# 3 The role of lots, streets and open spaces

This chapter investigates how the desired outcomes for the broader South Creek catchment can be divided into lots, streets and open space as the key components of each urban typology.

A framework is set out for changes between these components across different urban typologies or land uses.

## 3.1 Breaking down water management aspirations by urban typologies and components

Preliminary waterway health modelling indicates that urban runoff to the South Creek system must be maintained at around 0.9ML/ha/year in order to preserve key environmental values. This is an ambitious target which represents approximately 75% of typical average annual runoff volumes experienced in urban catchments.

This chapter investigates how urban developments can be designed to optimise stormwater retention on lots, streets and open spaces to work towards this target.

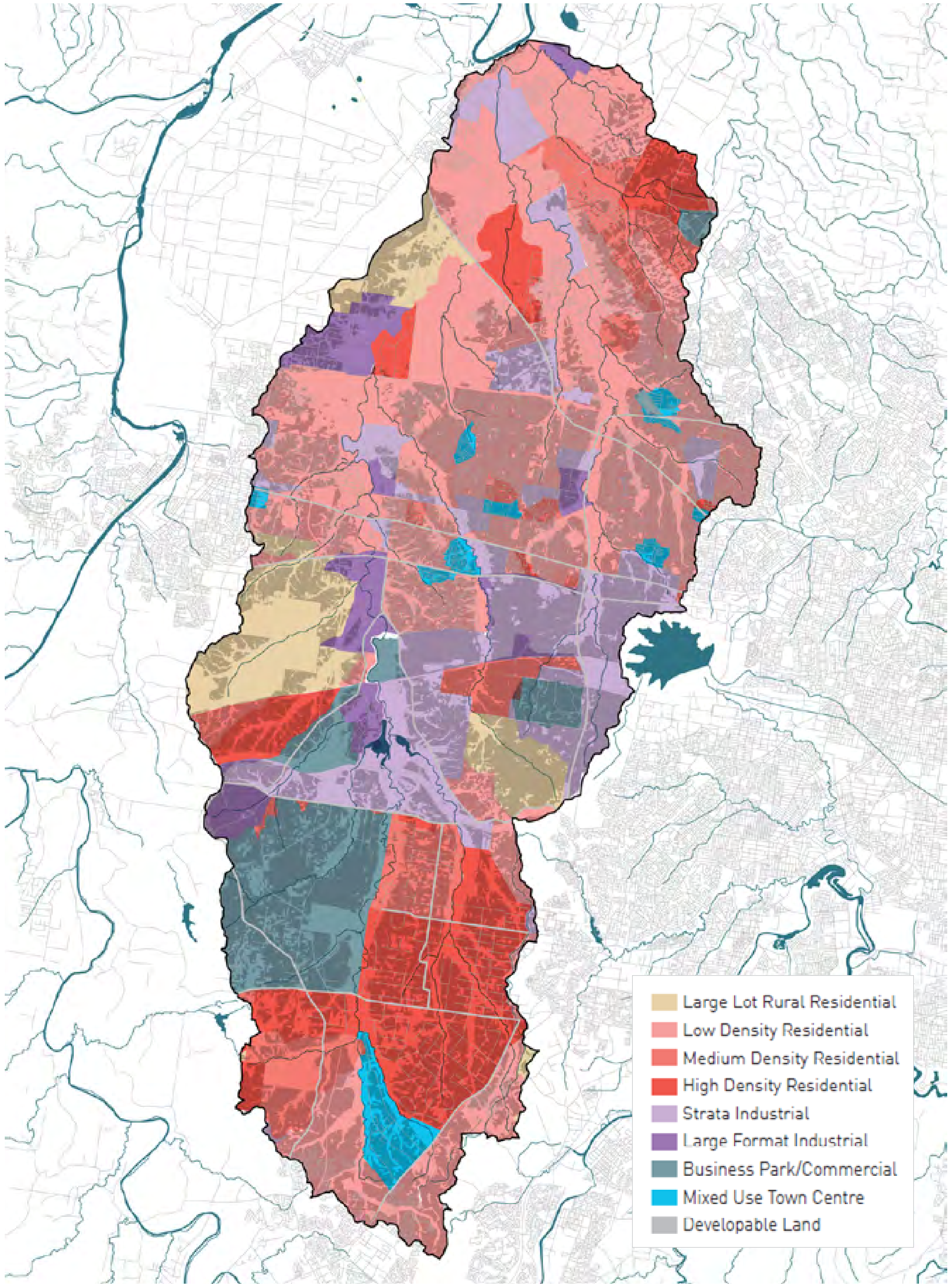



Figure 29. South Creek Catchment – Urban Development Scenario

## 3.2 The need for change across all urban typologies

Conventional greenfield development throughout Australia is often considered to be bleak, unsustainable and uncohesive with the natural environment.

The further issue of urban heat is exacerbated by a changing climate and has the potential to greatly impact the liveability of developments in Western Sydney.

Past experience has demonstrated that it is relatively easy to come up with targets and planning principles for new urban growth areas. However, most new urban areas end up looking like carbon copies of each other. The reasons range from how development is planned and financed, through to conventions in street design and the need to accommodate garbage trucks and other essential services. Many people are underwhelmed by conventional forms of urban development but can't see a way to change it.

By developing resolved urban typologies that consider housing density, affordability, liveability and practical civil engineering, and by aligning with the Western Sydney Street Design Guidelines and Western Sydney Engineering Manual, this study seeks to facilitate a step-change in urban design practice.

Western Sydney is already home to many new developments. It can be observed that a variety of configurations for certain land use types have been used. There is a clear disconnect between the vision for Western Sydney and the reality of what has been delivered in the past.

As seen in the business-as-usual imagery, urban areas are dominated by impervious paved surfaces. Paved areas store heat and exacerbate the urban heat island effect that increases local temperatures and intensifies the impacts of heat waves.

The integration of healthy trees and water in the urban streetscape will create cooler and green streets for the benefit of the local community.

The following pages describe reoccurring trends in development in Western Sydney and throughout Australia.

Figure 31. Examples of existing contemporary development in Western Sydney

Figure 30. There is a need to improve on 'business as usual'

## The need to change 'business as usual'

Figure 32. Aerial Imagery of Duplex housing development in Western Sydney (Nearmap)

Figure 33. Aerial Imagery of detached housing development in Western Sydney (Nearmap)

Figure 34. Eight Mile Plains Technology Park (Nearmap, 2019)

Figure 35. Aerial Imagery of industrial area in Western Sydney (Nearmap)

Duplex or quadplex housing developments need to provide the facilities of detached housing with significantly limited space. Hardstand areas made up of access roads, driveways and visitor carparks along with the roofs mean there is a very limited area for green space.

Typical greenfield housing developments in Australia are dominated by impervious surfaces. The streets are generally baking in the heat and the backyards are stark and unusable.

Business parks are made up of several office buildings where people come to work. These areas can be located in suburban regions where workers are likely to drive to work and require car parking. Roofs and carparks make up a large portion of the site area.

In Industrial areas, urban heat is particularly challenging to manage especially due to the scale of the lots and the nature of the developments. Rows upon rows of large roofs and expanses of pavements lead to further amplification of the urban heat island effect in industrial areas.

## 3.3 Metrics of existing precincts

The following pages provide measurements of existing precincts, broken down into the precinct components defined in Chapter 1.

This work has been used to:

- Understand the breakdown of permeability, green and open space across different precinct components (lots, streets and open spaces), and in particular the role of on-lot development (tested later in this document) against that of streets and open spaces.
- Understand the 'gap' from current practice to the urban typology aspirations. Based on preliminary waterway health modelling and mean annual runoff of 0.9 ML/ha/annum, an aspirational target permeability of 50% has been used as the benchmark.
- Assist in developing recommendations for provision of open space and streets (see following section in this chapter) within a broader precinct and the level of permeability which needs to be achieved in each.

**Key assumptions used in analysis:**

- Geoscape data has been used for existing building footprints.
- Open space is assumed as 100% permeable.
- Road reserves:
  - All carriageways are considered 100% impermeable
  - For verges and community titled roads, a typical block for each location has been measured to derive a permeable to impermeable ratio. This ratio is then extrapolated across the total area
  - Verge permeability ranges from 3.2% – 54.9% (residential), 49.6%-51.5% (commercial / business park) and 48.4-55.3% (industrial)
  - Community titled road's permeability ranges from 0.0% – 55.4%
  - Median strips are considered 100% permeable.
- Development Lots:
  - For residential precincts:
    - Private open space is the lot area, minus built area. A typical block for each location has been measured to derive a permeable to impermeable ratio. This ratio is then extrapolated across the total area.
    - Private open space permeability ranges from 18.4% – 77.1%.
  - For employment precincts:
    - Unbuilt area is the lot area, minus built area. A series of typical blocks across all locations has been measured to derive a permeable to impermeable ratio. This ratio is then extrapolated across the total area.
    - Unbuilt area permeability is 43.6% (commercial) and 19.0% (industrial).
- Dwelling density is derived from the Australian Bureau of Statistics mesh block data attribute, "MB16_DWELL". Where this information is out of date, address records from Sixmaps have been used.

### 3.3.1 Employment: Office

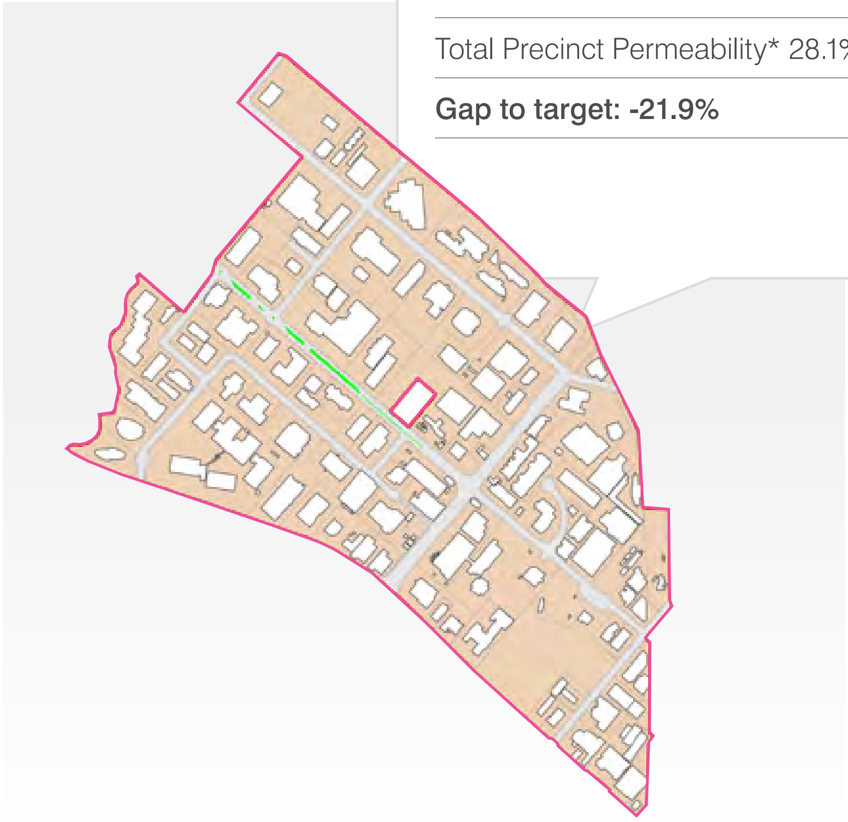
Overview

- Office precincts have a significant gap to the benchmark 50% permeability targets established through preliminary modelling.
- Significant work can be done through improving on-lot permeability particularly of large areas of paved surfaces.

