Biodiversity Sensitive Urban Design

Creating urban environments that are good for people and good for nature

Artist's Impression: Biodiverse Midrise for Fishermans Bend

Biodiversity Sensitive Urban Design

What is it?

Biodiversity Sensitive Urban Design (BSUD) is a protocol for urban design that aims to create suburbs that are a net benefit to native species and ecosystems through the provision of essential habitat and food resources.

It represents a new approach to urban biodiversity conservation by seeking to achieve biodiversity benefits on site, in contrast to the standard offsetting approach, which reduces the opportunity for urban residents to engage with nature and, at the same time, delivers questionable ecological outcomes.

What are the benefits?

BSUD aims to protect native species and ecosystems in the places where people live and work. Urban greening associated with BSUD also provides a range of proven benefits to individuals, communities and cities, including:

- Cooling of urban areas
- Air and water purification
- A range of human health and wellbeing benefits in areas such as mental health, cardiovascular health, social cohesion and cognitive ability.
- Increased worksplace productivity

How can I implement BSUD?

BSUD can be implemented at a range of scales, and by a range of people, from individual home owners wanting to reduce their impact on nature, through to local and regional authorities responsible for the planning and development of major towns and cities.

BSUD proceeds in **6 steps,** including an optional step allowing quantitative assessment of the contribution of the built environment to biodiversity.

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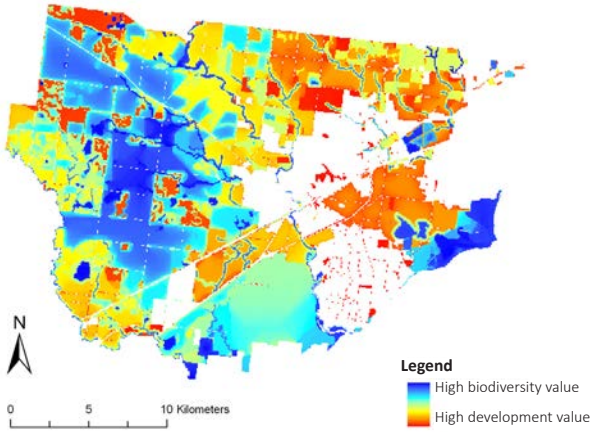
1. Identify and map ecological values

- Determine which native species and ecosystems are present in or utilise the area, paying particular attention to any that are threatened.
- Document the landscape context of the area, including geology, hydrology and any natural features of the landscape. Consider the role of the area for overall connectivity in the landscape.
- Where the landscape is heavily modified, seek information from historical records about species and ecosystems that once existed there. This will provide information about which species may exist there again.



Spatial planning tools can be used to identify areas of value for biodiversity (blue) and development (red), shown here for Wyndham in Melbourne's west. (Adapted from Bekessy et al. 2012)

