CO-DESIGNING STREETS WITH GREEN INFRASTRUCTURE

CASE STUDIES FROM AUSTRALIA

THE RETROFIT LAB 2026

The Re-imagining Streets with Green Infrastructure project is an interdisciplinary team spanning urban greening, landscape architecture, engineering and social sciences from the University of Melbourne, in collaboration with partners from Mosaic Insights and RMIT University. The team includes Professor Sarah Bell, Dr. Kylie Soanes, Dr. Nano Langenheim, Dr. Dom Blackham, Dr. Kerry Nice, Dr. Marie Dade, Gavin He Tian Chew, and Dr. Thami Croeser.

Project partners at Mosaic Insights and Alluvium made significant contributions to this report, including detailed analysis of street designs and the use of their StreetBuilder tool.

The Re-imagining Streets with Green Infrastructure (GC2011) project is funded through Hort Innovation Frontiers with co-investment from the University of Melbourne and the Victorian Government and contributions from the Australian Government. This project has human research ethics approval from the University of Melbourne Project ID #30838.

Cover image: Nano Langenheim

The Retrofit Lab, May 2026, The University of Melbourne

INTRODUCTION

Cities face mounting pressure to adapt to climate change and become more resilient, greener, and more liveable for the people and wildlife that live in them. Melbourne is famous for its network of parks, waterways and reserves, and significant investment in greening has been and continues to be made through State Government initiatives like Cooling and Greening Melbourne and Open Space for Everyone, and the efforts of local governments.

Streets account for as much as 80–90% of public land in Australian cities. The vast majority of that space is given over to vehicle movement and parking. Retrofitting streets with green infrastructure represents an enormous opportunity to change this, embedding the social, environmental and economic benefits of trees and other vegetation directly into the places where people live and move every day.

Modifying urban streets to meaningfully increase urban greening is challenging. Competing demands, technical complexity, and community concern about change all present real barriers.

The University of Melbourne Re-imagining Streets with Green Infrastructure research project aimed to demonstrate how streets can be adapted to improve resilience to heatwaves, drought and flooding, while improving their safety, liveability and sociability.

Operating across three Melbourne streets, the project partnered researchers with local communities to co-design green infrastructure retrofits — redistributing street space in ways that reflected local priorities while delivering measurable gains in climate resilience, urban cooling, biodiversity, and liveability.

Three focal streets included:

- Breese Street, Brunswick
- Alfrieda Street, St Albans
- Kookaburra Avenue, Werribee

Street snapshots

Breese Street

Breese Street, Brunswick,is set in a light industrial turned residential neighbourhood. The narrow road corridor is almost entirely paved, with little existing green infrastructure. Formal on-street parking is present along the stretch. At the time of our workshops, Breese Street had been identified as a priority street for green infrastructure by the local municipal council, City of Merribek, and was subject to the development of a masterplan. The local community were highly engaged in advocating for green infrastructure in their street.

Three workshops were attended by approximately 27 participants.

Alfrieda Street

Alfrieda Street, St Albans, is a residential suburban street in Melbourne's north-west. The street is includes wide traffic lanes, expansive green road verges, and no formal carparking. Given the street's role as a connector between retail and civic centres, Alfrieda Street had been the subject of a recent masterplan by Brimbank City Council with a view to support active transport. The local community were highly vulnerable to urban heat effects, with a high proportion of residents speaking languages other than English.

Three workshops were attended by approximately 8 participants.

Kookaburra Avenue

Kookaburra Avenue, is a suburban residential street in Werribee, Melbourne's outer-west. The segment of focus for our project included important community and civic centres, such as the Wyndham Park Community Centre, community garden and shed, health services, local primary schools and an early childhood education centre. The segment also included formal bike lanes and bus stops. The surrounding neighbourhood includes a high proportion of former and current social housing. The co-design was run in partnership with staff from the community centre.

Two workshops were attended by approximately sixteen participants.

STRUCTURE OF THE DESIGN PACK

This document includes an overview of our codesign process and assessment methods, followed by a design pack for each of the three codesigned streets. The design packs include:

- Brief overview of community co-design process and design intent
- Concept designs 'landscape architect as the pencil'
- Adaptation of those designs using StreetBuilder tool, including concept designs and visualisations for the street retrofit sites
- Estimated stormwater quality benefits of the retrofits
- Estimated benefits to urban cooling and thermal comfort
- Estimated costings for the concept designs

Note that stormwater quality analysis were not completed for Alfrieda Street or Kookaburra Avenue, as these features were not prioritised in the community co-design.

This document is structured so that the findings for each street can be considered individually. A comparative analysis of the outcomes across the three locations will be conducted elsewhere.

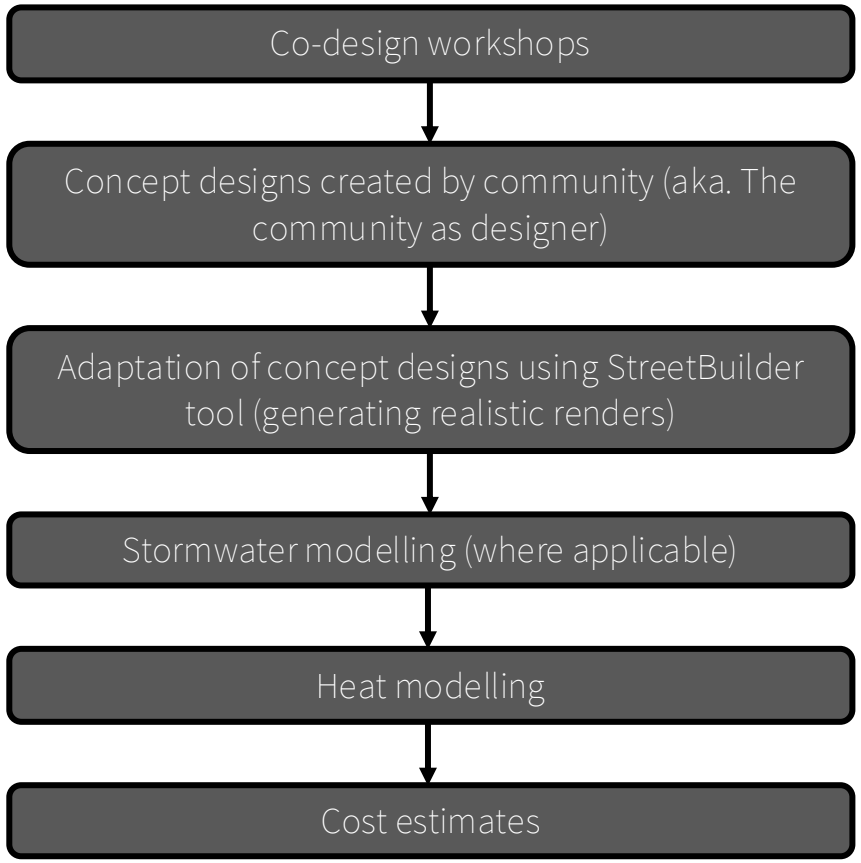
FURTHER INFORMATION

Complimentary information about the co-design process used within this project can be found:

Soanes K, Langenheim N, Blackham D, Chew HTG, Croeser T, Dade M, Nice K, Bell S (2026) Co-designing streets with green infrastructure: A toolkit. Report prepared by The Retrofit Lab, Melbourne Centre for Cities. The University of Melbourne.

Soanes K, Langenheim N, Blackham D, Chew HTG, Croeser T, Dade M, Nice K, Bell S (2026) Greener together: A guide to engaging heat-affected communities in the co-design of resilient streetscapes. Report prepared by The Retrofit Lab, Melbourne Centre for Cities. The University of Melbourne.

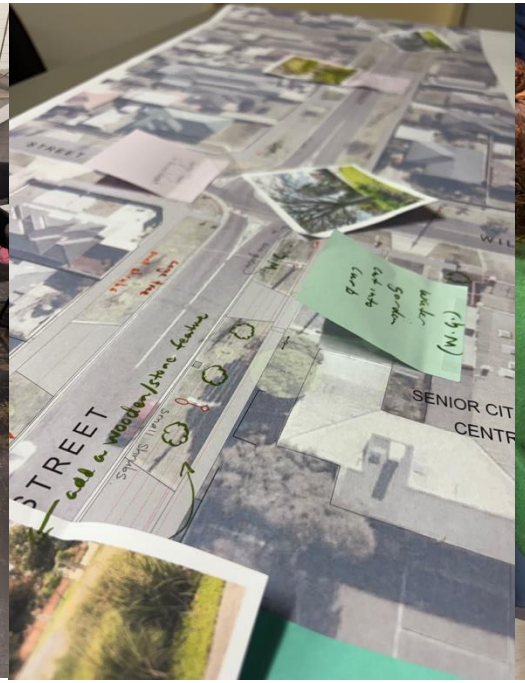
DESIGN PACK CONTENTS FOR EACH STREET

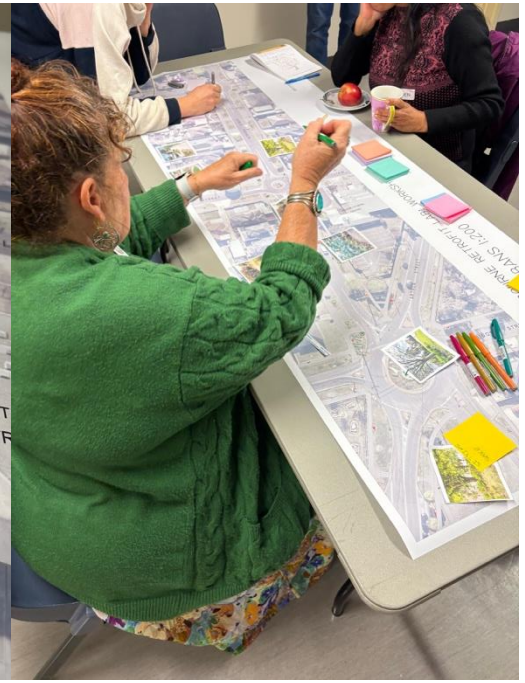


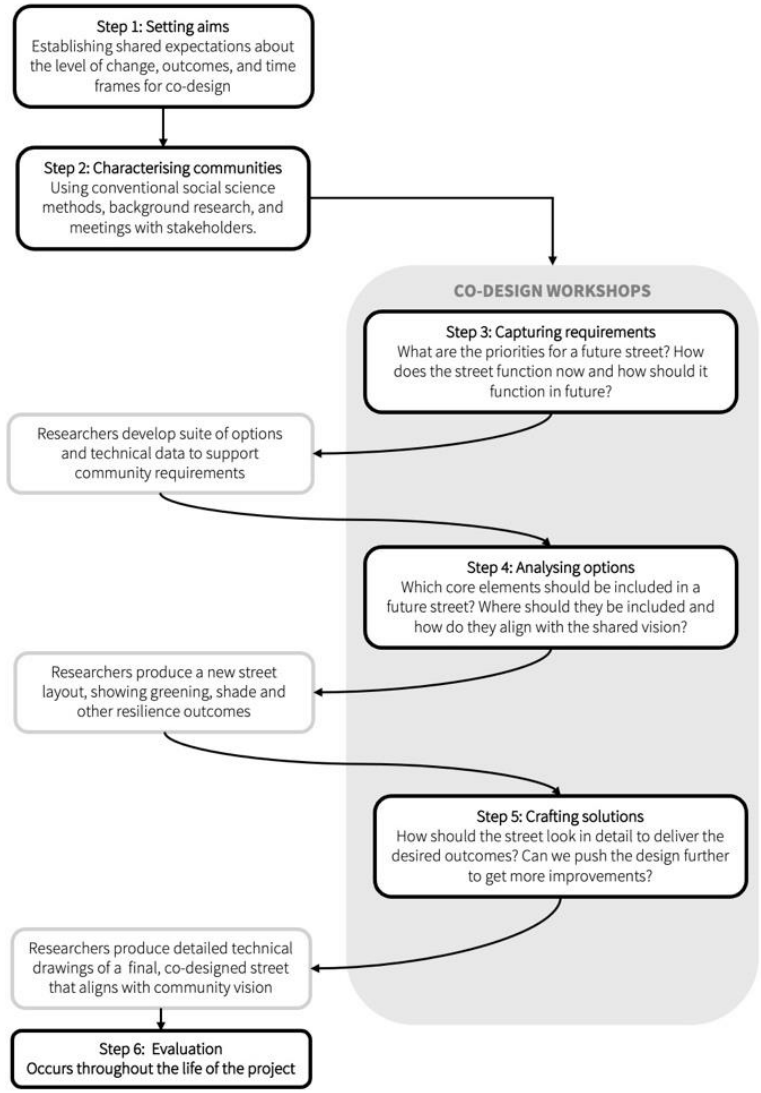
OVERVIEW OF CO-DESIGN PROCESS – COMMUNITY WORKSHOPS

Co-design is a promising tool to enable effective, ambitious street greening retrofits. It has two potential benefits: 1) the resulting streets are more socially acceptable because they are designed by the community and therefore fit for purpose, 2) it identifies creative solutions to technical challenges that would otherwise have not been discovered using traditional approaches and sources of knowledge. By bringing together community, technical experts, and other stakeholders to explicitly tackle the unique local challenges, co-design supports the crafting of street retrofits that offer creative, bespoke solutions.

We hosted co-design workshops in three streets: Breese Street, Brunswick; Alfrieda Street, St Albans, and; Kookaburra Avenue, Werribee. The streets varied in site context, the level of community engagement, planning approach by land manager stakeholders, and socio-demographic contexts.