## Macquarie Business Park

Total Precinct Permeability* 28.1%

**Gap to target: -21.9%**

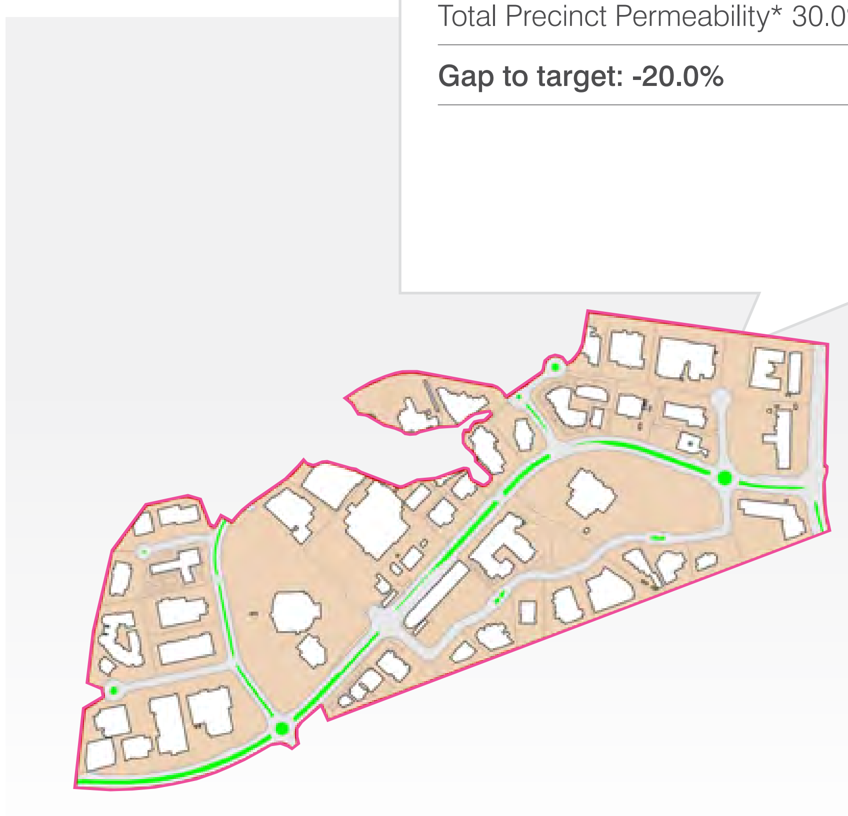


| Precinct Components | | % of Precinct | Permeability (%) |
|---|---|---|---|
| | Precinct Boundary | | |
| Local open space | Community Open Space<br>Public Open Space | 0.0 | 100.0 |
| Streets | Road, Community Title<br>Carriageway<br>Verge pervious/impervious | 11.5 | 16.7 |
| Lots | Built Form<br>Unbuilt Area | 88.5 | 29.5 |

## Norwest Business Park

Total Precinct Permeability* 30.0%

**Gap to target: -20.0%**



| Precinct Components | | % of Precinct | Permeability (%) |
|---|---|---|---|
| | Precinct Boundary | | |
| Local open space | Community Open Space<br>Public Open Space | 0.0 | 100.0 |
| Streets | Road, Community Title<br>Carriageway<br>Verge pervious/impervious | 17.7 | 25.1 |
| Lots | Built Form<br>Unbuilt Area | 82.3 | 31.0 |

Figure 36. Macquarie Business Park and Norwest Business

### 3.3.2 Employment: Industrial precincts

Overview

- Industrial precincts have a significant gap to the 50% permeability targets established through preliminary modelling.
- Significant work can be done through improving on-lot permeability particularly of large areas of paved surfaces.

## Erskine Park Industrial Area

Total Precinct Permeability* 11.7%

**Gap to target: -38.3%**

| Precinct Components | | % of Precinct | Permeability (%) |
|---|---|---|---|
| | Precinct Boundary | | |
| Local open space | Community Open Space<br>Public Open Space | 0.0 | 100.0 |
| Streets | Road, Community Title<br>Carriageway<br>Verge pervious/impervious | 8.8 | 18.7 |
| Lots | Built Form<br>Unbuilt Area | 91.2 | 11.1 |

## Eastern Creek Industrial Area

Total Precinct Permeability* 10.2%

**Gap to target: -39.8%**

| Precinct Components | | % of Precinct | Permeability (%) |
|---|---|---|---|
| | Precinct Boundary | | |
| Local open space | Community Open Space<br>Public Open Space | 0.0 | 100.0 |
| Streets | Road, Community Title<br>Carriageway<br>Verge pervious/impervious | 7.7 | 13.3 |
| Lots | Built Form<br>Unbuilt Area | 92.3 | 10.0 |

Figure 37. Erskine Park Industrial Area and Eastern Creek Industrial Area

### 3.3.3 Residential precincts

## Overview

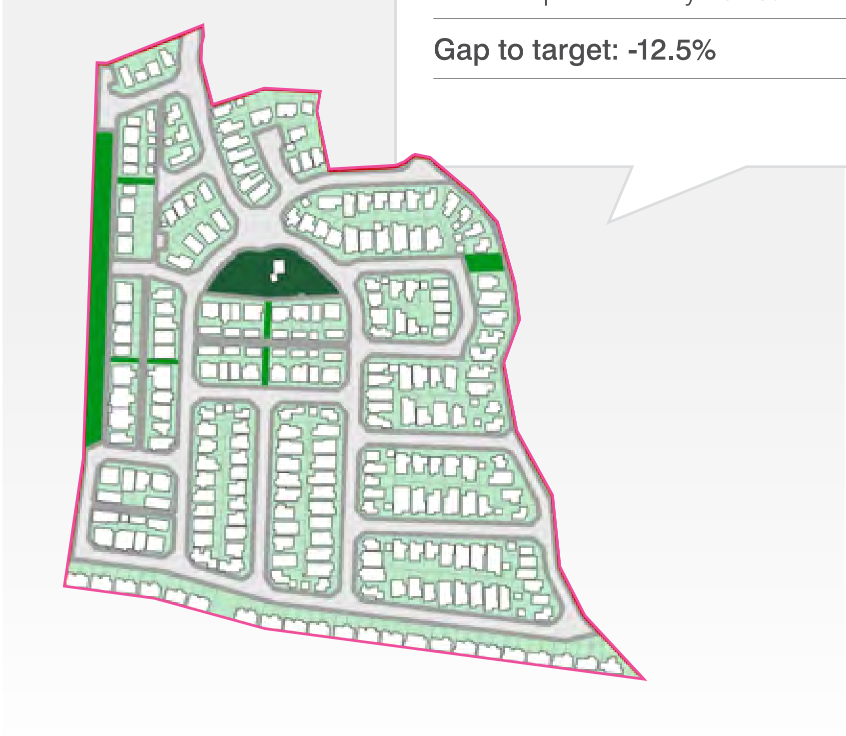
- There is a less significant gap between existing best practice and the preliminary permeability aspirations, across all residential development. To achieve close to these aspirational 50% targets will require changes to the current models of development.
- The biggest potential to change will be improving permeability of streets, permeability within lots and the quantum of local public open space.
- Newington (Sydney Olympic Village) is a standout precinct coming closer to the targets than other examples.
- Higher density locations (e.g. Victoria Park) tend to have greater hardscaping of streets.

## Brighton Lakes

*Low density*
19.2 dph [Precinct scale]
30.8 dph [Building lot scale]

Precinct permeability* 37.5%

**Gap to target: -12.5%**



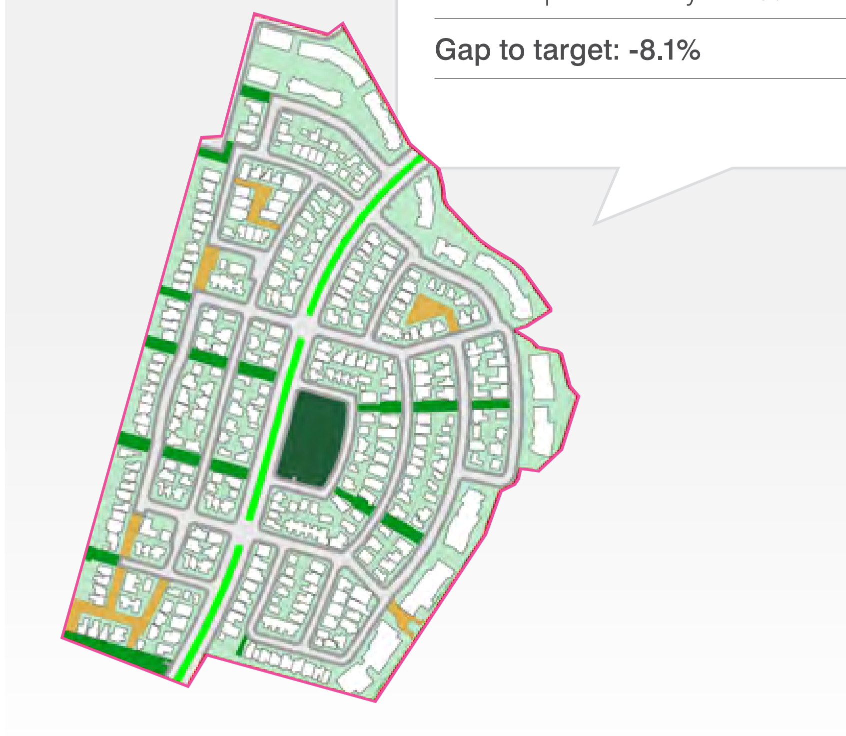
| Precinct Components | | % of Precinct | Permeability (%) |
|---|---|---|---|
| | Precinct Boundary | | |
| Local open space | Community Open Space; Public Open Space | 5.1 | 100.0 |
| Streets | Road, Community Title; Carriageway; Verge pervious/impervious | 32.7 | 20.9 |
| Lots | Built Form; Private Open Space | 62.2 | 41.1 |

## Newington

*Low-med density*
27.1 dph [Precinct scale]
44.0 dph [Building lot scale]

Precinct permeability* 41.9%

**Gap to target: -8.1%**



| Precinct Components | | % of Precinct | Permeability (%) |
|---|---|---|---|
| | Precinct Boundary | | |
| Local open space | Community Open Space; Public Open Space | 5.8 | 100.0 |
| Streets | Road, Community Title; Carriageway; Verge pervious/impervious | 32.6 | 34.1 |
| Lots | Built Form; Private Open Space | 61.6 | 40.5 |

Figure 38. Brighton Lakes and Newington

# Metrics of existing precincts

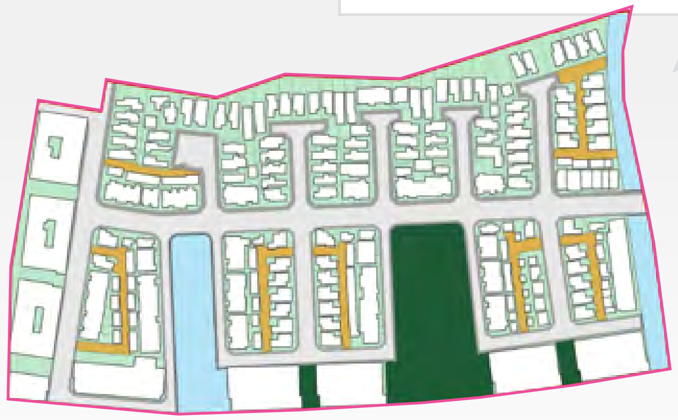
## Ermington

*Med-high density*
60.8 dph [Precinct scale]
107.2 dph [Building lot scale]

Precinct permeability* 38.4%

South Creek Stage 1 Sector Review Target Permeability: 74%

**Gap to target: -35.6%**



| Precinct Components (Precinct Boundary) | | % of Precinct | Permeability (%) |
|---|---|---|---|
| Local open space | Community Open Space; Public Open Space | 15.1 | 100.0 |
| Streets | Road, Community Title; Carriageway; Verge pervious/impervious | 28.1 | 15.0 |
| Lots | Built Form; Private Open Space | 56.8 | 33.5 |

## Victoria Park

*High density*
144.9 dph [Precinct scale]
279.8 dph [Building lot scale]

Precinct permeability* 17.2%

**Gap to target: -32.8%**

| Precinct Components (Precinct Boundary) | | % of Precinct | Permeability (%) |
|---|---|---|---|
| Local open space | Community Open Space; Public Open Space | 12.2 | 100.0 |
| Streets | Road, Community Title; Carriageway; Verge pervious/impervious | 36.0 | 3.8 |
| Lots | Built Form; Private Open Space | 51.8 | 6.9 |

Figure 39. Ermington and Victoria Park

## 3.4 Defining requirements for streets and local open space

To understand the impacts of building typologies at a precinct scale, an understanding of the precinct mix between streets, local open space and lots, which will all have different permeabilities is required.

