inspect seventeen trees located at the site and provide an arboricultural report in relation to a proposed development.

2.2 I have based this report on my site visit, observations, and the information provided. My conclusions and recommendations are based on my knowledge and experience, details of which are provided in appendix 3.

2.3 Below I have listed all documents and information provided to me by the client.

- Site plan, Unknown author, 2014OLDING-DA01A, 27 November 2014.
- Proposed floor plans, Unknown author, 2014OLDING-DA02A, 27 November 2014.
- Elevations & sections, Unknown author, 2014OLDING-DA03A, 27 November 2014.
- Site tree & landscape plans development application plans, Unknown author, 2014OLDING-DA04A, 27 November 2014.
- Site survey overlay, Craig and Rhodes, Ref: 1463, 21 November 2005.

2.4 I carried out one site inspection on 5 December 2014. The weather at the time of inspection was clear with average visibility.

3. SCOPE OF THE REPORT

3.1 This report has been undertaken to meet the following objectives.

2.1.1 Conduct a visual assessment of the subject trees.

2.1.2 Determine the trees estimated contribution years and remaining, useful life expectancy.

2.1.3 Award the trees a retention value.

2.1.4 Provide an assessment of the potential impact the proposed development may cause to the condition of the subject trees.

4. LIMITATIONS

4.1 My observations and recommendations are based on one site inspection. Access was available to the site and adjacent public road only. The findings of this report are based on the observations and site conditions at the time inspection.

4.2 All of my observations were carried out from ground level. I did not lift or remove any of the surrounding surfaces. I did not carry out any tests on the subject trees. I did not carryout any soil tests.

4.3 The report reflects the subject tree(s) as found on the day of inspection. Any changes to the growing environment of the subject tree, or tree management works beyond those recommended in this report may alter the findings of the report. There is no warranty, expressed or implied, that problems or deficiencies relating to the subject tree, or subject site may not arise in the future.

4.4 Tree identification is based on accessible visual characteristics at the time of inspection. As key identifying features are not always available the accuracy of identification is not guaranteed. Where tree species is unknown, it is indicated with an *spp*.

4.5 All diagrams, plans and photographs included in this report are visual aids only, and are not to scale unless otherwise indicated.

4.6 Priority Tree Services neither guarantees, nor is it responsible for, the accuracy of information provided by others that is contained within this report.

4.7 Although an assessment was made in relation to the trees condition and safe useful life expectancy, no tree risk assessment is included in this report.

4.8 The ultimate safety of any tree cannot be categorically guaranteed. Even trees apparently free of defects can collapse or partially collapse in extreme weather conditions. Trees are dynamic, biological entities subject to changes in their environment, the presence of pathogens and the effects of ageing. These factors reinforce the need for regular inspections. It is generally accepted that hazards can only be identified from distinct defects or from other failure-prone characteristics of a tree or its locality.

4.9 Alteration of this report invalidates the entire report.

5. METHODOLOGY

5.1 The following information was collected during the assessment of the subject tree(s).

5.1.1 Tree common name
5.1.2 Tree botanical name
5.1.3 Tree age class
5.1.4 DBH (Trunk/Stem diameter at 1.4 above ground level) - millimetres.
5.1.5 Height - metres
5.1.6 Crown spread (diameter) - metres
5.1.7 Health
5.1.8 Structural condition
5.1.1 Amenity value
5.1.2 Estimated remaining contribution years (SULE)[1]
5.1.3 Retention value (Tree AZ)[2]

---

[1] Barrell Tree Consultancy, *SULE: Its use and status into the New Millennium*, TreeAZ/03/2001, http://www.treeaz.com/.

[2] Barrell Tree Consultancy, *Tree AZ version 10.04-ANZ*, http://www.treeaz.com/.

5.1.4 Notes/comments

5.2 I have tagged each with a silver metal tag to assist with identifying trees discussed in this report.

5.3 An assessment of the trees condition was made using the visual tree assessment (VTA) model (Mattheck & Breleor, 1994).[3]

5.4 Tree diameter was measured using a DBH tape or in some cases estimated. Tree height and tree canopy spread was estimated. All other measurements were estimations unless otherwise stated.

5.5 The location of the trees discussed in this report had not been accurately plotted on any of the site plans provided by the client. I have prepared a site plan as a visual representation to assist with understanding the tree constraints discussed. I have based my assessment of the impact to trees on site observations, where the location of the proposed development had been marked out by the client prior to my assessment.

5.6 All information was imported into our computerised geographical information system (GIS) PT-mapper pro.

5.7 All DBH measurements, tree protection zones, and structural root zones were calculated in accordance with methods set out in AS4970 Protection of trees on development sites (2009).[4]

5.8 Details of how the observations in this report have been assessed are listed in the appendices.

6. SITE LOCATION AND DESCRIPTION

6.1 Site Description: The site is located in the Pittwater LGA. There is a currently a concrete driveway that accesses the South of the site. The slopes significantly from East down hill to the West. There is a relatively level area to the West of the site, with a retaining wall along the West edge of the site.

6.2 It is my understanding from a discussion with the client that there is a designated building platform that was identified during the subdivision of the land (see Site survey overlay, Craig and Rhodes, Ref: 1463, 21 November 2005), and that it will not be possible to construct outside the building platform area.

7. OBSERVATIONS, DISCUSSION AND CONCLUSIONS

7.1 Details of my observations taken while on site can be found in the tree inspection schedule (appendix 2) where I have calculated the indicative tree protection zone (TPZ) and structural root zone (SRZ) for each subject tree (see appendices for more information about the TPZ and SRZ). The TPZ and SRZ should be measured in radius from the centre of the trunk.

---

[3] Mattheck, C. & Breleor, H., *The body language of trees - A handbook for failure analysis*, The Stationary Office, London, England (1994).

[4] Council Of Standards Australia, *AS 4970 Protection of trees on development sites* (2009).

7.2 I have awarded the subject trees a retention value based on my observations. The system I have used to award the retention value is Tree AZ. Tree AZ is used to identify higher value trees worthy of being a constraint to development. I have included the Tree AZ categories sheet (Barrell Tree Consultancy) in appendix 11 to assist with understanding the retention values. The retention value that has been allocated to the subject tree in this report is not definitive and should only be used as a guideline.

7.3 Summary of trees that may be affected by the development.

Impact	Reason	Category A		Category Z
		A	AA	Z
Trees to be removed	Building construction, new surfacing and/or proximity, or trees in poor condition.	1, 2, 4, 5, 8, 9, 10, 11, 14, 17	15	3, 6, 16
Retained trees that may be affected through encroachment into TPZ	Removal of existing surfacing/structures and/or installation of new surfacing/structures	7, 12	None	None
Trees to be retained that will not be subject to TPZ encroachment	Space for development	13	None	None

7.4 **Trees located inside the building or driveway footprint**

7.4.1 In total eleven trees are located inside the footprint of the building or driveway. I have categorised nine of these trees as category A as they are generally in good condition and are native species. I have categorised tree 3 and tree 6 as category Z as the trees are dead.

7.5 **Trees in poor condition**

7.5.1 Tree 16 is in poor condition and displaying declining health and poor structural form. I have categorised the tree as category Z as should not be a constraint to development.

7.6 **Trees located outside building or driveway footprint that will be subject to TPZ encroachment**

7.6.1 Tree 5: The tree may be located inside the footprint of the proposed driveway turning area. If the tree is to be retained it needs to be accurately plotted on the proposed site plan to assess the percentage of encroachment into the trees TPZ and SRZ.

7.6.2 Tree 7: This tree is located to the West of the existing driveway. Encroachment is proposed into the trees indicative TPZ, however the tree is located down a slope from the proposed encroachment area and there is unlikely to be significant root growth from tree 7 into this area. I do not know the exact percentage of encroachment into the TPZ, as the tree is not plotted on the proposed site plans. The proposed encroachment is unlikely to have an impact on the condition of the tree, providing the tree is adequately protected during the development.

7.6.3 Tree 12: Tree 12 is located to the adjacent to the retaining wall at the West boundary of the site. The tree has two stems, which may be two individual trees close together. The West stem leans significantly and is dead and should be removed. The East stem appears to have formed from suckering growth. There will be encroachment into the indicative TPZ and SRZ of the tree, however the tree is located down a slope from the proposed encroachment area and there is also a retaining wall between the tree and this area. There is unlikely to be significant root growth from tree 12 into this area at the depth required for footings. The proposed encroachment is unlikely to have an impact on the condition of the tree, providing the tree is adequately protected during the development.

