5.2. MINOR CHANGE APPLICATION TO MATERIAL CHANGE OF USE (MULTI-UNIT HOUSING) 14 MUDLO STREET

REPORT AUTHOR(S)	Daniel Lamond, Planning Officer
GENERAL MANAGER	Scott Hahne, Acting General Manager Operations
DEPARTMENT	Development Assessment and Coordination
PROPOSAL	Minor Change to Development Approval (Multi-unit housing)
APPLICANT	Luigi & Marianna Bonomi 27 Old Port Road PORT DOUGLAS QLD 4877
LOCATION OF SITE	14 Mudlo Street PORT DOUGLAS
PROPERTY	Lot 919 on PTD2092

LOCALITY PLAN

Figure 1 - Locality Plan

ZONE	Tourist Accommodation
PLANNING SCHEME	2018 Douglas Shire Planning Scheme version 1.0
REFERRAL AGENCIES	There are no referral agencies for this minor change application
NUMBER OF SUBMITTERS	There were no submitters for this minor change application
STATUTORY ASSESSMENT DEADLINE	23 November 2018
APPLICATION DATE	23 October 2018

RECOMMENDATION

That Council approves the application for minor change to approval for a material change of use (Multi-unit Housing) over land described as Lot 919 on PTD2092, located at 14 Mudlo Street PORT DOUGLAS, subject to the following:

APPROVED DRAWING(S) AND / OR DOCUMENT(S)

The term 'approved drawing(s) and / or document(s)' or other similar expressions means:

Drawing or Document	Reference	Date
Site Plan	**Plan prepared by TPG Architects, Drawing No. DA.01c**	**November 2017**
Ground & First Floor Plan	**Plan prepared by TPG Architects, Drawing No. DA.02b**	**November 2017**
Site Elevations	**Plan prepared by TPG Architects, Drawing No. DA.03a**	**November 2017**
Elevations	**Plan prepared by TPG Architects, Drawing No. DA.04b**	**November 2017**
Sections	**Plan prepared by TPG Architects, Drawing No. DA.05a**	**November 2017**
Landscape Master Plan	**Plan prepared by Andrew Prowse Landscape Architect, Drawing No. LA-M.01**	**17 November 2017**
Landscape Planting Plan	**Plan prepared by Andrew Prowse Landscape Architect, Drawing No. LA-P.01**	**16 November 2017**
Landscape Planting Scheme	**Plan prepared by Andrew Prowse Landscape Architect, Drawing No. LA-S.01**	**17 November 2017**

ASSESSMENT MANAGER CONDITIONS

1. Carry out the approved development generally in accordance with the approved drawing(s) and/or document(s), and in accordance with:

a. The specifications, facts and circumstances as set out in the application submitted to Council; and

b. The following conditions of approval and the requirements of Council's Planning Scheme and the FNQROC Development Manual.

Except where modified by these conditions of approval

Timing of Effect

2. The conditions of the Development Permit must be effected prior to Commencement of Use, except where specified otherwise in these conditions of approval.

Air-conditioning Screens

3. Air-conditioning units located above ground level and visible from external properties and the street must be screened with appropriate materials to improve the appearance of the building. Such screening must be completed prior to the Commencement of Use.

Damage to Council Infrastructure

4. In the event that any part of Council's existing sewer/water or road infrastructure is damaged as a result of construction activities occurring on the site, the applicant/owner must notify Council immediately of the affected infrastructure and have it repaired or replaced at no cost to Council.

Water Supply Works External

5. Undertake the following water supply works external to the site to connect the site to existing water supply:

a. Augment existing water supply infrastructure to provide adequate water supply to the development. The extension of the water main must have regard to the ultimate configuration of the development.

Vehicle Parking

6. The car parking layout must comply with the Australian Standard AS2890.1 2004 Parking Facilities – off-street car parking and be constructed in accordance with Austroads and good engineering design. In addition, all parking, driveway and vehicular manoeuvring areas must be imperviously sealed, drained and line marked.

External Works

7. Undertake the following works external to the land at no cost to Council:

a. Provide a vehicle crossover and apron to Mudlo Street. The location and design of the access must not detrimentally impact on the significant street tree on the road verge.

b. Repair any damage to existing roadway (including removal of concrete slurry from footways, roads, kerb and channel and stormwater gullies and drain lines) that may occur during and works carried out in association with the construction of the approved development.

Demolish Structures

8. All structures not associated with the approved development (including disused services and utilities) must be demolished and/or removed from the subject land prior to Commencement of Use.

Stockpiling and Transportation of Fill Material

9. Soil excavated from the site is not to be stockpiled in locations that can be viewed from adjoining premises or a road frontage for any longer than one (1) month from the commencement of works.

Transportation of fill or spoil to and from the site must not occur within:

a. peak traffic times;

b. before 7:00 am or after 6:00 pm Monday to Friday;

c. before 7:00 am or after 1:00 pm Saturdays; or

d. on Sundays or Public Holidays.

Emissions

10. Dust emissions or other air pollutants, including odours, must not extend beyond the boundary of the site and cause a nuisance to surrounding properties.

Storage of Machinery and Plant

11. The storage of any machinery, material and vehicles must not cause a nuisance to surrounding properties, to the satisfaction of the Chief Executive Officer.

Lawful Point of Discharge

12. All stormwater from the property must be directed to a lawful point of discharge being Mudlo Street or Beryl Street, such that it does not adversely affect surrounding properties or properties downstream from the development.

Ponding and/or Concentration of Stormwater

13. The proposed development is not to create ponding nuisances and/or concentration of stormwater flows to adjoining properties.

Minimum Fill and Floor Levels

14. All habitable floor levels in all buildings must be located 300mm above the Q100 flood immunity level, plus any hydraulic grade effect (whichever is the greater), in accordance with FNQROC Development Manual and Planning Scheme requirements.

Construction Signage

15. Prior to the commencement of any construction works associated with the development, a sign detailing the project team must be placed on the road frontage of the site and must be located in a prominent position. The sign must detail the relevant project coordinator for the works being undertaken on the site, and must list the following parties (where relevant) including telephone contacts:

a. Developer;

b .Project Coordinator;

c. Architect/Building Designer;

d. Builder;

e. Civil Engineer;

f. Civil Contractor;

g. Landscape Architect.

Landscaping Plan

16. The site must be landscaped in accordance with the details included on the landscape plans prepared by Andrew Prowse Landscape Architect, Drawing No. LA-M.01, No. LA-P.01 and No. LA-S01. In the event the fig tree at the frontage of the site is required to be removed, a plan detailing the replacement landscaping must demonstrating deep planting of the setback area to the satisfaction of the Chief Executive Officer, prior to commencement of use or Survey Plan endorsement, whichever occurs first.

Sewer Works Internal

17. Undertake the following internal sewer works:

~~a. Upgrade the existing sewer line within the allotment boundaries and to the manhole on the adjacent allotment 0 on BUP70906 with extra heavy pipe to allow for the unit development to be constructed over the sewer. The works must be completed to the satisfaction of the Chief Executive~~

~~Officer. All works, including the submission and approval of the as-constructed drawings must be undertaken prior to the issue of a Development Permit for Building Works.~~

a. Repair the two holes within the existing sewer line within the allotment boundaries to the satisfaction of the Chief Executive Officer.

~~b. Provide a detailed solution to protect the new sewer line located under the development to the satisfaction of the Chief Executive Officer. The design of the development to extend over the sewer line must utilise the as-constructed detail of the new sewer line and be RPEQ Certified.~~

b. Provide a detailed solution to protect the new sewer line located under the development to the satisfaction of the Chief Executive Officer. The design of the development to extend over the sewer line must utilise the as-constructed detail of the sewer line works and be RPEQ Certified to demonstrate that the building will not cause any detrimental impact to the sewer line.

~~c. The detailed solution must include sewer line replacement with a suitable heavy duty sewer pipe to the satisfaction of the Chief Executive Officer. A new manhole must be developed at the northern side boundary incorporating a dropper for a new house connection branch which must be installed for the reliant development to the rear, this must be sited clear of any building work. An inspection manhole must be installed at the common boundary to lot 0 on SP199695 for the house connection branch. All redundant house connection branches must be removed.~~

c. Provide a new manhole at the northern side boundary with a house connection branch to service the development. All redundant house connection branches must be removed.

Sewer Easement

18. Create an easement in favour of Council having a width of three (3) metres over the sewer within the site area that is clear of the building footprint and covering the new manhole location, to the requirements and satisfaction of the Chief Executive Officer. An access easement is required over the access driveway to the sewer easement.

A copy of the easement documents must be submitted to Council for the approval by Council's solicitors at no cost to Council.

a. The approved easement documents must be submitted at the same time as seeking approval and dating of the Building Format Plan and must be lodged and registered with the Department of Natural Resources and Mines in conjunction with the Plan of Survey.

Inspection of Sewer

~~**19. CCTV inspections of sewers must be undertaken both prior to commencement of works on site and at works completion where works have been undertaken over or to sewers. Defects must be rectified to the satisfaction of the Chief Executive Officer at no cost to Council prior to Commencement of Use or approval and dating of the Building Format Plan, whichever occurs first.**~~

19. CCTV inspections of the sewer must be undertaken at works completion where works have been undertaken over or to sewers. Defects must be rectified to the satisfaction of the Chief Executive Officer at no cost to Council prior to Commencement of Use or approval and dating of the Building Format Plan, whichever occurs first.

Protection of Landscaped Areas from Parking

20. Landscaped areas adjoining the parking area must be protected by a 150 mm high vertical concrete kerb or similar obstruction. The kerb must be set back from the garden edge sufficiently to prevent vehicular encroachment and damage to plants by vehicles.