2. Define ecological objectives, such as:

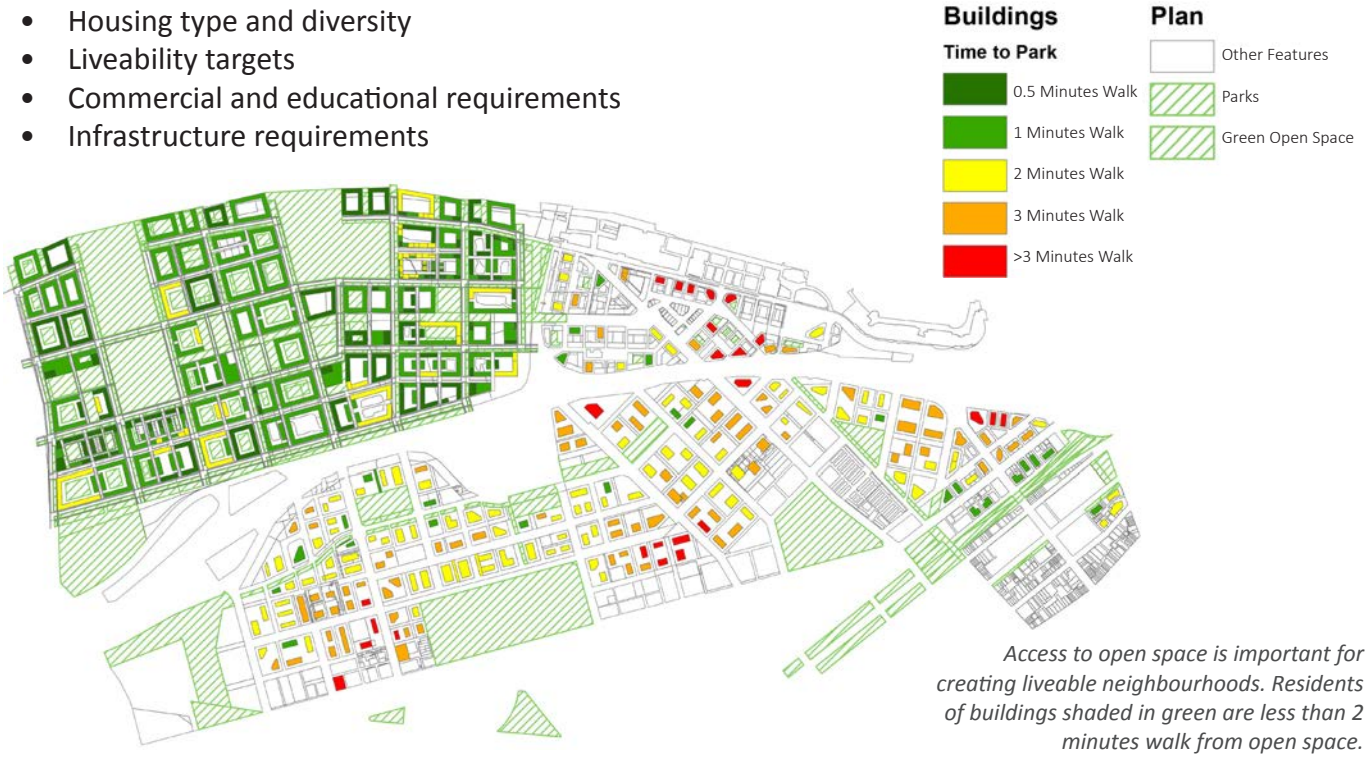
- Maintain viability of threatened species and ecosystems
- Protect and restore habitat quality
- Opportunities for rewilding

Photo by Peter Robinson

Maintaining or improving the viability of threatened species, such as the striped legless lizard, is a key environmental objective for BSUD.

3. Identify development objectives, including:

- Population and dwelling targets
- Housing type and diversity
- Liveability targets
- Commercial and educational requirements
- Infrastructure requirements



Access to open space is important for creating liveable neighbourhoods. Residents of buildings shaded in green are less than 2 minutes walk from open space.

4. Identify actions required to achieve objectives, considering the five principles of BSUD:

1. Maintain or create habitat for target species (feeding, nesting and protection; minimum patch sizes; landscape connectivity)
2. Facilitate dispersal of species
3. Minimise disturbance
4. Facilitate natural processes, considering the management requirements of target species and ecosystems (burning, weed control, mowing, etc.)
5. Facilitate positive human-nature interactions and engage the local community (creating “Cues-to-Care”; promoting active stewardship)