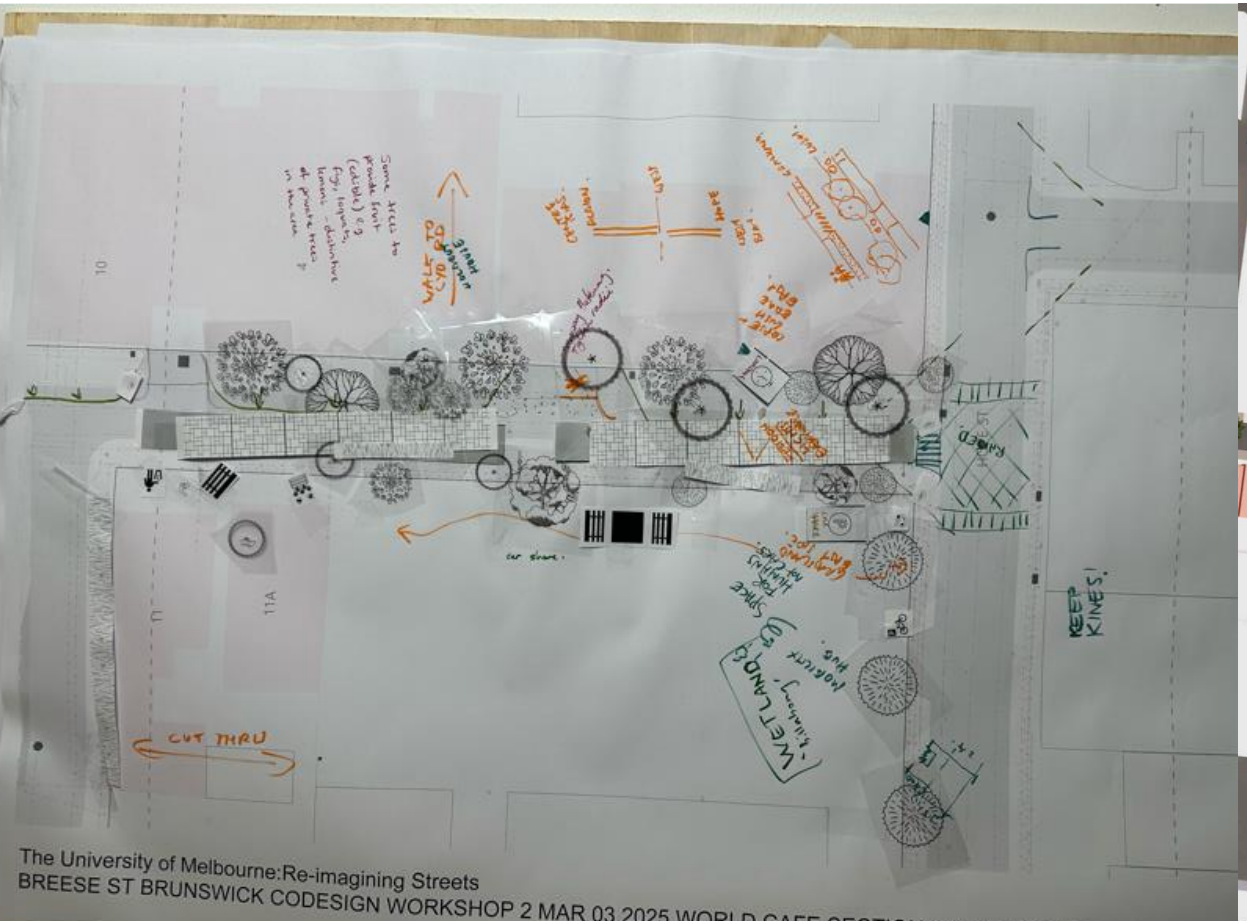




OVERVIEW OF COMMUNITY CO-DESIGN PROCESS –‘COMMUNITY AS DESIGNER. LANDSCAPE ARCHITECT AS THE PENCIL’

Throughout the co-design workshops, the research team continuously refined and updated the street design to reflect the community design. We described this process ‘community as the designer’ to reflect the fact that these designs were produced *by* the co-design participants, rather than presented *to* the co-design participants. The role of the landscape architect here was to realise the design intent rather than to lead it.

COMMUNITY DESIGN INTENT EXPRESSED DURING WORKSHOP ACTIVITIES

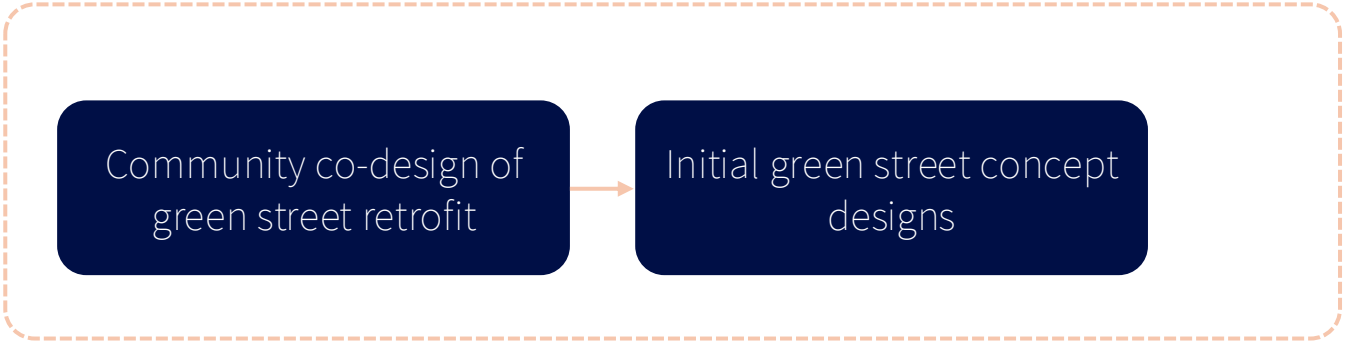


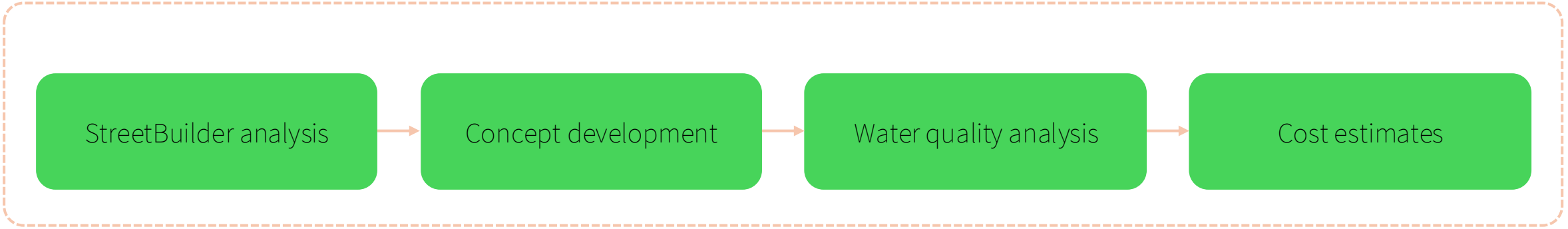
LANDSCAPE ARCHITECT RENDERING OF COMMUNITY DESIGN INTENT

OVERVIEW OF DETAILED DESIGN ANALYSIS

Mosaic Insights was engaged as a specialist technical partner throughout the research, contributing technical expertise to the design and delivery of community co-design process and peer-reviewed the initial concept designs for the three streets.

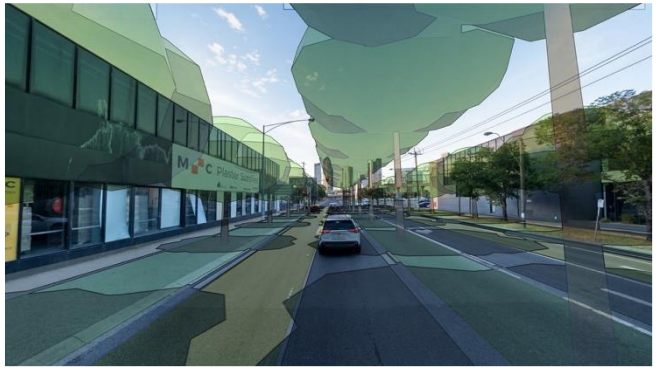
Following the co-design process, the team at Mosaic Insights and Alluvium used their StreetBuilder analysis to develop more refined concept designs, develop concept designs and visualisations, and quantify the implementation costs and stormwater benefits of the retrofit projects.





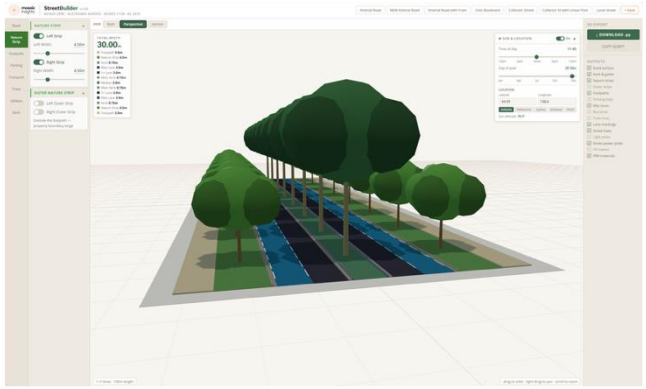
OVERVIEW OF DETAILED DESIGN ANALYSIS –STREETBUILDER

Existing street photo



Integrated 3d design alignment

Final photo realistic street render



StreetBuilder design export

Mosaic Insights' StreetBuilder is an integrated 3D design and image generation platform. It allows streetscape design solutions to be quickly and accurately modelled in real time, generating outputs that can then be quickly and cost effectively translated into photorealistic images.

OVERVIEW OF DETAILED DESIGN ANALYSIS –STREETBUILDER FEATURES LIST

StreetBuilder has been developed to incorporate or interface with streetscape features that influence the potential urban greening of streets. Features in the current version are listed below.

- Roads and lanes
- Centre verge
- Kerbs and channels

- Nature strips
- Linear parks
- Outstands and traffic treatments

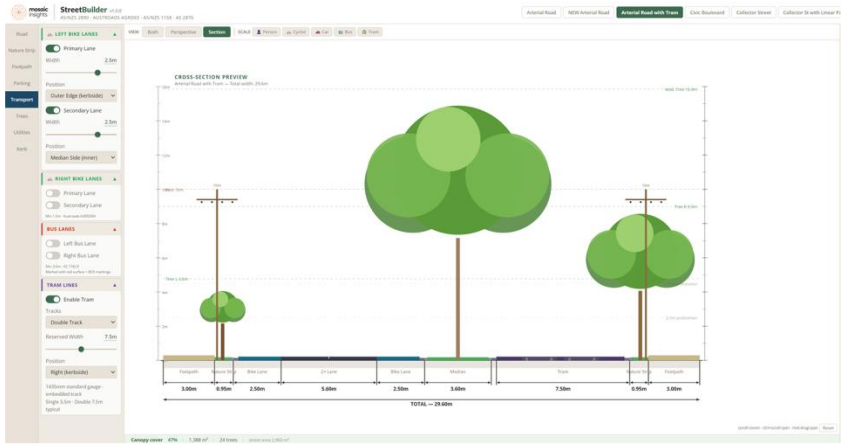
- Footpaths
- Parking
- Bike lanes
- Bus lanes
- Tram lines

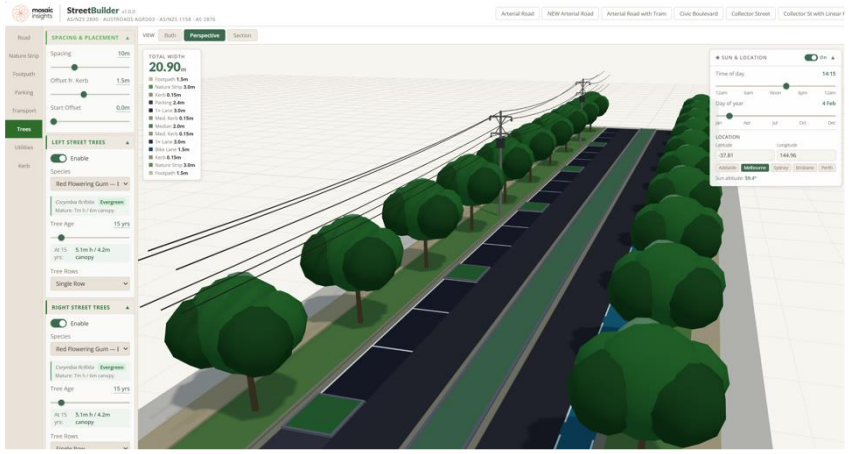
- Existing and new street trees – by species
- Tree canopy cover area
- Tree growth modelling

- Integration with stormwater and flood modelling

- Street lighting
- Overhead electricity
- Underground services

- Sun shade date location
- Adjustable development interface





Interactive cross-section and 3D viewport allows viewing from any angle with real time data on canopy cover, shade, parking and service impacts for any length or scale of street.

ANALYSIS OF IMPACTS ON HEAT

We quantified the cooling benefits of the street redesigns by:

- quantifying spatial heat patterns and identifying hotspots
- modelling the cooling potential of a community co-designed greening retrofit

Methods

The study applies a dual-model framework to assess the cooling performance at two complementary scales, capturing both human-scale thermal experience (mean radiant temperature and Universal Thermal Climate Index) and broader physical climate responses (air temperature and hydrology). Specifically, SOLWEIG is used to represent fine-scale thermal comfort processes (e.g. shading and radiative exchange).

The thermal comfort analysis was based on:

- a single representative hot day (21 February 2020) was selected, with meteorological inputs derived from ERA5 reanalysis data due to the absence of local, site-specific observations. This day reflects commonly experienced hot conditions, rather than peak or extreme heat conditions and aligns with conditions that are regularly experienced by street users, where cooling benefits are most likely to be consistently realised. Given the scale and nature of the proposed interventions, these measures are not expected to substantially reduce extreme heat conditions; therefore, focusing on typical high-heat days provides a more appropriate basis for evaluating their practical effectiveness.
- a surrounding buffer (50m from the centreline) for each street was included to ensure nearby buildings, trees, and street geometry that influence shading, wind flow, and local microclimate conditions are accurately represented. Within this buffer, data on three-dimensional urban form and land cover type was gathered to determine the movement distribution of radiation and heat across the

Scope and limitations

Given the scale of the co-design we focused on thermal comfort indicators, which are well suited to the spatial scale and resolution of the street design and provide the most direct insight into how users will experience heat along the corridor.

The application of these models focuses on corridor-scale thermal conditions along the three streets and does not capture broader city-wide heat dynamics.

For this assessment, the model simulates thermal conditions for a single representative hot day at an hourly timestep. This enables detailed assessment of diurnal thermal performance under typical high-heat conditions, including how heat exposure and cooling benefits vary throughout the day. However, this approach represents a simplified snapshot of conditions and does not capture variability across different weather conditions, seasons, or longer-term climate patterns.