7.6.4 Tree 15: This tree is mature Red Bloodwood that I have awarded a retention value of AA1. The tree had not been accurately plotted on site plans and I estimated its location in appendix 1. It will not be possible to retain the tree based on the design of the building. The North edge of the proposed building will be directly adjacent to the base of tree inside the TPZ and SRZ. Significant level changes are proposed to the South/South east of the tree (the finished levels are not identified on the plans I assessed), including excavating the slope at the base of the tree. To accommodate the building in the proposed location the buttresses to the South of the tree would have to be severed. The proposed TPZ/SRZ encroachment will not only be detrimental to the health of the tree but is also likely to cause the tree to be structurally unstable.

The whole of the proposed building is located inside the TPZ of tree 15. For tree 15 to be retained in a viable condition significant design modifications are required, including altering the location of the building to further from the base of the tree and minimizing level changes inside the TPZ and SRZ to allow for the retention of significant roots. It will not be possible to significantly change the soil levels at the slope at the base of the tree without impacting significant roots.

The retaining wall/rocky out crop located approximately 1m to the West of tree 15 may have reduced root growth into the lower level area to the West of the tree (the area directly to the North of the Existing driveway), however adjusting the building location to this area is likely to result in building out side he designated building platform. It may also impact other smaller trees to the West of the proposed building area and an updated impact assessment would be required.

If it is possible to alter the location of the building the lower section at the West of the site, tree sensitive construction methods such as pier and beam/suspended slab footings or cantilevered building sections would be required to minimize root disturbance inside the TPZ. Detailed root mapping by a qualified arborist minimum AQF5 is required to identify the location of significant roots (larger than 30mm in diameter) and demonstrate that footings could be constructed in a way that will allow for the retention of roots critical to the condition of the tree. An assessment would be required the impact that removing or reducing identified roots will cause the condition of tree 15.

8. PHOTOGRAPHS

	
Photo A: Looking North across the site from the existing driveway.	**Photo B:** Looking South across the site.

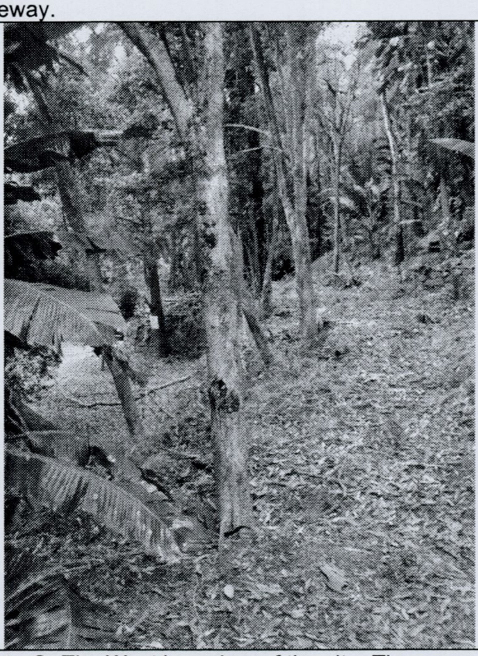



Photo C: The West boundary of the site. The green peg that can bee seen at the base of the tree in the middle identifies the building area that has been marked out by the client.	**Photo D:** The trunk of tree 14 in front with trunk of tree 15 in behind.

	
Photo E: Another photo of the base of tree 15 looking South East. I have marked the approximate location of the building footprint.	**Photo F:** The trunk of tree 15. I have marked the approximate location of the building footprint.

9. RECOMMENDATIONS

9.1 Twelve trees have been identified for removal, as they are located inside the building footprint or in poor condition. These include tree 1, 2, 3, 4, 6, 8, 9, 10, 11, 14, 16, 17.

9.2 Tree 5 has not been identified on the proposed site plans and I was unable to provide an assessment of the potential impact to the tree based on the information available. This tree must be accurately plotted for the construction impact to be assessed.

9.3 Tree 7, 12, and 13 can be retained in a viable condition in the development proposal. These trees must be protected during the development in accordance with the AMS (section 8.7).

9.4 Tree 15 will have to be removed in the current development proposal. The tree will be subject to an unacceptable loss of root mass that will be detrimental to the condition of the tree and is likely cause the tree to be structurally unstable. If the tree is to be retained significant design modifications are required including moving the location of the building further to the West/South and possibly outside the designated building platform area. Detailed root mapping to identify significant roots that are going to be impacted and an updated arborist impact assessment would be required and to assess the impact of any root loss to the condition of the tree (see section 6.6.4 for more info).

9.5 Additional root disturbance should be avoided. Tree sensitive landscaping is required inside the TPZ of all trees identified for retention to minimise further impact to the tree, such as avoiding new retaining walls that will require additional excavations. Advice may be required from the project arborist.

9.6 All recommendations in this report are subject to approval by Pittwater Council.

9.7 Arboricultural work method statement (AMS)

9.7.1 This report must be made available to all site personnel and contractors prior to works commencing and during any on site operations, and they must be made aware of the tree protection requirements outlined in this report and the DA conditions.

9.7.2 Prior to any construction works commencing at the site a project arborist should be appointed. The project arborist should be qualified to a minimum AQF level 5 and/or equivalent qualifications and experience, and should assist with any development issues relating to trees that may arise.

9.7.3 Tree protection: Tree protective should be installed in accordance with AS4970 protection of trees on development sites (2009) to minimise the impact to trees to be retained at the site. The tree protection must be installed prior to any works commencing and must remain intact and in good condition until all works are complete. Protective fencing must be installed to create an exclusion zone around the TPZ. The fencing must not be moved without prior approval from the project arborist. No contractors are to enter the exclusion zone without prior agreement of the project arborist. Tree protection must include the following:

A) Tree protective fencing: The protective fencing must be constructed from 1.8m height chainmesh fencing.

B) TPZ signage: Signage must be installed on the protective fencing on the outside of each side of the fenced off areas in a prominent position. The sign must clearly state 'Tree protection zone - No access'. The contact details of the site manager and project arborist must be identified on the signage.

C) Mulch: The area inside the exclusion should be mulched to a depth of 100mm with good quality wood chip mulch.

D) Ground protection: If it is not possible to enclose the whole TPZ of a tree to be retained ground protection is required. Ground protection must consist of a layer of geo textile fabric fixed over the face of the soil. Mulch should be spread over fabric to a depth of at least 100mm, and overlaid with durable ground protection/rumble boards to minimise soil compaction and spread the weight of construction traffic.

9.7.4 All excavations inside the TPZ must be supervised by the project arborist. Manual excavations are required along the perimeter of the TPZ. After the roots have been pruned back in accordance with the conditions outlined below, mechanical excavation is permitted inside the TPZ encroachment areas/outside the TPZ perimeter. Manual excavations and root pruning must in accordance with the following conditions:

A) Manual excavation may include the use of small hand tools such as mattocks. It can also include the use of pneumatic and hydraulic tools, high-pressure air, or a combination of high-pressure water and a vacuum device.

B) When hand excavating carefully work around roots retaining as many as possible. Take care to not fray, wound, or cause damage to any roots during excavations as this may cause decay or infection from pathogens.

C) Mechanical excavation is permitted beyond the radius of the TPZ after root pruning along the perimeter line is completed. Exposed roots must be covered with mulch or geotextile fabric and kept in a moist condition.

D) No roots larger than 30mm in diameter are to be severed or damaged unless approved by the project arborist. All root pruning must be carried out by a qualified arborist minimum AQF4. All root pruning is to be a clean cut with a sharp tool in accordance with AS4373 Pruning of amenity trees (2007).[5] The tree root is to be pruned back to a branch root if possible. Make a clean cut and leave as small a wound as possible.

E) All excavations and root pruning inside the TPZ must be documented in writing by the project arborist.

9.7.5 Tree work: All trees approved for removal must be carried out by a qualified and experienced arborist, in accordance with NSW Work Cover Code of Practice for the Amenity Tree Industry (1998) and AS4373 Pruning of amenity trees (2007). No tree pruning has been identified in this report.

---

[5] Council Of Standards Australia, *AS 4373 Pruning of amenity trees* (2007) page 18

9.7.6 Services: If possible underground services should be installed using thrust boring/ directional drilling to minimise the impact to trees identified for retention. If installed through thrust boring/ directional drilling the top of the service pipe must be at least 700mm below the existing ground level. Where this will not be possible services should be installed in accordance with the methods set out in section 8.10.4. All roots larger than 30mm in diameter must be retained during the installation of services. All excavations for services inside the TPZ must be supervised by the project arborist. To minimise the impact to trees to be retained all services should be bundled into the same trench.