This is influenced by:

- Current practice (see previous section of this document).
- Influences of street typologies (see draft Western Sydney Street Design Guidelines – WSPP 2019).
- Documentation on best practice for open spaces and open space aspirations for Western Sydney (see table adjacent).

Following review of the above, recommendations have been made opposite for the provision of streets and open spaces. These act as both assumptions that inform the testing in the later chapters of this document and recommendations towards future planning controls towards ensuring that the aspirations of the Western Parkland City and South Creek corridor can be met.

Table 8. Open space requirements – reference document summary

| Reference | Key notes |
|---|---|
| **New South Wales / Sydney policy** | |
| Greater Sydney Region Plan and Western City District Plan (2018) | GSRP Objective 31 notes all dwellings within 400m of open space and all high density development within 200m of open space.<br><br>Western City Parkland vision notes "new cool and green neighbourhoods and centres with generous open space in a parkland setting" |
| Greener Places, GAO 2017 (draft) | Aspirations provided however no metrics stated in this document. Architectus has also reviewed more recent work on this document that is not publicly available as part of this work. |
| NSW Government Architect's Office Case studies for Sydenham to Bankstown Corridor | 10-15% site area in urban locations noted as achievable in many case studies in urban contexts |
| **International standards** | |
| World Health Organisation | 9sqm per person target |
| UK Fields In Trust 'six acre standard' | 24sqm per person including 16sqm for outdoor sport (8sqm excluding 'outdoor sport but including play equipment, skateboard parks, etc.).<br><br>This has been widely applied to lower density development however has not been achieved in many urban areas. |

**Table 9. Recommended open space and street percentages for development in the South Creek Catchment**

| Typology | Minimum Dedicated public open space * | Minimum Streets * |
|---|---|---|
| **Residential** | | |
| Low density | 10% | 30% |
| Medium density | 15% | 30% |
| High density | 25% | 30% |
| Mixed use centre | 20% | 30% |
| **Employment** | | |
| Business Park | 10% | 20% |
| Industrial | 5% | 20% |

* As a percentage 'urban typology' area excluding 1:100 flood prone land and any other regional open space and sporting fields

# 4 Building typologies

This chapter describes lot and building typologies that can contribute to the greening, cooling and waterway health objectives for the Western City Parkland identified in the Western City District Plan and Western Sydney Aerotropolis Plan. It includes a range of approaches some of which represent small changes to current practice and some which require more substantial change to achieve innovative solutions.

Each typology is described with technical metrics including density, greening and stormwater outcomes as well as being considered at a high level against issues such as cost, efficiency, social outcomes and impacts on streetscape.

## 4.1 Approach to development of typologies

The typologies set out in this chapter have been developed to understand:

- The design impacts of the metrics needed to achieve the waterway health objectives.
- Solutions which are as close as possible to current development practice as innovative practice.
- A range of different parking approaches including underground parking, parking at-grade and separate parking structures.

Different built form typologies have been identified for each density range that may be suitable to different locations including:

- Employment: Office
- Employment: Industrial
- Apartment buildings
- Attached housing
- Detached housing.

## 4.2 Summary

The following pages provide a summary of the detailed testing in this chapter by building category.

It provides:

- Key metrics across density, greening, water and stormwater outcomes
- Anticipated zoning
- Identification of key issues and risks relevant to each.

Key conclusions of this work in relation to implementation and next steps are:

+ The aims of 0.9 ML/Ha/Yr surplus runoff are close to achievable with the application of the urban typologies and stormwater solutions.
+ There is more difficulty in achieving these outcomes in industrial and business areas than residential neighbourhoods. These may therefore require greater 'end of pipe' treatment.
+ Delivery of the typologies and associated waterway health outcomes will require appropriate planning and development controls. Modelling has informed and shaped some recommendations for controls which could be used to facilitate these outcomes (see Chapter 6).

## Employment: Office/Commercial Development

South Creek will need to accommodate a range of businesses in contemporary formats from small offices to larger floorplate and multi-storey formats accommodating national and international to businesses with larger workforces.

- Given their significant land take and relatively large floor plates these office strategies have one of the greatest drivers to work harder and realise more active storm water retention measures. Roof collection and green walls may be pursued to contribute to stormwater reuse.
- The business sector may be more willing to apply new technologies and invest in their environment than some other sectors considered. Opportunities for innovation in water management in these areas should be encouraged.
- Differentiation between at-grade parking and other parking options (including basement parking, above ground in building parking and separate parking structures) creates a fundamental difference in approach to building design. Designs should consider the ability to convert any current parking requirement to future usable space as far as practicable.

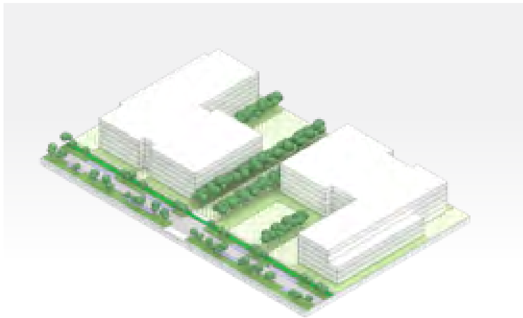
### Strategy 1 Business park – increased deep soil setbacks and planting

Anticipated zones: B2 B3 B4 B7

Key metrics*:

| | | |
|---|---|---|
| Density | 1.20 | FSR (x:1) [Building lot scale] |
| | 0.88 | FSR (x:1) [Urban typology scale] |
| Green | 37 | % canopy cover [Block+street scale] |
| Water | 40 | % permeability [Block+street scale] |
| | 1.84 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 40 | kL rainwater tank [per building lot] |
| | 12 | % sponge area [per building lot] |
| | 37 | 'Wianamatta' street trees [per building lot] |

### Strategy 2 Urban office – deep soil setbacks and planting



Anticipated zones: B2 B3 B4 B7

Key metrics*:

| | | |
|---|---|---|
| Density | 2.01 | FSR (x:1) [Building lot scale] |
| | 1.48 | FSR (x:1) [Urban typology scale] |
| Green | 31 | % canopy cover [Block+street scale] |
| Water | 34 | % permeability [Block+street scale] |
| | 1.90 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 40 | kL rainwater tank [per building lot] |
| | 12 | % sponge area [per building lot] |
| | 36 | 'Wianamatta' street trees [per building lot] |

### Strategy 3 Small office in landscaped setting

Anticipated zones: B2 B3 B4 B7

Key metrics*:

| | | |
|---|---|---|
| Density | 0.47 | FSR (x:1) [Building lot scale] |
| | 0.35 | FSR (x:1) [Urban typology scale] |
| Green | 44 | % canopy cover [Block+street scale] |
| Water | 62 | % permeability [Block+street scale] |
| | 0.91 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 40 | kL rainwater tank [per building lot] |
| | 6 | % sponge area [per building lot] |
| | 80 | 'Wianamatta' street trees [per building lot] |

Figure 40. Typology strategies for business areas

*For more information on scales used see Appendix A of this document
'Urban typology scale' is assumed 20% streets, 10% local open space and 70% lots
'Block + street scale' is assumed 22% streets and 78% lots
'Building Lot' includes community titled space

Approach to development of typologies

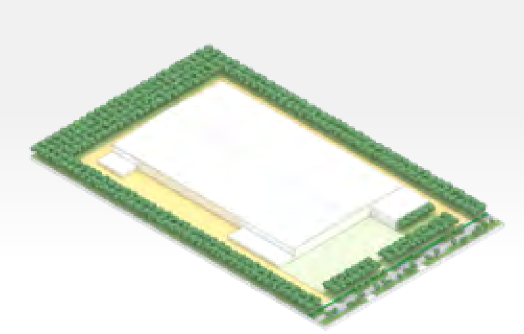
## Employment: Industrial and warehouse

To achieve the targets in both strategies considered requires an emphasis on:

- On-site greening requirements (typically on boundary)
- Permeable paving of both parking and circulation routes
- Adoption of Western Sydney Street Design Guidelines.

Even with a combination of the above, industrial strategies tend to achieve lower permeability and canopy cover numbers than other building forms and may have to rely on greater end-of-pipe treatment.

### Strategy 1 Large floorplate: Pervious paving and perimeter planting



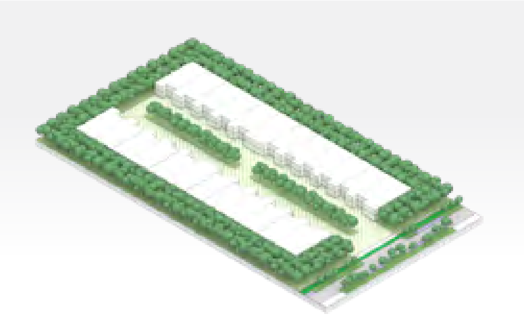
**Anticipated zones:** IN B5 B6 B7

**Key metrics*:**

| | |
|---|---|
| Density | 0.61 FSR (x:1) [Building lot scale]<br>0.47 FSR (x:1) [Urban typology scale] |
| Green | 32 % canopy cover [Block+street scale] |

| | | |
|---|---|---|
| Water | 34 | % permeability [Block+street scale] |
| | 2.55 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 0 | kL rainwater tank[1] [per building lot] |
| | 8 | % sponge area [per building lot] |
| | 53 | 'Wianamatta' street trees [per building lot] |

### Strategy 2 Strata industrial with perimeter planting



**Anticipated zones:** IN B6

**Key metrics*:**

| | |
|---|---|
| Density | 0.69 FSR (x:1) [Building lot scale]<br>0.53 FSR (x:1) [Urban typology scale] |
| Green | 37 % canopy cover [Block+street scale] |

| | | |
|---|---|---|
| Water | 48 | % permeability [Block+street scale] |
| | 1.01 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 0 | kL rainwater tank[1] [per building lot] |
| | 25 | % sponge area [per building lot] |
| | 73 | 'Wianamatta' street trees [per building lot] |

1 Whilst tanks were not modelled on industrial typologies, there is scope to explore the use of tanks connected to rooftop sprinkler systems to provide evaporative cooling as well as evaporation of excess stormwater

Figure 41. Typology strategies for industrial areas

*For more information on scales used see Appendix A of this document
'Urban typology scale' is assumed 20% streets, 5% local open space and 75% lots
'Block + street scale' is assumed 21% streets and 79% lots
'Building Lot' includes community titled space

# Approach to development of typologies

## Apartment buildings

For apartments there are two simple solutions for optimising perviousness and stormwater retention:

- Technology and greater soil depths within traditional typologies – Increasing soil depth over basements (if provided), permeability and technologies around water retention and reuse beyond existing standards.
- Greater open space – Large courtyards, setbacks or separate open space to maximise perviousness and deep soil presents significant benefits for tree canopy, amenity, long term flexibility without basements and improved building performance (potentially 50% more trees and configurations with almost 100% solar access and cross ventilation to apartments of around 3-5 storeys).

A new typology that should be considered is that of small apartment blocks with parking courts (Strategy 3). Separate parking structures or ground floor parking within buildings could also be accommodated in the typologies shown.

