



CRC for
Water Sensitive Cities



Business
Cooperative Research
Centres Programme

How can we support urban intensification?

Nigel Bertram

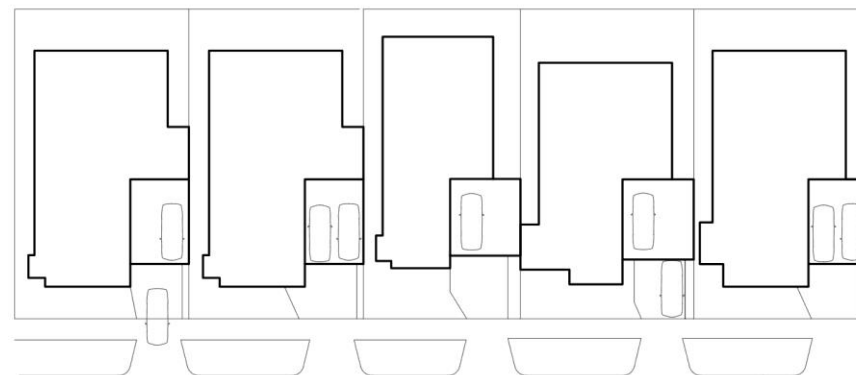
Monash University, Faculty of Art,
Design & Architecture

26-28 March 2019



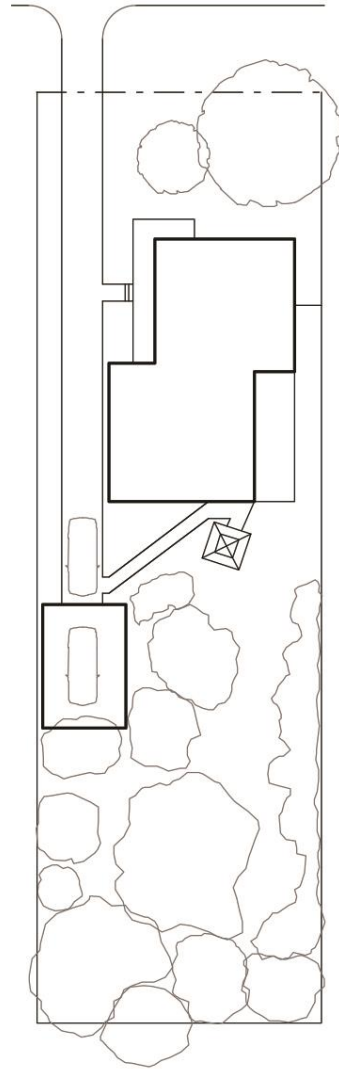


1940

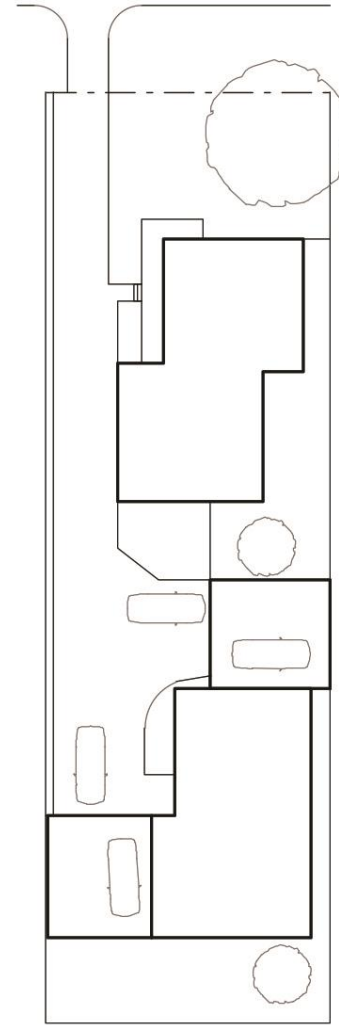


2018





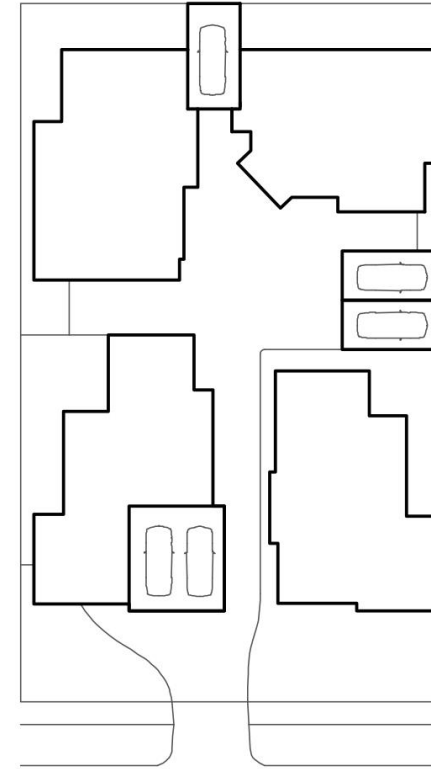
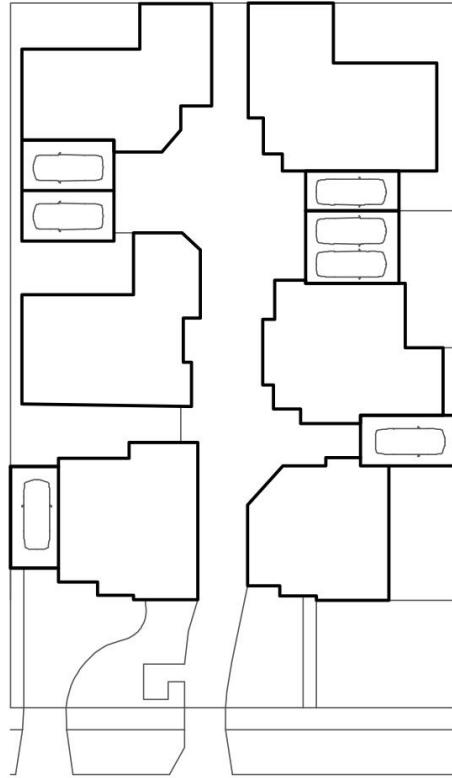
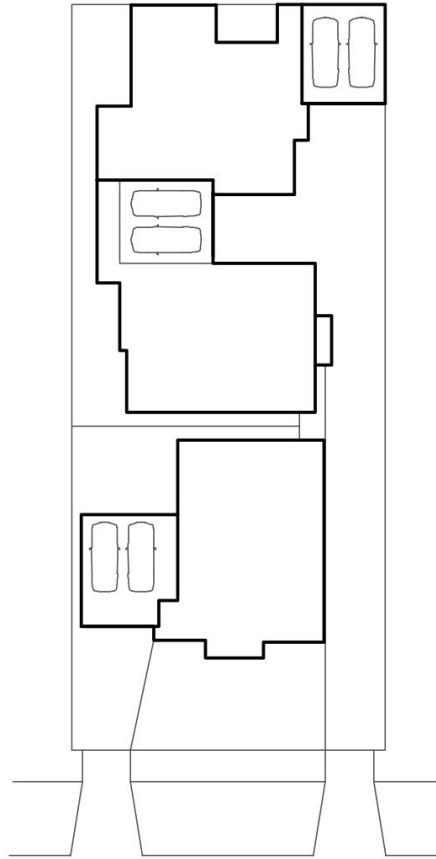
1950