Perimeter Fencing

21. Prior to the issue of a development permit for building work, demonstrate the detail of the perimeter fencing with respect to each boundary and treatment of each area, to the satisfaction of the Chief Executive Officer.

ADVICE

1. This approval, granted under the provisions of the *Planning Act 2016*, shall lapse six (6) years from the day the approval takes effect.

2. All building site managers must take all action necessary to ensure building materials and / or machinery on construction sites are secured immediately following the first cyclone watch and that relevant emergency telephone contacts are provided to Council officers, prior to commencement of works.

3. This approval does not negate the requirement for compliance with all other relevant Local Laws and other statutory requirements.

Infrastructure Charges Notice

1. A charge levied for the supply of trunk infrastructure is payable to Council towards the provision of trunk infrastructure in accordance with the Adopted Infrastructure Charges Notice, a copy of which is attached for reference purposes only. The original Adopted Infrastructure Charges Notice will be provided under cover of a separate letter.

The amount in the Adopted Infrastructure Charges Notice has been calculated according to Council's Adopted Infrastructure Charges Resolution.

Please note that this Decision Notice and the Adopted Infrastructure Charges Notice are stand-alone documents. The Planning Act 2016 confers rights to make representations and appeals in relation to a Decision Notice and an Adopted Infrastructure Charges Notice separately.

The amount in the Adopted Infrastructure Charges Notice is subject to index adjustments and may be different at the time of payment. Please contact Development Assessment and Coordination at Council for review of the charge amount prior to payment.

The time when payment is due is contained in the Adopted Infrastructure Charges Notice.

2. **For information relating to the *Planning Act 2016* log on to www.dilgp.qld.gov.au. To access the *FNQROC Development Manual*, Local Laws and other applicable Policies, log on to www.douglas.qld.gov.au.**

EXECUTIVE SUMMARY

Council is in receipt of a minor change application to a Material Change of Use for 'Multi-Unit Housing (3 units), over land located at 14 Mudlo Street, Port Douglas, being formally described as Lot 919 on PTD2092.

The land was contained within the 'Tourist and Residential Planning Area of the Port Douglas and Environs Locality within the 2006 Douglas Shire Planning Scheme. The application was made under the 2006 Planning Scheme. The allotment has a site area of 1,012m^2. Approval was given at the Ordinary Council meeting of 20 February 2018.

The minor change application is made to change conditions relating the requirements imposed on the applicant to undertake works to the sewer main traversing the site.

The application is recommended for approval subject to conditions.

TOWN PLANNING CONSIDERATIONS

Background

Council gave a development permit at the 20 February 2018 Ordinary Council Meeting for the development of three residential units at 14 Mudlo Street. Conditions imposed on the approval required the length of trunk sewer main traversing through the property to be replaced with extra heavy duty pipe so that the building proposed for development above the pipe did not crush the sewer main.

The sewer line traversing the site is a 300mm asbestos trunk sewer main developed in 1975 (see figure 1 above). This type of pipe is characterised as being fragile with little to no ability to flex if loaded. Once a building is developed over the sewer line, there a two risks Council as asset owner is faced with. The first of which is the risk the weight of the building imposes on the line. Conditions have been imposed to require that the building design is certified by

an RPEQ Engineer to certify that the building will not impose a significant load on the pipe resulting in damage. The industry standard is to pier footings down below the sewer pipe to load the earth below the pipe rather than above and around the pipe in conjunction with replacing the pipe with a heavy duty material pipe (ductile iron, high density PVC etc).

The second risk to Council is that if there is ever major damage cause, the pipe cannot be practically accessed for repair because a unit will be built on top of it. Councils maintenance teams have been faced with this circumstance a number of times in the Port Douglas Locality as Councils have historically approved unit developments on top of services.

The applicant accepted the conditions imposed on the development approval and attempted to replace the section of sewer within their boundaries with a heavy duty pipe. The construction method involved a dewatering process which aimed to lower the water table below the depth of the sewer so that the pipe could be replaced. The applicants contractors attempted to dewater the pipe for two weeks with no luck. There was too much ground water at the site resulting in no ability to lower the water table to below the 4.9 metre deep pipe.

The applicant then initiated discussions with officers to allow the development to proceed without the heavy duty pipe replacement. Council had the sewer internally re-lined in 2015 which gives the sewer a useful life of a minimum of a 100 year period according to the Interflow service life report (see attachment 2) for PVC spiral liners.

A CCTV inspection of the current state of the subject sewer line was carried out on 10 October 2018. The inspection and assessment concluded that the pipe is in good order with two minor patches required where redundant connection branches have been removed.

If the patching work is undertaken and the loading of the building on the sewer can be managed by way of engineering design then Council can be satisfied that the asset is able to be built over without significant risk. A new manhole has been conditioned to be developed at the down stream side of the sewer line at the property boundary so that in the event of blockage or damage under the building, Council can divert the flow of the sewer from the upstream manhole on the adjoining property to the new manhole at 14 Mudlo Street so that the infrastructure can continue to operate during repair.

Proposal

Proposed is a minor change to condition 17 and 19 of development approval MCUC2385/2017 for a material change of use for multi-unit housing (3 units) at 14 Mudlo Street Port Douglas.

The proposed change to the conditions are to allow the unit development to be built over the existing 300mm trunk sewer main without replacing the length of sewer with heavy duty pipe. The proposal is to accept the re-lining work done in 2015 as a solution to Councils concerns raised with building over the trunk sewer infrastructure.

State Planning Requirements

The *Planning Act 2016* and The *Planning Regulation 2017* require particular criteria for a proposal to be considered a minor change.

It is considered that the change would not result in substantially different development considering the individual circumstances of the development in the context of the change proposed, and having regard to the matters indicated at Section 4 of Schedule 1 to the Development Assessment Rules.

(a) *involves a new use;*

No new uses are proposed.

(b) results in the application applying to a new parcel of land;

No new land is brought into the proposal.

(c) dramatically changes the built form in terms of scale, bulk and appearance;

The built form is not proposed for change.

(d) changes the ability of the proposed development to operate as intended;

The operation of the use will not change.

(e) removes a component that is integral to the operation of the development;

No components are removed.

(f) significantly impacts on traffic flow and the transport network, such as increasing traffic to the site;

Traffic flows are not impacted by the change.

(g) introduces new impacts or increase the severity of known impacts;

The subject trunk sewer main traverses beneath almost all the buildings built on the block at the Mudlo Street frontage. Allowing the proposal to further constrain the ability to service and maintain the trunk sewer main is considered insignificant in the context of the surrounding pattern of development built over the same sewer line. Although not an ideal situation, the conditions requiring structural certification of the building load, patching of the two redundant existing connection branches and development of a new manhole for contingency and maintenance are considered appropriate measures to determine that the severity of known impacts will not be increased by the proposed minor change.

(h) removes an incentive or offset component that would have balanced a negative impact of the development;

No incentives were proposed in the original application.

(i) impacts on infrastructure provisions;

The proposed minor change does not create any further demand on infrastructure.

Referral Agency Requirements

There are no referral agencies triggered for this application.

Public Notification / Submissions

The original application was code assessable and the minor change does not trigger any public notification.

ADOPTED INFRASTRUCTURE CHARGES

The minor change does not trigger further infrastructure charges.

COUNCIL'S ROLE

Council can play a number of different roles in certain circumstances and it is important to be clear about which role is appropriate for a specific purpose or circumstance. The implementation of actions will be a collective effort and Council's involvement will vary from information only through to full responsibility for delivery.

The following area outlines where Council has a clear responsibility to act:

Regulator: Meeting the responsibilities associated with regulating activities through legislation or local law.

Under the *Planning Act 2016* and the *Planning Regulation 2017*, Council is the assessment manager for the application.

ATTACHMENTS

1. Attachment 2- Interflow Re-lining Design Life Paper **[5.2.1]**
2. Attachment 1- Previously Approved Plans **[5.2.2]**

No-Dig Down Under 2015
11th ASTT Conference and Exhibition

Gold Coast, Australia
8-11 September 2015

Paper 1.11

Dr Ian Bateman
Director, Interflow Australia

HOW LONG DO WE EXPECT SPIRAL LINED PIPES TO LAST?

Introduction

Lining of Australia's sewer pipes through trenchless methods commenced in earnest in the late 1980's / early 1990's. At the time, it was very difficult to predict how long re-lined pipes would last. Indeed, it was not clear whether re-lining was a "repair" of an existing pipe or a "renewal".

Now some 25 years later what can we say about the expected life of a re-lined pipe? Are we half way through the expected life? Have we had to go back and re-repair lined pipes? Are the lined pipes actually likely to last longer than the original pipes?

The objective of this paper is to explore these questions and in particular examine the condition of pipes lined with the spiral wound product, Expanda®, after 25 years of service and make a prediction of their service life.

Background

In Australia there are approximately 100,000km of sewer pipes. Around 500km of these are relined each year. A variety of relining products are used, but all of them are plastic and designed using very similar methods.

The quantity of installed sewer pipes has more or less followed the growth of the nation's population and the social demand to have a fully sewered community. As such a relatively large proportion of the sewers were laid in the post war decades, meaning that the median age of the sewers is approximately 50 years.