### Strategy 1 Courtyard deep soil zone

**Anticipated zones:** R1 R4 *+ within shoptop housing:* B1 B2 B4

**Key metrics*:**

| | | |
|---|---|---|
| Density | 109 | Dwellings per hectare |
| | 208 | Residents per hectare [Urban typology scale] |
| | 1.94 | FSR (x:1) [Building lot scale] |
| | 1.09 | FSR (x:1) [Urban typology scale] |
| Green | 27 | m² of open space [per building lot] |
| | 49 | % canopy cover [Block+street scale] |

| | | |
|---|---|---|
| Water | 43 | % permeability [Block+street scale] |
| | 1.13 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 80 | kL rainwater tank [per building lot] |
| | 1.09 | m² sponge area [per building lot] |
| | 27 | 'Wianamatta' street trees [per building lot] |

### Strategy 2 Deep soil front setbacks

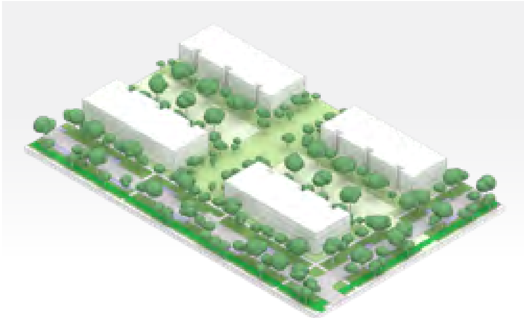
**Anticipated zones:** R1 R4

**Key metrics*:**

| | | |
|---|---|---|
| Density | 87 | Dwellings per hectare |
| | 165 | Residents per hectare [Urban typology scale] |
| | 1.54 | FSR (x:1) [Building lot scale] |
| | 0.87 | FSR (x:1) [Urban typology scale] |
| Green | 32 | m² of open space [per building lot] |
| | 51 | % canopy cover [Block+street scale] |

| | | |
|---|---|---|
| Water | 45 | % permeability [Block+street scale] |
| | 1.09 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 80 | kL rainwater tank [per building lot] |
| | 308 | m² sponge area [per building lot] |
| | 27 | 'Wianamatta' street trees [per building lot] |

### Strategy 3 Parking courts (no basement)



**Anticipated zones:** R1 R4

**Key metrics*:**

| | | |
|---|---|---|
| Density | 46 | Dwellings per hectare |
| | 87 | Residents per hectare [Urban typology scale] |
| | 0.81 | FSR (x:1) [Building lot scale] |
| | 0.46 | FSR (x:1) [Urban typology scale] |
| Green | 58 | m² of open space [per building lot] |
| | 49 | % canopy cover [Block+street scale] |

| | | |
|---|---|---|
| Water | 46 | % permeability [Block+street scale] |
| | 0.98 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 80 | kL rainwater tank [per building lot] |
| | 308 | m² sponge area [per building lot] |
| | 27 | 'Wianamatta' street trees [per building lot] |

### Strategy 4 Apartments to public park

**Anticipated zones:** R1 R4 *+ within shoptop housing:* B1 B2 B4

**Key metrics*:**

| | | |
|---|---|---|
| Density | 78 | Dwellings per hectare |
| | 149 | Residents per hectare [Urban typology scale] |
| | 1.40 | FSR (x:1) [Building lot scale] |
| | 0.78 | FSR (x:1) [Urban typology scale] |
| Green | 48 | m² of open space [per building lot] |
| | 54 | % canopy cover [Block+street scale] |

| | | |
|---|---|---|
| Water | 55 | % permeability [Block+street scale] |
| | 0.65 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 80 | kL rainwater tank [per building lot] |
| | 308 | m² sponge area [per building lot] |
| | 27 | 'Wianamatta' street trees [per building lot] |

Figure 42. Typology strategies for apartment buildings

*For more information on scales used see Appendix A of this document
'Urban typology scale' is assumed 30% streets, 25% local open space and 45% lots
'Block + street scale' is assumed 40% streets and 60% lots
'Building Lot' includes community titled space

## Apartments/Mixed Use

High density shoptop housing will likely occur in centres and around stations..

Although permeability of the higher density strategies may be lower, they have a high potential for water reuse on site.

## Strategy 5 High density shoptop housing

**Anticipated zones:** R4 B4

**Key metrics*:**

| | | |
|---|---|---|
| Density | 152 | Dwellings per hectare |
| | 289 | Residents per hectare [Urban typology scale] |
| | 2.70 | FSR (x:1) [Building lot scale] |
| | 1.52 | FSR (x:1) [Urban typology scale] |
| Green | 19 | $m^2$ of open space [per building lot] |
| | 46 | % canopy cover [Block+street scale] |

| | | |
|---|---|---|
| Water | 38 | % permeability [Block+street scale] |
| | 1.30 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 80 | kL rainwater tank [per building lot] |
| | 308 | $m^2$ sponge area [per building lot] |
| | 27 | 'Wianamatta' street trees [per building lot] |

Figure 43. Typology strategy for high density, mixed use areas

*For more information on scales used see Appendix A of this document
'Urban typology scale' is assumed 30% streets, 25% local open space and 45% lots
'Block + street scale' is assumed 40% streets and 60% lots
'Building Lot' includes community titled space

# Approach to development of typologies

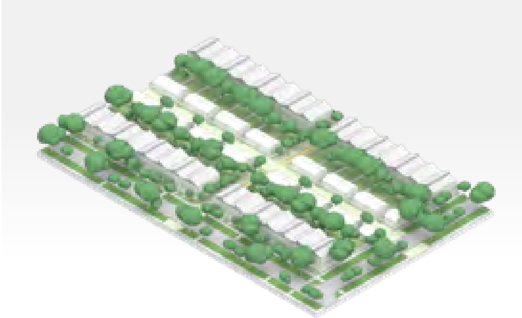
## Attached housing

Attached dwellings have two basic forms – street vs rear lane access:

- On small streets, rear lane access may be preferred because large front yards uninterrupted by driveways allows for large trees in the private domain which improve the experience of the street. The rear laneways may have to work hard to ensure the complex issues of titling, appropriate runoff and service access can be managed. Rear lane access often also gives the opportunity for the addition of secondary dwellings over garages in the future. A rear-loaded terrace that addresses the street with a minimal front setback is a great response in an urban setting.
- Front access reduces the ability for good permeability and greening on streets, particularly at narrow lot frontages. This places an emphasis on the space between dwellings to be green, whether this be part of the lot (Strategy 3) or in public/communal ownership of some form (Strategy 4).

Attached dwellings face many of the same challenges as detached dwellings, with regard to existing planning policy which allow for much smaller open space on site than required under these strategies) and this typology therefore represents a departure from recent practice of market delivery.

## Strategy 1 Community laneways + narrow streets



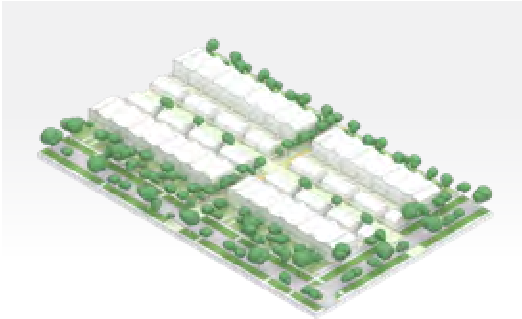
Anticipated zones: R1 R3

**Key metrics*:**

| | | |
|---|---|---|
| Density | 22 | Dwellings per hectare |
| | 70 | Residents per hectare [Urban typology scale] |
| | 0.54 | FSR (x:1) [Building lot scale] |
| | 0.28 | FSR (x:1) [Urban typology scale] |
| Green | 133 | m² of open space [per building lot] |
| | 50 | % canopy cover [Block+street scale] |

| | | |
|---|---|---|
| Water | 41 | % permeability [Block+street scale] |
| | 1.05 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 5 | kL rainwater tank [per building lot] |
| | 10.35 | m² sponge area [per building lot] |
| | 0.75 | 'Wianamatta' street trees [per building lot] |

## Strategy 2 Living out front



Anticipated zones: R1 R3

**Key metrics*:**

| | | |
|---|---|---|
| Density | 22 | Dwellings per hectare |
| | 70 | Residents per hectare [Urban typology scale] |
| | 0.54 | FSR (x:1) [Building lot scale] |
| | 0.28 | FSR (x:1) [Urban typology scale] |
| Green | 135 | m² of open space [per building lot] |
| | 45 | % canopy cover [Block+street scale] |

| | | |
|---|---|---|
| Water | 41 | % permeability [Block+street scale] |
| | 1.11 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 5 | kL rainwater tank [per building lot] |
| | 10.35 | m² sponge area [per building lot] |
| | 0.75 | 'Wianamatta' street trees [per building lot] |

## Strategy 3 Large rear yards

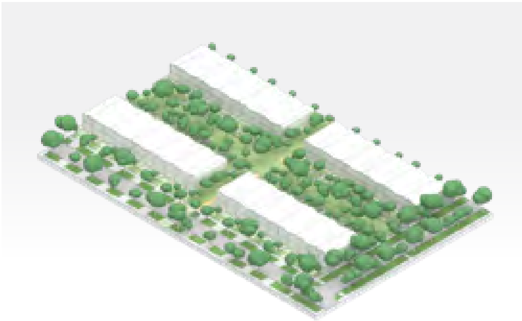
Anticipated zones: R1 R3

**Key metrics*:**

| | | |
|---|---|---|
| Density | 25 | Dwellings per hectare |
| | 80 | Residents per hectare [Urban typology scale] |
| | 0.58 | FSR (x:1) [Building lot scale] |
| | 0.33 | FSR (x:1) [Urban typology scale] |
| Green | 151 | m² of open space [per building lot] |
| | 46 | % canopy cover [Block+street scale] |

| | | |
|---|---|---|
| Water | 43 | % permeability [Block+street scale] |
| | 0.98 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 5 | kL rainwater tank [per building lot] |
| | 8.97 | m² sponge area [per building lot] |
| | 0.65 | 'Wianamatta' street trees [per building lot] |

## Strategy 4 Open Space



Anticipated zones: R1 R3

**Key metrics*:**

| | | |
|---|---|---|
| Density | 32 | Dwellings per hectare |
| | 103 | Residents per hectare [Urban typology scale] |
| | 0.72 | FSR (x:1) [Building lot scale] |
| | 0.37 | FSR (x:1) [Urban typology scale] |
| Green | 113 | m² of open space [per building lot] |
| | 49 | % canopy cover [Block+street scale] |

| | | |
|---|---|---|
| Water | 42 | % permeability [Block+street scale] |
| | 0.79 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 5 | kL rainwater tank [per building lot] |
| | 6.9 | m² sponge area [per building lot] |
| | 0.5 | 'Wianamatta' street trees [per building lot] |

Figure 44. Typology strategies for attached housing

*For more information on scales used see Appendix A of this document
'Urban typology scale' is assumed 30% streets, 15% local open space and 55% lots
'Block + street scale' is assumed 35% streets and 65% lots
'Building Lot' includes community titled space

# Approach to development of typologies

## Detached housing

Detached houses in established suburbs often have excellent permeability outcomes and canopy cover. However recent subdivisions have not prioritised this, with smaller lots and a prevalence of large, single storey dwellings resulting in little permeable space on-lot. The strategies tested to increase permeability include:

- A big front and back yard – which presents great outcomes even for a single-storey residence however its low density is likely to be appropriate only as part of a broader mix or in environmental or rural living zones.
- Two-storey dwellings on a regular lot – which can achieve the required permeability and a good rear yard with trees however is a departure from recent practice.
- Green fingers and communal spaces – which can ensure managed and protected canopy however requires strata titling or public ownership which not typical of many subdivisions.
- Suspended / elevated construction which can achieve very high permeability outcomes however brings potential access and maintenance issues.

Delivery of these typologies will require departure from the Codes SEPP which has provisions that allow near complete site coverage and hence little greening and permeability – including up to 78% of sites as Gross Floor Area (cl. 3.9) and rear setbacks of 3m (cl. 3.10). The Growth Centres DCP's have similar provisions (typical 4m rear setback). To achieve the targets these metrics will need to be close to 50% and 8m respectively.