REIMAGINING STREETS WITH GREEN INFRASTRUCTURE

BREESE STREET BRUNSWICK, VICTORIA

Design pack

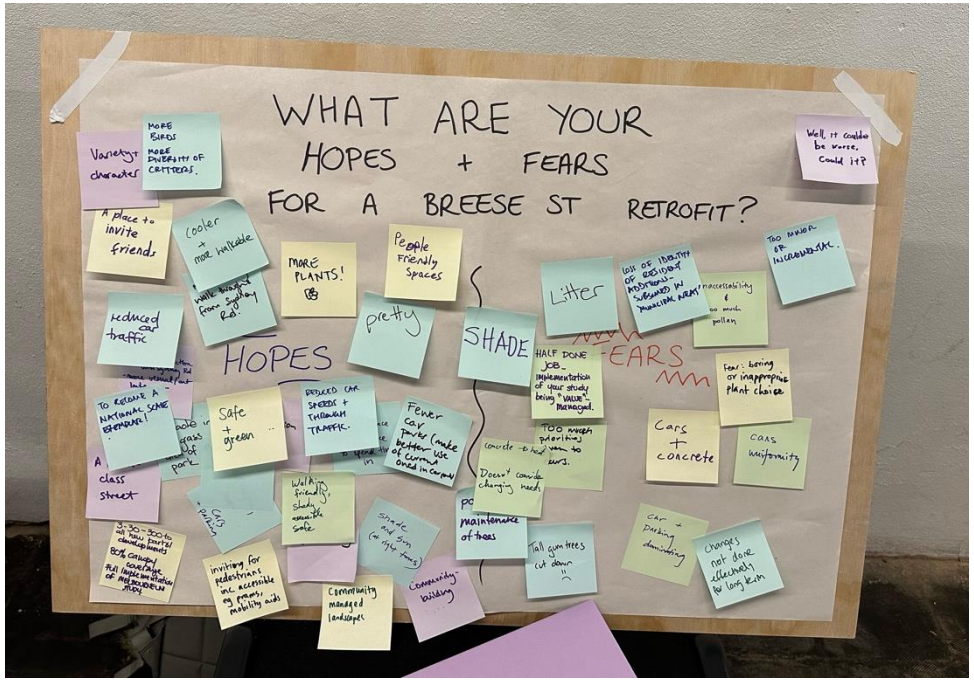
Melbourne Centre
For Cities

mosaic insights

BREESE STREET DESIGN INTENT

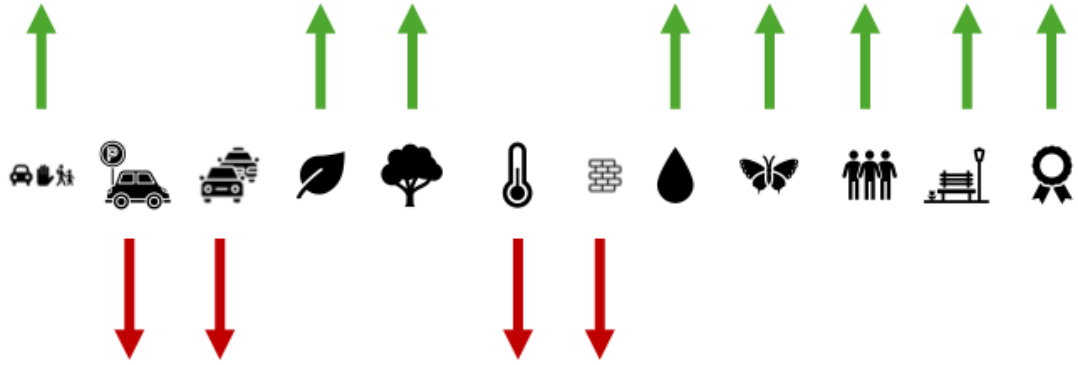
Eight overlapping themes emerged to represent community requirements for a future greening retrofit. The majority of these themes emerged during the exercises of Workshop 1 and were reinforced through design decisions, refinements and conversations throughout the workshops.

- An inviting, cared for place
- Safe and accessible for pedestrians
- A green, living street
- Natural shade, in the right place, at the right time
- Beauty, character, and identity
- Supports community building
- Well thought-out, future-proof implementation
- Resilient to extreme weather

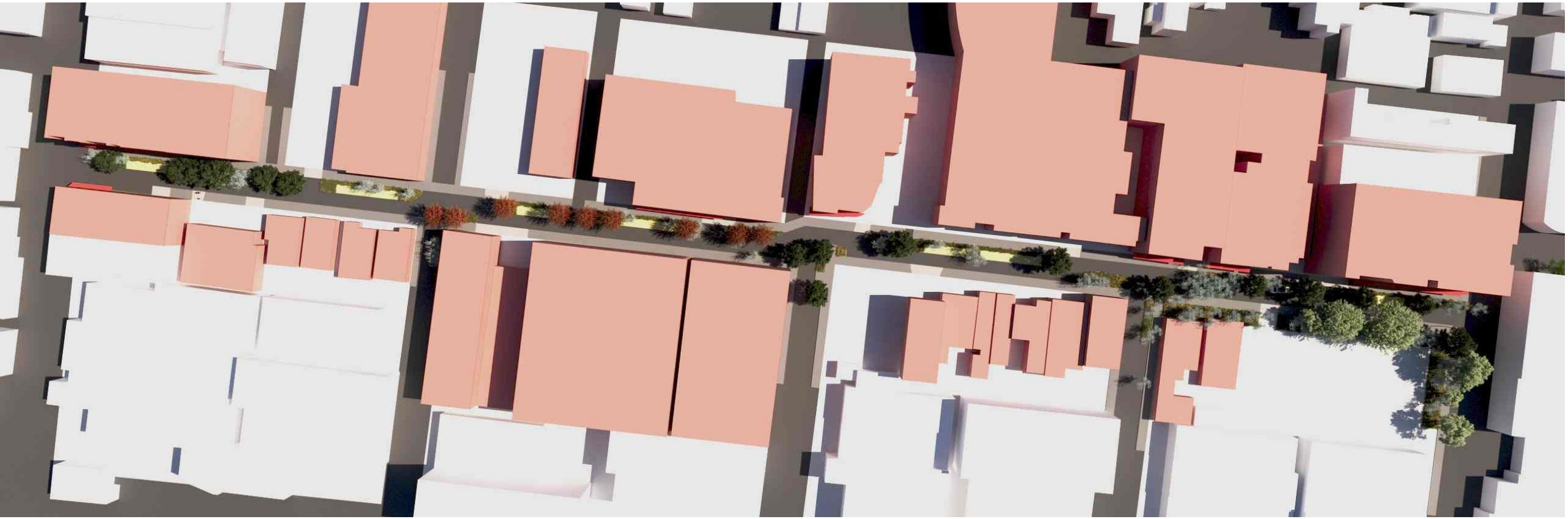


BREESE STREET SHOULD BE A PLACE THAT IS…

- Safe and accessible for pedestrians
- Not dominated by cars and parking
- Greener
- Tree-lined
- Shady
- Cooler
- Less concrete
- Water sensitive
- More biodiverse
- Beautiful and cared for
- A space for community
- Leading by example



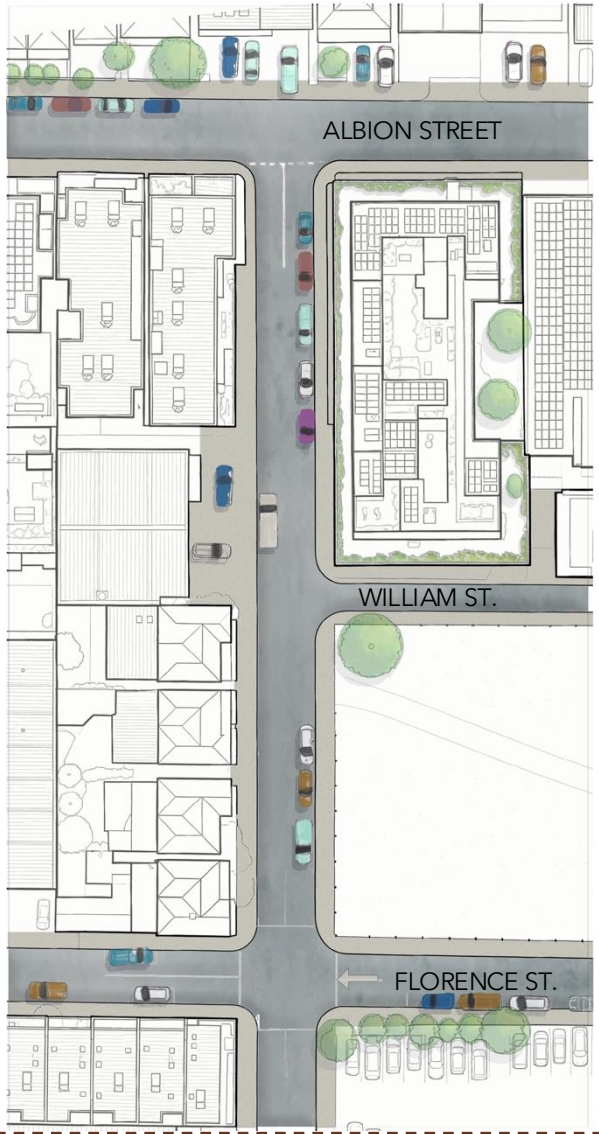
REALISATION OF COMMUNITY DESIGN – BREESE STREET



REALISATION OF COMMUNITY DESIGN – BREESE STREET

STREETBUILDER ADAPTATION OF COMMUNITY DESIGN : BREESE STREET: ALBION STREET TO FLORENCE STREET

Existing conditions

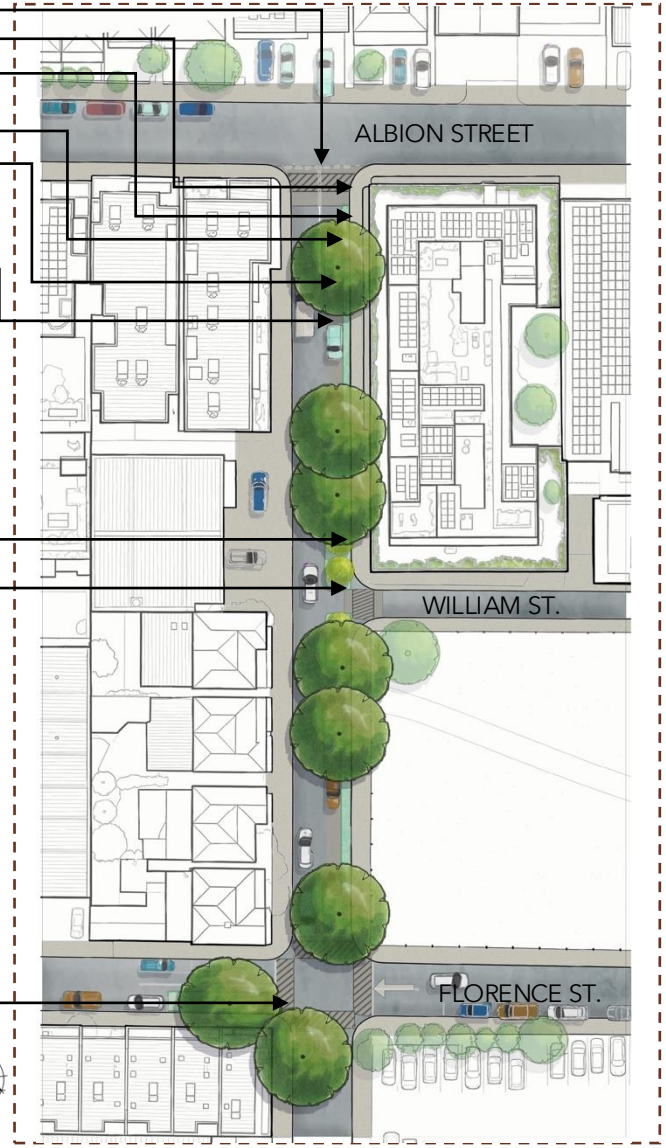


Concept design

- Raised crossing (could extend to raised intersection corner radius tightening
- Footpath minimum 2.5 m width requires new kerb
- Replace existing kerb with semi mountable to enable continuous levels on footpath surface
- Rain garden at road surface level to enable passive irrigation 40 m^2
- Proposed large evergreen tree – consider *Eucalyptus leucoxylon* subsp. *megalocarpa*.
- 2.4 m wide parking spaces to allow door opening. These could be moved closer to the kerb (loses adjacent green space would make the parking more functional
- Retain bicycle parking
- Garden beds at road level require edge protection (particularly at intersections)
- Understory copse planting consider *Eucalyptus pulverulrnta* baby blue @ 4 m spacing
- Raised pavement at intersection
- Future development front setback for private garden driveway removal/ redesign for improved walk quality
- Removed disused driveway and reuse bluestone pavers
- Install strip grates to retain drainage through intersection

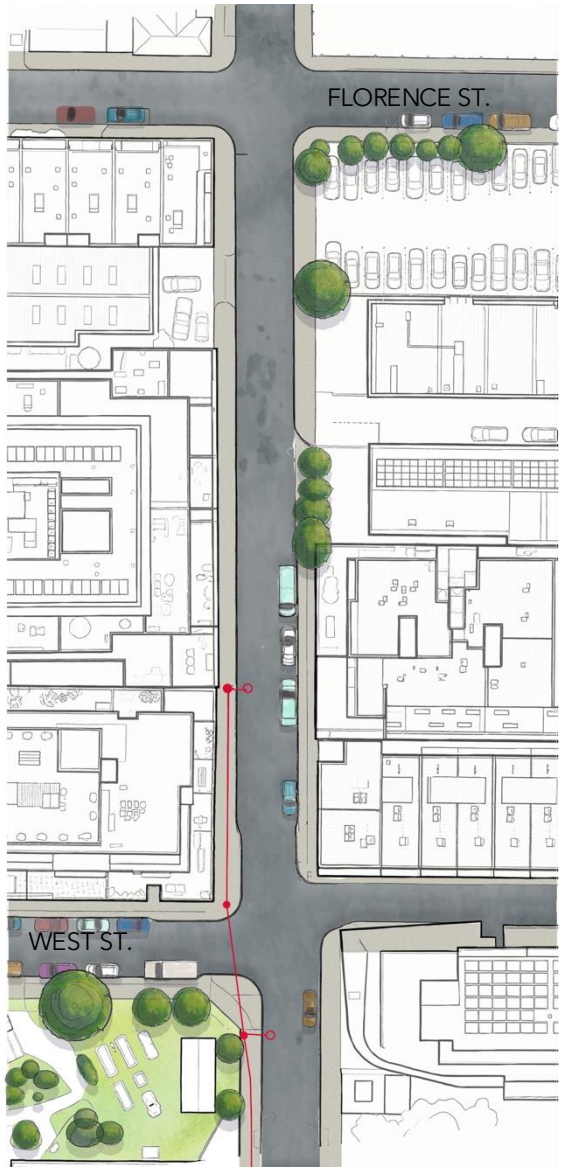
Drawing key

- Existing large trees
- Existing small (new) trees
- New evergreen trees
- New deciduous trees
- Grass nature strip (existing lawns)
- Proposed garden bed. >600 mm high planting
- Existing overhead power poles, lines & lighting