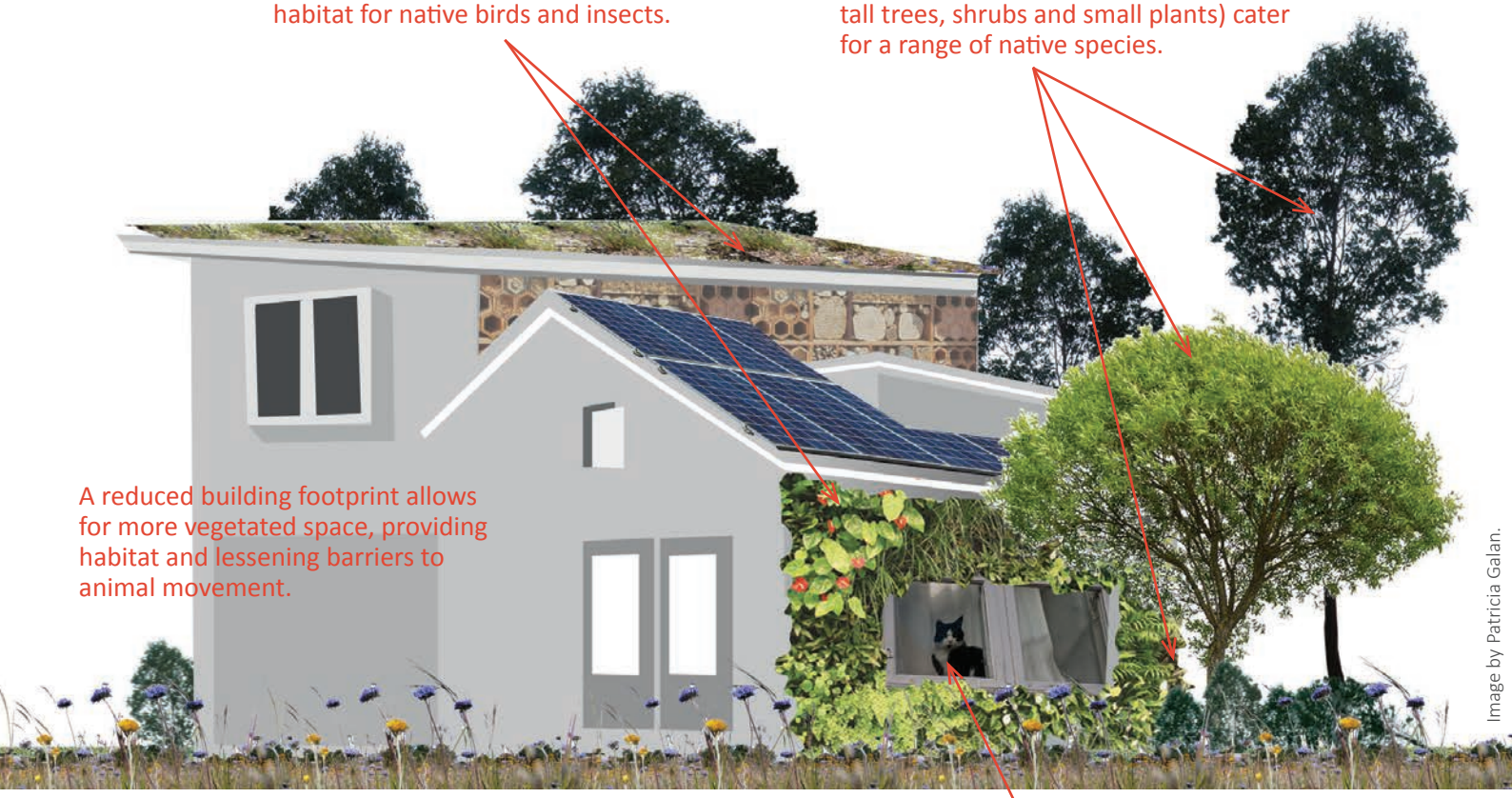


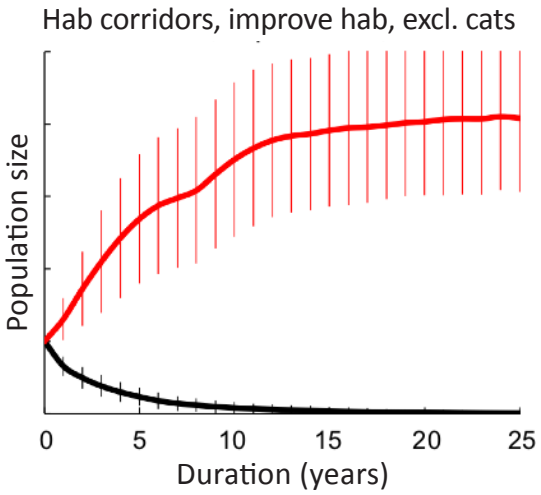
Image by Patricia Galan.

5. Quantitative assessment of contribution to biodiversity

This step will help to answer questions such as: "If I do this, this and this, how much will it benefit native species and ecosystems?" To arrive at an answer, you will need to assess the probability that the species or ecosystem can persist in the landscape. This can be measured using multiple methods, including, in increasing order of technical complexity:

- Literature review
- Expert elicitation
- Formal population viability analysis.