### Strategy 1 The big front + back yard

**Anticipated zones:** E RU R5 *+ as part of a mix in* R1 R2

**Key metrics*:**

| | | |
|---|---|---|
| Density | 9 | Dwellings per hectare |
| | 30 | Residents per hectare [Urban typology scale] |
| | 0.33 | FSR (x:1) [Building lot scale] |
| | 0.19 | FSR (x:1) [Urban typology scale] |
| Green | 318 | m² of open space [per building lot] |
| | 43 | % canopy cover [Block+street scale] |
| Water | 47 | % permeability [Block+street scale] |
| | 1.06 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 5 | kL rainwater tank [per building lot] |
| | 31.5 | m² sponge area [per building lot] |
| | 2.45 | 'Wianamatta' street trees [per building lot] |

### Strategy 2 Two storey dwelling on a regular lot

**Anticipated zones:** R1 R2

**Key metrics*:**

| | | |
|---|---|---|
| Density | 20 | Dwellings per hectare |
| | 64 | Residents per hectare [Urban typology scale] |
| | 0.62 | FSR (x:1) [Building lot scale] |
| | 0.35 | FSR (x:1) [Urban typology scale] |
| Green | 142 | m² of open space [per building lot] |
| | 42 | % canopy cover [Block+street scale] |
| Water | 46 | % permeability [Block+street scale] |
| | 0.98 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 5 | kL rainwater tank [per building lot] |
| | 21.6 | m² sponge area [per building lot] |
| | 1.68 | 'Wianamatta' street trees [per building lot] |

### Strategy 3 Green fingers + communal spaces

**Anticipated zones:** R1 R2 E

**Key metrics*:**

| | | |
|---|---|---|
| Density | 13 | Dwellings per hectare |
| | 42 | Residents per hectare [Urban typology scale] |
| | 0.53 | FSR (x:1) [Building lot scale] |
| | 0.25 | FSR (x:1) [Urban typology scale] |
| Green | 262 | m² of open space [per building lot] |
| | 45 | % canopy cover [Block+street scale] |
| Water | 53 | % permeability [Block+street scale] |
| | 0.92 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 5 | kL rainwater tank [per building lot] |
| | 26.1 | m² sponge area [per building lot] |
| | 2.03 | 'Wianamatta' street trees [per building lot] |

### Strategy 4 Suspended / elevated construction

**Anticipated zones:** R1 R2 E

**Key metrics*:**

| | | |
|---|---|---|
| Density | 14 | Dwellings per hectare |
| | 43 | Residents per hectare [Urban typology scale] |
| | 0.75 | FSR (x:1) [Building lot scale] |
| | 0.43 | FSR (x:1) [Urban typology scale] |
| Green | 158 | m² of open space [per building lot] |
| | 38 | % canopy cover [Block+street scale] |
| Water | 73 | % permeability [Block+street scale] |
| | 0.76 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 5 | kL rainwater tank [per building lot] |
| | 25.2 | m² sponge area [per building lot] |
| | 1.96 | 'Wianamatta' street trees [per building lot] |

Figure 45. Typology strategies for detached housing

*For more information on scales used see Appendix A of this document
'Urban typology scale' is assumed 30% streets, 10% local open space and 60% lots
'Block + street scale' is assumed 33% streets and 67% lots
'Building Lot' includes community titled space

## Strategy 1

## Business park – Increased deep soil setbacks and planting

This strategy explores the use of deep soil and substantial trees to add greening and canopy cover as well as permeability.

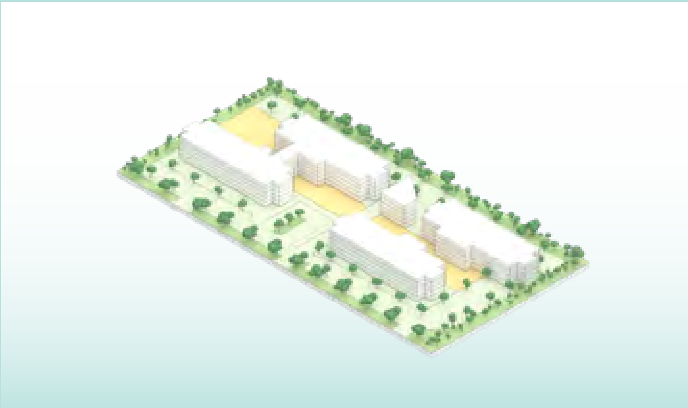



Figure 46. Strategy 1 Business Park – Increased deep soil setbacks and planting

## Building lot typology study

**Benefits:**

- Improves tree canopy, shade and reduce heat island effects
- Deep soil setbacks are simple to prescribe and implement with planning controls
- At grade parking has the potential to act as land banking for the future if appropriately arranged.

**Further testing required:**

- Deep soil requirements may limit site efficiency for developers
- Requires some permeable paving to reach a 50% permeability target.

**Typology overview:**

- Large floor plate commercial office campus
- Internal road + parking network
- On grade + basement car parking
- Hardstand areas including loading areas and parking (50% permeable assumed).

**Table 10. Key metrics: Employment – Office Strategy 1**

| Lot size | Approx. GFA | Approx. FSR |
|---|---|---|
| 40,652$m^2$ | 48,816$m^2$ | 1.20:1 |

| Permeable surfaces | Permeability | Area |
|---|---|---|
| Deep soil | 100% | 8000$m^2$ (20%) |
| Parking hardstand | 50% | 13350$m^2$ (33%) |
| Service hardstand | 50% | 3027$m^2$ (7%) |
| Building site coverage | 0% | 10170$m^2$ (25%) |
| Non building hardstand | 0% | 6105$m^2$ (15%) |
| | Total | 40652$m^2$ |

## Blocks + streets
Stormwater management strategies

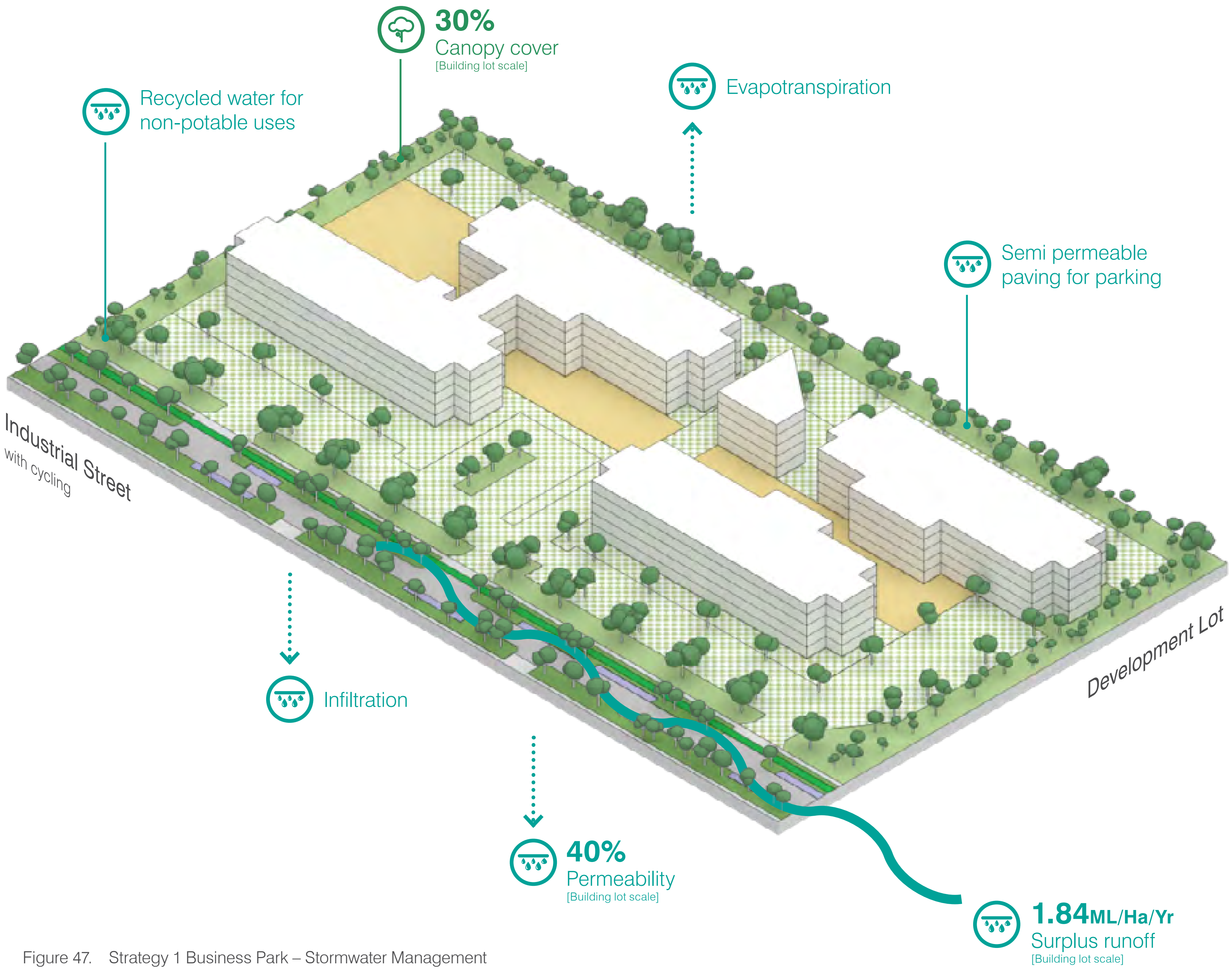
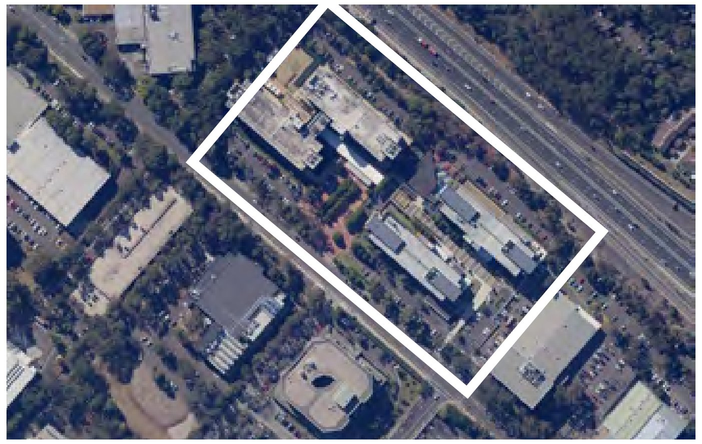



Figure 47. Strategy 1 Business Park – Stormwater Management

### Key metrics

| | | |
|---|---|---|
| Density | 1.20<br>0.88 | FSR (x:1) [Building lot scale]<br>FSR (x:1) [Urban typology scale] |
| Green | 37 | % canopy cover [Block+street scale] |
| Water | 40 | % permeability [Block+street scale] |
| | 1.84 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 40 | kL rainwater tank [per building lot] |
| | 12 | % sponge area [per building lot] |
| | 37 | 'Wianamatta' street trees [per building lot] |

**Precedent**
Macquarie Business Park, Macquarie Park

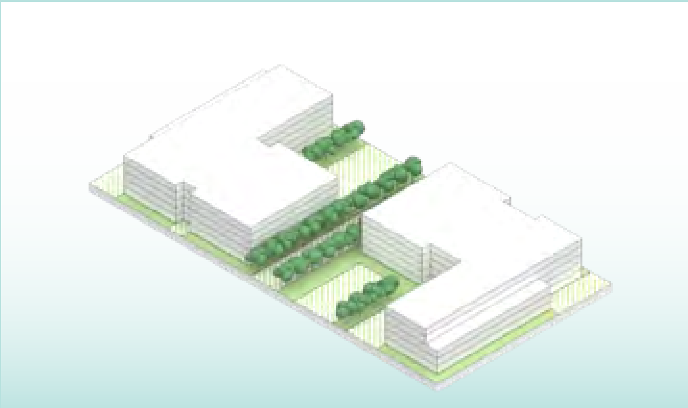

Aerial view


Courtyard elevation

## Strategy 2

### Urban office – deep soil setbacks and planting

This strategy explores low rise, large floorplate campus style buildings on a single site, with no at-grade parking