STREETBUILDER ADAPTATION OF COMMUNITY DESIGN: BREESE STREET: FLORENCE STREET TO WEST STREET

Existing conditions

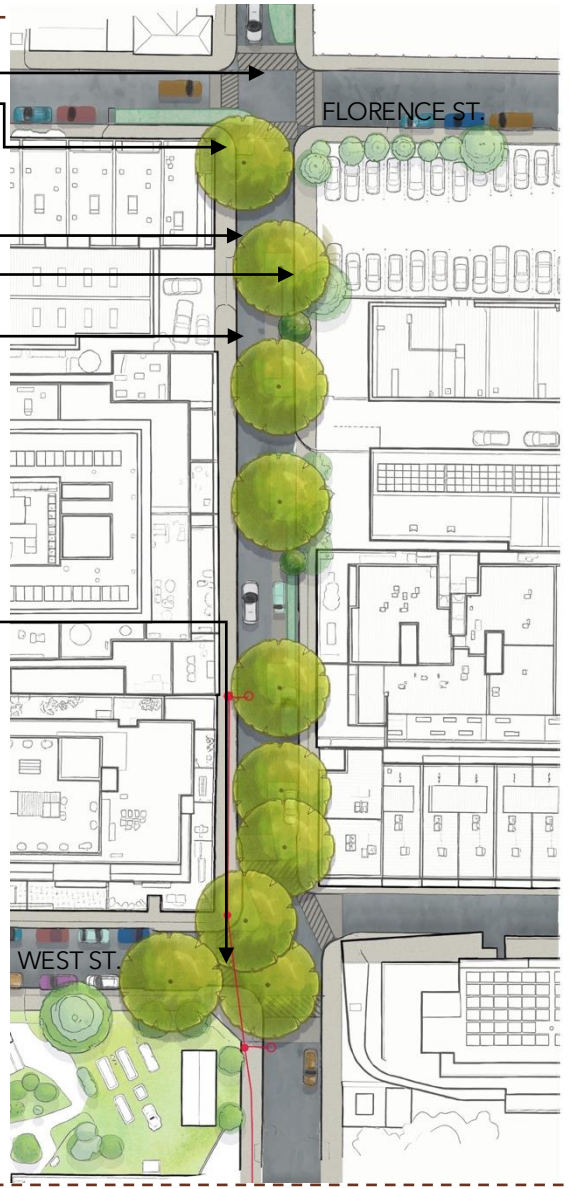


- Raised intersection
- Substantial garden bed protection required
- Reconfigure driveway/ discuss with landholder
- Heavily shaded canyon: consider *Gleditsia tricanthios* or *Jacaranda mimosifolia* (for light canopy effects)
- Potentially remove driveway
- 4 x rain gardens at the corner of West Road (50 m²)

Drawing key

- Existing large trees
- Existing small (new) trees
- New evergreen trees
- New deciduous trees
- Grass nature strip (existing lawns)
- Proposed garden bed. >600 mm high planting
- Existing overhead power poles, lines & lighting

Concept design



STREETBUILDER ADAPTATION OF COMMUNITY DESIGN: BREESE STREET: WEST STREET TO DUCKETT STREET

Existing conditions

- Drainage under
- Proposed deciduous tree *Gleditsia tricanthos*
- Reconfigure driveway/ discuss with landholder
- Proposed large evergreen tree - *Eucalyptus leucoxylon* subsp. *megalocarpa*
- Rain garden (48 m²) and protected café seating area

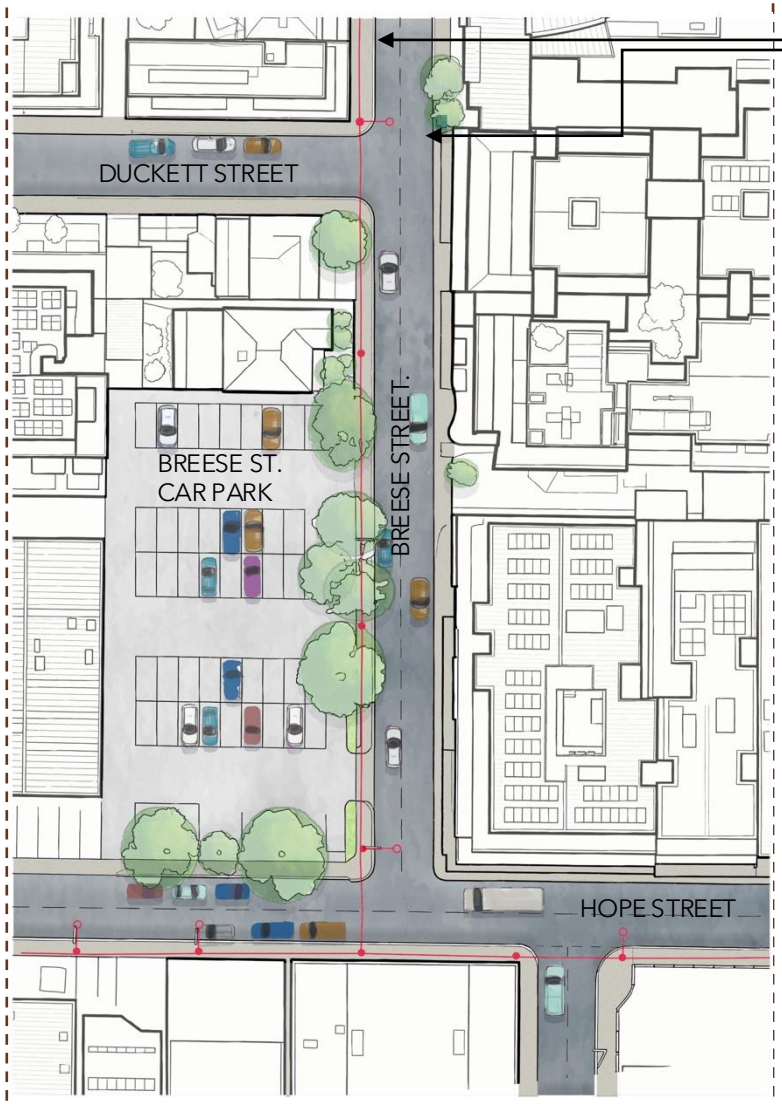
Drawing key

- Existing large trees
- Existing small (new) trees
- New evergreen trees
- New deciduous trees
- Grass nature strip (existing lawns)
- Proposed garden bed. >600 mm high planting
- Existing overhead power poles, lines & lighting

Concept design

STREETBUILDER ADAPTATION OF COMMUNITY DESIGN: BREESE STREET : DUCKETT STREET TO HOPE STREET

Existing conditions

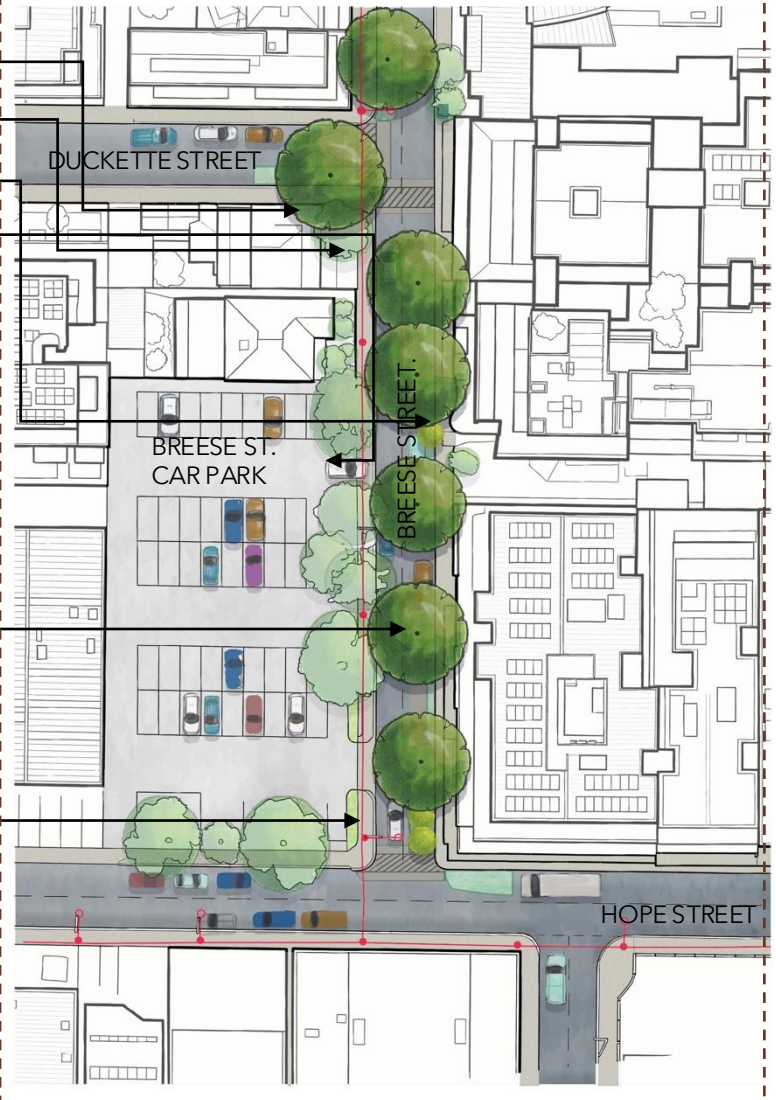


- Reconfigure driveway / discuss with landholder
- Existing kerb line
- Shared space for kids/ potential for Duckett Street to be shared zone/ note lots of drop offs to park
- Future development/ maintain 4-5 m setback to maintain streetlight
- Shrubs with mixed sized trees
- Reconfigure existing driveway to suit internalised carpark circulation
- Work from park spaces/ adult open space requirements
- Low volume access to substation/ potentially green pave
- Proposed large evergreen tree - *Eucalyptus leucoxylon* subsp. *megalocarpa*
- WSUD treatment system (305 m²)

Drawing key

- Existing large trees
- Existing small (new) trees
- New evergreen trees
- New deciduous trees
- Grass nature strip (existing lawns)
- Proposed garden bed. >600 mm high planting
- Existing overhead power poles, lines & lighting

Concept design



BREESE STREET – EXISTING CONDITIONS

BREESE STREET – STREETBUILDER IMPRESSION OF REDESIGN

STORMWATER MODELLING OF BREESE STREET

Streetscape and rain garden design

The proposed Breese Street retrofit design includes several rain gardens to capture and treat stormwater runoff and provide passive irrigation for new and existing street trees.

Stormwater modelling approach

The stormwater treatment performance of these assets has been modelled using MUSIC, the industry standard software that models stormwater treatment removal efficiency in urban catchments. The model quantifies stormwater quality improvements and stormwater volume reductions.

Key assumptions

The stormwater modelling is based on two key assumptions:

1. rain garden catchments include adjacent roads and footpaths that drain to each rain garden.
2. The catchment is assumed to be 70% imperviousness as per Melbourne Water's MUSIC guidelines 'typical value' assumption for roads. This is seen as a conservative approach.

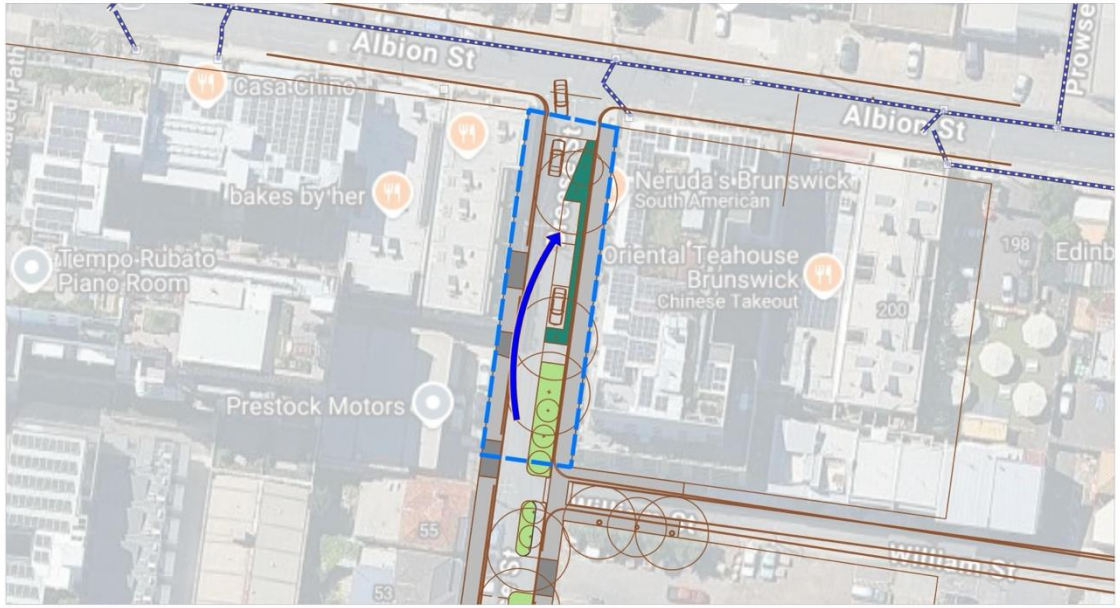
Modelling method

The modelling of passive irrigation results draws on empirical MUSIC models developed by Alluvium as part of previous passive irrigation projects for the City of Casey and Melton City Council. In those projects passive irrigation systems were assumed to support 100 street trees. For this project, parameters have been scaled proportionally based on the number of trees in each Breese Street rain garden.