9.7.7 The following activities must be avoided inside the TPZ of trees to be retained. If at any time these activities cannot be avoided an alternative must be agreed with the project arborist.

A) Machine excavation.
B) Ripping or cultivation of soil.
C) Storage of spoil, soil or any such materials
D) Preparation of chemicals, including preparation of cement products.
E) Refuelling.
F) Dumping of waste.
G) Wash down and cleaning of equipment.
H) Placement of fill.
I) Lighting of fires.
J) Soil level changes.
K) Any physical damage to the crown, trunk, or root system.
L) Parking of vehicles.

9.7.8 Any wounding or injury that occurs to a tree during the demolition/construction process will require the project arborist to be contacted immediately for an assessment of the injury and provide mitigation/remediation advice by the principle contractor. It is generally accepted that trees may take many years to decline and eventually die from root damage. All repair work is to be implemented immediately by the principle contractor as directed by the project arborist, at the contractor's expense. The project arborist must provide a detailed written report of any recommended works to the principle certifier.

9.7.9 Where it is not practical to carryout works in accordance with my recommendations, guidance is required from the project arborist.

9.7.10 After all construction works are complete the project arborist should assess that the subject tree has been retained within the same condition and vigour. If changes to condition are identified the project arborist should provide recommendations for remediation.

9.7.11 The project arborist must provide certification upon completion of the construction that all works were carried out in accordance in with the recommendations in this report and AS4970 Protection of trees on development sites (2009).

9.7.12 I have included additional information in appendix 13 to assist with understanding the potential impact development can cause to trees.

10. REFERENCES

- Council Of Standards Australia, *AS 4970 Protection of trees on development sites* (2009).
- Council Of Standards Australia, *AS 4373 Pruning of amenity trees* (2007).
- Mattheck, C. & Breleor, H., *The body language of trees - A handbook for failure analysis*, The Stationary Office, London, England (1994).
- Lonsdale, D., *Principles of tree hazard assessment and management*, The Stationary Office, London, England (1999).
- Matheny, N. & Clark, J. R, *A technical guide to preservation of trees during land development*, International Society of Arboriculture, P.O Box 3029, Champaign, IL, USA (1998).
- Barrell Tree Consultancy, *SULE: Its use and status into the New Millennium*, TreeAZ/03/2001, http://www.treeaz.com/.
- Barrell Tree Consultancy, *Tree AZ version 10.04-ANZ*, http://www.treeaz.com/.

11. LIST OF APPENDICES

The following are included in the appendices:

Appendix 1 - Site plan
Appendix 2 - Tree inspection schedule
Appendix 3 - Brief Qualifications and Experience of the author
Appendix 4 - Tree Protection Zone
Appendix 5 - Structural Root Zone
Appendix 6 - Amenity Value
Appendix 7 - Age Class
Appendix 8 - Health
Appendix 9 - Structural Condition
Appendix 10 - SULE (Safe useful life expectancy)
Appendix 11 - Retention Value (Tree AZ)
Appendix 12 - Tree protection guidelines
Appendix 13 - Effects of development to trees

Jack Williams
Dip. Arboriculture (AQF5)
FdSc Arboriculture
MAA, MISA

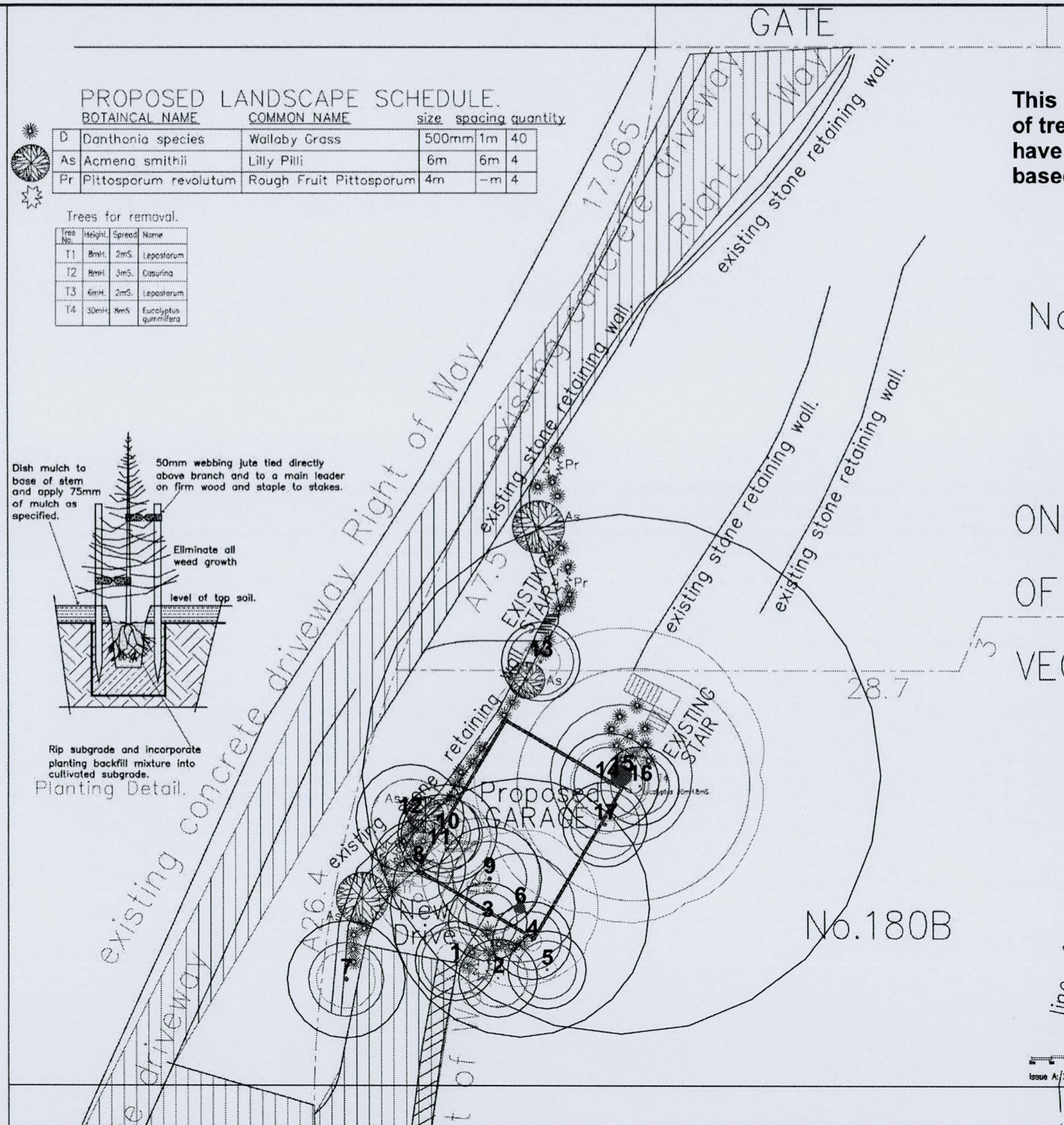
This site plan is a visual representation of of tree constraints only and is not to scale. I have estimated the location of all trees based on my observations while on site.

PROPOSED LANDSCAPE SCHEDULE.

	BOTAINCAL NAME	COMMON NAME	size	spacing	quantity
D	Danthonia species	Wallaby Grass	500mm	1m	40
As	Acmena smithii	Lilly Pilli	6m	6m	4
Pr	Pittosporum revolutum	Rough Fruit Pittosporum	4m	–m	4

Trees for removal.