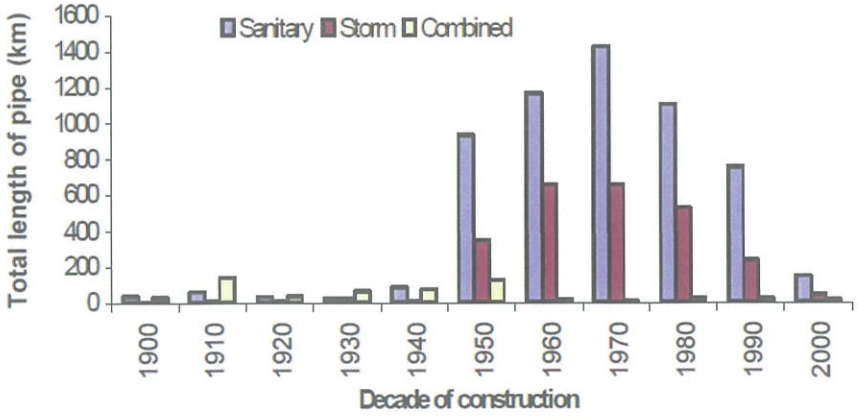


Figure 1. Typical age distribution of pipes in Australia

In Australia, there were several materials of construction used for sewer pipes. The most common being

- Concrete
- Vitrified Clay

The definition of *Service Life* is also not clear and can be interpreted in a few different ways. Based on some studies referenced below the following definitions appear to be used commonly.

Maximum Average Service Life: The average age that a large sample of pipes will have reached the end of their lives (i.e. the average time taken to failure). Note this is a definition pertaining to the individual pipe / material not the sewer as a whole.

Actual Average Service Life: The average age that a large sample of pipes are *actually replaced* or renewed.

Providing a single figure for the actual service life is fraught with difficulty because it can be arrived at in several different ways. The following studies show different ways in which this has been estimated.

Global Study Drawing Data from USA, Canada and UK.

A study performed by *Newton and Vanier (2006)* looked at estimating and modelling the service life of a variety of materials and referenced data from Canada, USA and UK. By using the WRc method for classifying the Structural Pipe Grade (SPG) of 1 to 5, where 5 is considered structurally failed, 4 = poor, 3=fair, they defined the maximum service life as the time taken to reach a SPG of 5. Most asset owners will act to renew the asset when the SPG is 4.

The conclusion drawn from this was the concrete and vitreous clay have a maximum service life of between 105 and 130 years (SPG=5). But they will reach SPG of 4 approximately 10 to 30 years earlier.

Study by Martin, Johnson and Anschell (2007).

This study looked at behaviour of concrete and vitrified clay sewers in the city of Seattle, USA. The average years of total life for clay was stated to be 120 years and for concrete 80 years.

NSW Office of Water, June 2014

This document published a table stating the useful lives of a variety of water infrastructure assets in NSW, Australia. It quantifies the useful life of clay pipes to be 70 years and concrete to be 45 years.

Yarra Valley Water Study Presented at Trenchless Live, Coffs Harbour 2010

In information provided by Yarra Valley Water from Victoria, Australia, the average age of relining of its concrete and clay assets was stated as approximately 50 years.

Average Age of Sewers Interflow Is Currently Relining

In the last 12 months Interflow has relined over 250km of sewers in Australia. The average age of those sewers was approximately 50 years.

When examining these reports in more detail it is clear that the practical age at which sewers are relined in Australia is well short of the predicted maximum service life of the pipes. Furthermore the principle reason why pipes are relined is rarely due to structural deterioration of the pipes, rather it is driven by *blockages*. The major contributors to blockage (over 80%) in Australia tend to be tree root infiltration, fat build-up and objects in the line. The contribution to blockage from collapsed or broken pipes is less than 5%. This indicates that the key driver that defines the end of life is more related to a loss of seal (i.e. the ability for foreign objects to penetrate the pipe) than the structural collapse or failure of the pipe material. It therefore explains why the service lives stated in the last 3 studies above, are far less than the service lives of the pipe materials themselves. Based on the above independent studies and current practice it would be reasonable to describe the life expectancy of concrete and clay pipes in Australia to be as follows

	Definition	Concrete	Clay
Maximum Average Service Life of Pipe Material	The age at which the pipe material has failed. And /or the point at which the SPG=5	75 -120 years	100 - 130 years
Actual Average Service Life of Pipe Material	The age at which a proportion (5%) of the pipes will have failed. And/or the point at which the SPG=4	50 – 90 years	70 to 100 years
Actual Average Service Life of the Sewer	The age at which the sewers are actually relined for any reason	40 – 50 years	50 – 70 years

Performance of Sewer Pipes Lined with Expanda Pipe

Interflow began lining sewers in Australia with Rib Loc Expanda® in 1990. In the early years, the conventional thinking had been that the liners should last 50 years. Indeed, the NSW Office of Water states that the useful life of relined sewers is 50 years. These statements and estimates were based on best guesses, common sense and some logical extrapolation of the performance of plastic pipes. Of course, the 50 year estimate was not able to be based on data. However, with 25 years of experience now behind us, we are in a position to perform some analysis of the early liners and make an estimate of what the maximum service life may be.

Interflow has been responsible for relining over 50% of all of Australia's sewers since the industry began. As such more than 50% of the liners are spiral liners. There have been studies performed in other parts of the world looking at the condition of CIPP liners, but never before have spiral liners been analysed and certainly not in Australian conditions.

When a pipe is lined there are 3 main attributes expected from the liner

1. That it is structural sound and capable of bearing applied soil and water loads.
2. That it is sealed and will prevent ingress of tree roots, ground water etc
3. That it is hydraulically sound. In most cases the re-lined sewer will have equivalent or better hydraulic capacity than the unlined host pipe

Each of these attributes is expected to remain for the duration of the service life.

To quantify the condition of spiral liners installed 25 years ago, Interflow selected 3 locations and set about analysing the liners with respect to each of the above attributes. Specifically, the following aspects were inspected.

1. Structural
   a. Evidence of deflection
   b. Measurement of physical properties
   c. Measurement of critical dimensions (wall thickness)
2. Seal
   a. Evidence of leakage through the spiral seam
   b. Analysis of the condition of the seal in the spiral seam

3. Hydraulics
   a. Condition of the surface of the pipe (build up or damage of theliner) Interflow working with Sekisui Rib Loc, selected three locations for this study.

Location 1 – a sewer pipe, located in water charged ground in Adelaide. The host pipe was vitreous clay. At the time of lining the host pipe was showing signs of water ingress through the joints. The pipe was lined in 1992. The camera survey was carried out and assessed by an independent contractor.

Samples taken from the liner were analysed by a NATA accredited laboratory. The analysis occurred last in 2009. The liner was CCTV surveyed, pressure tested, and samples taken for thickness measurement.

Location 2 – a sewer pipe located in Sydney. The host pipe was concrete. The pipe was lined in 1996. Liner was inspected in August 2015. A CCTV survey was performed, a sample of pipe from the invert was removed and physical properties were measured by NATA accredited laboratory.

Location 3 – a sewer pipe, located in Sydney. The host pipe was concrete. The pipe was lined in 1996. Liner was inspected in August 2015. A CCTV survey was performed, a sample of pipe from the invert was removed and physical properties were measured by NATA accredited laboratory.

Results

The results of sampling taken from each location is summarised in the table below.

Table 1

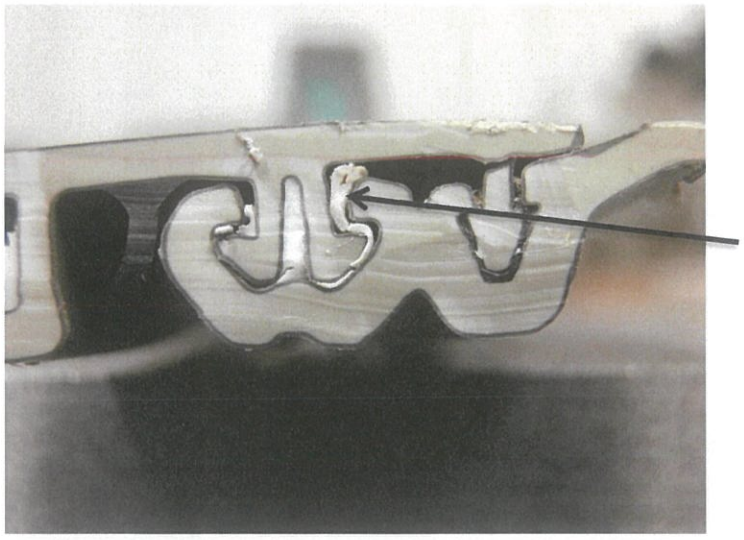
		Location 1	Location 2	Location 3
Structural / Physical Properties	Evidence of deflection	None	None	None
	Modulus of Elasticity (flexural) Initial = 2,798 MPa	Data not measured. Visual inspection only	2,865 MPa	2,865 MPa
	Tensile Strength Initial = 44.1 MPa		44.5 MPa	44.3 MPa
	Elongation at Break =120%		103%	119%
	Wall thickness Loss	0.00mm	0.00 mm	0.00mm
Sealing	Evidence of leakage through seal	None. Pressure test according to AS/NZS2032	None	None
	Analysis of condition of sealant	Quantity unchanged Properties unchanged	Quantity unchanged Properties unchanged	Quantity unchanged Properties unchanged
	through seal	Pressure test according to AS/NZS2032		
	Analysis of condition of sealant	Quantity unchanged Properties unchanged	Quantity unchanged Properties unchanged	Quantity unchanged Properties unchanged
Hydraulics	Condition of surface of liner	Surface roughness unchanged	Surface roughness unchanged	Surface roughness unchanged

Structural Appearance / Properties

On the CCTV surveys, there were no signs of deflection or structural distress. The physical properties of the PVC have remained unchanged. There is no measurable loss of wall thickness due to abrasion. In fact, on all the liners the printing (ink) is still clear and visible.