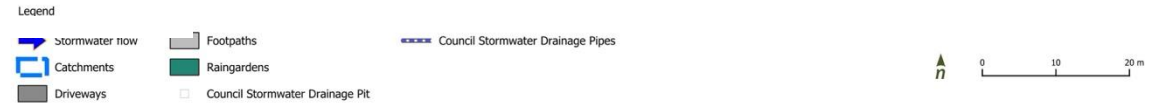
The modelled treatment results were compared against the pollutant loads generated from the street to assess the treatment efficiencies. This model also assess the percentage of irrigation demand met at each rain garden.

The modelling parameters and results for four sections of Breese Street are provided on the following pages.

Breese Street – Section 1



Breese Street - Section 1



Catchment area: 460 m^2

Rain garden area: 40 m^2

Number of trees: 2

Stormwater pollutant removal:

- Total Suspended Solids: 4.40 kg/yr (14% reduction in pollutant load)
- Total Phosphorus: 0.01 kg/yr (13% reduction in pollutant load)
- Total Nitrogen: 0.05 kg/yr (11% reduction in pollutant load)

Volume Reduction: 0.011ML/yr (37.2% irrigation demand met)

Breese Street – Section 2

Breese Street - Section 1

Catchment area: 1220 m^2

Rain garden area: 50 m^2

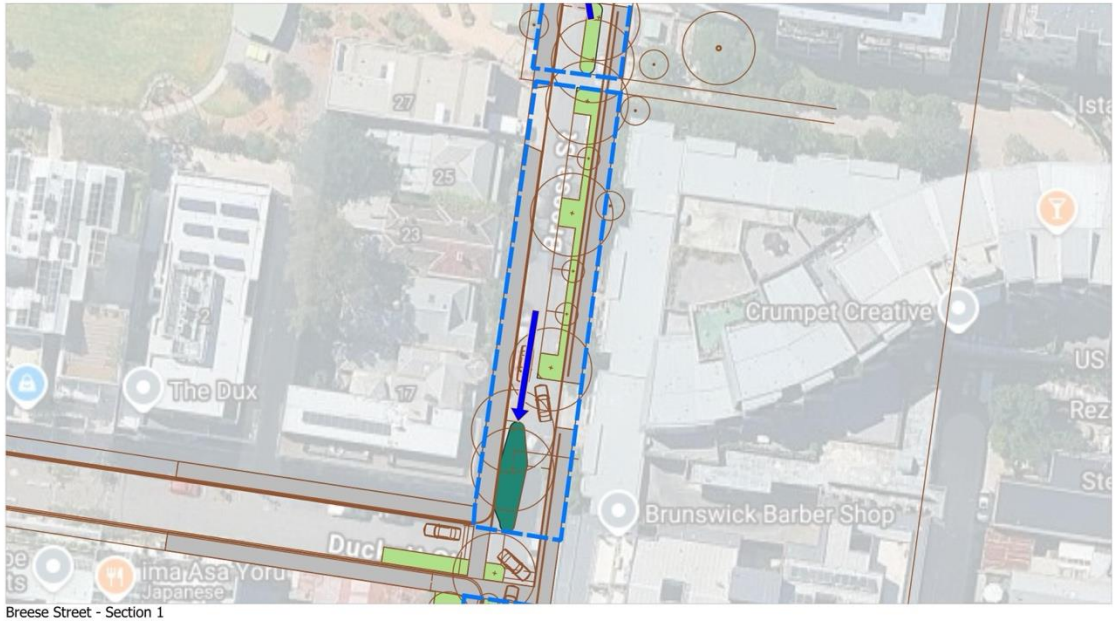
Number of trees: 7

Stormwater pollutant removal:

- Total Suspended Solids: 15.49 kg/yr (19% reduction in pollutant load)
- Total Phosphorus: 0.03 kg/yr (17% reduction in pollutant load)
- Total Nitrogen: 0.18 kg/yr (15% reduction in pollutant load)

Volume reduction: 0.039ML/yr (37.8% irrigation demand met)

Breese Street - Section 3



Catchment area: 740 m^2

Number of trees: 2

Rain garden area: 48 m^2

Stormwater pollutant removal:

- Total Suspended Solids: 4.40 kg/yr (9% reduction in pollutant load)
- Total Phosphorus: 0.01 kg/yr (8% reduction in pollutant load)
- Total Nitrogen: 0.05 kg/yr (7% reduction in pollutant load)

Volume Reduction: 0.011ML/yr (37.2% irrigation demand met)

Breese Street - Section 4

Catchment area: 1010 m^2

Rain garden area: 305 m^2

Number of trees: 3

Stormwater pollutant removal:

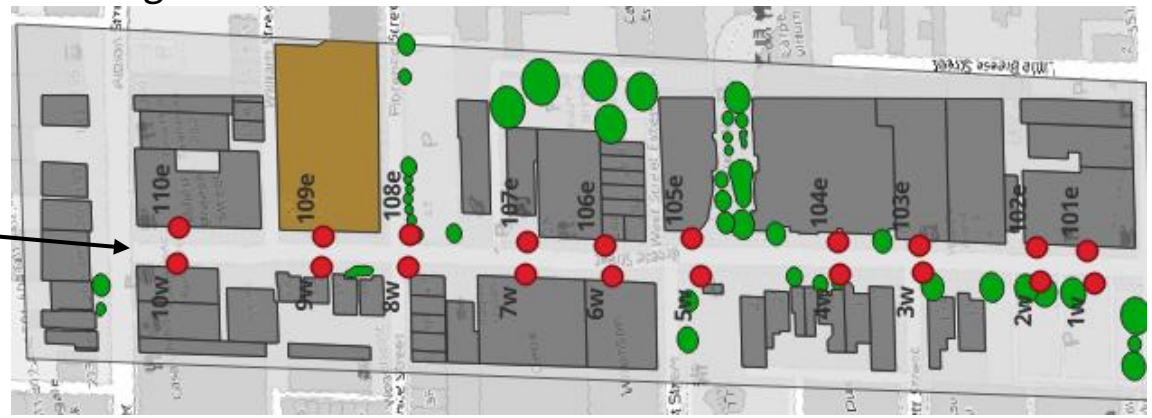
- Total Suspended Solids: 6.70 kg/yr (10% reduction in pollutant load)
- Total Phosphorus: 0.01 kg/yr (9% reduction in pollutant load)
- Total Nitrogen: 0.08 kg/yr (8% reduction in pollutant load)

Volume Reduction: 0.016ML/yr (37.3% irrigation demand met)

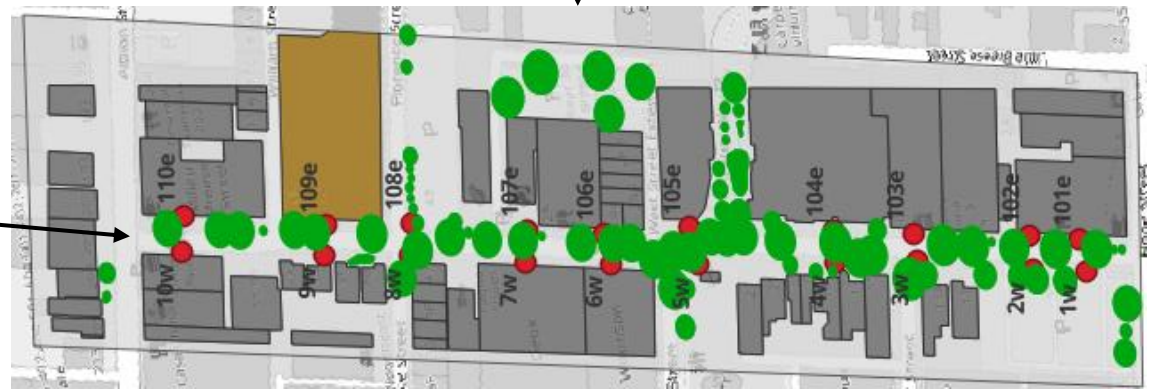
ANALYSIS OF TREE COVER AND THERMAL COMFORT OF BREESE STREET

Change in tree cover with redesign

Existing baseline conditions



Redesigned street



The existing baseline conditions of Breese Street included 4 mature trees.

34 new trees were added as part of the street redesign. These included a mix of deciduous and evergreen species.

The figures (left) show the modelled area and land cover used to generate the thermal comfort analysis (SOLWEIG model) for Breese Street.

Note that the redesign exercise focused on the street envelope itself and not the broader landscape. As such, the modelled area is greater than the target envelope of the community co-design process.

Landform measures used to inform the model

Landform	Baseline	Redesign
Building	35%	35%
Paved	57%	57%
Bare Soil	4%	4%
Grass	0%	0%
Trees	4%	11%

ANALYSIS OF TREE COVER AND THERMAL COMFORT OF BREESE STREET

Breese Street is a narrow street with sections of high building heights.

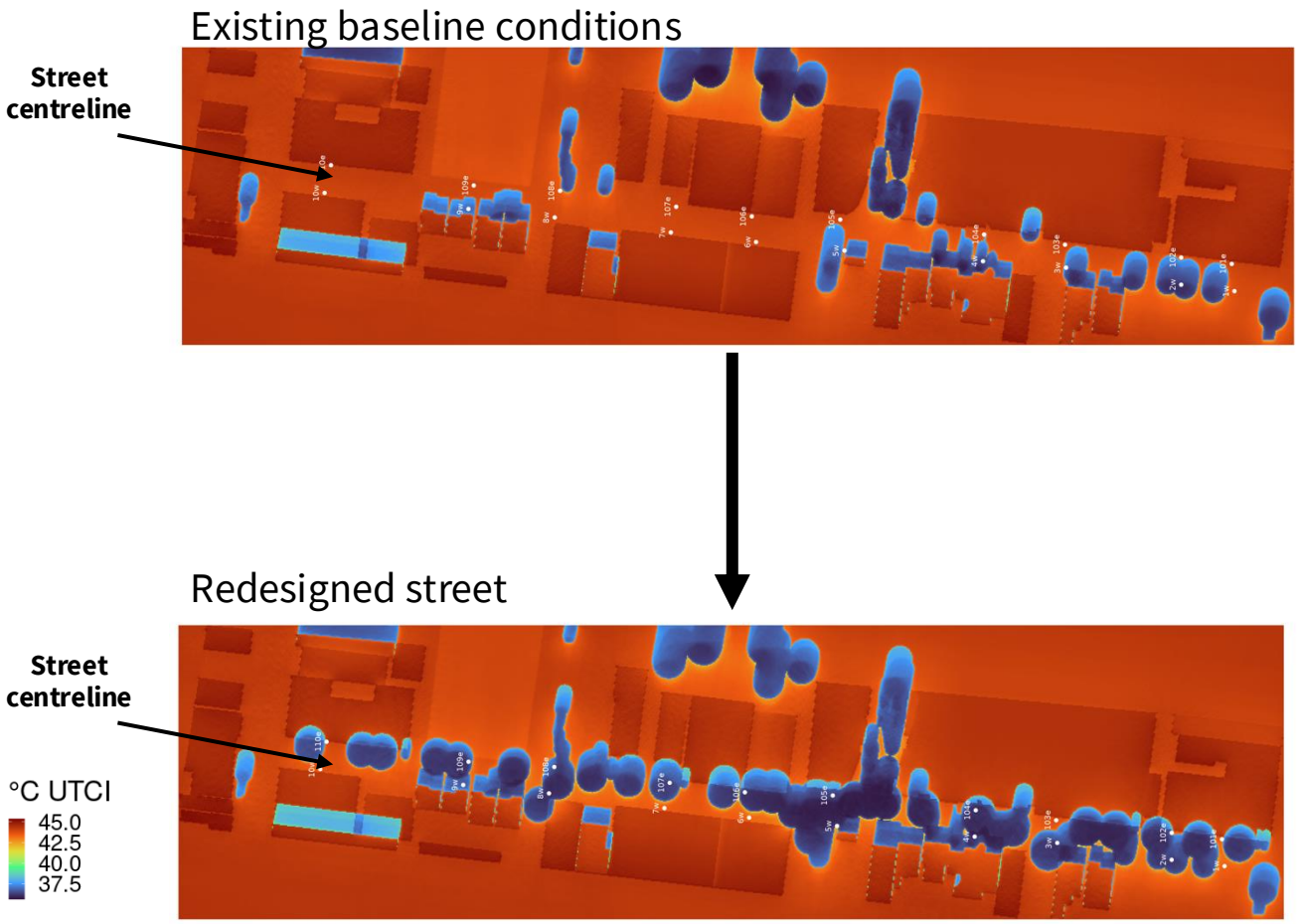
Reductions in UTCI of of 5–6°C were observed during the late morning and early afternoon, shifting conditions from “very strong heat stress” to “strong heat stress. These widely distributed across the transits, with stronger reductions on the west side of the street between Hope and West Street and stronger reductions on the east side between West and Albion Steets.

Reductions of 3–4°C are also observed across sections of the streets at midday.

The cooling varies depending on the street orientations, widths, and position of the sun throughout the day. This creates temporally varying zones of reduced heat exposure, particularly adjacent to vegetated areas. However, the cooling effect remains highly localised, generally extending only a few metres from shaded areas.

Further details on the methodology and outcomes of this analysis are presented in a technical report.

Change in thermal comfort with redesign



BREESE STREET COST ESTIMATE

The cost estimate (a preliminary opinion of probable cost) for the proposed works at Breese Street (Albion Street to Hope Street) is provided in the table on this page.

The cost estimate is based on current industry rates and the works included in the concept designs. They are for planning purposes only, and subject to detailed design.