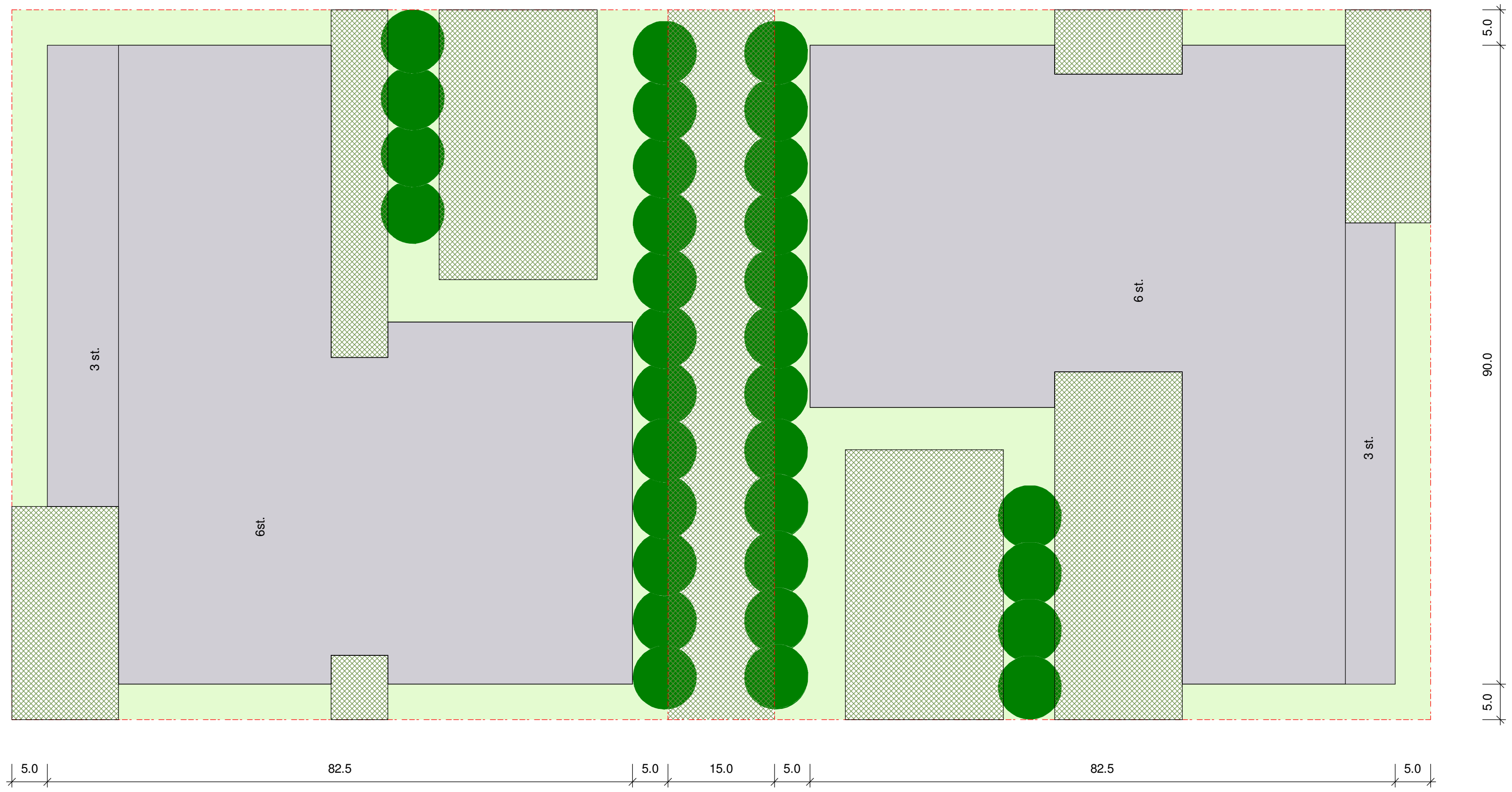



Figure 48. Strategy 2 Urban Office – Deep soil setbacks and planting

## Building lot typology study

**Benefits:**

- Desirable floorplate for many commercial occupants
- Can accommodate a range of different parking outcomes including basement, above-ground or separate parking structures.

**Further testing required:**

- Large floorplates result in high site coverage and lower overall permeability.

**Typology overview:**

- Low-rise, large floorplate campus style buildings
- Suitable for academic, commercial and research purposes
- Typically no taller than 5 storeys
- Underground parking/loading
- Extremely deep floorplates up to 30m (acceptable to technology/laboratory uses)
- Supersized 200mx100m lots.

**Table 11. Key metrics: Employment – Office Strategy 2**

| Lot size | Approx. GFA | Approx. FSR |
|---|---|---|
| 20,000m² | 40,168m² | 2.01:1 |

| Permeable surfaces | Permeability | Area |
|---|---|---|
| Deep soil | 100% | 4,003m² (20%) |
| Parking hardstand | 50% | 5,121m² (26%) |
| Service hardstand | 50% | 0m² (0%) |
| Building site coverage | 0% | 10,876m² (54%) |
| | Total | 20,000m² |

## Blocks + streets
Stormwater management strategies

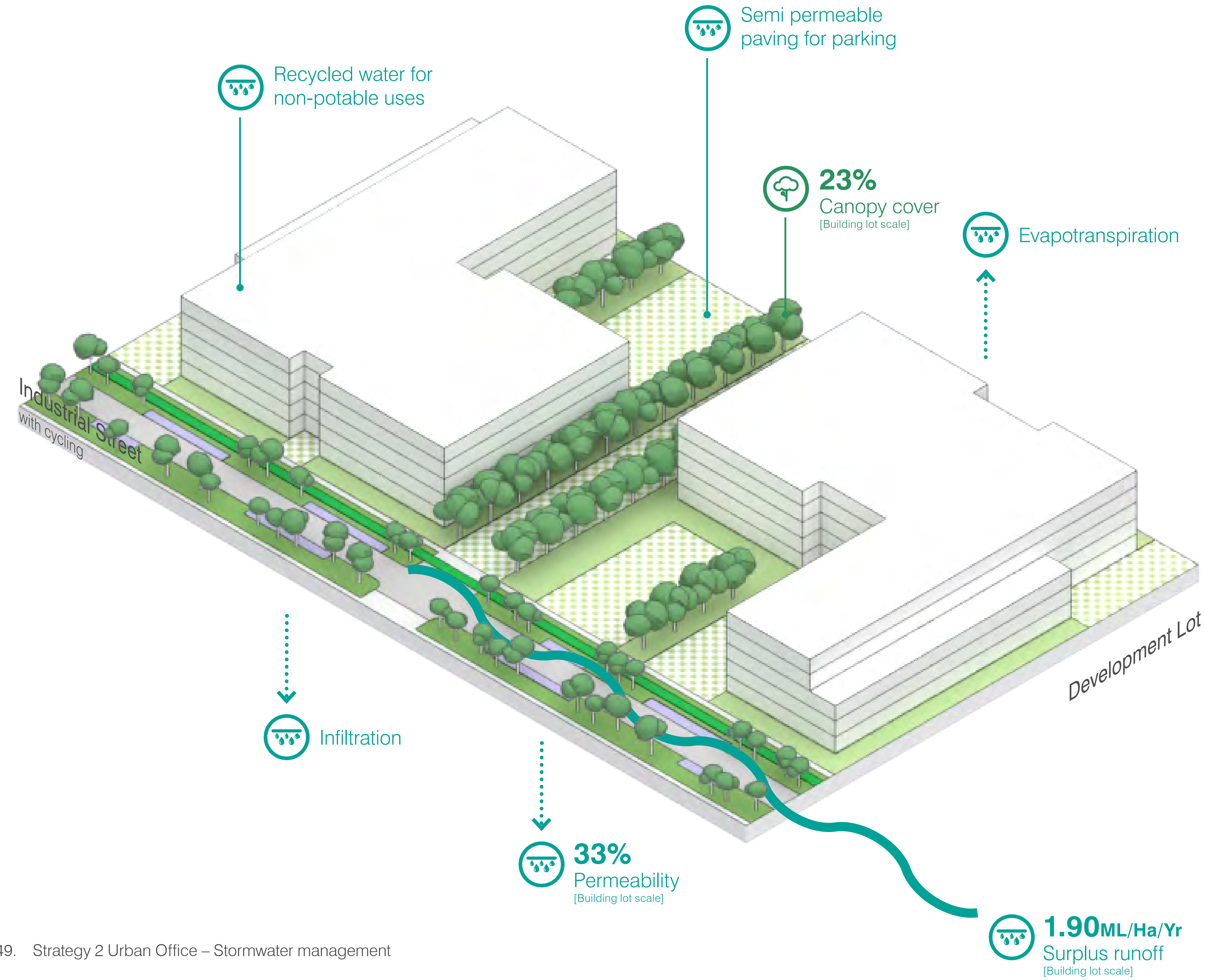
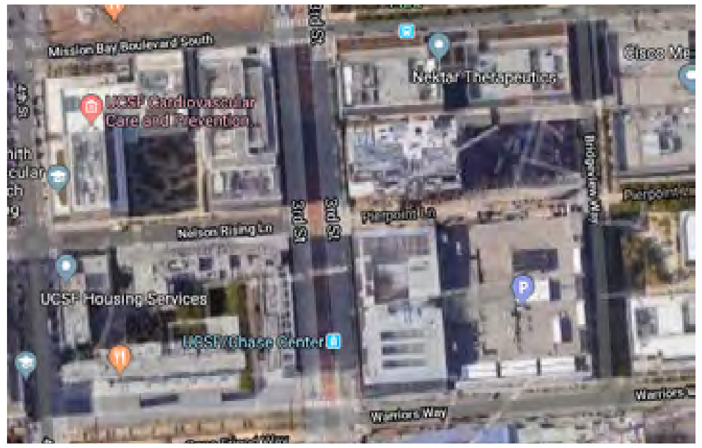



Figure 49. Strategy 2 Urban Office – Stormwater management

### Key metrics

| | | |
|---|---|---|
| Density | 2.01 | FSR (x:1) [Building lot scale] |
| | 1.48 | FSR (x:1) [Urban typology scale] |
| Green | 31 | % canopy cover [Block+street scale] |
| Water | 34 | % permeability [Block+street scale] |
| | 1.90 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 40 | kL rainwater tank [per building lot] |
| | 12 | % sponge area [per building lot] |
| | 36 | 'Wianamatta' street trees [per building lot] |

### Precedent
Mission Bay, San Francisco


Aerial view


Street view

## Strategy 3

### Small office in landscaped setting

A high amenity setting for small businesses with large areas of open space and permeable on grade car parking.

## Building lot typology study

**Benefits:**

- High overall permeability due to low density and high use of permeable paving
- Very high canopy outcomes compared to other employment strategies. Improves tree canopy, shade and reduce heat island effects
- Able to be accommodated in areas of complex constraints such as riparian zones
- Provides diversity to employment strategies and outcomes.

**Further testing required:**

- At-grade parking likely to only be able to deliver the parking need for smaller buildings
- Typically lower value for office use than larger floorplate uses.

Figure 50. Strategy 3 – Small Office in landscaped setting

**Typology overview:**

- Variable size commercial office spaces including small footprint domestic scale buildings in landscape setting, including riparian zones
- Assumed 18m wide street (Aspect local street 3)
- Building heights ranging from 1-5 storeys
- On grade car parking for small buildings, larger buildings could incorporate basement car parking
- Hardstand areas including loading areas and parking (50% permeable assumed).

Table 12. Key metric: Employment – Office Strategy 3

| Lot size | Approx. GFA | Approx. FSR |
|---|---|---|
| 81,572m² | 38,535m² | 0.47:1 |

| Permeable surfaces | Permeability | Area |
|---|---|---|
| Deep soil | 100% | 47,191m² (58%) |
| Parking hardstand | 50% | 17,208m² (21%) |
| Service hardstand | 50% | 0m² (0%) |
| Building site coverage | 0% | 17,173m² (21%) |
| | Total | 81,572m² |