Sealing

There were no junctions on the line in location 1. As such a pressure test was able to be performed (according to AS/NZS2032). The liner passed the test. There was no evidence of leakage via this test. For locations 2 and 3, the condition of the sealant in the spiral seam was analysed. In particular the quantity and properties of silicone were examined. As shown in the photograph below there is clear evidence that there has been no loss of sealant. Furthermore, the silicone removed from the lock has very similar properties (qualitatively) to new silicone. Furthermore, CCTV inspection showed no evidence of water or root ingress along the length of the liner.



Silicone sealant still present

Hydraulics

The surface roughness of the liner appeared unchanged and equally as smooth as a new liner. There was no sign of mechanical damage to the liner anywhere along its length.

Summary

It can reasonably be concluded that there is essentially no change in any of the properties of the liners over their 20 years of service. While this is an excellent result, it does not allow us to make any predictions about the maximum service life, i.e. there is no deterioration to extrapolate from. It is also a limited sample size. In order to be able to make a statistically valid prediction about the end of life, a much greater sample would be necessary and ideally, we would be able to measure some degree of deterioration. This is beyond the scope of this current study.

But what can we say and how can we make some predictions?

This data alone tells us that there is no underlying deterioration of the product, unlike the host pipes. For example, if we were to select 25 year old concrete pipes we would be able to measure a reduction in the wall thickness due to erosion and/or gas attack. We know this would ultimately correlate to the data presented in the previous section concerning the service life of the pipe. Figure 2 published by *Park (2009)* shows a typical curve of concrete pipe deterioration. Clearly the deterioration process is continuous and is measurable quite early in the product's life.

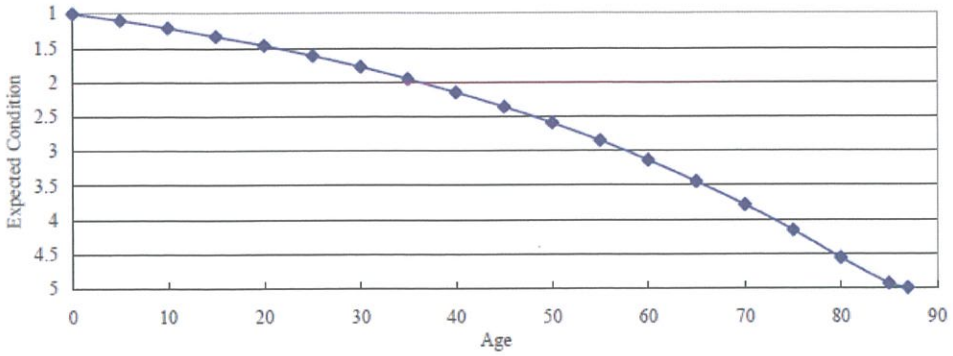


Figure 2: Model of Rate of 8" Concrete Pipe Deterioration *(Park 2009)*

A recent study performed by *Whittle and Tennakoon (2005)* attempted to estimate the service life of direct buried PVC sewer pipes. This study took a similar approach to our study, whereby they exhumed seven PVC sewer pipes and analysed the samples for signs of deterioration. The results they obtained also indicated there were no signs of deterioration. The conclusion drawn by *Whittle and Tennakoon (2005)* was

"There is nothing in the test results to suggest the life of the pipes will be limited to 50 years. Given the pipes have been in service for 25 years and are in such good condition, there is no reason to suppose they will not achieve upwards of 100 years' service."

The preface to latest AS/NZS Standards for PVC-U pipes includes the statement that:

" It should be noted that, by convention, plastics pipe systems are often designed on the basis of 50 years extrapolated test data. This is established international practice but is not intended to imply the service life of drainage pipes is limited to 50 years. For correctly manufactured and installed systems, the actual life cannot be predicted, but can logically be expected to be well in excess of 100 years before major rehabilitation is required."

This is consistent with Interflow's experience in lining over 2,800 kilometres of deteriorated sewers - over 50,000 separate sewer lines. The proportion of those sewers for which the host pipe was made from PVC has been negligible and defects in PVC host pipes tend to be due to leaking joints or improper installation. There has been no requirement to line any PVC pipes that are "worn out" or deteriorated – even though such pipes have been installed in Australia since the 1960s.

Arguably a direct buried sewer pipe has a tougher life that a spiral liner. The direct buried pipe is not housed within an existing pipe and furthermore it is well known that the harshest condition that a direct buried pipe experiences occurs in the process of installation, backfilling and compacting.

The behaviour of PVC pipes is also consistent with the PVC spiral wound liners Interflow has installed since 1990. Post-installation callouts have been statistically insignificant and have been restricted to repairing post- installation damage or defects missed at the time of installation. There have been no reported instances of spiral wound liners becoming deteriorated or "worn out".

Having installed over 2,800 km of spiral liners in Australia and New Zealand (more than 50,000 lines), Interflow has never been called out to replace or repair a deteriorated spiral liner - which is consistent with there being no underlying deterioration of the product as found in the 3 sample sites and consistent with the finding of *Whittle and Tennakoon (2005)*. So, what can we say about the life of a spiral liner? Extrapolating the data, we have would suggest the liners will last infinitely long. This is not logical. Rather than predicting the life based on extrapolation we can take a different approach and look at it from a statistical modelling angle.

Deterioration phenomena such as this and other physical processes involving wear and tear, reliability and fatiguing are modelled in specialised areas of engineering using a Weibull Distribution Function. This Function was applied in the work of *Newton and Vanier (2006)* and *Martin, Johnson and Anschell (2007)* to model the age dynamics of sewer pipes. If we assume that our spiral liners will exhibit similar deterioration we can then use a Weibull Distribution Function to test a series of what/if scenarios. Let us assume that out of the 50,000 lines currently installed, we eventually find 5 of them that have reached the end of their lives. Based on the time from now that this occurs, we can then predict when the rest of the pipes will reach their maximum and actual service lives. By way of illustration 4 scenarios have been modelled.

Assume that of the 50,000 liners installed (and that none have failed after 25 years) we eventually find that 5 have reached the end of their service lives due to deterioration after

i/ 30 years

ii/ 35 years

iii/ 40 years

iv/ 50 years

Using the Weibell Distribution Function model we can predict the maximum and actual service lives of the spiral liners. The results are shown in Table 1 and illustrated in Figure 3.

Table 2

Scenario	If we find 5 of the 50,000 installed liner to be fully deteriorated by …	Predicted Maximum Service Life *	Predicted Actual Service Life**
1	30 years	67 years	49 years
2	35 years	155 years	86 years
3	40 years	320 years	141 years
4	50 years	1080 years	321 years

- *Defined as the time at which 95% of all pipes have failed
- ** Defined as the time that 5% of the pipes have failed

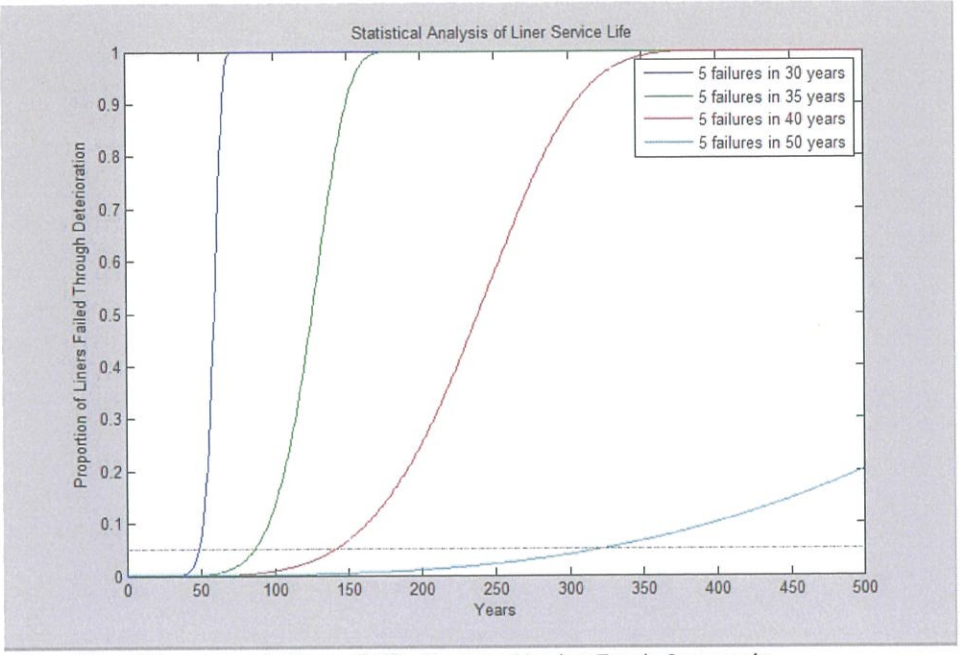


Figure 3: Graphical Representation of Life Curves Under Each Scenario

This approach allows us to see that as the number of years passes without any failures, the impact it has on the predicted service life increases rapidly. For example, if we have accumulated 5 failures by the time the liners have reached age 30 years the predicted actual service life would be 49 years. But if it takes 5 years longer to reach 5 failures the service life estimate increases to 86 years.

As can be seen the predicted maximum and actual service lives in all scenarios are substantially greater than the current experience with the traditional concrete and clay materials. Bearing in mind that that at 25 years we have registered zero failures and there is no sign of any deterioration. This paints a very positive picture about the potential service life of spiral liners.