Tree No.	Height.	Spread	Name
T1	8mH.	2mS.	Leposlorum
T2	8mH.	3mS.	Casurina
T3	6mH.	2mS.	Leposlorum
T4	30mH.	8mS	Eucalyptus gummifera



Legend

Tree Crown

Tree Protection Zone

Structural Root Zone

0 25m

Priority Tree Services

PO Box 450, Turramurra, NSW, 2074

sales@prioritytrees.com.au, (02) 9482 5353

180A Prince Alfred Parade Newport NSW

Plan not to scale	DATE : 18/12/2014
Appendix 1 - Arborist report site plan	
Ref:14/12/21/180APAPN	

PRIORITY TREE SERVICES

Appendix 2 - Tree Inspection Schedule

Tree no.	Tree Species	Age Class	DBH (MM)	Height (M)	Spread (M)	TPZ (M)	SRZ (M)	Health	Structure	Amenity Value	SULE	Retention Value	Required works	Notes/comments
1	*Allocasuarina torulosa* (Forest Oak)	S M	(1)170 (x)210	7	2	2.0	1.7	Good	Good	Medi um	2.Medium	A1	• None.	• None.
2	*Pittosporum undulatam* (Sweet Pittosporum)	S M	(1)110 (x)130	3	3	2.0	1.5	Fair	Good	Low	2. Medium	A1	• None.	• None.
3	*Allocasuarina torulosa* (Forest Oak)	S M	(1)90 (x)110	5	1	2.0	1.5	Dead	N/A	Very low	4.Remove	Z4	• Remove tree.	• None.
4	*Allocasuarina torulosa* (Forest Oak)	M	(1)120 (x)150	7	1	2.0	1.5	Good	Fair	Medi um	2.Medium	A1	• None.	• None.
5	*Allocasuarina torulosa* (Forest Oak)	M	(1)120 (x)140	6	1	2.0	1.5	Good	Fair	Low	2. Medium	A1	• None.	• None.
6	*Corymbia gummifera* (Red Bloodwood)	M	(1)550 (x)660	19	8	2.0	2.8	Dead	N/A	Low	4.Remove	Z4	• Remove tree	• None.
7	*Allocasuarina torulosa* (Forest Oak)	M	(1)250 (x)270	8	3	6.6	1.9	Fair	Good	Medi um	2.Medium	A1	• None.	• None.
8	*Glochidion ferdinandi* (Cheese Tree)	M	(1)200 (x)220	9	2	2.4	1.8	Good	Good	Medi um	2.Medium	A2	• None.	• Wound on trunk at 700mm.
9	*Allocasuarina torulosa* (Forest Oak)	S M	(1)220 (x)260	8	1	2.6	1.9	Fair	Good	Low	3.Short	A1	• None.	• None.
10	*Glochidion ferdinandi* (Cheese Tree)	M	(1)210 (x)230	6	2	2.5	1.8	Fair	Good	Low	2.Medium	A1	• None.	• None.

Appendix 2 - Tree Inspection Schedule

11	*Glochidion ferdinandi* (Cheese Tree)	SM	(1)130 (x)160	5	1	2.0	1.5	Good	Fair	Low	3.Short	A2	• None.	• None.
12	*Glochidion ferdinandi* (Cheese Tree)	M	(1)200 (2)110 (x)300	5	4	2.8	2.0	Fair	Fair	Medium	2.Medium	A2	• Remove dead leaning stem.	• Twin stemmed. • One stem is dead and leans significantly.
13	*Glochidion ferdinandi* (Cheese Tree)	M	(1)160 (x)200	5	2	2.0	1.7	Good	Good	Medium	2.Medium	A1	• None.	• None.
14	*Allocasuarina torulosa* (Forest Oak)	M	(1)210 (x)240	8	4	2.5	1.8	Good	Good	Medium	2.Medium	A1	• Remove suspended branch.	• Dead suspended branch in crown.
15	*Corymbia gummifera* (Red Bloodwood)	M	(1)1100 (2)1250 est	27	15	13.2	3.6	Fair	Good	Very high	2.Medium	AA1	• None.	• Co dominant stems. • Major deadwood.
16	*Allocasuarina torulosa* (Forest Oak)	SM	(1)120 (x)140	4	1	2.0	1.5	Poor	Poor	Low	3.Short	Z4	• None.	• None.
17	*Allocasuarina torulosa* (Forest Oak)	M	(1)180 (x)220	7	1	2.2	1.8	Good	Good	Medium	Medium	A1	• None.	• None.

Notes

Tree species - Botanical name followed by common name in brackets. Where species is unknown I have indicated it with an *'sp'*.

Age class - Over mature (OM), Mature (M), Semi mature (SM), Young (Y).

Diameter at Breast Height (DBH) - Measured with a DBH tape at approximately 1.4m above ground level. Where DBH has been estimated it is indicated with an est. The (1) indicates the stem number. The (x) indicates the diameter above buttresses for calculating the SRZ.

Height - All heights are estimated unless otherwise indicated.

Spread - All tree spreads are estimated unless otherwise indicated.

Tree Protection Zone (TPZ) - Measured in radius from the centre of the trunk.

Structural Root Zone (SRZ) - Measured in radius from the centre of the trunk.

Safe useful life expectancy (SULE) - 1. Long (40+years), 2. Medium (15 - 40 years), 3. Short (5 - 15 years), 4. Remove (under 5 years), 5. Small/young, 6. Unstable.

Major deadwood - Larger than 50mm in diameter or over 5% of crown.

Minor deadwood - Between 25mm-50mm in diameter.

Report on trees at: 180A Prince Alfred Pde, Newport, NSW
Prepared for: Simon Olding.
Prepared by: Jack Williams, Priority Tree Services, jack@prioritytrees.com.au, (02) 9482 5353.
Date: 21 December 2014

Appendix 3 - Jack Williams Brief Qualifications and Experience

Scientific and botanical qualifications:

- Diploma of Arboriculture (AQF5)
- Foundation Degree in Arboriculture (UK)
- National Diploma in Horticulture with Arboriculture (UK)
- First Diploma in Horticulture (UK)
- Registered Quantified Tree Risk Assessment assessor (QTRA)
- ISA Tree risk assessment qualification (TRAQ)

Professional memberships:

- Member of Arboriculture Australia (AA)
- AA Registered consulting arborist #2556
- Member of International Society of Arboriculture (ISA)

Experience:

- Three years as a Consulting arborist, covering all aspects of written and verbal arboricultural consultancy for commercial and residential clients, including tree condition assessments and development related arborist reports and providing advice in relation to trees and development.
- Four years as an Arboricultural surveyor, managing a tree stock of over 40,000 trees including carrying out tree hazard assessments, prioritising works in relation to available budgets, auditing tree works, and designing and implementing a computerised database system for recording tree data for risk management purposes. Provided verbal and written consultancy for residential and commercial clients.
- One year as a Council tree officer, managing the tree stock for a London Estate, carrying out health and safety surveys to trees situated near the underground train network and public highways. Making and confirming tree preservation orders (TPO's), dealing with applications for works to TPO protected trees and trees within conservation areas, and enforcing TPO orders. Processing tree related issues in relation to planning applications, and reviewing arboricultural impact assessment reports.
- Three years as a Contracting arborist, working as a groundsman and tree climber, carrying out all aspects of tree work.
- One year as a Grounds maintenance contractor, covering various aspects of horticulture and landscaping.

Appendix 4 - Tree Protection Zone (TPZ)

The tree protection zone (TPZ) is the principle means of protecting trees on development sites. The TPZ is a combination of the root area and crown area requiring protection. It is an area isolated from construction disturbance, so that the tree remains viable. The TPZ incorporates the structural root zone (SRZ).

Determining the TPZ

The radius of the TPZ is calculated for each tree by multiplying its DBH × 12.