No.	Description	Qty	Item	Rate	Total (ex GST)
1	PRELIMINARIES				
1.1	Contract preliminaries and compliance with the general conditions of contract		Item		$15,000
1.2	Traffic management - assume local area traffic closures for each section and footpath diversion only during works		Item		$24,000
1.3	Site Environmental Management Plan (SEMP) and implementation		Item		$6,000
1.4	Arborist nursery check on tree stock prior to delivery		Item		$1,000
1.5	Service checks and depthing where required.		Item		$6,000
2	DEMOLITION				
2.1	Saw cut and remove existing bluestone kerb and channel for WSUD, traffic treatments and garden beds (clean and reuse in new outstands and raised pavements)	150	m	$100	$15,000
2.2	Excavate and remove asphalt, road base and subsoil from new WSUD and garden bed areas - dispose off site	590	cum	$60	$35,400
2.2	Remove asphalt footpaths, redundant crossovers and replace damaged pit covers and lids (provisional sum)		Item		$20,000
3	WSUD WORKS				
3.1	Supply and install new WSUD treatments including new kerb, inlets, sub surface drainage, pit adjustment, filtration media, topsoil granitic mulch and planting (6/m2) in tubestock	440	sqm	$2500	$1,100,000
3.2	Supply and install new garden bed areas including new kerb, topsoil, mulch and planting (6/m2 in tubestock)	695	sqm	$1200	$834,000
4	STREETSCAPE WORKS				
4.1	Existing road pavement asphalt regulation and waste disposal	4	days	$10000	$40,000
4.2	Install 30mm hot mix asphalt overlay to regulated road pavement incl repair and tack coat	1735	sqm	$40	$69,400
4.3	Reinstate 30mm asphalt footpaths including recondition and recompact existing	1500	sqm	$45	$67,500
4.4	Supply and install 150mm 32Mpa reinforced coloured concrete raised pavement crossings	3	No.	$10000	$30,000
4.5	New line marking and signage (Provisional Sum)		Item		$20,000

No.	Description	Qty	Item	Rate	Total (ex GST)
4	STREETSCAPE WORKS				
4.1	Existing road pavement asphalt regulation and waste disposal	4	days	$10000	$40,000
4.2	Install 30mm hot mix asphalt overlay to regulated road pavement incl repair and tack coat	1735	sqm	$40	$69,400
4.3	Reinstate 30mm asphalt footpaths including recondition and recompact existing	1500	sqm	$45	$67,500
4.4	Supply and install 150mm 32Mpa reinforced coloured concrete raised pavement crossings	3	No.	$10000	$30,000
4.5	New line marking and signage (Provisional Sum)		Item		$20,000
5	TREE PLANTING				
5.1	Supply and install new 45 L trees including 3 black H/W stakes and mulch bowl	47	No.	$300	$14,100
6	ESTABLISHMENT MAINTENANCE				
6.1	Establishment maintenance of new trees incl water truck irrigation and formative prune when stakes removed	52	weeks	$1000	$52,000
	BREESE STREET Ex GST				$2,350,620
	Contingency 10 %				$235,062
	BREESE STREET - Ex GST				**$2,585,682**

7	LONG TERM MAINTENANCE - 20 YEARS				
7.1	Tree inspections, formative pruning and replacements	47	No.	$400	$18,800
7.2	WSUD area maintenance including rubbish collection, weed control, mulch top up and lost plant replacement	442	sqm	$70	$30,940
7.3	Garden bed area maintenance including weed control, mulch top up and lost plant replacement	693	sqm	$50	$34,650

REIMAGINING STREETS WITH GREEN INFRASTRUCTURE

ALFRIEDA STREET
ST ALBANS, VICTORIA

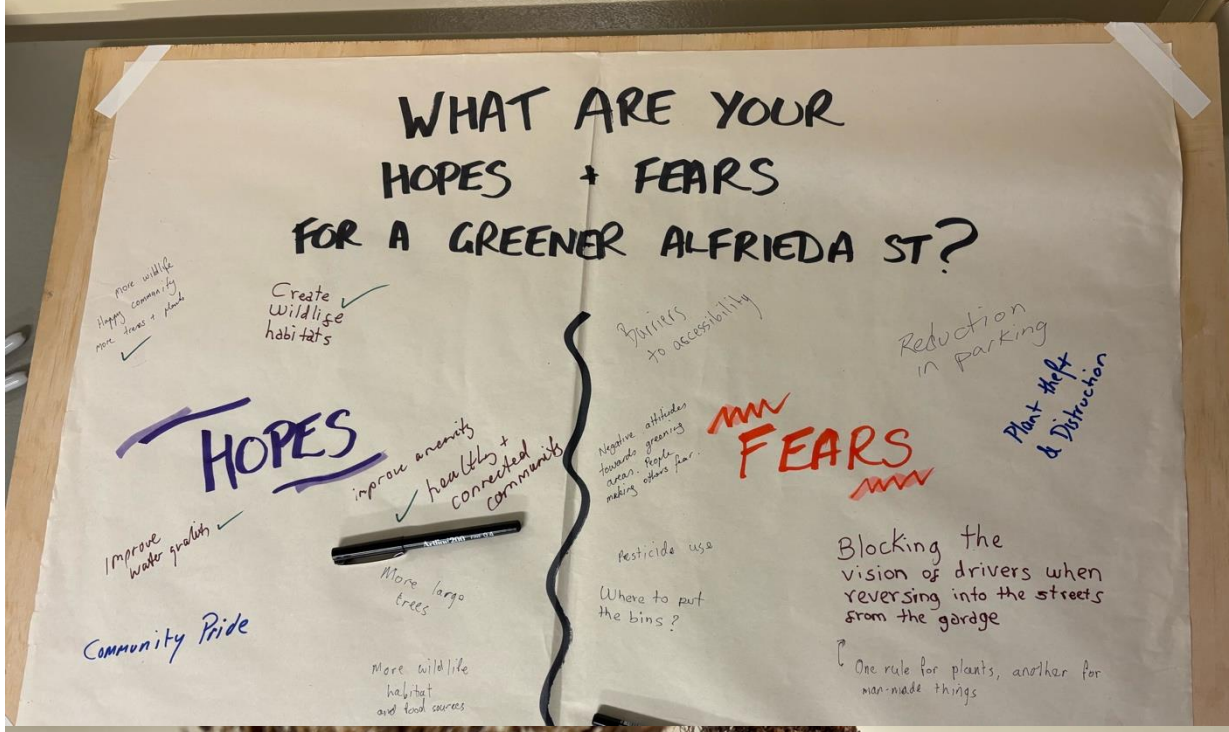
Design pack

Melbourne Centre
For Cities

ALFRIEDA STREET DESIGN INTENT

Key priorities for the Alfrieda Street community included:

- Habitat for wildlife and a diversity of street planting
- Accessibility for all
- Beauty
- Avoid high-maintenance designs that fall quickly into disrepair
- A desire to retain informal parking
- Increased greening without impeding vehicle traffic or safety



REALISATION OF COMMUNITY DESIGN – ALFRIEDA STREET

Community opted to retain the powerlines and instead structure plant selection to provide enhanced shade, wildlife habitat and beautification. This included selecting trees of different growing heights on opposite sides of the road to accommodate existing infrastructure. Wide nature strips were converted to native wildflower meadows and a separate bike lane was created to support active transport. Shade trees were selected to provide comfort to pedestrians and cyclists.

REALISATION OF COMMUNITY DESIGN – ALFRIEDA STREET

STREETBUILDER ADAPTATION OF COMMUNITY DESIGN: ALFRIEDA STREET – HENRY STREET TO WILLIAM STREET

- Ensure roundabouts (if retained) are used for large trees
- Narrow and inconsistent existing footpaths and crossings
- Wide verge strips on both sides of road
- New cycle lane on both sides of street. If 2 way, cycle way will require resolution at intersections during feasibility.
- Number of driveways will increase impacting space for trees and green infrastructure - consider revising tree clearance rules
- Maintain existing unstructured parking
- Use native shrubs for colour and ecological value (e.g. *Callistemon* spp.)
- Use larger species on the western verge to improve canopy cover over driveways and increase afternoon shade reaching the eastern footpath

Tree selection suggestions

Small native trees to consider under powerlines (eastern verge)

Calistemon 'Kings Park Special (colour and biodiversity 4 m
Calistemon Salignus (taller choice) 6 m

Large native trees to consider for western verge

Corymbia Maculata (height for eastern verge shade provision) 18 m

Angophora Costata (denser canopy for shade provision) 15 m

Eucalyptus Sideroxylon (biodiversity and canopy density)

Eucalyptus Nicholii (hardy, dense canopy and biodiversity)

Drawing key

- Existing large trees
- Existing small (new) trees
- Proposed large trees
- Proposed small trees
- Grass nature strip (existing lawns)
- Proposed garden bed. >600 mm high planting
- New bicycle path
- Existing overhead power poles, lines & lighting

Existing conditions

Concept design

STREETBUILDER ADAPTATION OF COMMUNITY DESIGN: ALFRIEDA STREET – WILLIAM STREET TO BIGGS STREET

- Ensure roundabouts (if retained) are used for large trees
- Narrow and inconsistent existing footpaths and crossings
- Wide verge strips on both sides of road
- New cycle lane on both sides of street. If 2 way, cycle way will require resolution at intersections during feasibility.
- Number of driveways will increase impacting space for trees and green infrastructure - consider revising tree clearance rules
- Maintain existing unstructured parking
- Use native shrubs for colour and ecological value (e.g. *Callistemon* spp.) under powerlines on eastern verge
- Use larger species on the western verge to improve canopy cover over driveways and increase afternoon shade reaching the eastern footpath

Tree selection suggestions

Small native trees to consider under powerlines (eastern verge)

Calistemon 'Kings Park Special (colour and biodiversity 4 m
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Large native trees to consider for western verge

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Drawing key

- Existing large trees
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- Proposed small trees
- Grass nature strip (existing lawns)
- Proposed garden bed. >600 mm high planting
- New bicycle path
- Existing overhead power poles, lines & lighting

Existing conditions

Concept design

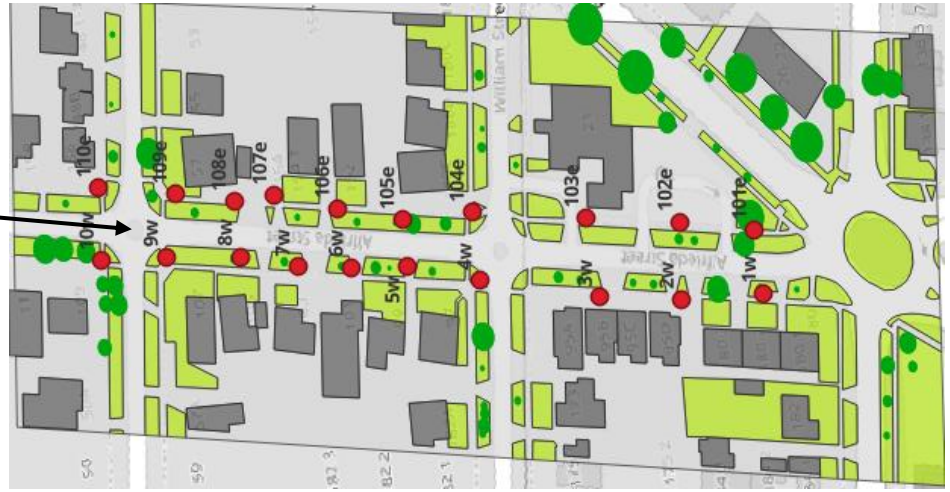
ALFRIEDA STREET – EXISTING CONDITIONS

ALFRIEDA STREET – STREETBUILDER IMPRESSION OF REDESIGN

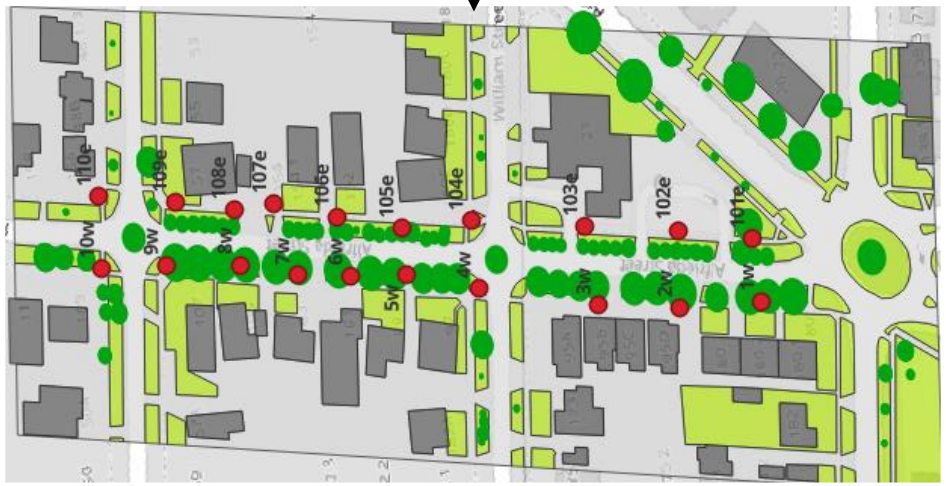
MODELLING TREE COVER AND THERMAL COMFORT OF ALFRIEDA STREET

Change in tree cover with redesign

Existing baseline conditions



Redesigned street



Legend

- Paved
- Building
- Tree
- Grass
- Transit point

The existing baseline condition of Alfrieda Street included 44 trees, primarily *Zelkova serrata*, many of which were newly planted or in poor condition.

27 large trees and 37 small trees were added to Alfrieda Street as part of the street redesign. These were primarily native species, aligning with community preferences.

The figures (left) show the modelled area and land cover used to generate the thermal comfort analysis (SOLWEIG model) for Breese Street.

Note that the redesign exercise focused on the street envelope itself and not the broader landscape. As such, the modelled area is greater than the target envelope of the community co-design process.

Landform measures used to inform the model

Land cover	Baseline	Redesign
Building	15%	15%
Paved	61%	61%
Bare Soil	0%	0%
Grass	20%	20%
Trees	4%	9%

MODELLING TREE COVER AND THERMAL COMFORT OF ALFRIEDA STREET

Alfrieda St is a wide street with low building heights.

Reductions in UTCI of of 5–6°C were observed during the late morning and early afternoon, shifting conditions from “very strong heat stress” to “strong heat stress. Main reductions in thermal stress are seen in the transits on the east side of the street between William and Henry Street Reductions of 3–4°C are also observed across sections of the streets at midday.