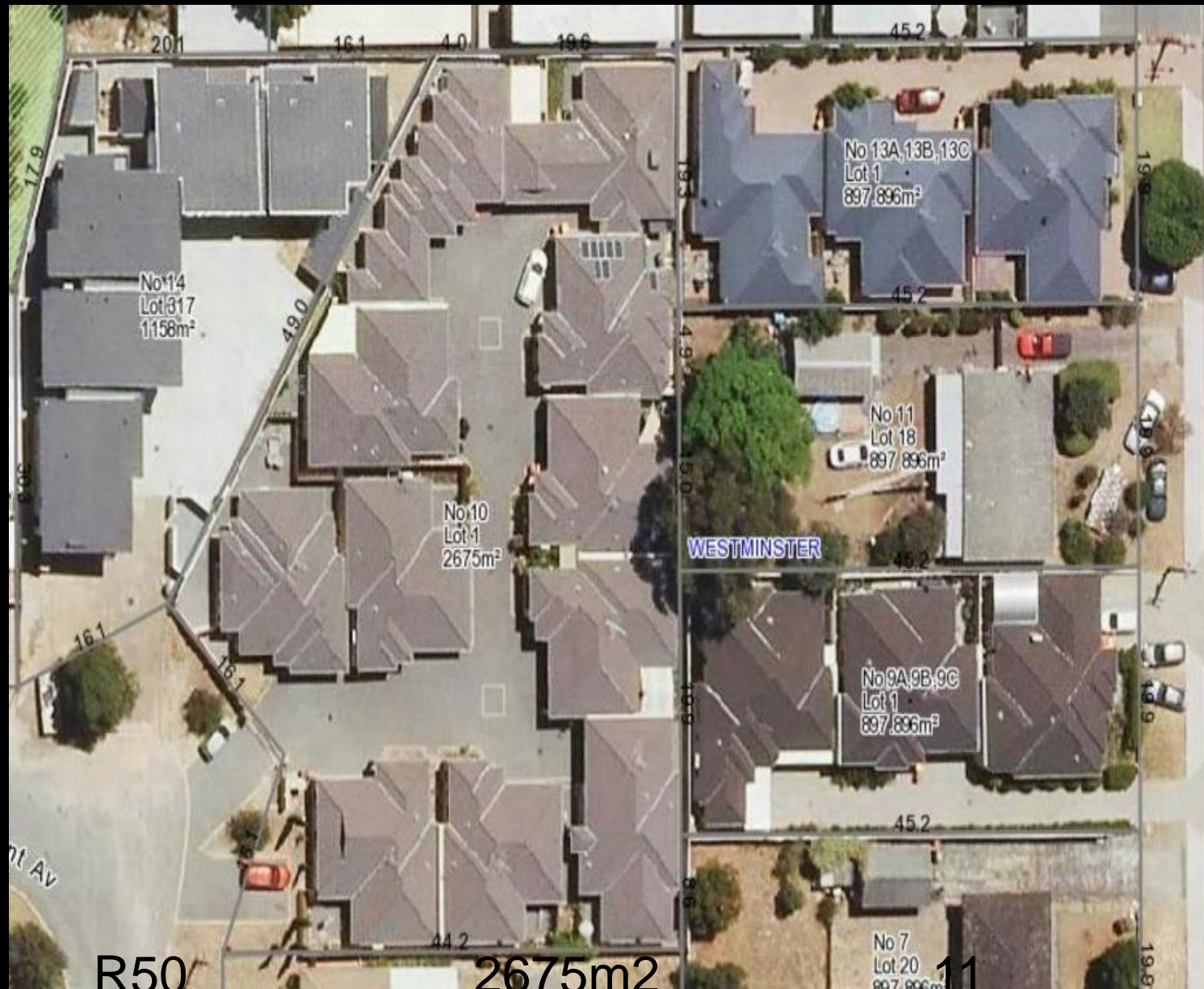
2018



TYPICAL DUAL OCCUPANCY - BEFORE & AFTER



2012



R50

2675m²

11



CRC for
Water Sensitive Cities

watersensitivecities.org.au

Development Typologies

- a. Suburban lot subdivision
- b. Small infill combination
- c. Block infill site + courtyard model
- d. Suburban precinct
- e. Mixed-use precinct
- f. Employment cluster model
- g. Major urban renewal.

subthemes:

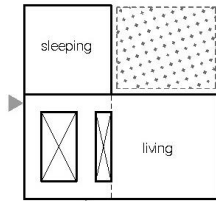
- building typology
- landscape typology
- procurement typology

The Missing Middle

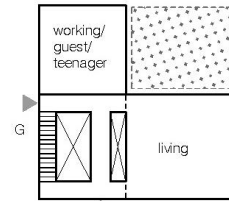
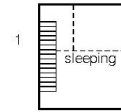




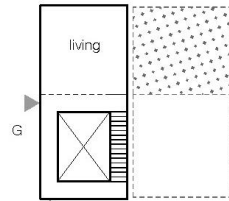
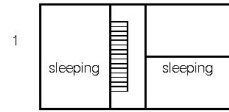
- student
- single adult



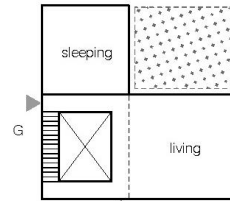
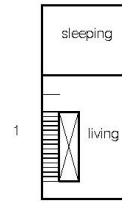
- couple
- single with office



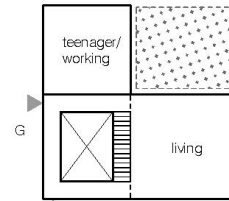
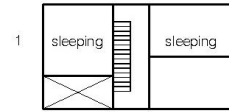
- couple with home office
- couple with occasional guest
- mother with child and teenager



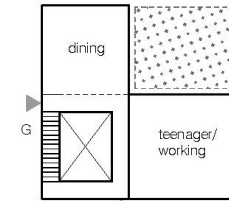
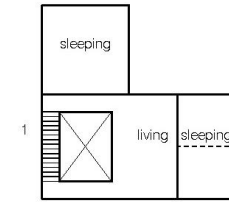
- couple with 2 kids



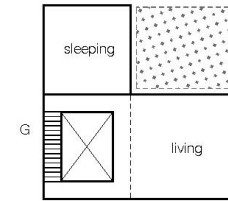
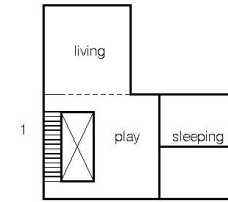
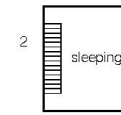
- disabled person with live-in carer



- couple with 2 kids and teenager or home office



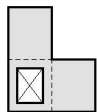
- family with kids and teenager or home office