Conclusion

If we return to the 1990's when we were trying to estimate the service lives of these liners, we were speculating that they should last 50 years. Now 25 years on, it is reasonable to predict with a high degree of confidence that the service life will be well in excess of 50 years. This is based on

- Our exhumation of liners that show no signs of deterioration after 25 years
- Our practical experience has showed there have been no reported deterioration failures for the last 25 years
- Our statistical modelling indicates that under almost any scenario the service lives will be well in excess of 50 years
- Our nearest product "cousin", being PVC sewer pipes have been predicted to last in excess of 100 years

Prediction of service life based on extrapolation is inherently non-robust – particularly when there is zero signs of deterioration from which to extrapolate from. However it is reasonable to expect that the actual service life of PVC spiral liners will at least equal that of PVC pipes. As such, at the 25 year mark of spiral liners, we would estimate that the service life these liners will be at least 100 years.

Furthermore, it is important to note that a service life of 100 years far out-performs the actual service lives of the existing sewers. It is reasonable to expect that the relined pipes will last at least twice as long as the original pipes. Psychologically this is an important point for the trenchless technology industry. It appears reasonable to state that when we reline a sewer pipe we are not *repairing* or *rehabilitating* it. We are in fact providing a new asset to the client with a performance and life expectancy far greater than the original one.

From an economic point of view, should our industry be assuming a life of 100 years rather than 45 or 50 years for a relined pipe? Should we re-consider the life cycle cost of re-lining sewers on this basis? Do we need to re- consider the depreciated value of lined pipes?

References

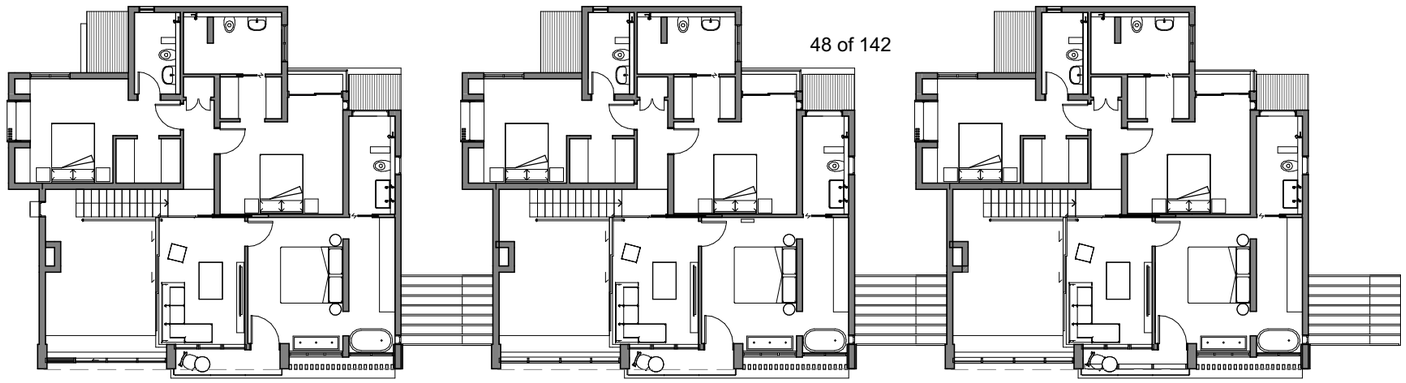
Newton, L.A. and Vanier, D.J.(2006); MIIP Report: "The State of Canadian Sewers -Analysis of Asset Inventory and Condition"

Martin, T. , Johnson, D. and Anschell,S. (2007); "Using Historical Repair Data to Create Customized Predictive Failure Curves for Sewer Pipe Risk Management". International Water Association. Leading Edge Asset Management

Whittle, A. and Tennakoon, J., (2005); "Predicting The Residual Life of PVC Sewer Pipes" Journal of Plastics, Rubber and Composites, Volume 34, Issue 7 (01 September 2005), pp 311-317.

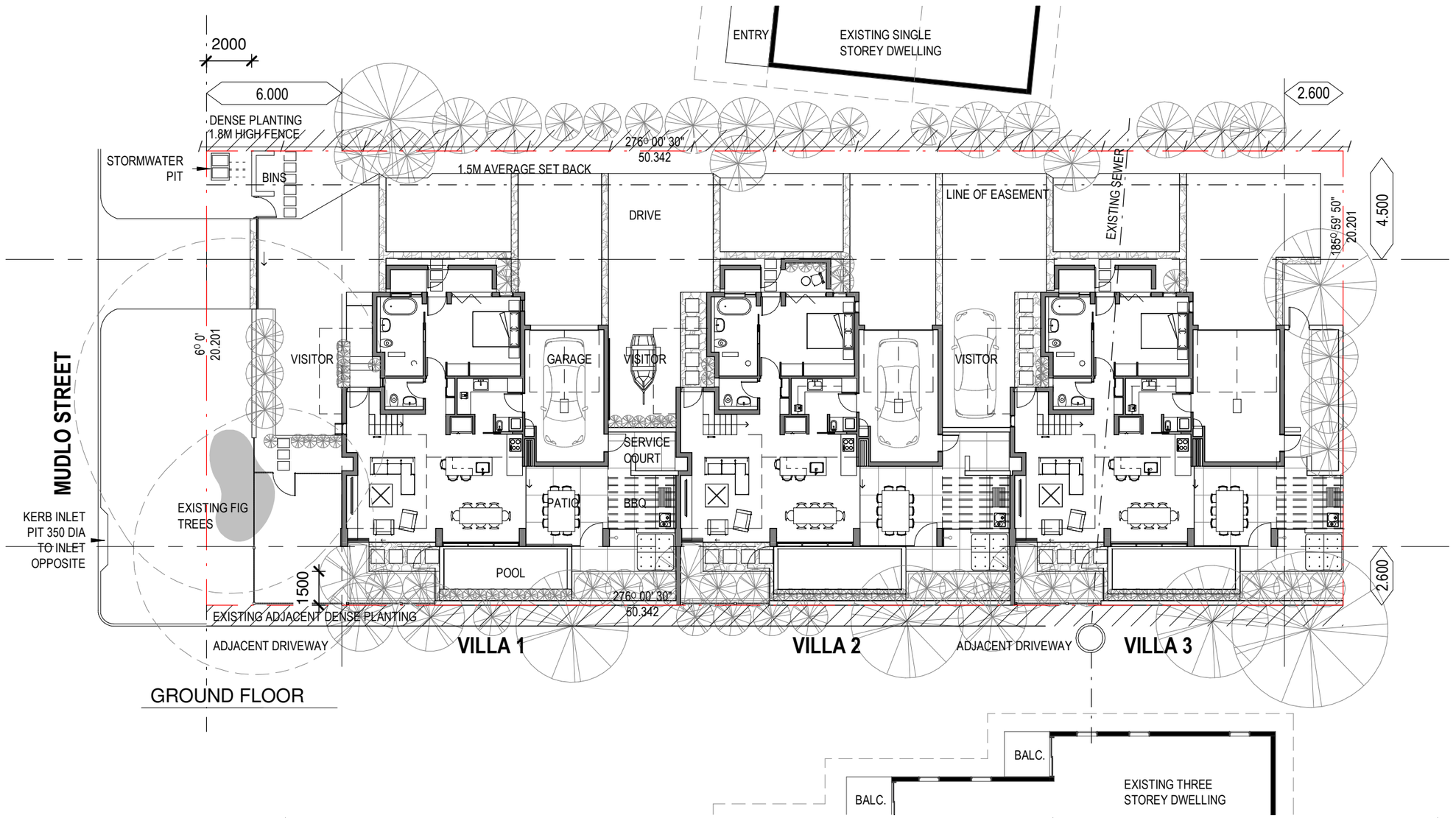
Park, T., (2009); "A Comprehensive Asset Management System For Sewer Infrastructures". PhD Thesis University of Civil Engineering, The Pennsylvannia State University

Fig Tree Villas



UPPER FLOOR

VILLA 1 **VILLA 2** **VILLA 3**



GROUND FLOOR

SITE AREA 1017m²

GFA

UPPER

Internal	121m²
Covered External	4m²
Total	125m²

GROUND FLOOR

Internal	85m²
Garage	20m²
Covered External	15m²
Total	120m²

SITE COVER

UPPER

Maximum 40%	= 407m²
3 Villas 36%	= 375m²

GROUND FLOOR

Maximum 45%	= 457m²
3 Villas 36%	= 360m²

LANDSCAPE + RECREATION

Minimum 35%	= 356m²
Provided 36%	= 365m²
Minimum Landscaped 30%	= 107m²
Provided 63%	= 230m²
Recreational Area per villa 4 x 4m²	= 16m²
Provided 4 x 5m²	= 20m²

CARPARKING

1.5 Spaces per villa	= 5 spaces
Provided	= 6 spaces
60% Covered	= 3 spaces
Provided	= 3 spaces

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1:400 @ A1 (0 8)
1:200 @ A3 (0 2 4)
As indicated @ a3

n

Site Plan

LMB-01 DA.01c
FIG TREE VILLAS
NOV 2017

Fig Tree Villas

BINS
GATE
4000
3750
6700
5850
200
3000
3500
5400
POND
COURTYARD
ENS 1
BED 1
VISITOR CAR PARK
PWD
LINEN
BOOK CASE
PANTRY
REF
ENTRY
1 2 3 4 5 6 7 8 9 10
KITCHEN
LINE OF CEILING
LOUNGE
DINE
PATIO
BBQ
SERVICE COURT
TERRACE
POOL
POOL TERRACE
DAYBED
DA.04a
1 DA.05a
EXISTING FIG TREES
2 DA.05a
DA.04a
COURT BELOW
VISITOR CAR PARK BELOW
ENS 3
BATH
LINEN
WIR
BED 3
BED 4
ENS 2
16
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16
LOFT LOUNGE
BED 2
WIR
LINE OF SKYLIGHT OVER
VOID
BALCONY
POOL BELOW