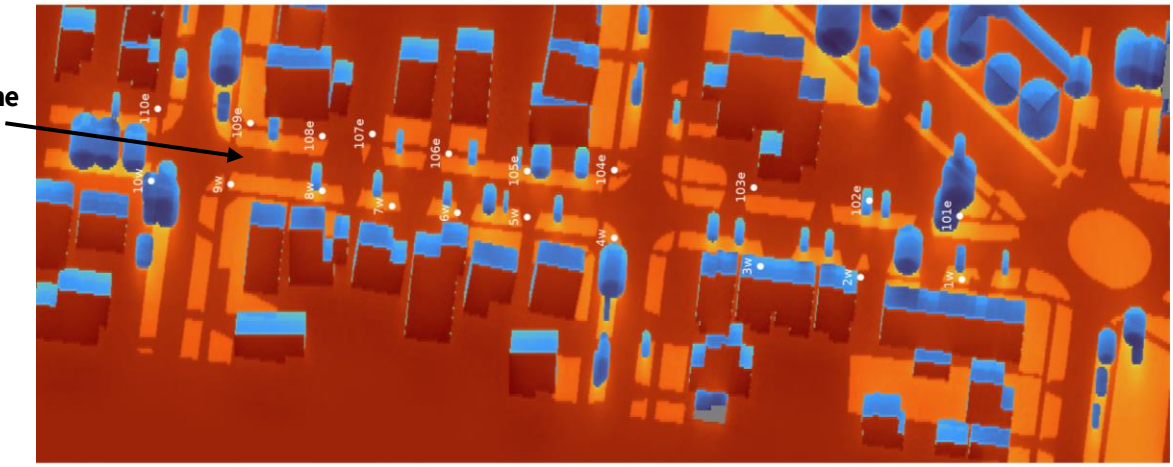
The cooling varies depending on the street orientations, widths, and position of the sun throughout the day. This creates temporally varying zones of reduced heat exposure, particularly adjacent to vegetated areas. However, the cooling effect remains highly localised, generally extending only a few metres from shaded areas.

Compared to the baseline, there is a modest increase in the proportion of the corridor experiencing lower UTCI values during the daytime period (08:00–17:00), reflected in an increase in the distribution of lower UTCI values (blue) and a reduction in mean UTCI over this period. This indicates that the interventions extend the area of relatively cooler conditions associated with the central median, rather than shifting the overall corridor-wide thermal profile. Substantial reductions in corridor-scale air temperature would require much larger increases in canopy cover and reductions in impervious surfaces than represented in the current scenarios.

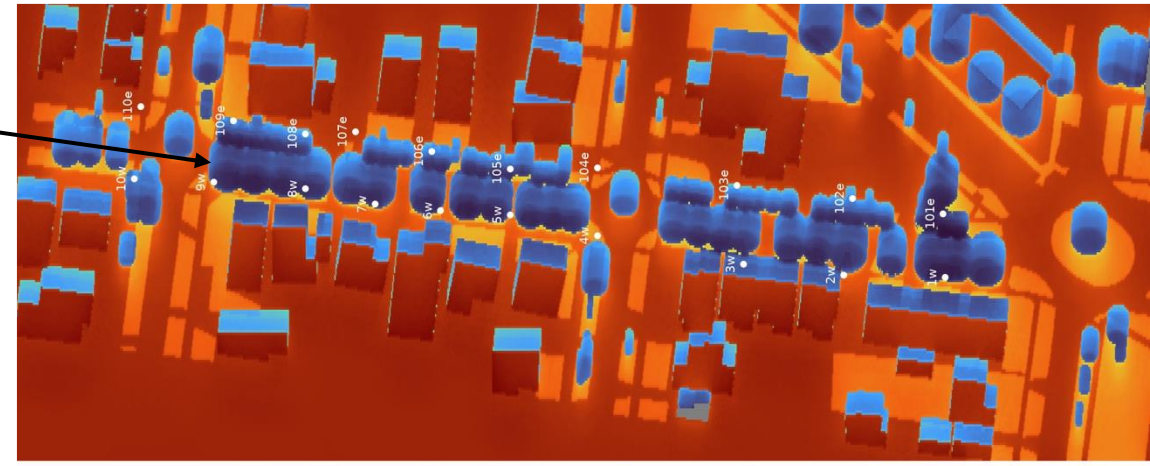
Further details on the methodology and outcomes of this analysis are presented in a technical report.

Change in thermal comfort with redesign

Existing baseline conditions



Redesigned street



ALFRIEDA STREET COST ESTIMATE

The cost estimate (a preliminary opinion of probable cost) for the proposed works at Alfrieda Street (Henry Street to Arthur Street) is provided in the table on this page.

The cost estimate is based on current industry rates and the works included in the concept designs. They are for planning purposes only, and subject to detailed design.

No.	Description	Qty	Item	Rate	Total (ex GST)
1	**Preliminaries**				
1.1	Contract preliminaries and compliance with the general conditions of contract		Item		$15,000
1.2	Traffic management - assume single lane closure and footpath diversion only during works		Item		$7,500
1.3	Site Environmental Management Plan (SEMP) and implementation		Item		$2,500
1.4	Arborist nursery check on tree stock prior to delivery		Item		$1,000
1.5	Service checks and depthing where required.		Item		$3,000
2	**Demolition**				
2.1	Saw cut and remove 1.5m existing concrete B2 kerb for passive irrigation openings west side of street only (retain channel in)	23	No.	$1000	$23,000
2.2	Remove non-performing trees and grub out roots	18	No.	$200	$3,600
3	**Path works**				
3.1	Strip and remove 150mm depth topsoil from nature strip	100	cum	$65	$6,500
3.2	Saw cut and remove concrete B2 kerb & channel and replace with new concrete crossover - reinstate asphalt	12	No.	$3000	$36,000
3.3	Supply and install 125mm 32Mpa reinforced concrete path over 25-50mm compacted Class 2 FCR	660	sqm	$100	$66,000
3.4	Line marking and green oxide at intersections		Item		$10,000
3.5	New signage	12	No.	$800	$9,600
3.6	Sawcut remove and replace existing footpaths/kerbs/driveways damaged during works		Item		$5,000
4	**Tree planting**				
4.1	Supply and install new 45 L trees including 3 black H/W stakes and mulch bowl	64	No.	$300	$19,200
4.2	Reinstate and reseed existing grass nature strips		Item		$10,000
5	**Establishment maintenance**				
5.1	Establishment maintenance of new trees incl water truck irrigation and formative prune when stakes removed	52	weeks	$250	$13,000
	Alfrieda Street - Henry St to Arthur St				$230,900
	Contingency 10 %				$23,090
	ALFRIEDA STREET - Henry St to Arthur St Ex GST				**$253,990**
6	**Long term maintenance - 20 years**				
6.1	Tree inspections, formative pruning and replacements	64	No.	$400	$25,600

REIMAGINING STREETS WITH GREEN INFRASTRUCTURE

KOOKABURRA AVENUE WERRIBEE, VICTORIA

Design pack

Melbourne Centre
For Cities

mosaic insights

KOOKABURRA AVENUE DESIGN INTENT

The community expressed a strong desire for a street greening retrofit to elevate the profile and pride in their local area. Workshop participants used the redesign as an opportunity to show investment in their community – the decision to underground the powerlines was made knowing that this was a major investment, but one that they felt was worth it.

A focus on native wildlife to match the bird monikers assigned to local streets was also highlighted as a way to change old narratives about the neighbourhood – from a birdcage to a place that beautiful birds call home.

Key priorities for the community:

- A beautiful place to be
- Provide shade for streets users (e.g. families waiting to collect children from school, commuters at the bus stop)
- Homes for native wildlife
- Resilient to extreme weather
- Foster a sense of neighbourhood pride

REALISATION OF COMMUNITY DESIGN – KOOKABURRA AVENUE

REALISATION OF COMMUNITY DESIGN – KOOKABURRA AVENUE

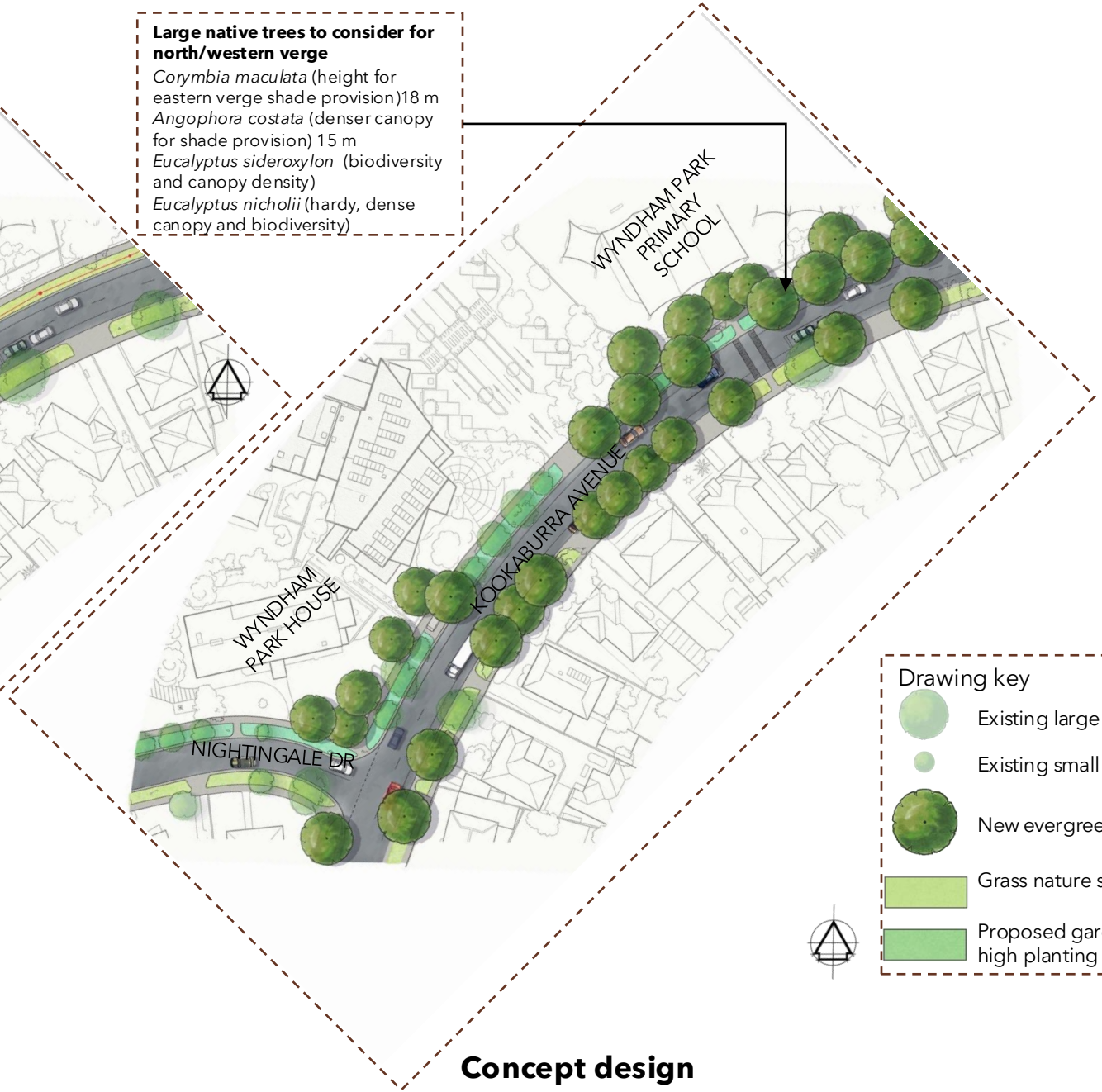
STREETBUILDER ADAPTATION OF COMMUNITY DESIGN: KOOKABURRA AVENUE TO NIGHTINGALE DRIVE (OPTION 1 – REMOVE POWERLINES)

- Existing power pole infrastructure
- Narrow existing footpath
- Maintain existing unstructured parking

Existing conditions

Large native trees to consider for north/western verge

Corymbia maculata (height for eastern verge shade provision)18 m
Angophora costata (denser canopy for shade provision) 15 m
Eucalyptus sideroxylon (biodiversity and canopy density)
Eucalyptus nicholii (hardy, dense canopy and biodiversity)



Concept design

STREETBUILDER ADAPTATION OF COMMUNITY DESIGN: KOOKABURRA AVENUE TO SHERRIN COURT (OPTION 1 – REMOVE POWERLINES)

- Existing power pole infrastructure
- Narrow existing footpath
- Maintain existing unstructured parking

Large native trees to consider for north/western verge

Corymbia maculata (height for eastern verge shade provision)18 m
Angophora costata (denser canopy for shade provision) 15 m
Eucalyptus sideroxylon (biodiversity and canopy density)
Eucalyptus nicholii (hardy, dense canopy and biodiversity)

Existing conditions

Concept design

STREETBUILDER ADAPTATION OF COMMUNITY DESIGN: KOOKABURRA AVENUE TO NIGHTINGALE DRIVE (OPTION 2 – RETAIN POWERLINES)

- Existing power pole infrastructure
- Narrow existing footpath
- Maintain existing unstructured parking

Existing conditions

Large native trees to consider for north/western verge

Corymbia maculata (height for eastern verge shade provision)18m
Angophora costata (denser canopy for shade provision) 15m
Eucalyptus sideroxylon (biodiversity and canopy density)
Eucalyptus nicholii (hardy, dense canopy and biodiversity)