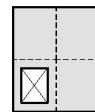
- extended family



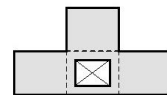
core + 1 room
50m²



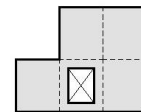
core + 2 room
75m²



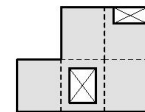
core + 3 room
90m²



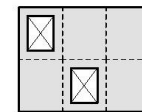
core + 3 room
90m²



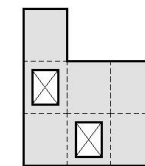
core + 4 rooms
120m²



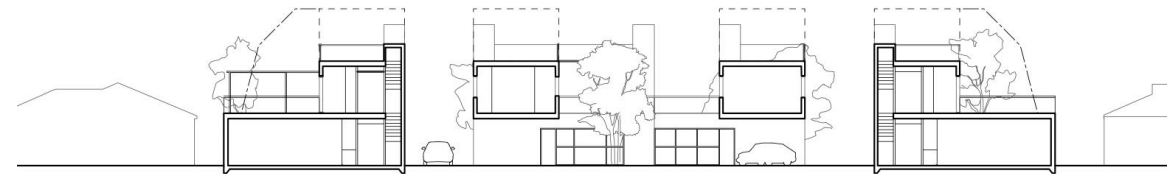
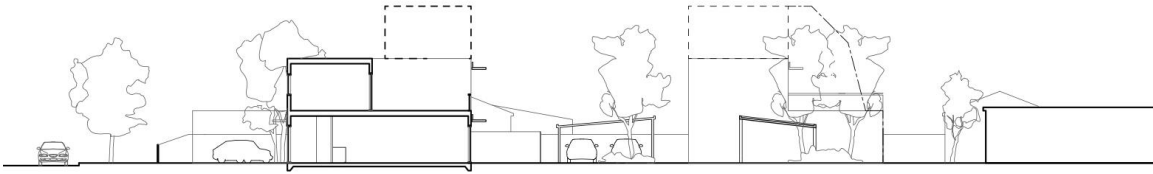
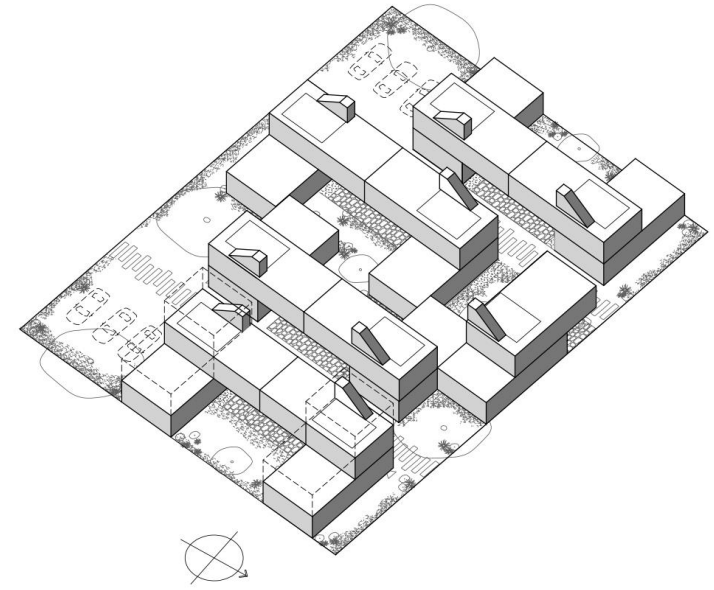
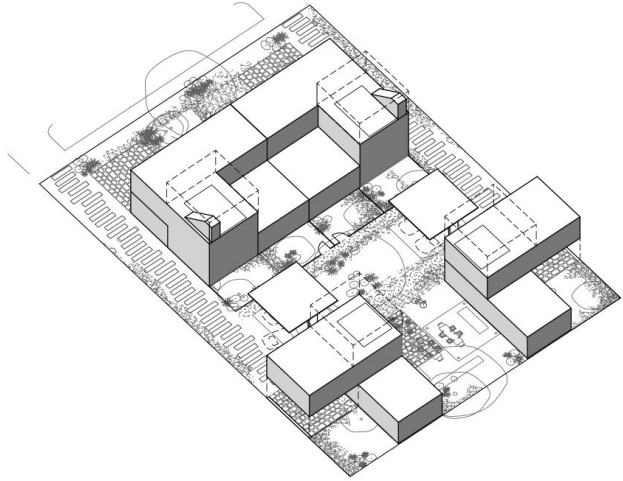
1.5 cores + 3.5 rooms
130m²

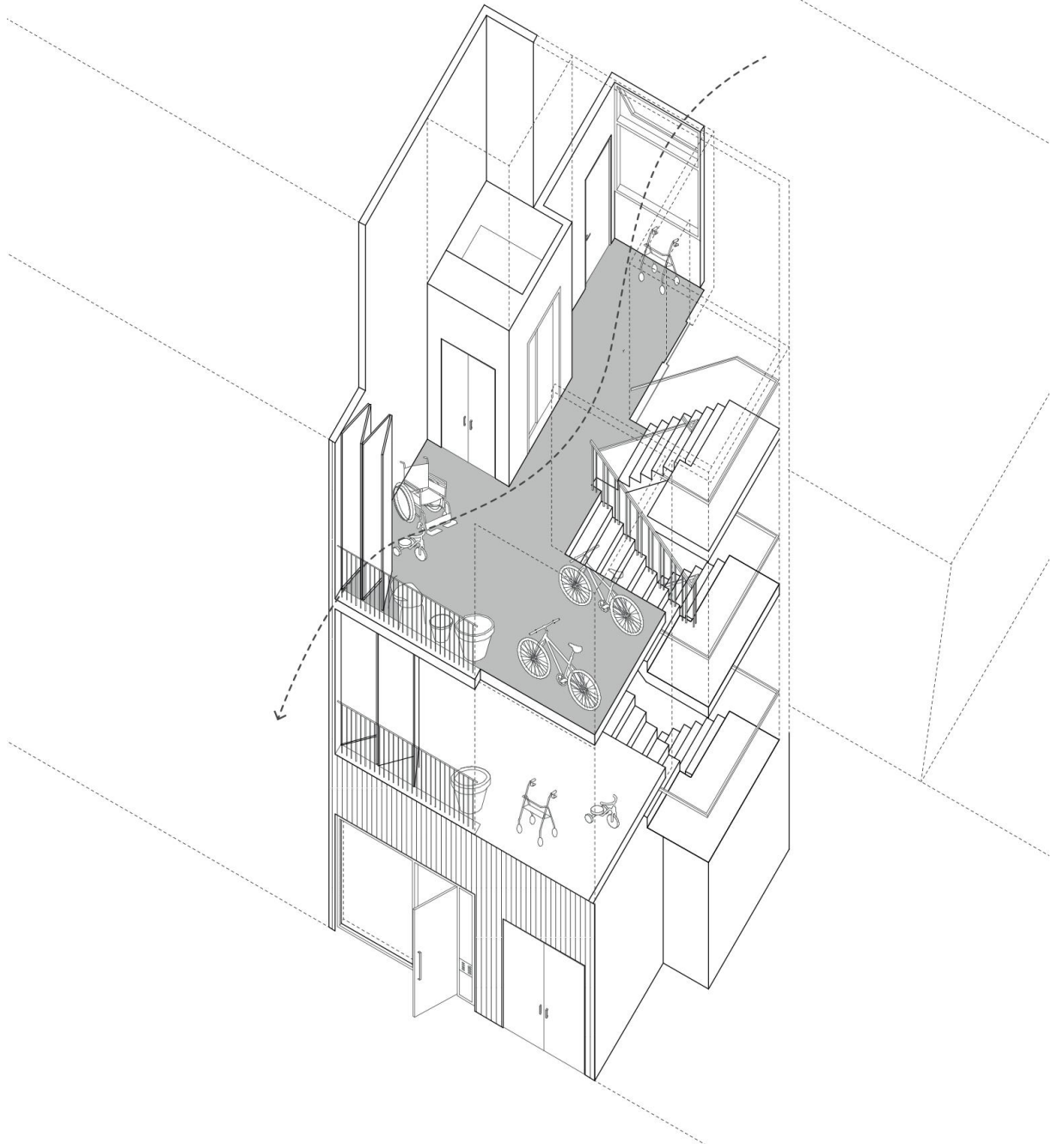
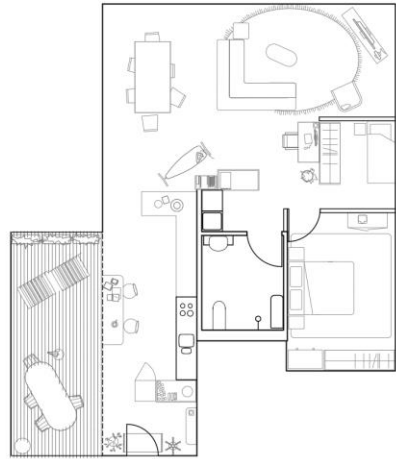
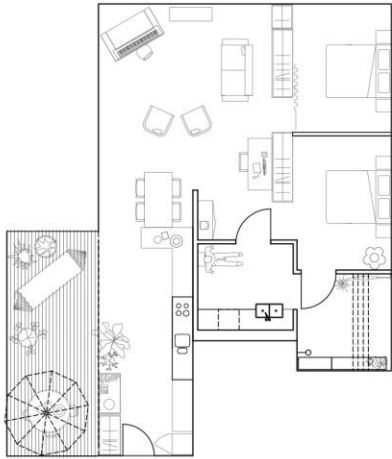
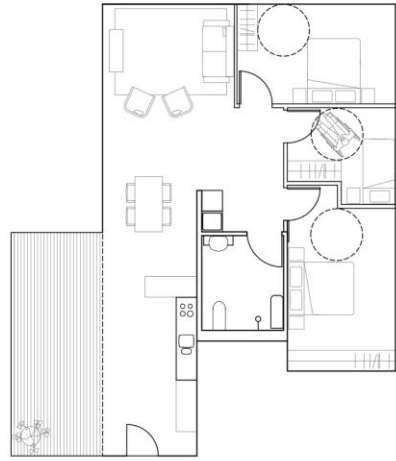
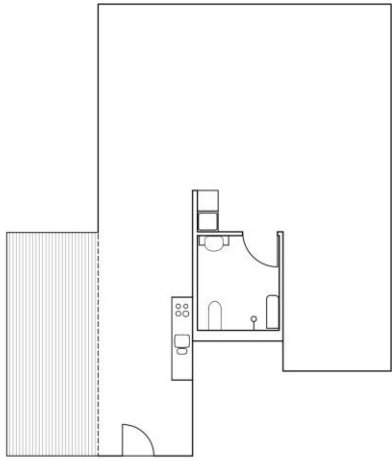