Step 5 is optional, but has the added benefit of enabling the actions or suite of actions that provide most cost-effective biodiversity benefit (the most bang for your buck) in Step 6.



Population viability analysis is a useful tool for estimating the positive contribution of BSUD to native species and ecosystems.

6. Identify the BSUD actions that best meet ecological objectives (Step 2), while also accommodating development objectives (Step 3) for the area.

BSUD Action - Native Grasslands

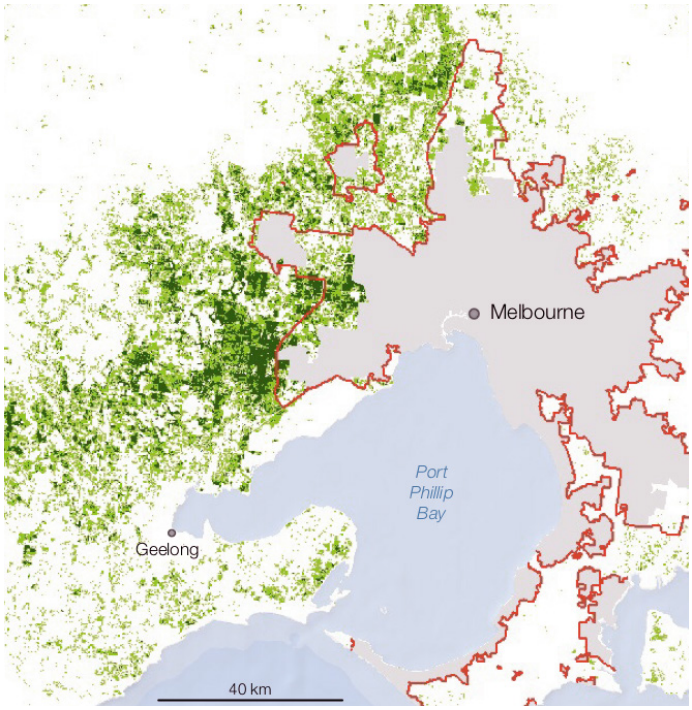
Design	
Appropriate adjacent land use	0.02
Effective buffers	0.03
Dispersal corridors, connecting habitat	
Fire-retardant design	<0.01
Sensitive landscaping - public	<0.01
Sensitive landscaping - private	<0.01
Enhance habitat	
Construction	
Early protection	0.08
Clean construction	0.02
Appropriate transitional management	0.08

BSUD Case Study 1:
Native Grasslands in Melbourne's Urban Fringe

The native temperate grasslands of the Victorian Volcanic Plain are amongst the most endangered ecosystems in Australia. More than 99% of the original extent has been cleared or converted to agriculture, and less than 0.1% remains in good condition. Much of the remaining grassland exists in areas designated as growth corridors for Melbourne, and thus, these grasslands and the species that inhabit them are threatened by urban development.

In this case study, our ecological objective was to maximise the likelihood of grasslands and a protected striped legless lizard persisting in new suburbs after development had occurred. We aimed to show how BSUD could improve the likelihood that native grasslands and the striped legless lizard, *(Delma impar)* would persist in new suburbs. We assessed the extent to which BSUD could contribute to persistence using expert opinion (native grasslands) and population viability analysis (striped legless lizard). We did not have specific development targets.

The BSUD actions examined were those that addressed major threats posed to native grasslands (loss and fragmentation of habitat, loss of species diversity caused by lack of burning and invasion by weeds, and poor public perception) and striped legless lizards (predation by cats, loss of habitat quality and quantity, and barriers to dispersal) in urban environments.



Conflict between grassland conservation and urban growth in Melbourne. Areas in green represent modelled native grassland occurrence. Darker green = native grasslands more likely to occur. Designated urban growth areas are those between the urban growth boundary (red line) and established urban areas (grey shaded areas).

Outcomes
We identified aspects of BSUD that could improve prospects for native grasslands and striped legless lizards in all phases of development.

BSUD was estimated to more than double the probability of persistence of native grasslands in urban landscapes and the legless lizard was thought to stand little chance of persisting without it. BSUD during construction was thought to confer the greatest potential to improve persistence of native grasslands in urban environments, while design elements aimed at reducing predation by cats during the inhabitation phase were most effective for the striped legless lizard.