GROUND FLOOR
VILLA 1

DA.04a

2 DA.05a

UPPER FLOOR
VILLA 2

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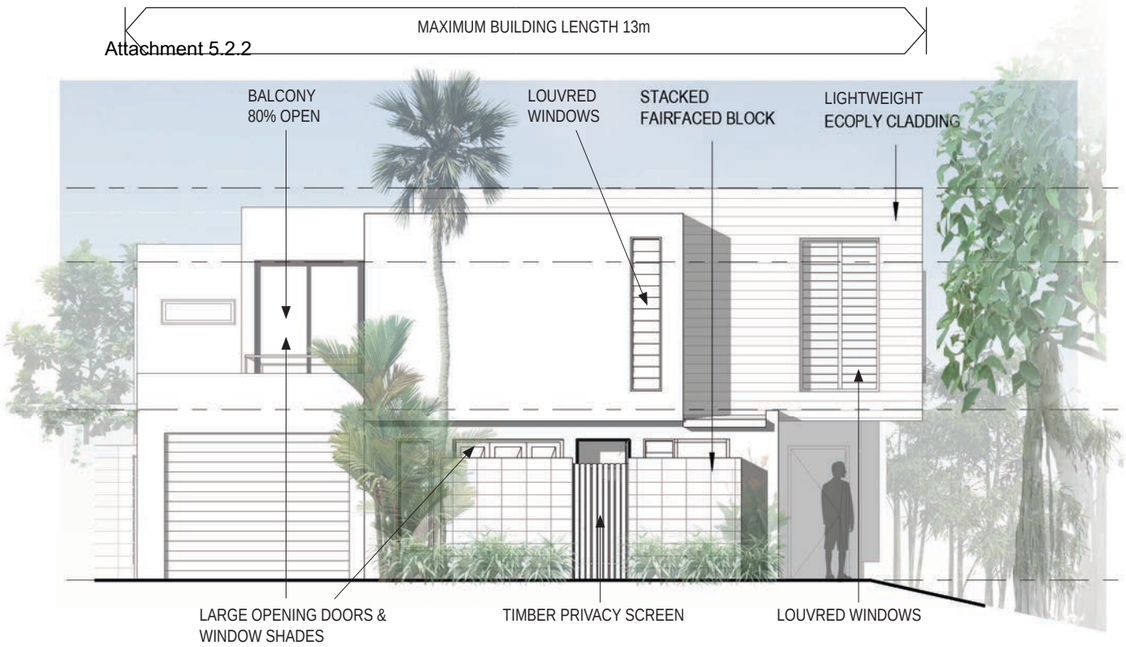
1:200 @ A1
1:100 @ A3
1 : 100 @ a3

n

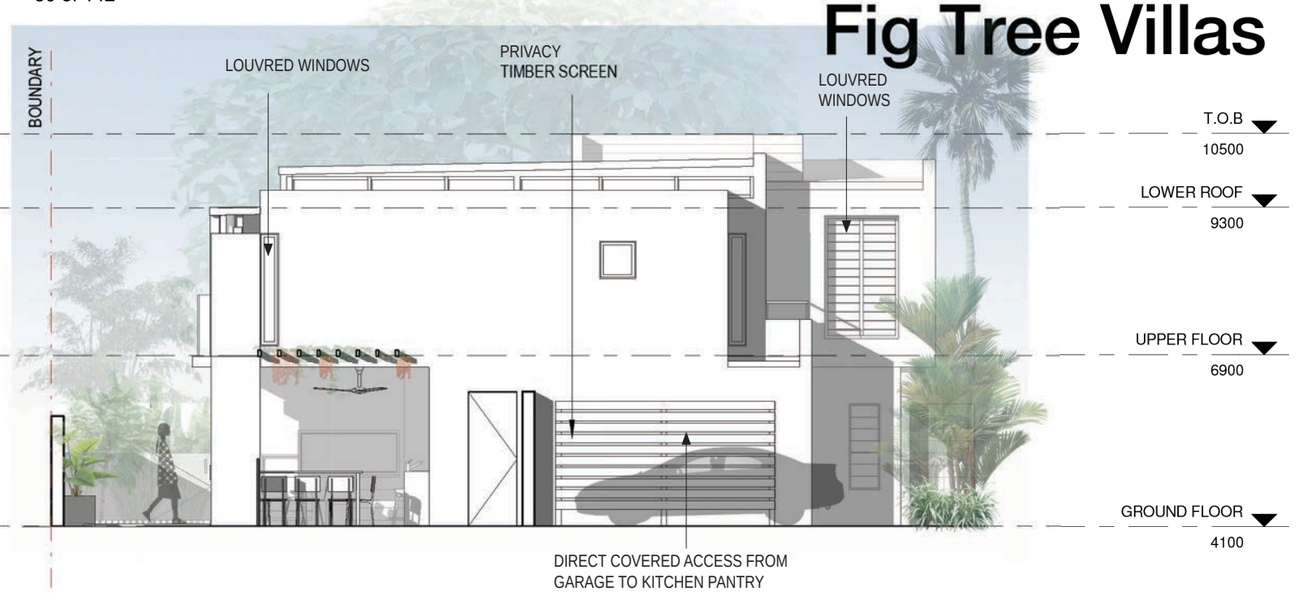
Ground & First Floor Plan

LMB-01 FIG TREE VILLAS
DA.02b NOVEMBER 2017

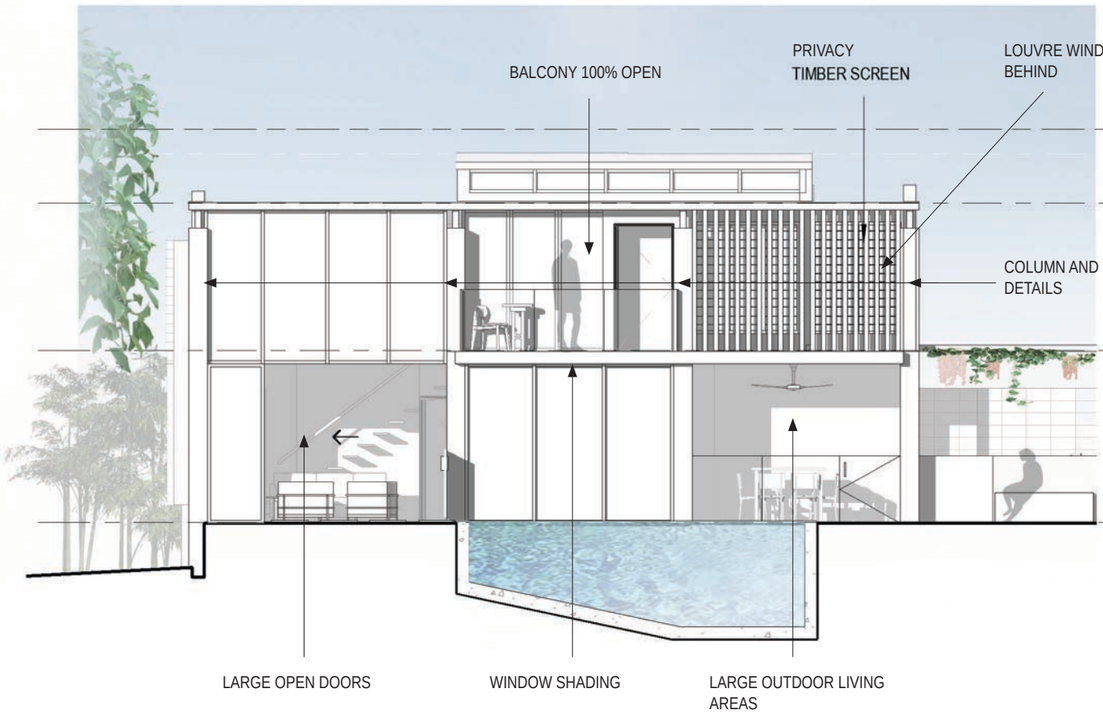
Fig Tree Villas

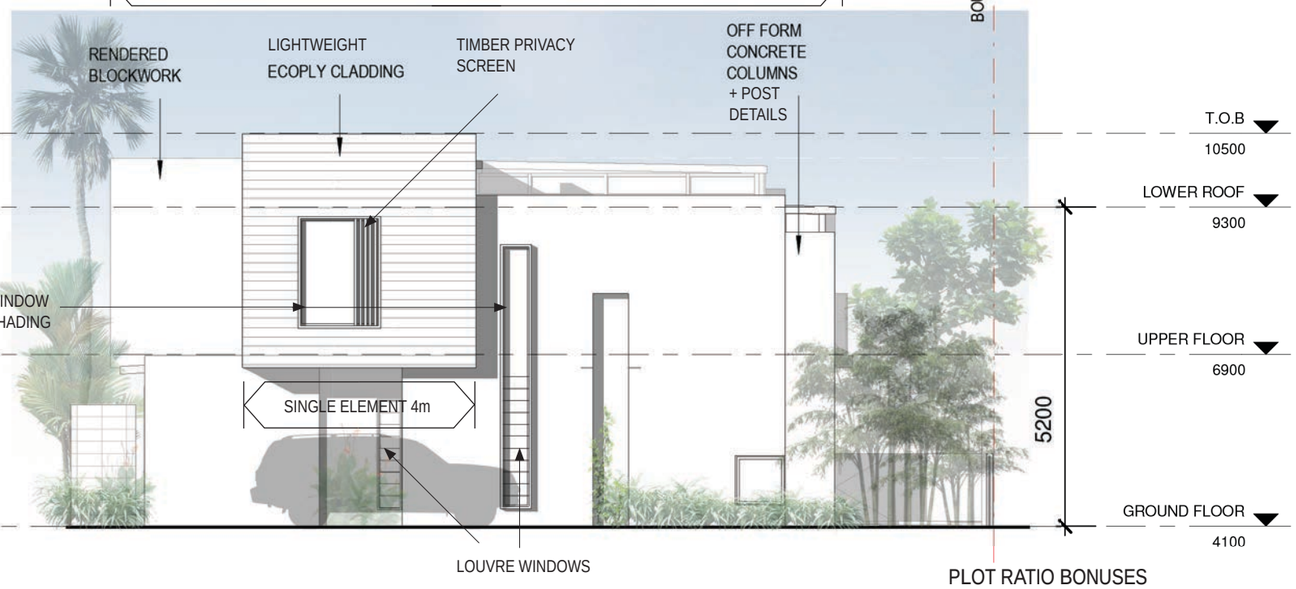


TYPICAL VILLA - NORTH ELEVATION



TYPICAL VILLA - EAST ELEVATION





TYPICAL VILLA - SOUTH ELEVATION

TYPICAL VILLA - WEST ELEVATION

PLOT RATIO BONUSES

Privacy screens	.05 (complies)
Covered pedestrian access to car	.05 (complies)
Covered or screened windows	.15 (complies)
Building bulk no greater than 30m length	(complies)
No single feature greater than 15m	.10 (complies)
Total Bonus	.35
Required Bonus	.11 (complies)