2 cores + 4 rooms
150m²



2 cores + 5 rooms
175m²





CSIRO

RESIDENTIAL

Shops

UNIVERSITY

Campus Centre

Library

Pool/
sports



understanding qualities as well as quantities









40



experimenting + prototyping / reflecting, refining

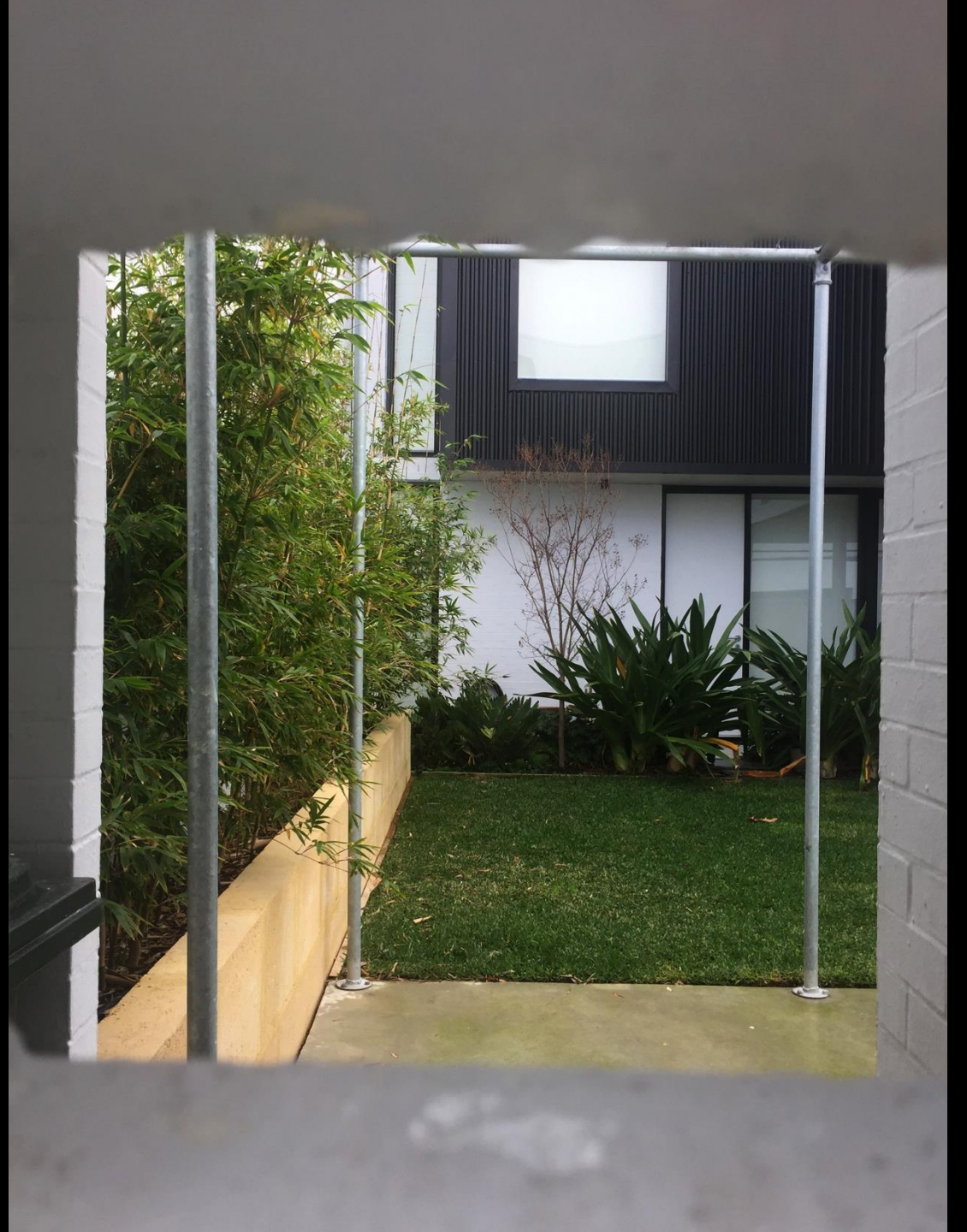