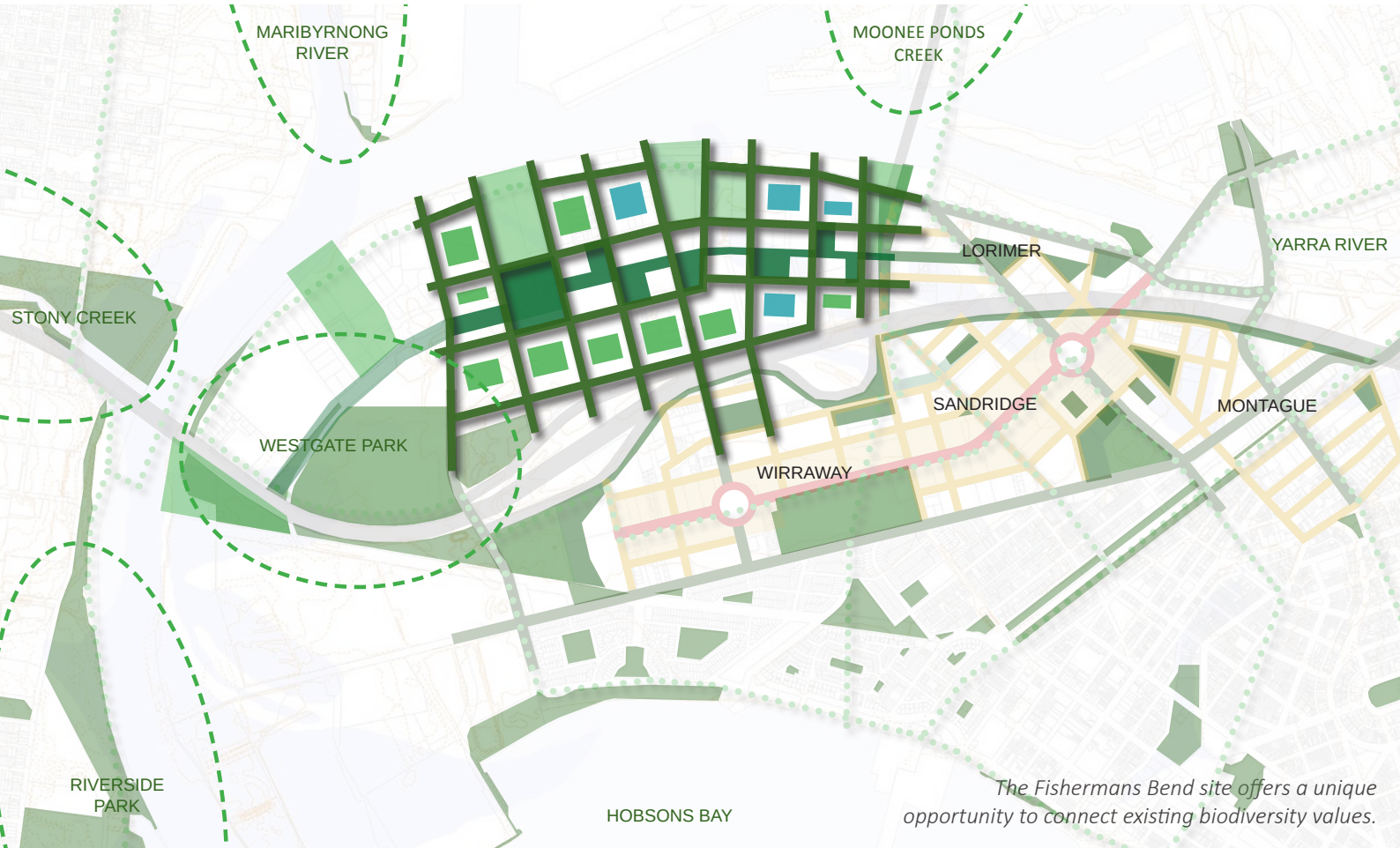
BSUD Action	Native Grasslands	Striped Legless Lizard
Design		
Appropriate adjacent land use	0.02	
Effective buffers	0.03	
Dispersal corridors, connecting habitat		<0.01
Fire-retardant design	<0.01	
Sensitive landscaping - public	<0.01	
Sensitive landscaping - private	<0.01	
Enhance habitat		0.05
Construction		
Early protection	0.08	
Clean construction	0.02	
Appropriate transitional management	0.08	
Inhabitation		
Cues to care	0.02	
Community education	0.02	
Active stewardship	0.03	
No cats outside		0.93
Total contribution to persistance	***0.31***	***0.94***

