Fairbairn Park Pavilion

The design and construction of a hydraulically disconnected drainage system

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Engeny Water Management

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City of
Moonee Valley

Introduction

- What is a “disconnected” drainage system?
- The scope of work
- The Site
- Fairbairn Park Masterplan
- Stormwater management approach
- Detailed design
- Construction
- Applicability to other areas
- Questions

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What is a “disconnected” drainage system?

- Disconnecting impervious areas from receiving waterways generally by infiltrating and reusing
- Waterway benefits
  - Hydrological
  - Water quality
- Improved water availability for terrestrial plants

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Scope of Work

- Flooding, drainage and stormwater quality system design for Fairbairn Park Pavilion
- Integrate the design with the landscape and building design
- Work closely with Council's engineering, parks and gardens and landscape teams

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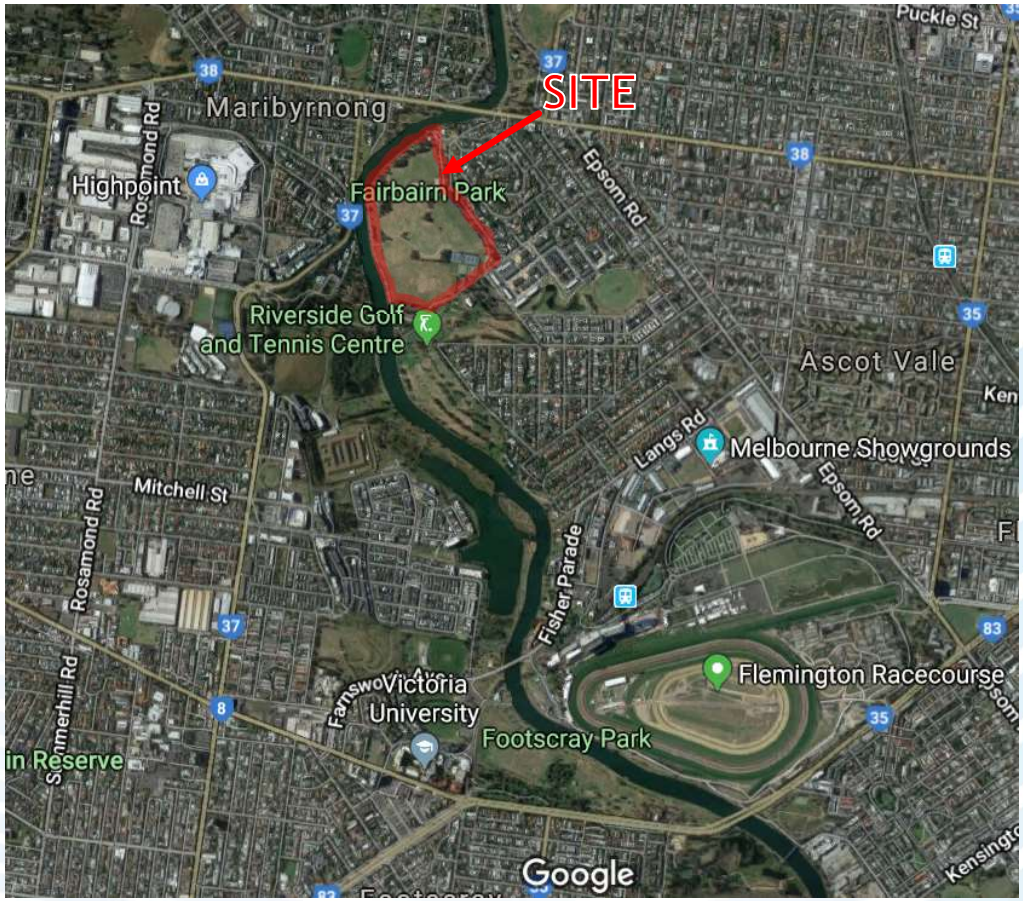
The Site