David Barr architect, 2013



David Barr architect, 2013







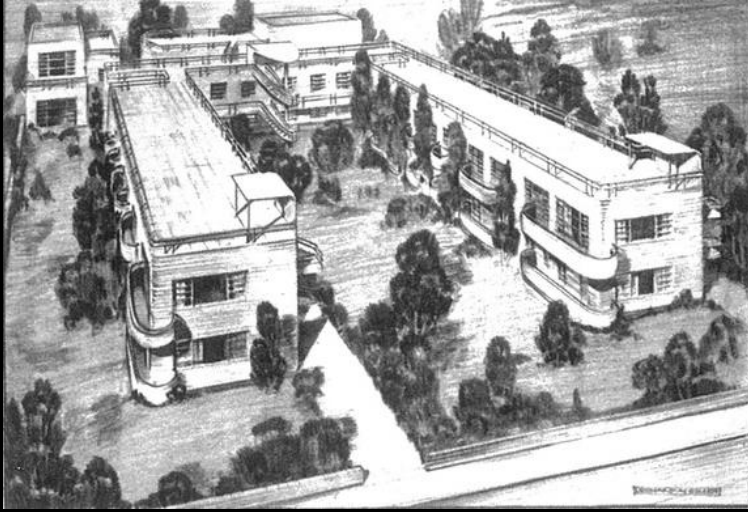








long-term thinking - good bones



1935







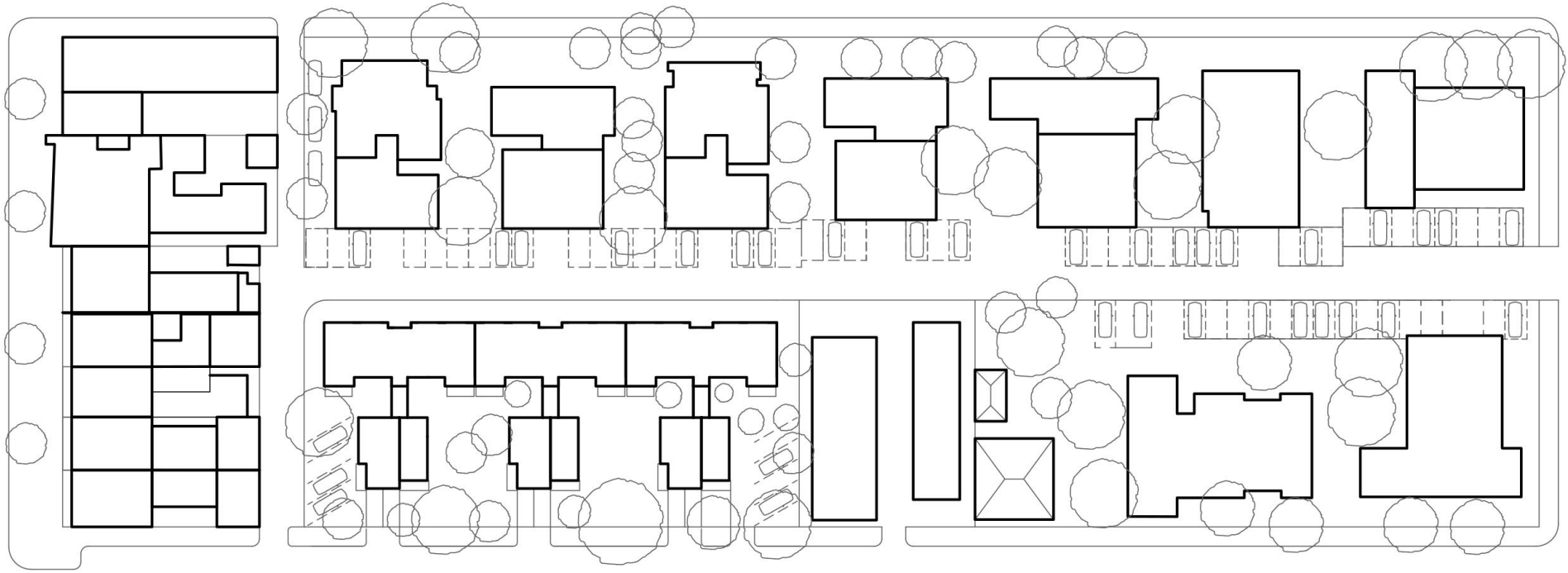


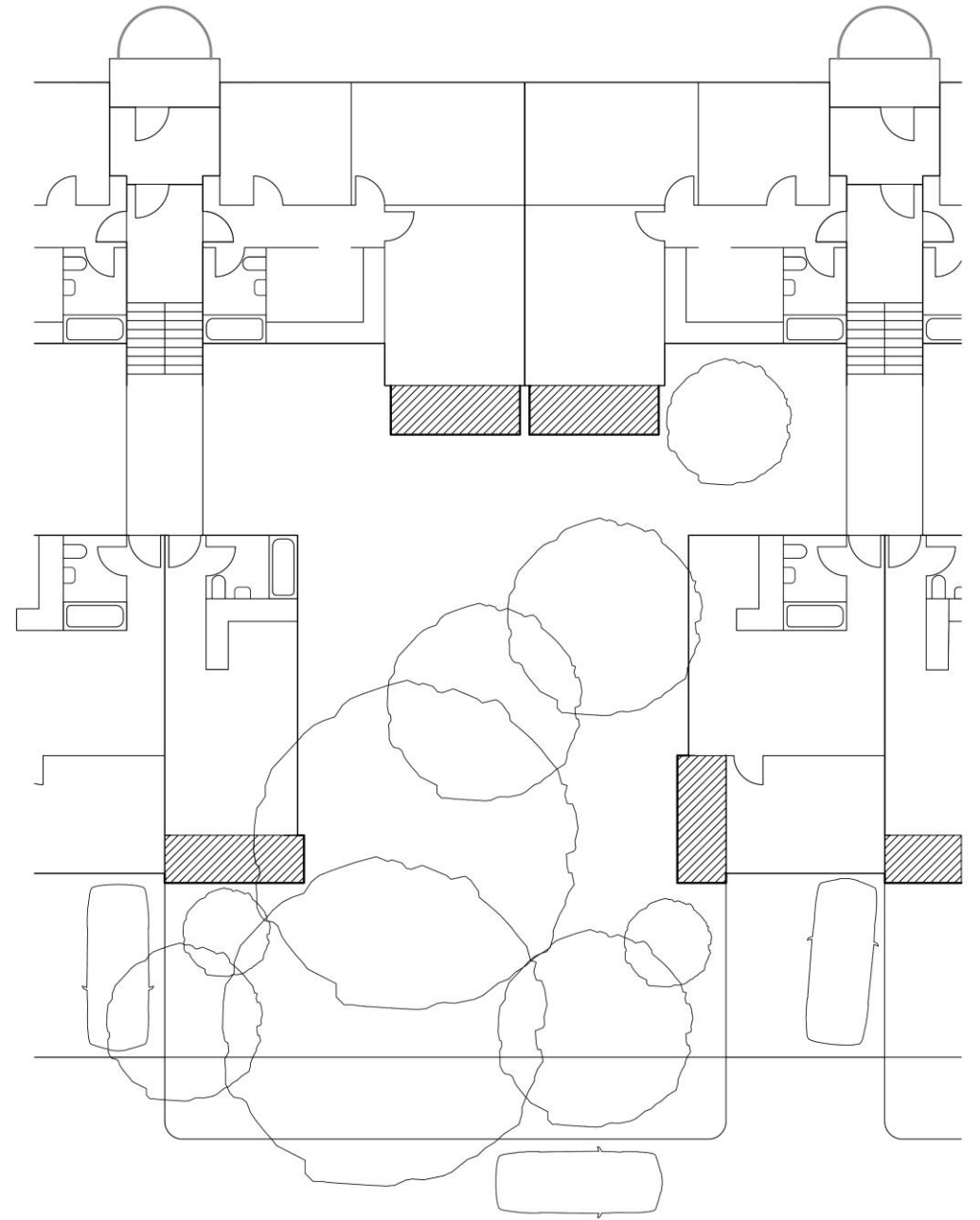
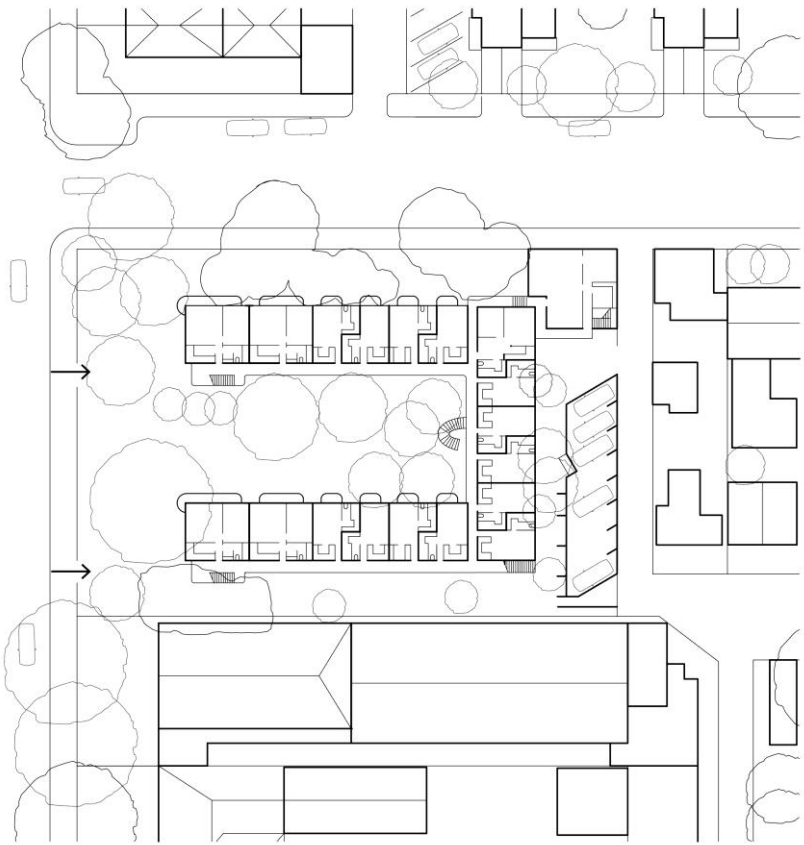
1965