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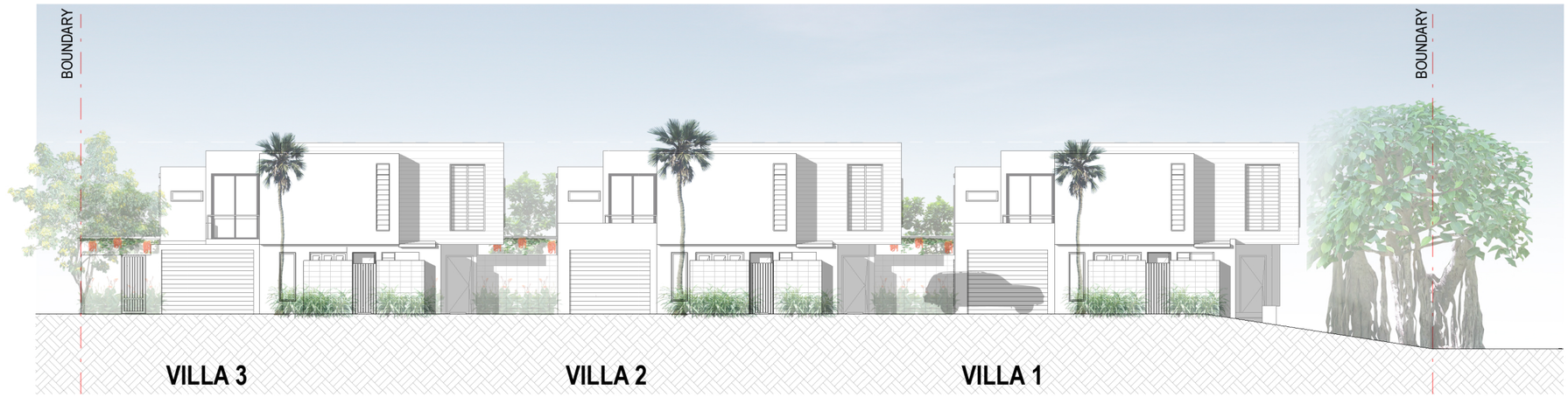
1:200 @ A1 0 1
1:100 @ A3 0 1 2

1 : 100 @ a3

Elevations

LMB-01 **FIG TREE VILLAS**
DA.04b **NOVEMBER 2017**

Fig Tree Villas



FRONT ELEVATION

BACK ELEVATION

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1:400 @ A1 (0 8)

1:200 @ A3 (0 2 4)