TPZ = DBH × 12

Where

DBH = trunk diameter measured at 1.4 m above ground

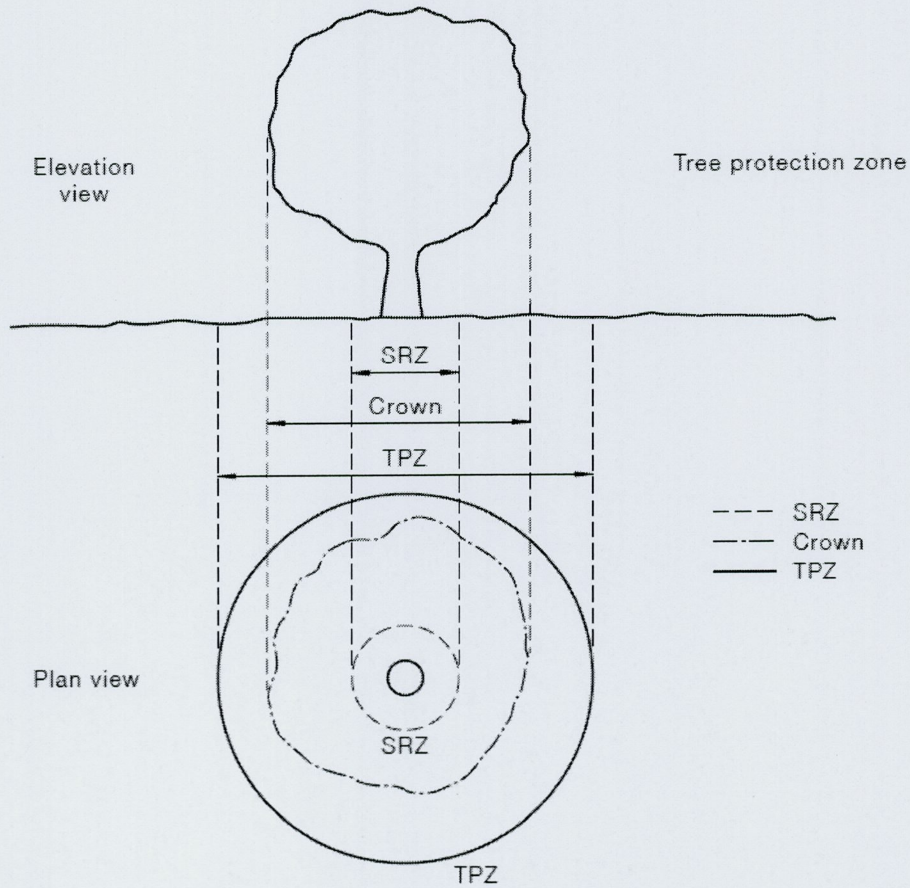
Radius is measured from the centre of the stem at ground level.
A TPZ should not be less than 2 m nor greater than 15 m (except where crown protection is required).

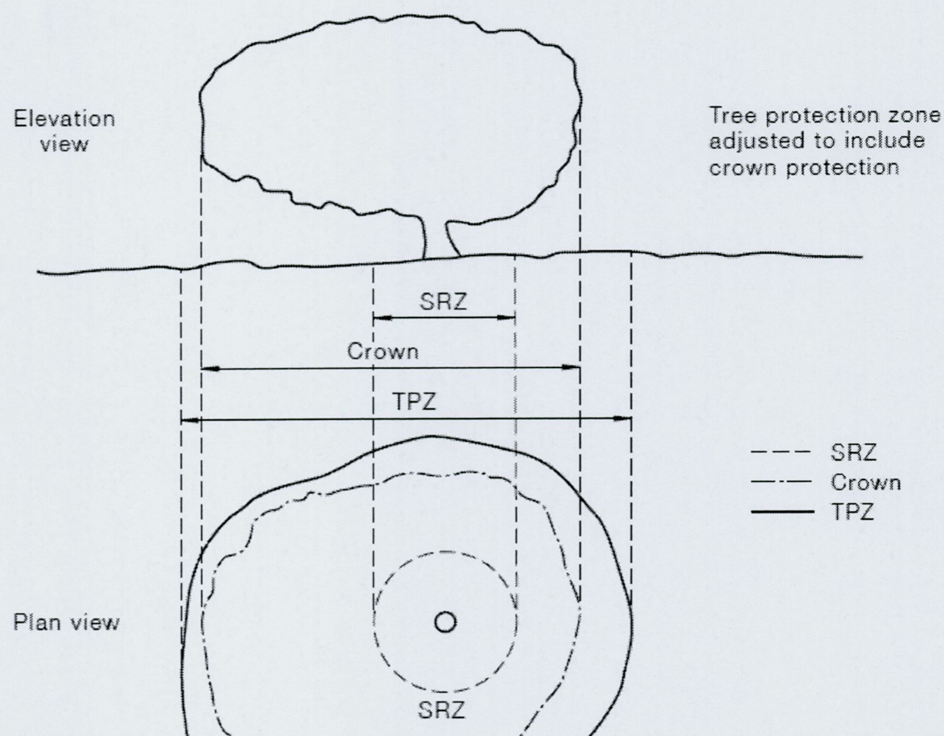
Minor encroachment into the TPZ

Where encroachment into the TPZ is unavoidable it is generally accepted that encroachment of under 10% of the total TPZ is possible without carrying out detailed root investigations. This minor loss of root area is normally compensated by the roots developing elsewhere.

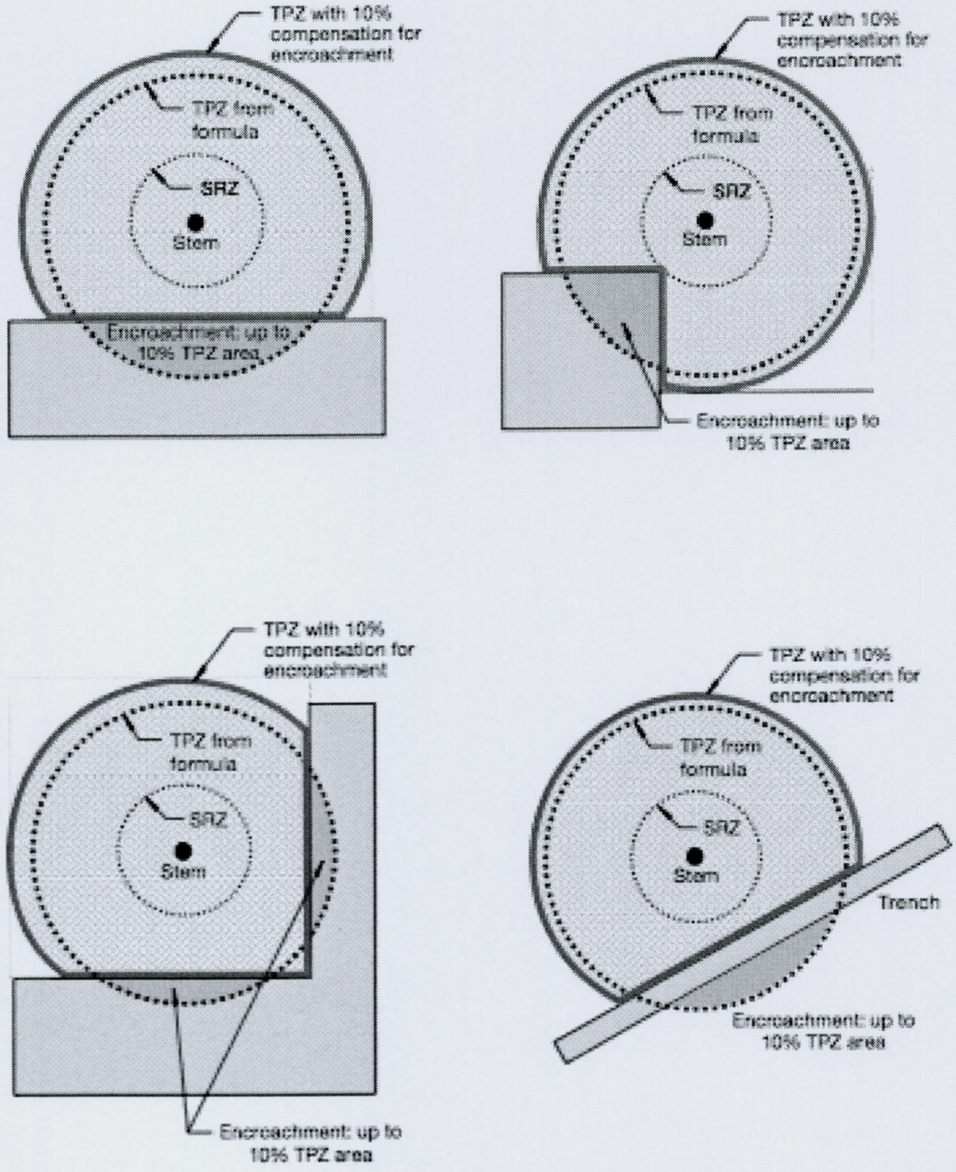
Major encroachment into the TPZ

If an encroachment of more than 10% is proposed into the TPZ it would be necessary to demonstrate that the tree would remain viable. None destructive root investigations may be required to determine any potential impact the encroachment may have on the tree.


Elevation view
Tree protection zone
SRZ
Crown
TPZ
SRZ
Crown
TPZ
Plan view
SRZ
TPZ


Elevation view
Tree protection zone adjusted to include crown protection
SRZ
Crown
TPZ
SRZ
Crown
TPZ
Plan view
SRZ
TPZ

Encroachment into the tree protection zone (TPZ) is sometimes unavoidable. Figure D1 provides examples of TPZ encroachment by area, to assist in reducing the impact of such incursions.