2019







TYOLOGIES CATALOGUE

**DRAFT 3 - MARCH 2019
NOT FOR PUBLICATION**

Authors

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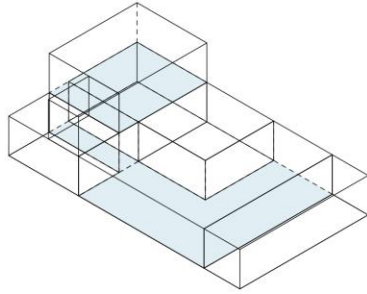
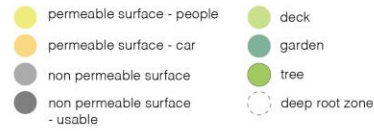
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Category 1: Dual Occupancy

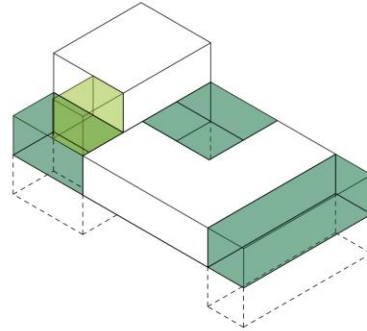
Redcliffe Courtyard

Monash University & University Of Western Australia

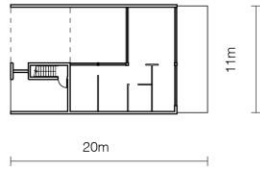
2017



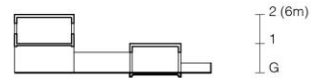
axo (built spaces)



axo (landscape spaces)



plan 1 / 500



section 1 / 500

Dwelling Data			
Bedrooms:	2 beds and 1 bed	Garden Area:	130 m2
Occupants:	2 - 6	Roof Surface Area:	136 m2
Cars:	2	Roof Surface Type:	?
Building Storeys:	2	Volume:	438 m3
Building Site Area:	225 m2	Area of roof area connected to rainwater storage:	100%
Building Footprint:	100 m2	Rainwater Storage Capacity:	? litres
Floor Area (building):	120 m2	Household water appliances: (per dwelling)	2 x basin, wc, shower, kitch sink. 1 x laun tub, wm.
Floor Area (deck):	8 m2	Building material:	Masonry

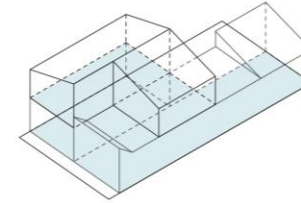
Category 2: Terrace House

Water Sensitive Design

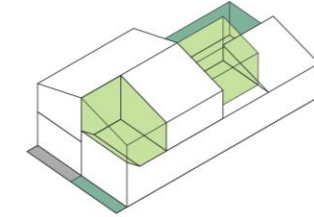
Salisbury Terrace

Monash University & University Of Western Australia

2019



axo (built spaces)



axo (landscape spaces)



plan 1 / 500



section 1 / 500

Dwelling Data			
Bedrooms:	3	Garden Area:	40 m2
Occupants:	4 - 5	Roof Surface Area:	92 m2
Cars:	1	Roof Surface Type:	metal
Building Storeys:	1	Volume:	m3
Building Site Area:	180 m2	Area of roof area connected to rainwater storage:	100%
Building Footprint:	135 m2	Rainwater Storage Capacity:	? litres
Floor Area (building):	180 m2	Household water appliances: (per dwelling)	2 x basin, wc, shower, kitch sink. 1 x laund tub, wm.
Floor Area (deck):	34 m2	Building material:	Reverse brick veneer

Category 4: Six Pack
 Water Sensitive Design
 Gertrude St Apartments, Monash University
 2012

- permeable surface - people
- permeable surface - car
- non permeable surface
- non permeable surface - usable
- deck
- garden
- tree
- deep root zone

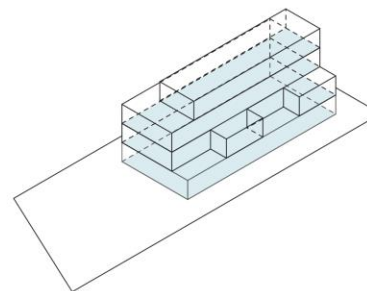


context plan 1/1000

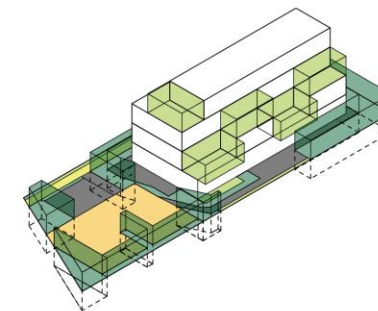


Category 4: Six Pack
 Water Sensitive Design
 Gertrude St Apartments, Monash University
 2012

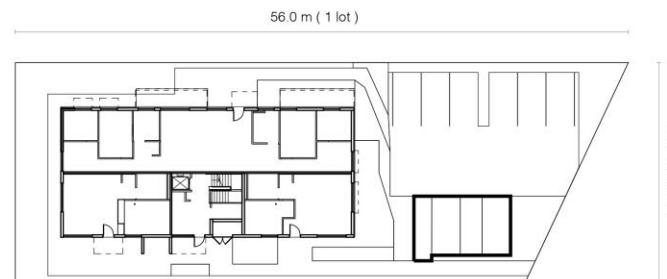
- permeable surface - people
- permeable surface - car
- non permeable surface
- non permeable surface - usable
- deck
- garden
- tree
- deep root zone



axo (built spaces)



axo (landscape spaces)



plan 1 / 500

56.0 m (1 lot)