## Blocks + streets
Stormwater management strategies

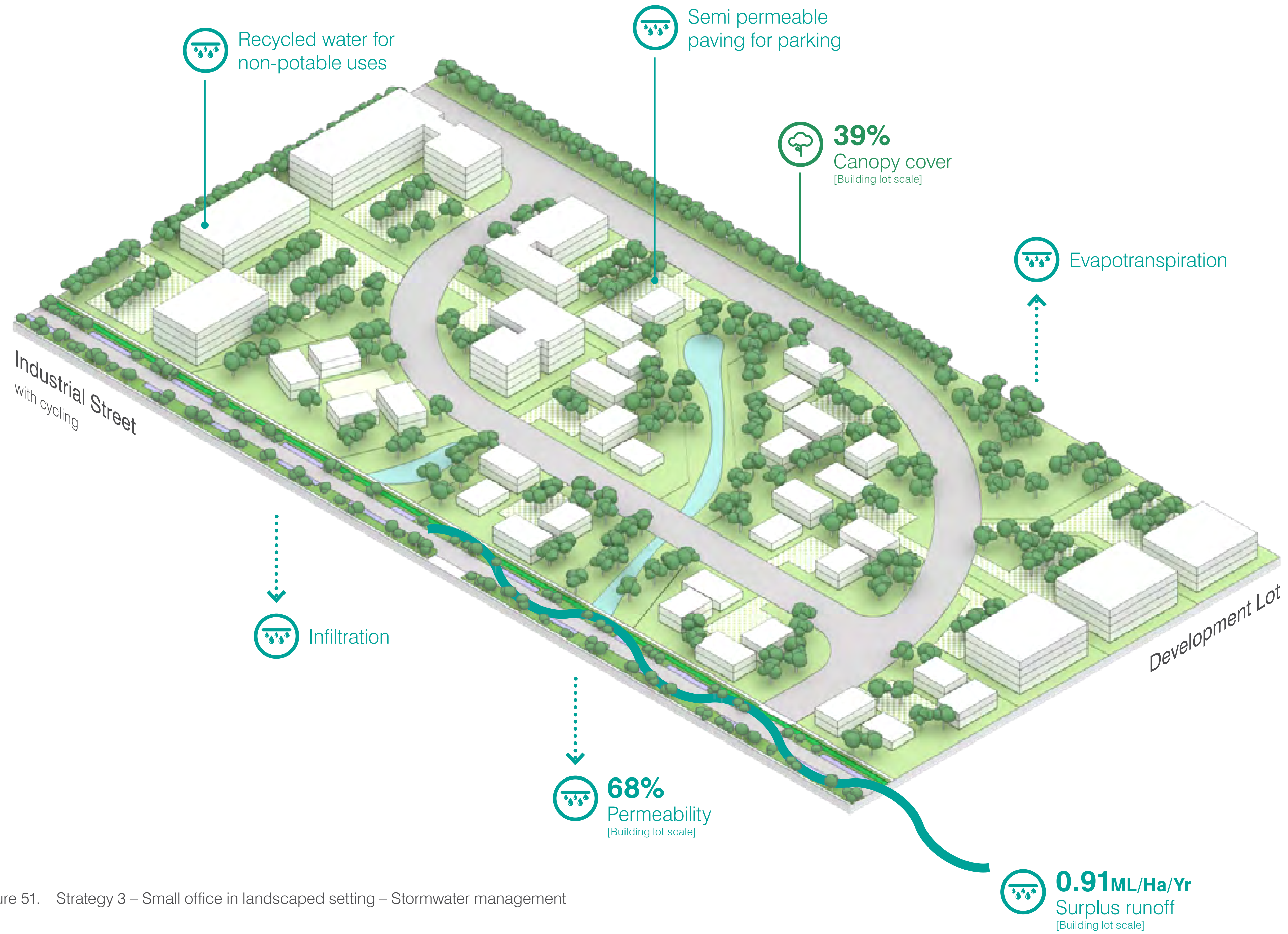



Figure 51. Strategy 3 – Small office in landscaped setting – Stormwater management

### Key metrics

| | | |
|---|---|---|
| Density | 0.47 | FSR (x:1) [Building lot scale] |
| | 0.35 | FSR (x:1) [Urban typology scale] |
| Green | 44 | % canopy cover [Block+street scale] |
| Water | 62 | % permeability [Block+street scale] |
| | 0.91 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 40 | kL rainwater tank [per building lot] |
| | 6 | % sponge area [per building lot] |
| | 80 | 'Wianamatta' street trees [per building lot] |

**Precedent**
Garden City Office Park, QLD


Aerial view

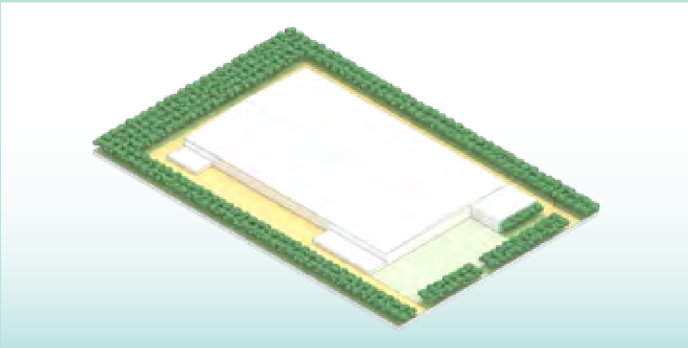
Street view

# 4.4 Employment: Industrial and Warehouse

## Strategy 1

### Large floorplate: Pervious paving and perimeter planting

Increasing the permeability of typical large format uses through permeable paving and asphalt as well as boundary vegetation corridors



## Building lot typology study

**Benefits:**

- Building format reflects market need for storage, distribution and industrial examples
- Green buffer to perimeter provides areas for runoff to be absorbed into the ground
- Potential to utilise expansive roof space for evaporative cooling systems linked to on site rainwater tanks for stormwater reuse
- Consider options for precinct scale stormwater harvesting and reuse in areas of higher water demand.

**Further testing required:**

- Few built examples of pervious surfaces capable of supporting heavy vehicular loads in these contexts
- Even with improvements shown outcomes remain limited
- May be difficult to prescribe and maintain good planting outcomes (including ecology and urban heat outcomes as well as water flow) where this is privately owned.

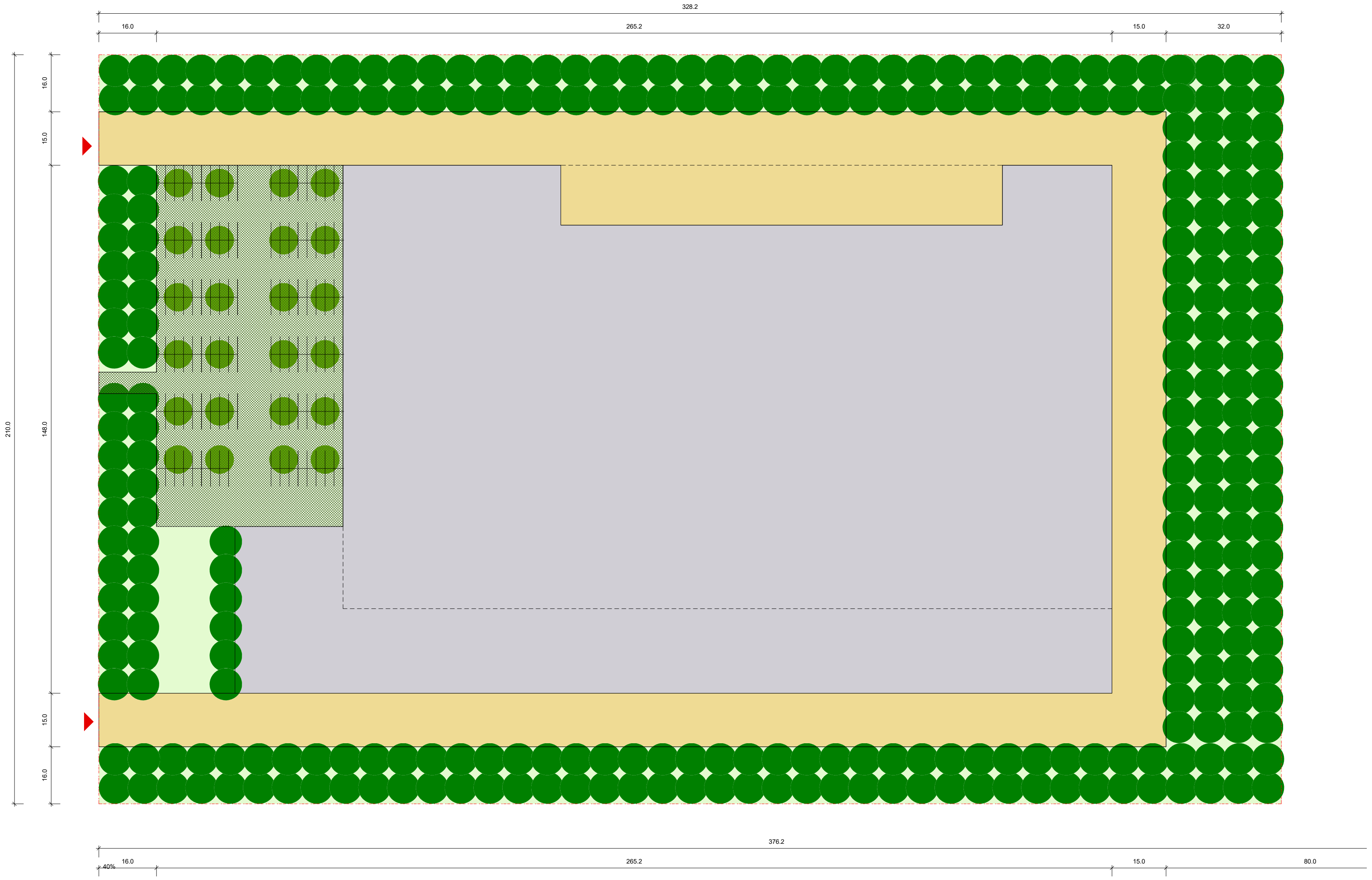


Figure 52. Strategy 1 Industrial – Large floorplate, pervious paving and perimeter planting

**Typology overview:**

- Single storey factory/warehouse with upper storey office
- Lightweight tilt-up + roof frame construction
- On grade car parking
- Hardstand areas including loading areas and parking (50% permeable assumed).

Table 13. Key metrics: Employment – Indusrial and Warehouse Strategy 1

| Lot size | Approx. GFA | Approx. FSR |
| --- | --- | --- |
| 61,000m$^2$ | 37124m$^2$ | 0.61:1 |

| Permeable surfaces | Permeability | Area |
| --- | --- | --- |
| Deep soil | 100% | 9330m$^2$ (15%) |
| Parking hardstand | 50% | 6279m$^2$ (10%) |
| Service hardstand | 50% | 14446m$^2$ (24%) |
| Building site coverage | 0% | 30929m$^2$ (51%) |
| | Total | 61000m$^2$ |

## Blocks + streets
Stormwater management strategies

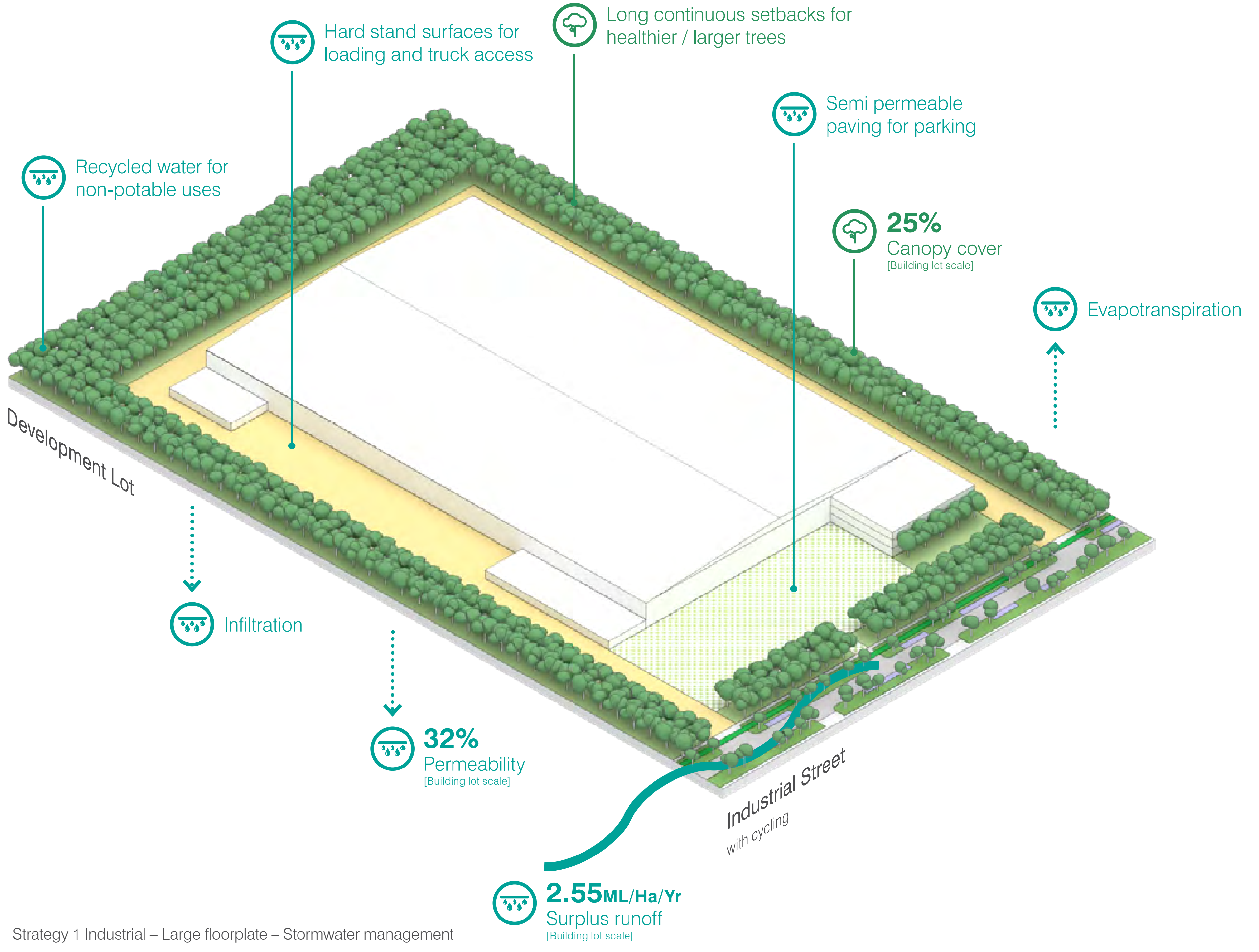



Figure 53. Strategy 1 Industrial – Large floorplate – Stormwater management

### Key metrics

| | | |
|---|---|---|
| Density | 0.61 | FSR (x:1) [Building lot scale] |
| | 0.47 | FSR (x:1) [Urban typology scale] |
| Green | 32 | % canopy cover [Block+street scale] |
| Water | 34 | % permeability [Block+street scale] |
| | 2.55 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 0 | kL rainwater tank [per building lot] |
| | 8 | % sponge area [per building lot] |
| | 53 | 'Wianamatta' street trees [per building lot] |