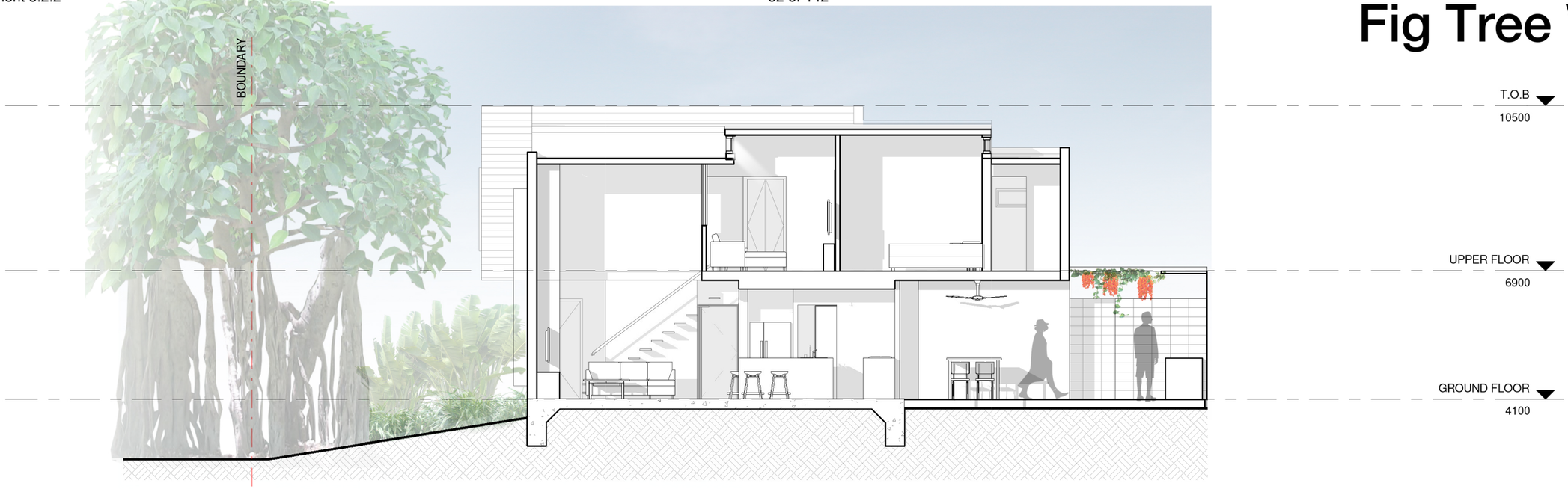
1 : 200 @ a3

Site Elevations

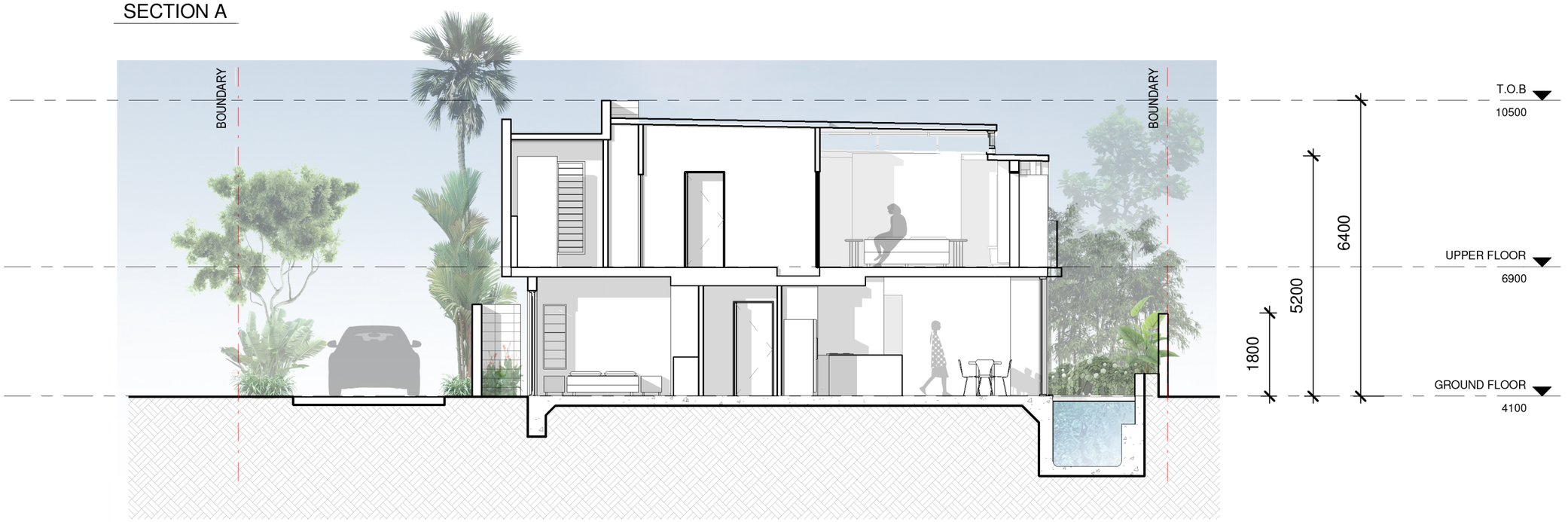
LMB-01 **FIG TREE VILLAS**

DA.03a **NOVEMBER 2017**

Fig Tree Villas



SECTION A



SECTION B

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1:200 @ A1

1:100 @ A3

0 1 2

1 : 100 @ a3

Sections

LMB-01 **FIG TREE VILLAS**

DA.05a **NOVEMBER 2017**

FIG TREE VILLAS, 14 MUDLO STREET, PORT DOUGLAS

LANDSCAPE MASTER PLAN

ISSUE DATE : 17/NOV/2017

DRAWING NO.: LA-M.01

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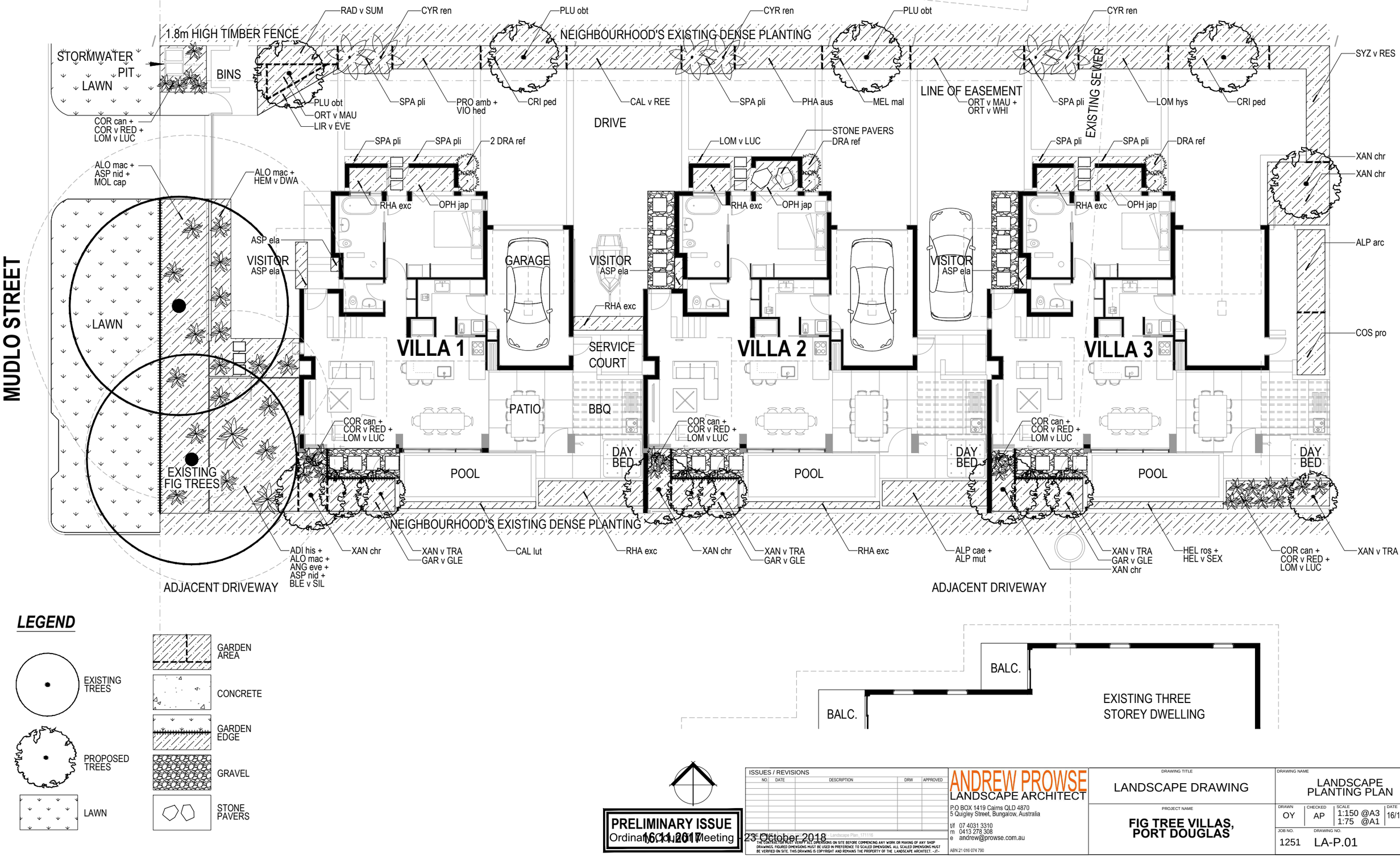

LEGEND

- EXISTING TREES
- PROPOSED TREES
- LAWN
- GARDEN AREA
- CONCRETE
- GARDEN EDGE
- GRAVEL
- STONE PAVERS

PRELIMINARY ISSUE
Ordinary Council Meeting 23 October 2018
16.11.2017

ISSUES / REVISIONS

NO.	DATE	DESCRIPTION	DRW	APPROVED

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DRAWING TITLE: LANDSCAPE DRAWING
DRAWING NAME: LANDSCAPE PLANTING PLAN
PROJECT NAME: **FIG TREE VILLAS, PORT DOUGLAS**
DRAWN: OY | CHECKED: AP | SCALE: 1:150 @A3, 1:75 @A1 | DATE: 16/11/2017
JOB NO.: 1251 | DRAWING NO.: LA-P.01 | REV: -

PLANTING SCHEME

Code	Botanical Name	Common Name	Size	Spacing
TREES				
MEL rub	*Melicope rubra*	Little Evodia	45lt	As shown
PLU obt	*Plumeria obtusa*	Evergreen Frangipani	45lt	As shown
PLU rub	*Plumeria rubra*	Frangipani	45lt	As shown
XAN chr	*Xanthostemon chrysanthus*	Golden Penda	45lt	As shown
XAN v TRA	*Xanthostemon chrysanthus 'Trailblazer'*	Golden Penda Trailblazer	45lt	As shown
PALMS				
CYR ren	*Cyrtostachys renda*	Lipstick Palm	45lt	As shown
LIC ram	*Licuala ramsayi*	Daintree Fan Palm	45lt	As shown
PTY ele	*Ptychosperma elegans*	Solitaire Palm	45 lt	As shown
RHA exc	*Rhapis excelsa*	Rhaphis Palm	200mm	As shown
SHRUBS & GROUND COVERS				
ADI his	*Adiantum hispidulum*	Rough Maidenhair Ferns	140mm	9/㎡
ALO mac	*Alocasia macrorrhiza*	Elephants Ears	200mm	2/㎡
ALP arc	*Alpinia arctiflora*	Snow Ginger	200mm	3/㎡
ALP cae	*Alpinia caerulea*	Red Back Native Ginger	200mm	2/㎡
ALP mut	*Alpinia mutica*	False Cardamon	200mm	2/㎡
ANG eve	*Angiopteris evecta*	King Fern	200mm	1/㎡
ASP ela	*Aspidistra elatior*	Cast Iron Plant	140mm	9/㎡
ASP nid	*Asplenium nidus*	Bird's-Nest-Fern	200mm	1/㎡
BLE v SIL	*Blechnum v 'Silver'*	Silver Blechnum Fern	140mm	1/㎡
CAL lut	*Calathea lutea*	Havana Cigar	200mm	5/㎡
CAL v REE	*Callistemon v 'Reeves Pink'*	Reeves Pink Bottlebrush	140mm	1/㎡
COR can	*Cordyline cannifolia*	Native Cordyline	140mm	6/㎡
COR v RED	*Cordyline fruticosa 'Red Sister'*	Red Sister Cordyline	140mm	1/㎡
COS pro	*Costus productus*	Costus	200mm	1/㎡
CRI ped	*Crinum pedunculatum*	Swamp Lily	140mm	2/㎡
DRA ref	*Dracaena reflexa*	Song of India	140mm	1/㎡
GAR v GLE	*Gardenia psidioides 'Glennie River'*	Gardenia Glennie River	140mm	3/㎡
HEL ros	*Heliconia rostrata*	Heliconia Lobster Claw	140mm	1/㎡
HEL v SEX	*Heliconia chartacea v 'Sexy Pink'*	Heliconia Sexy Pink	140mm	10/㎡
LIR v EVE	*Liriope muscari 'Evergreen Giant'*	Giant Liriope	140mm	5/m²
LOM hys	*Lomandra hystrix*	Matt Rush	140mm	3/㎡
LOM lon	*Lomandra longifolia*	Matt Rush	140mm	1/㎡
LOM v LUC	*Lomandra hystrix 'Luckystripe'*	Matt Rush Luckystripe	140mm	5/㎡
MEL mal	*Melastoma malabathricum*	Native Lassandra	140mm	3/㎡
MOL cap	*Molineria capitulata*	Weevil Palm	140mm	5/㎡
OPH jap	*Ophiopogon japonicus*	Mondo Grass	140mm	6/㎡
ORT v MAU	*Orthosiphon aristatus 'Mauve'*	Cats Whiskers	200mm	2/㎡
ORT v WHI	*Orthosiphon aristatus 'White'*	Cats Whiskers (White Flowers)	140mm	3/㎡
PHA aus	*Phaius australis*	Swamp Orchid	140mm	3/㎡
PRO amb	*Proiphys amboinensis*	Cardwell Lily	140mm	3/㎡
RAD v SUM	*Radermachera sp. Kunming 'Summerscent'*	Radermachera Summerscent	200mm	1/㎡
SPA pli	*Spathoglottis plicata*	Ground Orchid	140mm	9/㎡
SYZ v RES	*Syzygium australe 'Resilience'*	Lilly Pilly	200mm	1/㎡
VIO hed	*Viola hederacea*	Native Violet	140mm	12/㎡

REPLACEMENT PLANTING

BAR asi	*Barringtonia asiatica*	Box Fruit Tree	45lt	As shown
DIL ala	*Dillenia alata*	Red Beach	45lt	As shown
FIC vir	*Ficus virgata*	Fig Wood	45lt	As shown
MEL mal	*Melastoma malabathricum*	Native Lassandra	140mm	3/㎡

Ficus superba (existing fig tree)
Strangler Fig

FIG TREE VILLAS, 14 MUDLO STREET, PORT DOUGLAS

LANDSCAPE PLANTING SCHEME

DRAWING NO.: LA-S.01

ISSUE DATE : 17/NOV/2017

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