Medium deciduous trees

Melia azedarach

Concept design

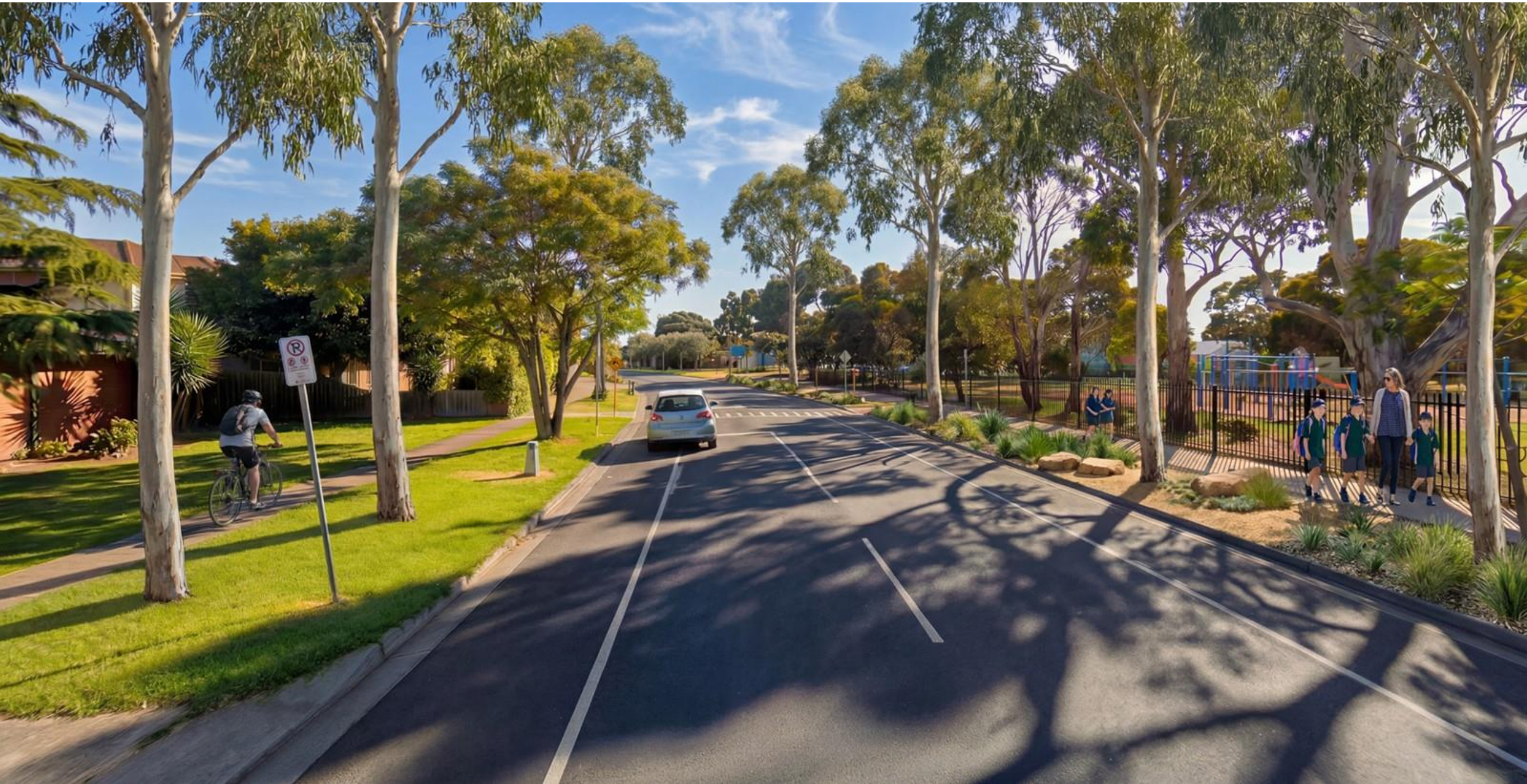
Drawing key

- Existing large trees
- Existing small (new) trees
- New evergreen trees
- New deciduous trees
- Grass nature strip (existing lawns)
- Proposed garden bed. >600 mm high planting
- Existing overhead power poles, lines & lighting

STREETBUILDER ADAPTATION OF COMMUNITY DESIGN: KOOKABURRA AVENUE TO SHERRIN COURT (OPTION 2 – RETAIN POWERLINES)

KOOKABURRA AVENUE –EXISTING CONDITIONS

KOOKABURRA AVENUE – STREETBUILDER IMPRESSION OF REDESIGN OPTION 1 (REMOVE POWERLINES)



KOOKABURRA AVENUE – STREETBUILDER IMPRESSION OF REDESIGN OPTION 2 (RETAIN POWERLINES)

MODELLING TREE COVER AND THERMAL COMFORT OF KOOKABURRA AVENUE

Legend

- Paved
- Building
- Tree
- Grass
- Transit point

Existing baseline conditions

Scenario 1 (powerlines removed)

Scenario 2 (powerlines retained)

The existing baseline condition of Alfrieda Street included 24 street trees primarily *Melia azedarach* and Callistemon species.

Under scenario 1 (powerlines removed) 64 new large green evergreen trees were added to the redesign of Kookaburra Avenue. Under scenario 2 (powerlines retained), 45 new large evergreen and 30 medium deciduous trees were added to the redesign.

The figures (left) show the modelled area and land cover used to generate the thermal comfort analysis (SOLWEIG model) for Breese Street.

Note that the redesign exercise focused on the street envelope itself and not the broader landscape. As such, the modelled area is greater than the target envelope of the community co-design process.

Landform measures used to inform the model

Landform	Baseline	Codesign
Building	11%	11%
Paved	60%	60%
Bare Soil	1%	1%
Grass	22%	22%
Trees	7%	13%

MODELLING TREE COVER AND THERMAL COMFORT OF KOOKABURRA AVENUE

Kookaburra Ave is wide street with low building heights but shifts in orientation from north/south to west/east..

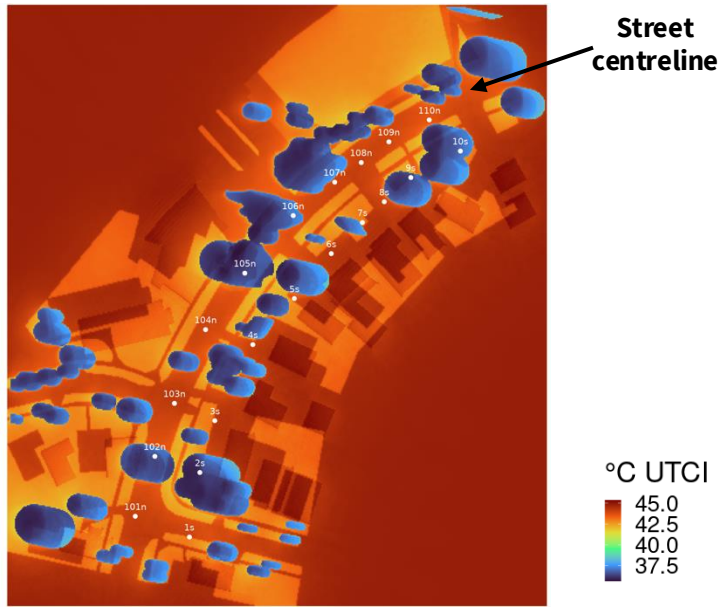
Reductions in UTCI of of 5–6°C were observed during the late morning and early afternoon, shifting conditions from “very strong heat stress” to “strong heat stress. The shifting orientation of the street results in little reductions in the transits in the north/south section (towards the bottom of the images, right) but large reductions on the north side of the street in the west/east orientation (towards the top of the images, right).

The cooling varies depending on the street orientations, widths, and position of the sun throughout the day. This creates temporally varying zones of reduced heat exposure, particularly adjacent to vegetated areas. However, the cooling effect remains highly localised, generally extending only a few metres from shaded areas.

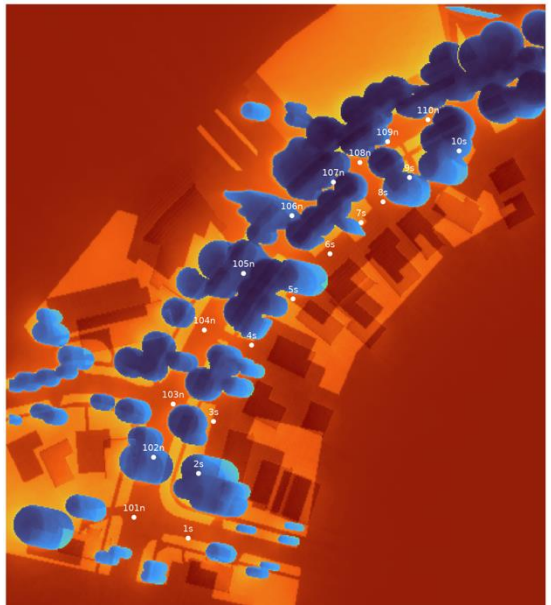
Compared to the baseline, there is a modest increase in the proportion of the corridor experiencing lower UTCI values during the daytime period (08:00–17:00), reflected in an increase in the distribution of lower UTCI values (blue) and a reduction in mean UTCI over this period. This indicates that the interventions extend the area of relatively cooler conditions associated with the central median, rather than shifting the overall corridor-wide thermal profile. Substantial reductions in corridor-scale air temperature would require much larger increases in canopy cover and reductions in impervious surfaces than represented in the current scenarios.

Further details on the methodology and outcomes of this analysis are presented in a technical report.

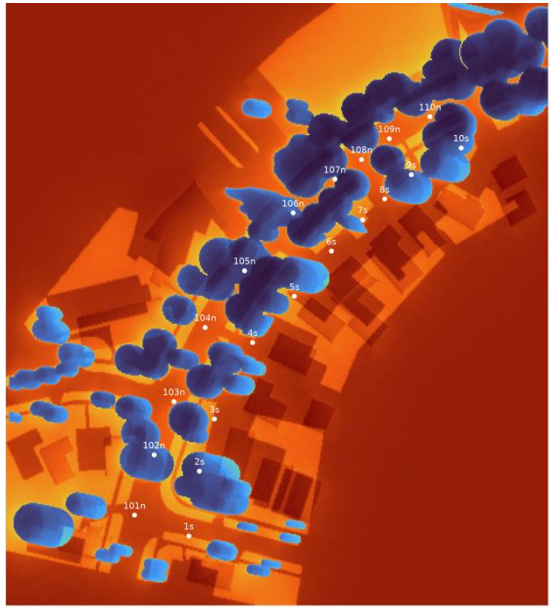
Existing baseline conditions



Scenario 1 (powerlines removed)



Scenario 2 (powerlines retained)



KOOKABURRA AVENUE: OPTION 1 COST ESTIMATE

The cost estimate (a preliminary opinion of probable cost) for option 1 for the proposed works at Kookaburra Avenue (Nightingale Street to Sherrin Court) is provided in the table on the following page. Option 1 involves undergrounding of the powerlines. The cost estimate is based on current industry rates and the works included in the concept designs. They are for planning purposes only, and subject to detailed design.

No.	Description	Qty	Item	Rate	Total (ex GST)
1	**Preliminaries**				
1.1	Contract preliminaries and compliance with the general conditions of contract		Item		$15,000
1.2	Traffic management - assume single lane closure and footpath diversion only during works		Item		$7,500
1.3	Site Environmental Management Plan (SEMP) and implementation		Item		$2,500
1.4	Arborist nursery check on tree stock prior to delivery		Item		$1,000
1.5	Service checks and depthing where required.		Item		$3,000
2	**Demolition**				
2.1	Saw cut and remove 1.5m existing concrete B2 kerb for passive irrigation openings both sides of street (retain channel in)	54	No.	$1000	$54,000
2.2	Underground power Nightingale Street to Sherrin Court	600	m	$1500	$900,000
3	**Tree planting**				
3.1	Supply and install new 45 L trees including 3 black H/W stakes and mulch bowl to nature strip	54	No.	$300	$16,200
3.2	Supply and install new 45 L trees including 3 black H/W stakes and mulch bowl to school and community centre	20	No.	$300	$6,000
3.3	Reinstate and reseed existing grass nature strips (residential side only)		Item		$5,000
4	**Garden bed**				
4.1	Strip grass (200mm) from existing school nature strip and dispose off site	480	cum	$65	$31,200
4.2	Garden bed preparation including weed control, cultivation and top up with 150mm commecial grade toposil and 50mm mulch	2400	sqm	$40	$96,000
4.3	Supply and plant tubestock size grasses, groundcover and to prepared garden bed areas at 6/m^2.	14400	No.	$6	$86,400

No.	Description	Qty	Item	Rate	Total (ex GST)
5	**Establishment maintenance**				
5.1	Establishment maintenance of new trees incl water truck irrigation and formative prune when stakes removed	52	weeks	$250	$13,000
5.1	Establishment maintenance of new garden bed areas incl water truck irrigation, weeding, mulch top up and failed plant replacement	52	weeks	$500	$26,000
	Kookaburra Ave - Nightingale St to Sherrin Ct				**$1,262,800**
	Contingency 10 %				$126,280
	KOOKABURRA AVE - Nightingale St to Sherrin Ct Ex GST				**$1,389,080**
6	**Long term maintenance - 20 years**				
6.1	Tree inspections, formative pruning and replacements	54	No.	$400	$21,600
6.2	Garden bed maintenance to school frontage only	2400	sqm	$50	$120,000

KOOKABURRA AVENUE: OPTION 2 COST ESTIMATE

The cost estimate (a preliminary opinion of probable cost) for option 2 for the proposed works at Kookaburra Avenue (Nightingale Street to Sherrin Court) is provided in the table on this page. Option 2 is retention of the powerlines.

The cost estimate is based on current industry rates and the works included in the concept designs. They are for planning purposes only, and subject to detailed design.

No.	Description	Qty	Item	Rate	Total (ex GST)
1	**Preliminaries**				
1.1	Contract preliminaries and compliance with the general conditions of contract		Item		$15,000
1.2	Traffic management - assume single lane closure and footpath diversion only during works		Item		$7,500
1.3	Site Environmental Management Plan (SEMP) and implementation		Item		$2,500
1.4	Arborist nursery check on tree stock prior to delivery		Item		$1,000
1.5	Service checks and depthing where required.		Item		$3,000
2	**Demolition**				
2.1	Saw cut and remove 1.5m existing concrete B2 kerb for passive irrigation openings both sides of street (retain channel in)	54	No.	$1000	$54,000
3	**Tree planting**				
3.1	Supply and install new 45 L trees including 3 black H/W stakes and mulch bowl to nature strip	54	No.	$300	$16,200
3.2	Supply and install new 45 L trees including 3 black H/W stakes and mulch bowl to school and community centre	20	No.	$300	$6,000
3.3	Reinstate and reseed existing grass nature strips		Item		$10,000
4	**Establishment maintenance**				
4.1	Establishment maintenance of new trees incl water truck irrigation and formative prune when stakes removed	52	weeks	$250	$13,000
	Kookaburra Ave - Nightingale St to Sherrin Ct				$128,200
	Contingency 10 %				$12,820
	KOOKABURRA AVE - Nightingale St to Sherrin Ct Ex GST				**$141,020**
6	**Long term maintenance - 20 years**				
6.1	Tree inspections, formative pruning and replacements	54	No.	$400	$21,600
6.2	Nature strip mowing to school frontage only	2720	sqm		$18,000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