20.1 m (1 lot)

46.6 m (1 lot)

Site Data			
Site Area:	1025 m2	Vegetated Surface (garden/trees)	255 m2
Number of Lots:	1	Deep Root Zones:	10 (189 m2)
Number of Dwellings:	8	Canopy Trees	up to 15
Density:	78 dwellings per hectre	Other on-site rainwater water storage capacity (stormwater):	water tanks
Open Space:	705 m2	Expected irrigation pattern for planned garden area:	none
Site Coverage:	31%	Vegetation characteristics (i.e., vegetation type, leaf area):	?
Permeable Hard Surface (car, people):	189 m2	Soil characteristics (i.e., soil type, top soil depth)	?
Non Permeable Hard Surface:	249 m2		

Dwelling Data			
Bedrooms:	1 to 4 (per dwelling)	Garden Area:	255 m2
Occupants:	1 - 4 (per dwelling)	Roof Surface Area:	244 m2
Cars:	8	Roof Surface Type:	?
Building Storeys:	4	Volume:	? m3
Building Site Area:	1025 m2	Area of roof area connected to rainwater storage:	100%
Building Footprint:	320 m2	Rainwater Storage Capacity:	?
Floor Area (building):	770 m2	Household water appliances: (per dwelling)	9 x shower, basin, wc, kitch sink, laund tub, wm.
Floor Area (deck):	140 m2	Building material:	brick veneer

Category 6: Urban Spaces

Suburban Laneway - Water Sensitive Design

Knutsford, WA, Spaceagency

- permeable surface - people
- permeable surface - car
- non permeable surface
- non permeable surface - usable
- deck
- garden
- tree
- deep root zone



context plan 1/1000

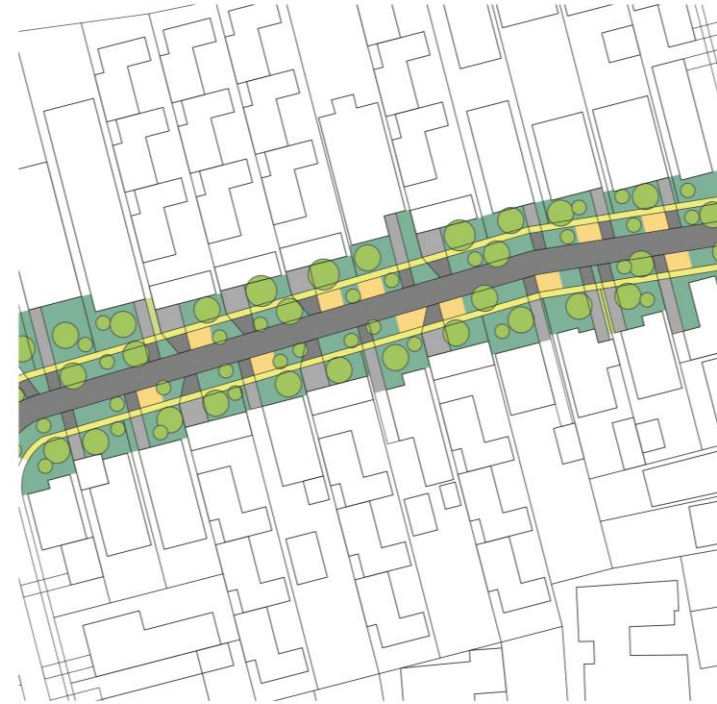


Category 6: Urban Spaces

Suburban Street - Water Sensitive Design

Five Dock, NSW, Neeson Murcutt

- permeable surface - people
- permeable surface - car
- non permeable surface
- non permeable surface - usable
- deck
- garden
- tree
- deep root zone



context plan 1/1000



Site Data			
Site Area:	1632 m2	Vegetated Surface (garden/trees)	327 m2
Number of Lots:	14	Deep Root Zones:	12 (327 m2)
Number of Dwellings:	?	Canopy Trees	11+
Density:	? dwellings per hectre	Other on-site rainwater water storage capacity (stormwater):	?
Open Space:	439 m2 (road) 1193 m2 (non-road)	Expected irrigation pattern for planned garden area:	?
Site Coverage:	?%	Vegetation characteristics (i.e., vegetation type, leaf area):	?
Permeable Hard Surface (car, people):	224 m2	Soil characteristics (i.e., soil type, top soil depth)	?
Non Permeable Hard Surface:	1060 m2		

Site Data			
Site Area:	4782 m2	Vegetated Surface (garden/trees)	2380 m2
Number of Lots:	24	Deep Root Zones:	52 (2355 m2)
Number of Dwellings:	?	Canopy Trees	70+
Density:	? dwellings per hectre	Other on-site rainwater water storage capacity (stormwater):	?
Open Space:	758 m2 (road) 4024 m2 (non-road)	Expected irrigation pattern for planned garden area:	?
Site Coverage:	?%	Vegetation characteristics (i.e., vegetation type, leaf area):	?
Permeable Hard Surface (car, people):	670 m2	Soil characteristics (i.e., soil type, top soil depth)	?
Non Permeable Hard Surface:	1439 m2		