BSUD Case Study 2:
Biodiverse Mid-rise for Fishermans Bend

Fishermans Bend is a heavily modified location, with little in the way of existing ecological values. Of exceptional ecological value is Westgate Park on the western edge of the site, which provides habitat for a significant number of native plant, bird, insect and amphibian species. Fishermans Bend is notable for its potential to provide improved ecological connectivity in the landscape. The site could become an important corridor for connecting existing biodiversity values, including the Yarra and Maribyrnong Rivers, Moonee Ponds and Stony Creeks, Westgate Park and a patch of remnant mangroves at the mouth of the Stony Creek.

Because of the heavily modified nature of the site, ecological objectives focus on rewilding; creating the habitat and resource availability to attract native biodiversity to the area. We focused on five native species including birds (brolga & spotted pardalote), a butterfly (dainty swallowtail), a frog (growling grass frog) and a micro-bat (striped free-tailed bat). These species were chosen for their charismatic characteristics (eg. Brolgas are large, spectacular water birds), potential co-benefits (eg. Bats and frogs are insectivorous and therefore help control pests like mosquitos, and butterflies provide residents with restorative psychological benefits), and feasibility of their ecological requirements (eg. Spotted pardalote are already resident in nearby Westgate Park, and the Dainty swallowtail has a preference for domestic nature such as citrus trees as well as native vegetation). We identified the habitat and resource requirements for these species, and incorporated them into the built environment through habitat walls, semi-private and public open space.

Photo courtesy of BirdLife Australia



The Fishermans Bend site offers a unique opportunity to connect existing biodiversity values.

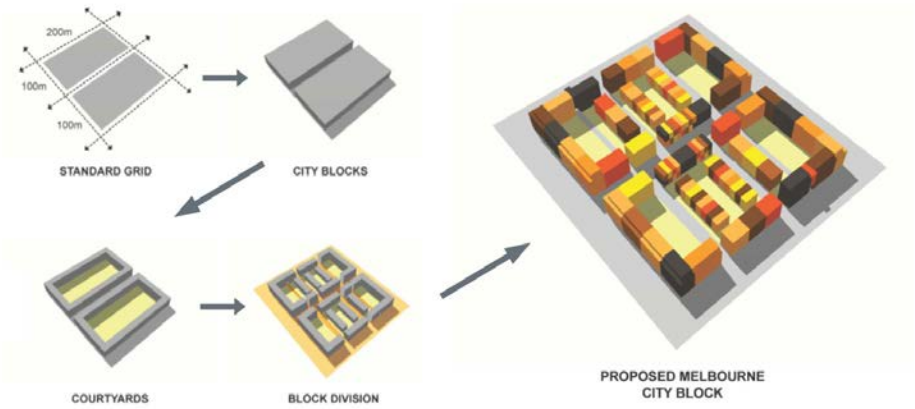
Development objectives reflected ambitions to create a more liveable and resilient urban environment than that provided by proposed development for the area, which features the podium-tower style construction of similar developments such as Southbank and Docklands.