**Precedent**
Warehouse, Marsden Park

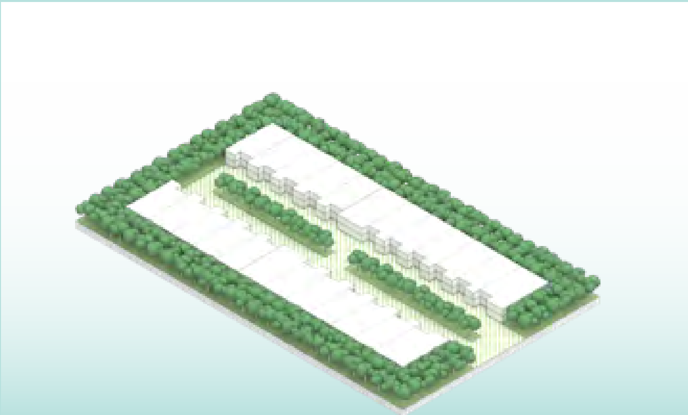
Aerial view

Street elevation

## Strategy 2

### Strata industrial with perimeter planting

Increasing permeability through perimeter planting and permeable paving.



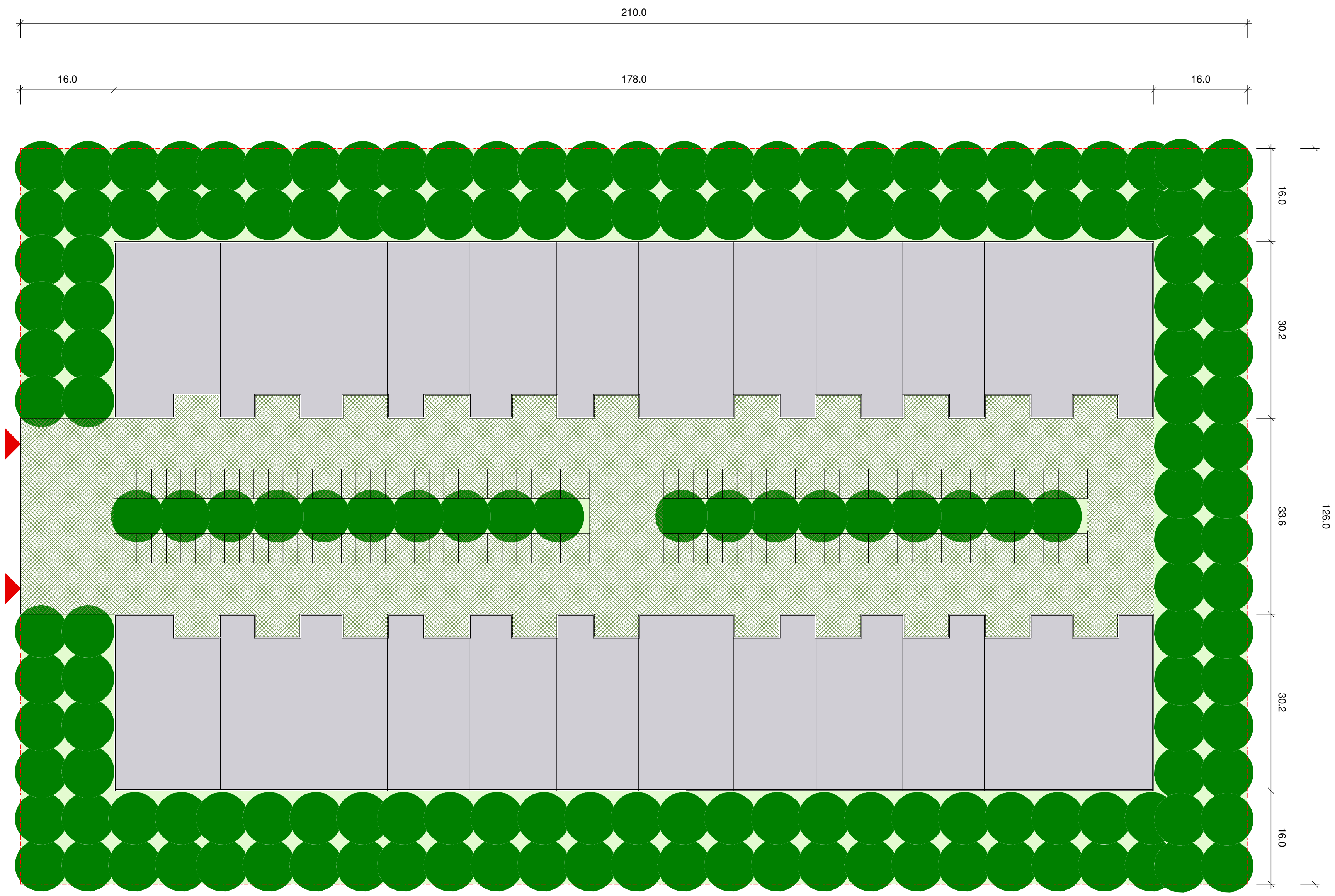



Figure 54. Strategy 2 – Strata industrial, perimeter planting

### Building lot typology study

**Benefits:**

- Building format reflects market need for strata industrial units
- Green buffer to perimeter provides areas for runoff to be absorbed into the ground.

**Further testing required:**

- Few built examples of pervious surfaces capable of supporting heavy vehicular loads in these contexts.

**Typology overview:**

- One to two storey unit complexes for light industrial use
- Lightweight tilt-up + roof frame construction
- On grade car parking
- Hardstand areas including loading areas and parking (50% permeable assumed)
- Double row of planted tees to side boundaries.

Table 14. Key metrics: Employment – Indusrial and Warehouse Strategy 2

| Lot size | Approx. GFA | Approx. FSR |
|---|---|---|
| 26,460m² | 18,180m² | 0.69:1 |

| Permeable surfaces | Permeability | Area |
|---|---|---|
| Deep soil | 100% | 10,115m² (38%) |
| Parking hardstand | 50% | 6,242m² (24%) |
| Service hardstand | 50% | 0m² (0%) |
| Building site coverage | 0% | 10,103m² (38%) |
| | Total | 26,460m² |

## Blocks + streets
Stormwater management strategies

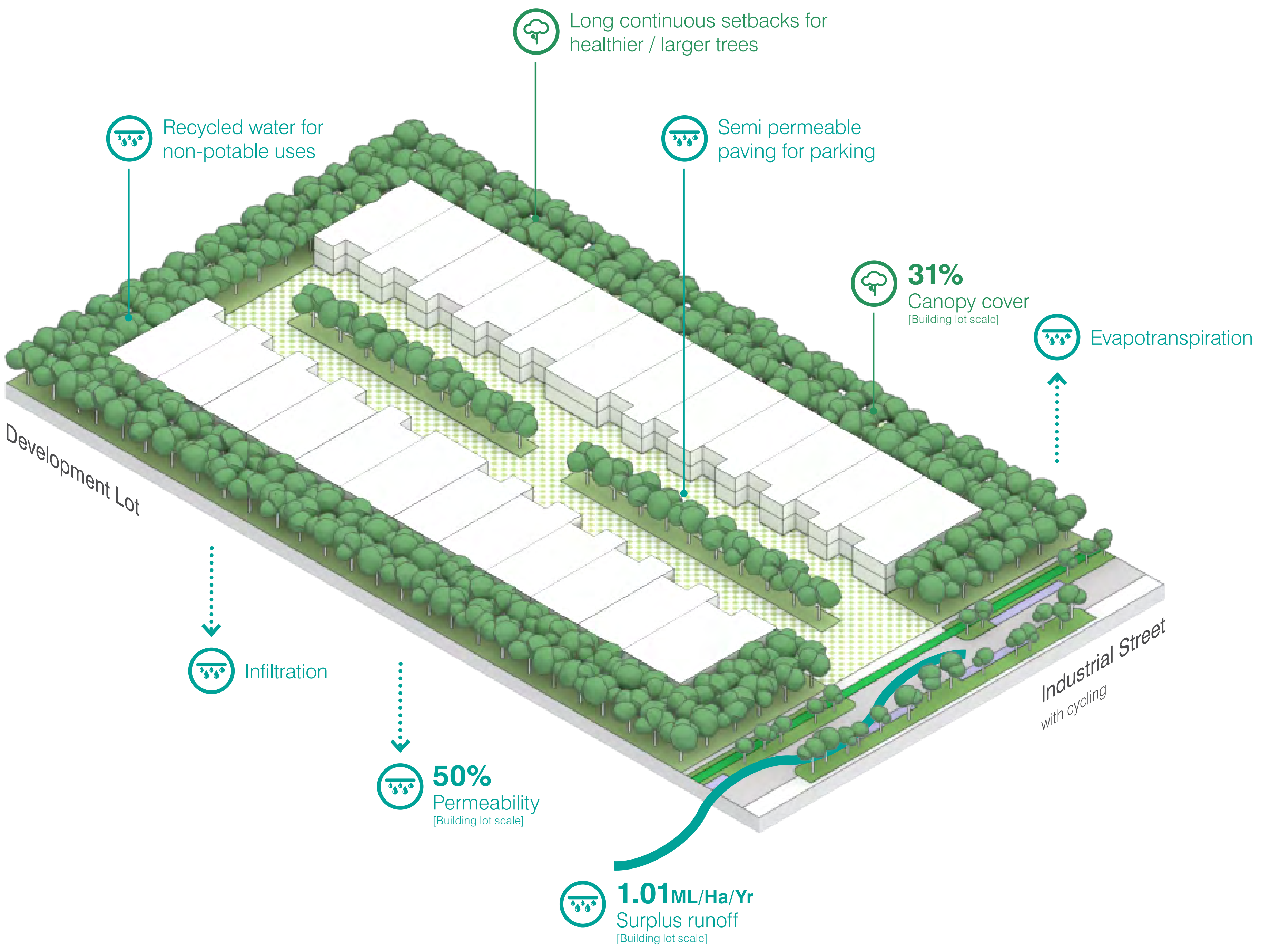



Figure 55. Strategy 2 – Strata industrial – Stormwater management

### Key metrics

| | | |
|---|---|---|
| Density | 0.69 | FSR (x:1) [Building lot scale] |
| | 0.53 | FSR (x:1) [Urban typology scale] |
| Green | 37 | % canopy cover [Block+street scale] |
| Water | 48 | % permeability [Block+street scale] |
| | 1.01 | ML/Ha/Yr surplus runoff [Block+street scale] |
| | 0 | kL rainwater tank [per building lot] |
| | 25 | % sponge area [per building lot] |
| | 73 | 'Wianamatta' street trees [per building lot] |

**Precedent**
Newington, NSW

Aerial view

Street view