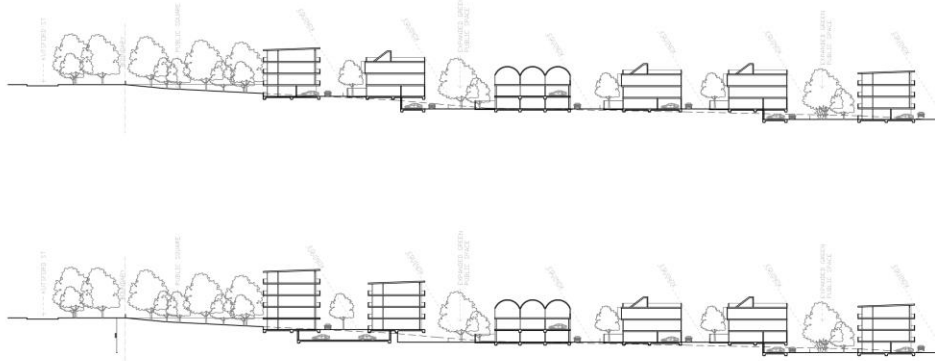
Category 7: Precincts

Knutsford, WA

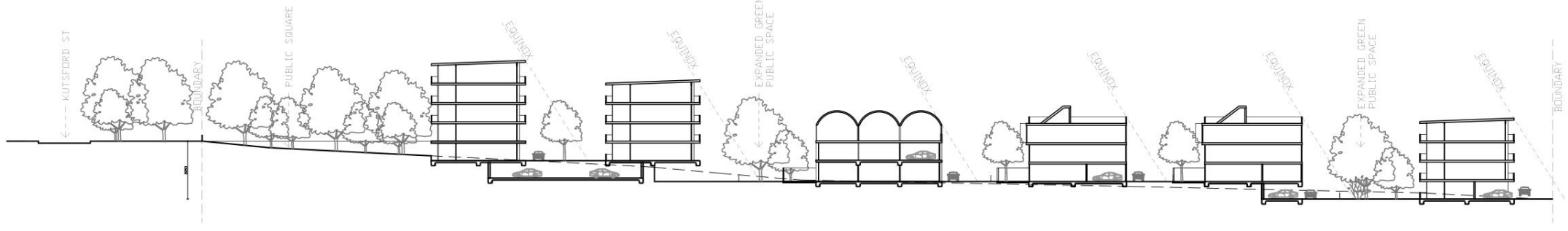
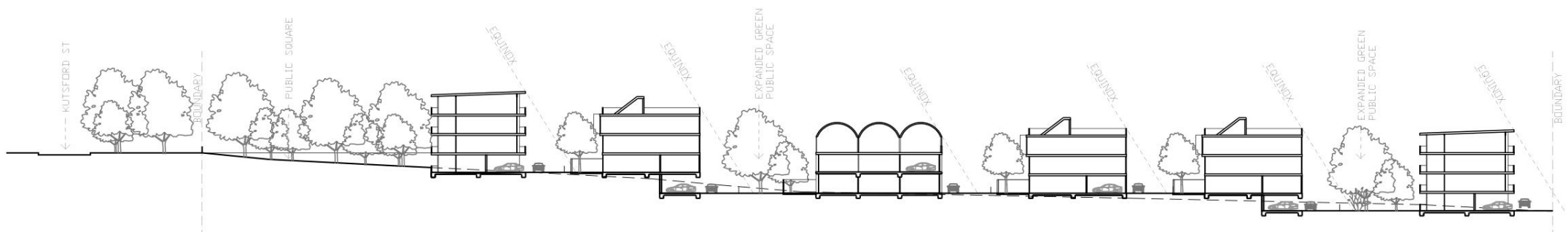
Monash University & University Of Western Australia

2018

- permeable surface - people
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- garden
- tree
- deep root zone

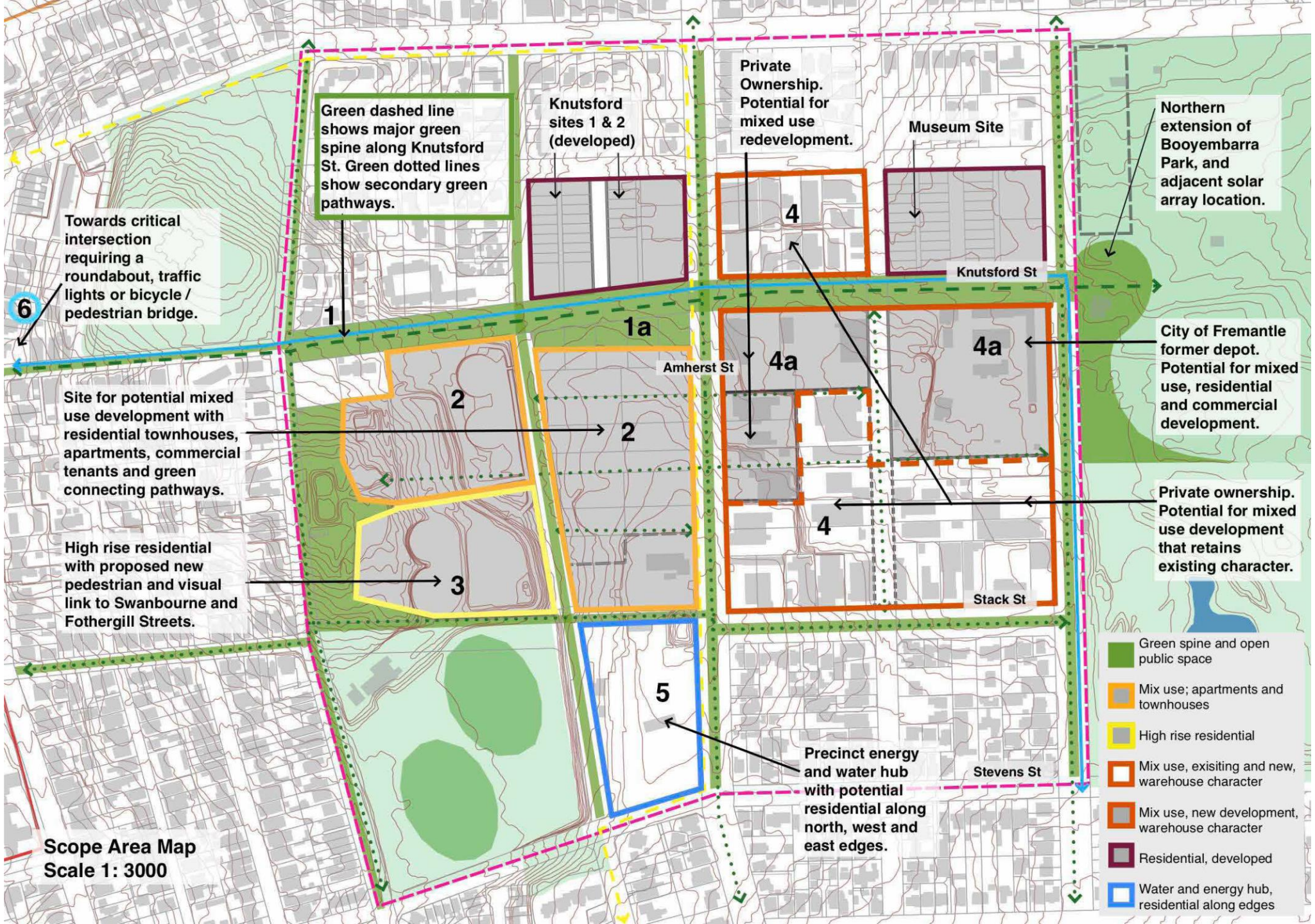


Site Data			
Site Area:		Vegetated Surface (garden/trees)	
Number of Lots:		Deep Root Zones:	
Number of Dwellings:		Canopy Trees	
Density:		Other on-site rainwater water storage capacity (stormwater):	
Open Space:		Expected irrigation pattern for planned garden area:	
Site Coverage:		Vegetation characteristics (i.e., vegetation type, leaf area):	
Permeable Hard Surface (car, people):		Soil characteristics (i.e., soil type, top soil depth)	
Non Permeable Hard Surface:			





Scope Area Aerial
Scale 1 : 3000



Green dashed line shows major green spine along Knutsford St. Green dotted lines show secondary green pathways.

6
Towards critical intersection requiring a roundabout, traffic lights or bicycle / pedestrian bridge.

Site for potential mixed use development with residential townhouses, apartments, commercial tenants and green connecting pathways.

High rise residential with proposed new pedestrian and visual link to Swanbourne and Fothergill Streets.

Knutsford sites 1 & 2 (developed)

Private Ownership. Potential for mixed use redevelopment.

Museum Site

Northern extension of Booyembarra Park, and adjacent solar array location.

City of Fremantle former depot. Potential for mixed use, residential and commercial development.

Private ownership. Potential for mixed use development that retains existing character.

Precinct energy and water hub with potential residential along north, west and east edges.

Scope Area Map
Scale 1: 3000

- Green spine and open public space
- Mix use; apartments and townhouses
- High rise residential
- Mix use, existing and new, warehouse character
- Mix use, new development, warehouse character
- Residential, developed
- Water and energy hub, residential along edges

evaluation framework for water-sensitive infill

1. Dwelling amenity: flexibility, adaptability, orientation...
2. Access to quality private open space
3. Access to quality communal space and facilities
4. Access to (and contribution to) quality public realm
5. Thermal comfort
6. Hydrological performance: runoff, infiltration, evapotranspiration...
7. Water-related energy
8. Flood storage
9. Water efficiency

qualitative and quantitative

multi-criteria evaluation

— EXISTING — BUSINESS AS USUAL — WATER SENSITIVE