- Ascot Vale
- 26 hectares
- Maribyrnong River Floodplain

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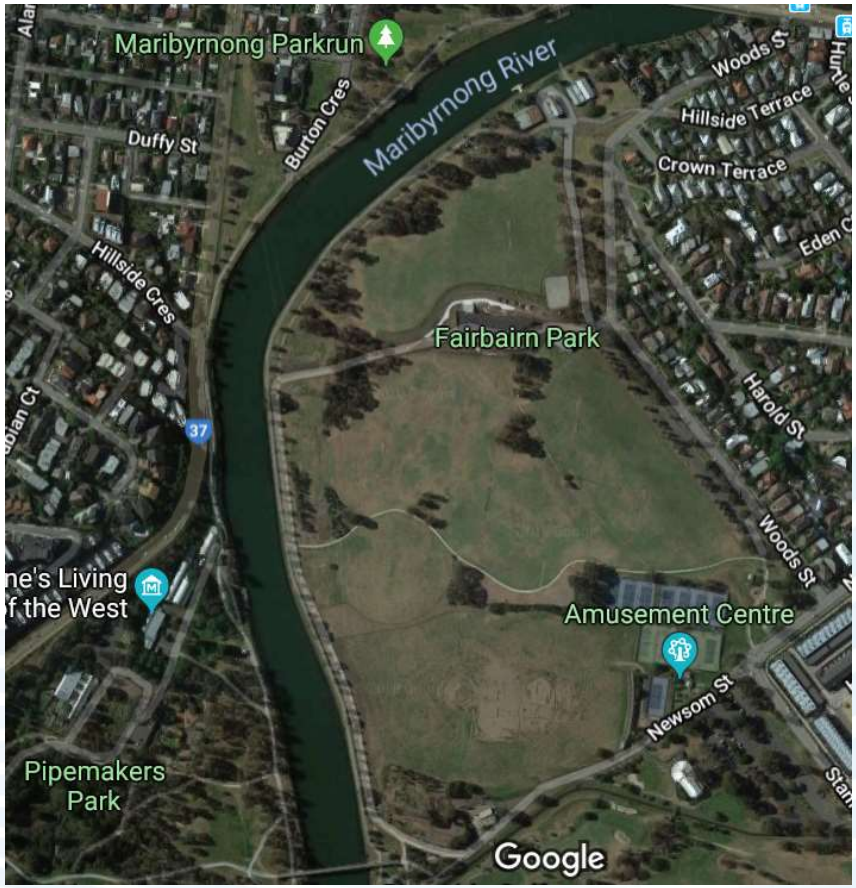
The Site



- Existing site uses:
  - Exercise / Sports
  - Trail walking
  - Dog walking
  - River activities
- Residential development increasing in the area

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Fairbairn Park Masterplan

- Masterplan objectives
  - Improve sporting facilities
  - Improve pedestrian connectivity
  - Enhance the natural environment
  - Construct sporting pavilion/community centre hub

Fairbairn Park Masterplan

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Stormwater Management

- Objectives
  - 1% AEP flood protection
  - Drainage
    - 10% AEP minor underground
    - 1% AEP major overland
  - Stormwater quality
    - BPEMG targets

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Stormwater Management

- Options for stormwater management at the site
  1. Traditional pipe and pit drainage system with separate stormwater quality system
  2. Disconnected infiltration system integrated with stormwater quality system.