NOTE: Less than 10% TPZ area and outside SRZ. Any loss of TPZ compensated for elsewhere.

Appendix 5 - Structural root zone (SRZ)

This is the area around the base of a tree required for the trees stability in the ground. An area larger than the SRZ always need to be maintained to preserve a viable tree as it will only have a minor effect on the trees vigour and health. There are several factors that determine the SRZ which include height, crown area, soil type and soil moisture. It can also be influenced by other factors such as natural or built structures. Generally work within the SRZ should be avoided.

Determining the SRZ

An indicative SRZ radius can be determined from the diameter of the trunk measured immediately above the root buttresses. Root investigation could provide more information about the extent of the SRZ. The following formula should be used to calculate the SRZ.

SRZ radius = $(D \times 50)^{0.42} \times 0.64$

where

D = trunk diameter in m, measured above the root buttress.

Note - The SRZ for trees with trunk diameters less than 0.15 will be 1.5m.

Appendix 6 - Amenity value

To determine the amenity value of a tree we assess a number of different factors which include but are not limited to the information below.

- The visibility of the tree to adjacent sites.
- The relationship between the tree and the site.
- Whether the tree is protected by any statuary conditions.
- The habitat value of the tree.
- Whether the tree is considered a noxious weed species.

Appendix 7 - Age class

If can be difficult to determine the age of a tree without carrying out invasive tests that may damage the tree, so we have categorised there likely age class which is defined below.

Category	Description
Young/Newly planted	• Young or recently planted tree.
Semi Mature	• Up to 20% of the usual life expectancy for the species.
Early mature/Mature	• Between 20% - 80% of the usual life expectancy for the species.
Over mature	• Over 80% of the usual life expectancy for the species.
Dead	• Tree is dead or almost dead.

Appendix 8 - Health/Physiological condition

Category	Example condition	Summary
Good	• Crown has good foliage density for species. • Tree shows no or minimal signs of pathogens that are unlikely to have an effect on the health of the tree. • Tree is displaying good vigour and reactive growth development.	• The tree is in above average health and condition and no remedial works are required.
Fair	• The tree may be starting to dieback or have over 25% deadwood. • Tree may have slightly reduced crown density or thinning. • There may be some discolouration of foliage. • Average reactive growth development. • There may be early signs of pathogens which may further deteriorate the health of the tree. • There may be epicormic growth indicating increased levels of stress within the tree.	• The tree is in below average health and condition and may require remedial works to improve the trees health.
Poor	• The may be in decline, have extensive dieback or have over 30% deadwood. • The canopy may be sparse or the leaves may be unusually small for species. • Pathogens or pests are having a significant detrimental effect on the tree health.	• The tree is displaying low levels of health and removal or remedial works may be required.
Dead	• The tree is dead or almost dead.	• The tree should generally be removed.

Appendix 8 - Physiological condition & health

Category	Example condition	Summary
Good	• Crown has good foliage density for species. • Tree shows no or minimal signs of pathogens that are unlikely to have an effect on the health of the tree. • Tree is displaying good vigour and reactive growth development.	• The tree is in above average health and condition and no remedial works are required.
Fair	• The tree may be starting to dieback or have over 25% deadwood. • Tree may have slightly reduced crown density or thinning. • There may be some discolouration of foliage. • Average reactive growth development. • There may be early signs of pathogens which may further deteriorate the health of the tree. • There may be epicormic growth indicating increased levels of stress within the tree.	• The tree is in below average health and condition and may require remedial works to improve the trees health.
Poor	• The may be in decline, have extensive dieback or have over 30% deadwood. • The canopy may be sparse or the leaves may be unusually small for species. • Pathogens or pests are having a significant detrimental effect on the tree health. •	• The tree is displaying low levels of health and removal or remedial works may be required.
Dead	• The tree is dead or almost dead.	• The tree should generally be removed.

Appendix 9 - Structural condition

Category	Example condition	Summary
Good	• Branch unions appear to be strong with no sign of defects. • There are no significant cavities. • The tree is unlikely to fail in usual conditions. • The tree has a balanced crown shape and form.	• The tree is considered structurally good with well developed form.
Fair	• The tree may have minor structural defects within the structure of the crown that could potentially develop into more significant defects. • The tree may a cavity that is currently unlikely to fail but may deteriorate in the future. • The tree is an unbalanced shape or leans significantly. • The tree may have minor damage to its roots. • The root plate may have moved in the past but the tree has now compensated for this. • Branches may be rubbing or crossing.	• The identified defects are unlikely cause major failure. • Some branch failure may occur in usual conditions. • Remedial works can be undertaken to alleviate potential defects.
Poor	• The tree has significant structural defects. • Branch unions may be poor or weak. • The tree may have a cavity or cavities with excessive levels of decay that could cause catastrophic failure. • The tree may have root damage or is displaying signs of recent movement. • The tree crown may have poor weight distribution which could cause failure.	• The identified defects are likely to cause either partial or whole failure of the tree.

Appendix 10 - Safe Useful Life Expectancy (SULE), (Barrel, 2001)

A trees safe useful life expectancy is determined by assessing a number of different factors including the health and vitality, estimated age in relation to expected life expectancy for the species, structural defects, and remedial works that could allow retention in the existing situation.

Category	Description
1. Long - Over 40 years	(a) Structurally sound trees located in positions that can accommodate future growth. (b) Trees that could be made suitable for retention in the long term by remedial tree care. (c) Trees of special significance for historical, commemorative or rarity reasons that would warrant extraordinary efforts to secure their long term retention.
2. Medium - 15 to 40 years	(a) Trees that may only live between 15 and 40 more years. (b) Trees that could live for more than 40 years but may be removed for safety or nuisance reasons. (c) Trees that could live for more than 40 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting. (d) Trees that could be made suitable for retention in the medium term by remedial tree care.
3. Short - 5 to 15 years	(a) Trees that may only live between 5 and 15 more years. (b) Trees that could live for more than 15 years but may be removed for safety or nuisance reasons. (c) Trees that could live for more than 15 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting. (d) Trees that require substantial remedial tree care and are only suitable for retention in the short term.
4. Remove - Under 5 years	(a) Dead, dying, suppressed or declining trees because of disease or inhospitable conditions. (b) Dangerous trees because of instability or recent loss of adjacent trees. (c) Dangerous trees because of structural defects including cavities, decay, included bark, wounds or poor form. (d) Damaged trees that are clearly not safe to retain. (e) Trees that could live for more than 5 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting. (f) Trees that are damaging or may cause damage to existing structures within 5 years. (g) Trees that will become dangerous after removal of other trees for the reasons given in (a) to (f). (h) Trees in categories (a) to (g) that have a high wildlife habitat value and, with appropriate treatment, could be retained subject to regular review.

5. Small/Young	(a) Small trees less than 5m in height. (b) Young trees less than 15 years old but over 5m in height. (c) Formal hedges and trees intended for regular pruning to artificially control growth.

TreeAZ Categories Field Sheet (Version 10.04-ANZ)

CAUTION: TreeAZ assessments must be carried out by a competent person qualified and experienced in arboriculture. The following category descriptions are designed to be a brief field reference and are not intended to be self-explanatory. They must be read in conjunction with the most current explanations published at www.TreeAZ.com.