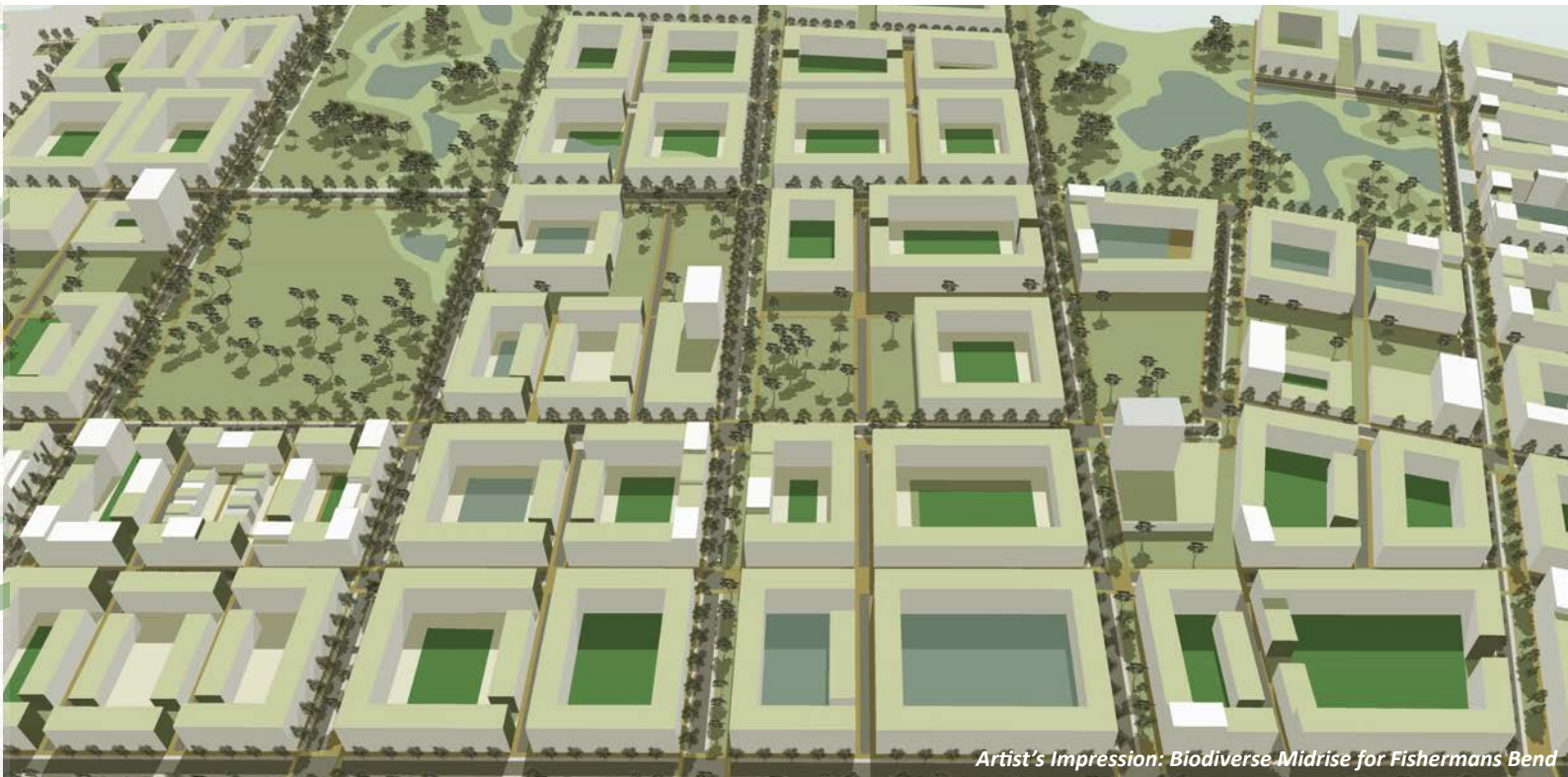
Development objectives included:

- Height limits of 4-7 storeys to improve accessibility and connectedness to nature and streets.
- Active streetscapes to improve safety and strengthen community.
- Diversity of building typologies to ensure dwellings for a range of urban residents.
- Incorporating Melbourne's unique city block and laneway features.
- High quality living spaces, with average apartment size of 100 m^2.

Outcomes

Our biodiverse mid-rise model achieves housing densities that are comparable to those identified for brownfield development sites in Plan Melbourne. However, when compared to the proposed high-rise development for Fishermans Bend, the sustainable mid-rise model will provide better urban design and human health and well-being outcomes, including better access to open space and improved streetscapes, a reduction in the urban heat island effect, a reduction in household energy use, and improved workplace productivity and childhood cognitive development. In addition, the wetlands required by some species provide additional water purification and flood mitigation services in a flood-prone landscape like Fishermans Bend.





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