Category Z: Unimportant trees not worthy of being a material constraint

	Local policy exemptions: Trees that are unsuitable for legal protection for local policy reasons including size, proximity and species
Z1	Young or insignificant small trees, i.e. below the local size threshold for legal protection, etc
Z2	Too close to a building, i.e. exempt from legal protection because of proximity, etc
Z3	Species that cannot be protected for other reasons, i.e. scheduled noxious weeds, out of character in a setting of acknowledged importance, etc
	High risk of death or failure: Trees that are likely to be removed within 10 years because of acute health issues or severe structural failure
Z4	Dead, dying, diseased or declining
Z5	Severe damage and/or structural defects where a high risk of failure cannot be satisfactorily reduced by reasonable remedial care, i.e. cavities, decay, included bark, wounds, excessive imbalance, overgrown and vulnerable to adverse weather conditions, etc
Z6	Instability, i.e. poor anchorage, increased exposure, etc
	Excessive nuisance: Trees that are likely to be removed within 10 years because of unacceptable impact on people
Z7	Excessive, severe and intolerable inconvenience to the extent that a locally recognized court or tribunal would be likely to authorize removal, i.e. dominance, debris, interference, etc
Z8	Excessive, severe and intolerable damage to property to the extent that a locally recognized court or tribunal would be likely to authorize removal, i.e. severe structural damage to surfacing and buildings, etc
	Good management: Trees that are likely to be removed within 10 years through responsible management of the tree population
Z9	Severe damage and/or structural defects where a high risk of failure can be temporarily reduced by reasonable remedial care, i.e. cavities, decay, included bark, wounds, excessive imbalance, vulnerable to adverse weather conditions, etc
Z10	Poor condition or location with a low potential for recovery or improvement, i.e. dominated by adjacent trees or buildings, poor architectural framework, etc
Z11	Removal would benefit better adjacent trees, i.e. relieve physical interference, suppression, etc
Z12	Unacceptably expensive to retain, i.e. severe defects requiring excessive levels of maintenance, etc

NOTE: Z trees with a high risk of death/failure (Z4, Z5 & Z6) or causing severe inconvenience (Z7 & Z8) at the time of assessment and need an urgent risk assessment can be designated as ZZ. ZZ trees are likely to be unsuitable for retention and at the bottom of the categorization hierarchy. In contrast, although Z trees are not worthy of influencing new designs, urgent removal is not essential and they could be retained in the short term, if appropriate.

Category A: Important trees suitable for retention for more than 10 years and worthy of being a material constraint

A1	No significant defects and could be retained with minimal remedial care
A2	Minor defects that could be addressed by remedial care and/or work to adjacent trees
A3	Special significance for historical, cultural, commemorative or rarity reasons that would warrant extraordinary efforts to retain for more than 10 years
A4	Trees that may be worthy of legal protection for ecological reasons (Advisory requiring specialist assessment)

NOTE: Category A1 trees that are already large and exceptional, or have the potential to become so with minimal maintenance, can be designated as AA at the discretion of the assessor. Although all A and AA trees are sufficiently important to be material constraints, AA trees are at the top of the categorization hierarchy and should be given the most weight in any selection process.

Further explanations to assist categorization

Z1	Any existing statutory definitions of trees that are too small to be legally protected should be applied and trees less than those heights or diameters will be Z1. If there are none, then if the tree has been planted for less than 5 years it is Z1. If it is less than 5m in height, it will be Z1 unless it is significant, i.e. clearly mature, but small trees are not Z1. If it is greater than 10m in height it is not Z1 unless it was planted in the last 5 years. Applying Z1 to trees between 5–10m is a matter of judgment; the most obvious test being that the tree could be easily and reliably moved or replaced. Ideally, the replacement tree should not be less than 20% of the replaced tree's trunk, height and spread dimensions.
Z2	Any existing statutory rules that prevent protection of trees within a fixed distance of a structure will allow a tree to be subcategorized as Z2.
Z3	Any existing statutory rules or guidance that prevent protection of trees for reasons other than size and proximity dictate Z3, i.e. invasive or alien species. If none exist, then Z3 cannot be applied.
Z4	This subcategory is for trees that are unlikely to recover from a serious health problem. The condition must be terminal with no obvious potential to recover, i.e. severe crown dieback related to excavation damage or root decay, to the extent that the structural branch framework is compromised. Trees that are likely to recover or improve should not be placed in this subcategory, i.e. trees suffering from a foliar problem that has little impact on the branch framework and varies from year to year.
Z5	Severe means so bad that there is no realistic chance of the tree achieving its full potential and there is a high of failure risk. In many cases, the risk of failure can be reduced by dramatic reduction in tree size, but this has severe health, maintenance cost and amenity implications, so is unlikely to be a sustainable management option. A common example is a severely unbalanced tree within a group that will be particularly vulnerable in adverse weather conditions and the adjacent trees mean there is no hope of remedial works resulting in an

	improvement. Topped trees do not automatically fit into this subcategory, although there is an obvious temptation. Species prone to decay, such as willow and poplar, often have severe decay at the origin of vigorous re-growth, creating a high risk of failure in adverse weather conditions. Z5 is clearly appropriate for them. However, this needs to be a careful judgment because topping in itself does not necessarily condemn a tree to this subcategory. Some trees, such as plane, oak and lime, are particularly good at coping with this treatment and often are able to mature with a low risk of failure. If remedial works will allow the tree to be retained with no significant adverse impact on amenity, health or maintenance costs, then it does not fit here.
Z6	Trees can become poorly anchored because of soil erosion through climatic factors, i.e. water or wind, wear from traffic - pedestrian or vehicular, changing soil conditions - increasing wetness, sudden and severe physical stress from storms and root damage such as decay or severance reducing root strength. In some case, i.e. storm induced instability, there may be a realistic chance of recovery and a subcategorization of Z6 may be premature. However, if excessive remedial work is required, it is likely that Z6 is a defensible subcategory. Alterations to tree exposure to the wind occurs because of changes in the shelter provided by adjacent objects such as buildings or trees. This often applies to groups of trees where one large dominant individual will be lost because of poor health or a structural problem, which then dramatically exposes the remaining trees.
Z7	**Establishing thresholds of acceptable levels of inconvenience:** In its broadest sense, inconvenience is the interference with the authorized use of land. In relation to trees, it can be in the form of roots disrupting landscaping and hard surfacing, parts of trees physically preventing land use, tree debris such as leaves and fruit falling and tree crowns causing excessive shade. The principles for establishing what are acceptable levels of inconvenience are the same irrespective of the cause. In a community context, it is generally accepted that trees provide a significant benefit to society and it is reasonable for individuals to tolerate some level of inconvenience from their presence. However, the precise location or value of these thresholds is not always obvious and is often a subjective interpretation rather than a definitive point. There will always have to be a balancing of the benefit to the community weighed against the inconvenience suffered by the individual. What is an acceptable, tolerable or reasonable level of inconvenience is often a matter of judgment for each specific situation, tempered by experience and common sense. This, in turn, should be guided by court, tribunal and planning decisions that have made informed judgments on these issues. **Common examples:** Very large trees near existing occupied buildings can dominate to the extent that the disbenefit from the anxiety of the occupants outweighs the benefit of the tree. Regular and severe staining caused by fallen debris to a swimming pool surround may be unacceptable because the stark contrast in colours creates a dirty impression whereas the same staining on a path or drive surface may be more acceptable. In contrast, falling leaves blocking gutters causing them to be cleaned once a year is not that much of a local inconvenience in the context of the wider benefits that trees impart. **Making the decision:** Assessing inconvenience is almost entirely a subjective judgment, based on experience and understanding of what is perceived as being reasonable and unreasonable for a normal person. As with all these judgments, a simple test is to imagine a court hearing where a judge has to decide if the levels of inconvenience are intolerable. If they are, then the tree is Z7; if they are not that bad, then the tree belongs in another subcategory.
Z8	Where more serious damage occurs to property from root action, then court/tribunal judgments on liability help to focus on what level of damage is deemed tolerable by society. The most common example is direct damage from roots, trunks and branches to structures and surfacing. Repairs to walls may require such extensive excavation and cutting of roots that the tree cannot be retained. However, the use of innovative techniques may reduce root damage, but still produce a viable boundary, allowing the tree to be retained. Root damage to surfacing is often a sustainable reason for removal if rectifying the damage will significantly adversely affect the tree. In contrast, the potential for roots to deform surfacing would be a less reliable basis for allocation to this subcategory because it is so unpredictable. As a general rule, there would need to be good evidence for ongoing damage, with little scope for remedial works, before a tree could be reliably allocated to this subcategory.
Z9	This is a similar subcategory to Z5, but where the defect is not so severe that remedial works have to be extensive and immediate. Quite often, there are less severe defects that are so bad there is no realistic potential for the tree to improve, but it could be retained in the short term with some significant remedial works. This would only be seen as a temporary measure because to continue applying the same principle would not be cost-effective compared to replacement. A typical example would be a tree with a large and progressive cavity that will clearly prevent it ever improving its condition or contribution to amenity. However, substantial thinning and reduction would allow it to be retained in the short term to allow other replacement trees to develop to buffer its inevitable loss. The benefit of retaining it in the short term might outweigh the cost of doing the works as a one-off, but not on a regular basis.
Z10	It is common to find trees that are obviously not good enough for long term retention because they look unhealthy or are so unbalanced or so tall and thin or that they will never improve. However, the problems are not so severe that there is a high risk of death or failure, and they cannot be discounted for that reason. This subcategory is for those trees and relies on the principle of sustained amenity to justify the allocation. Trees with no potential to improve are taking up space where new trees could be growing, which would be enhancing the desirable objective of an uneven age class structure. The replacements would obviously be small trees and these would then fall into the Z1 subcategory. As set out in the Z1 explanations, the precise location on the site is not often that critical, so these trees would not generally be considered worthy of being a material constraint.
Z11	This applies to trees in groups where one individual is destructively interfering with another. The judgment of which is the better tree is obviously subjective and would be informed by which tree had the best potential for sustainable retention. An obvious example is one tree growing up through another and directly rubbing causing damage. Retaining both would probably result in the loss of each, whereas removing one may allow the other to achieve its full potential. Another example would be one tree shading and preventing the sustainable development of a neighbour to the extent that both trees would be prematurely removed if left alone. The removal of one tree may be justified if it allowed the remaining tree to reach its full potential. If both trees could be retained as a group and achieve their full potential, then they should not be included in this subcategory.
Z12	This is a matter of judgment and may vary widely. It primarily applies to existing trees that are not suited to their location, but there is resistance to their replacement. As a general principle, all trees will incur some management costs and these would normally not be a valid reason for removal. However, as those costs increase, their acceptability decreases to a point where it will be more cost-effective to plant a new tree more suited to the location rather than incur the burden of repeated and excessive costs indefinitely. Typical examples include topped trees with excessive decay, pollarded trees to reduce subsidence risk, trees beneath power lines and trees close to buildings, roads and paths. All these examples will require high levels of maintenance that may not be financially acceptable unless the benefits that arise from retaining the trees are particularly high.
A1	Trees that do not require any specific remedial works above those that would be required for normal maintenance.
A2	Trees with minor defects likely to recover from remedial works to be retainable in the long term, i.e. pollards with little decay.
A3	'Special' means unusual, rare or uncommon, i.e. a tree of some historical/cultural significance, etc.
A4	Trees can be valuable ecological habitat that may be protected by legislation, which may be a material constraint on the type and timing of changes that can occur on a site. If an ecological assessment has not been carried out by the time of the survey, and the arborist suspects there may be habitat issues, the tree should be identified as A4, and specialist assessment should be sought.

Appendix 12 - Tree protection guidelines

The following guidelines should be followed where possible. Where is not reasonably practical to comply with these guidelines alternative arrangement should be agreed with a qualified arborist.

- All trees identified for retention should be clearly identified on the site.
- The construction specifications should include details and plans to protect retained trees during the development. Methods should be identified for the following activities as they are generally considered unacceptable within then TPZ.
  1. Machine excavation including trenching.
  2. Excavation for silt fencing.
  3. Cultivation.
  4. Storage.
  5. Preparation of chemicals, including preparation of cement products.
  6. Parking of vehicles and plant.
  7. Refuelling.
  8. Dumping of waste.
  9. Wash down and cleaning of equipment.
  10. Placement of fill.
  11. Lighting of fires.
  12. Soil level changes.
  13. Temporary or permanent installation of utilities and signs.
  14. Physical damage to the tree.
- Penalties should be included in the construction specifications for damage to the trees that are to be retained.
- Tree protective fencing - Trees that are to be retained should be protected by installing a temporary fencing in accordance with the details below.
  1. Wire mesh fence with a minimum height of 1.8m supported by steel posts driven 0.6m into the ground.
  2. If tree protective fencing is not detailed in the report it should at minimum enclose the SRZ, and also as much of the SRZ as possible.
  3. Trees on adjacent properties should have any area of their TPZ that encroaches into the development site protected as described above.
  4. The tree protective fencing should be installed after tree removals, and **prior** to any construction works.
  5. The tree protective fencing should be inspected by a qualified arborist prior to the commencement of construction works.
  6. Access within the tree protective fencing should be restricted and signage should be in place to identify this.
  7. The area inside the protective fencing should be mulched to a depth of at least 100mm, with wood chip mulch, to assist with water retention during construction.

- Ground protection – Where tree protective fencing cannot be installed to protect the whole of the TPZ ground protection should be installed to reduce soil compaction. This can consist of any platform that will spread the weight on any load points within the TPZ. This can include, but is not limited to, the following methods.
  1. Industrial pallets joined together.
  2. Plywood joined together.
  3. Planks of timber joined together.
- The ground protection should be made from suitable and durable enough to survive the entire construction process.
- The ground protection should be installed after tree removals, and **prior** to any construction works.
- No excavation should take place within the SRZ or TPZ unless absolutely necessary. If unavoidable the following guidelines should be adhered to.
  1. All excavation within SRZ should be carried by hand.
  2. All excavation within the TPZ should be carried out carefully to minimise any potential root damage.
  3. Any excavation that is carried out within the SRZ should be supervised by a qualified arborist.
  4. Any root pruning within the SRZ or TPZ should be supervised by a qualified arborist. Roots should be reduced to branch root where possible, and accurate pruning cuts should be performed.

Appendix 13 – Effects of development to trees

General

All parts of the tree may be damaged by development. Damage to any one part of the tree will affect its functioning as a whole. This section considers the possible impact of injury on the functioning of each main section of the tree. This highlights the specific protective measures that need to be undertaken.

Crown damage

The canopy of trees can be directly or indirectly damaged. Indirect damage will occur as a result of trunk and or root damage and will not be discussed here. Usually, foliage may be lost or damaged on development sites by pruning or mechanical injury by trucks, cranes, excavators and so on. The removal of leaves reduces the level of photosynthesis and thus the production of sugars. This in turn reduces the tree's capacity to function normally and to withstand stresses imposed by a change in its environment. Incorrect techniques of pruning such as lopping or flush cutting may produce wounds that are susceptible to infection by wood decay organisms. Similarly, mechanical damage to branches by machinery, etc. will also create wounds. Trees automatically respond to wounding and in doing so use stored sugars. Any wound places an additional load on trees that will inevitably be stressed during construction.

Trunk damage

Trunks of trees may be wounded mechanically during demolition and construction work. This not only predisposes a tree to potential decay but it also interferes with the transport of water, nutrients and sugars throughout the tree. Serious impacts may structurally weaken the tree.

Root damage

Root damage is the most common cause of damage to trees on development sites. Tree roots are far more extensive and closer to the surface than commonly thought. Roots can be damaged in the following ways:

- Removed during grading, excavation and trenching for foundations services, etc.
- Mechanically wounded, crushed or torn.
- Compaction by machinery, storage of materials, and installation of work sheds.
- Soil build up.
- Laying of pavements.
- Chemical contamination of the soil by solvents, fuel, oil, diesel, herbicides, cement waste, etc.
- Changes in air levels through changes in drainage patterns.
- Changes in available water.

Apart from the actual removal of roots during excavation or trenching, soil compaction is one of the major causes of root damage on development sites. Compaction is defined as the loss of large pore spaces (macropores) within the soil with a net loss of total pore space. Macropores are essential for the exchange of gases between the soil air and the atmosphere (aeration) and the removal of excess water from the soil (drainage). Compaction results from loads or stress forces applied to the soil as well as shear forces.

Both foot traffic and vehicle traffic exert both forces on soils. Vehicle traffic may cause significant compaction at depths of 150–200 mm (the area in which most absorbing roots are located). The degree of compaction will depend on weight of vehicles, number of movements, soil moisture levels and clay content. Soil handling, stockpiling and transporting also tend to lead to the breakdown of soil structure and thus to compaction. Vibration as a result of frequent traffic or adjacent construction activities will also compact soils.

The effects of compaction include:

- reduced aeration (oxygen levels decrease and carbon dioxide concentration increases to perhaps toxic levels);
- low oxygen levels discourage root growth and thus the uptake of water and nutrients;
- reduced infiltration of water into the soil and more run-off;
- increased run-off increases soil losses by erosion;
- low oxygen levels also lead to chemical changes in the soil which can reduce the availability of some plant nutrients.
- the reduction in the number and diversity of beneficial soil organisms (including mycorrhizal fungi)

In summary, the effects of root loss or damage by any means could include the following:

- loss of stability if structural woody roots or even lower order woody roots are cut;
- reduction in water and nutrient uptake;
- an eventual loss of leaves, reduced photosynthesis and thus sugar production;
- decay as a result of wounding.
- predisposition to soil borne pathogens.

It is commonly observed that trees may take many years to decline and eventually die from root damage.

Adapted from AS4970-2009 Protection of trees on development sites.