- Option 2 chosen as the preferred option for the following reasons:
  - Opportunity to lead by example
  - Cost competitive
  - Avoided need for connection to waterway approvals

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Design Considerations

Test Hole No 1 Depth (m)	Classification	Shear Vane Strength kPa	ENGINEERING LOG
0.900			SILT Brown Moist to dry Medium dense Becoming dry at 0.200
1.200			CLAY, silty Brown Dry Hard
1.500			SAND, silty White grey Moist Medium dense
3.500			SAND, clayey Brown mottled orange Moist Medium dense Becoming moist to wet at 2.000 Becoming wet at 3.000 Groundwater at 3.200
			SILT, sandy Grey Wet Medium dense

Source: Geotechnical Report – Civil Test (2016)

- Flat (~1:1000) but generally grading towards the River.
- Variable soil profile
  - Low to high permeability
  - Clayey SAND 1.5 – 3.0 m/day
- Water table ~3.2 m

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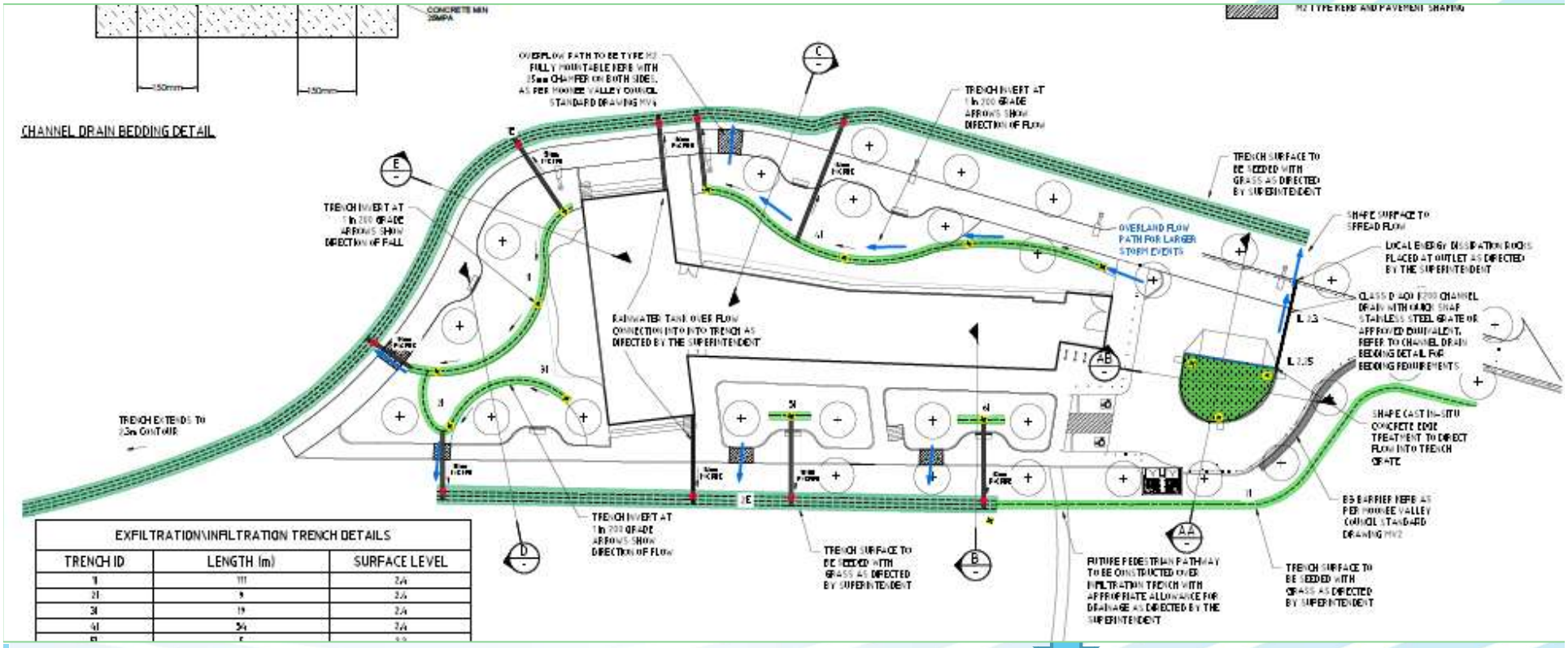
Drainage system design approach



- Surrounding soil

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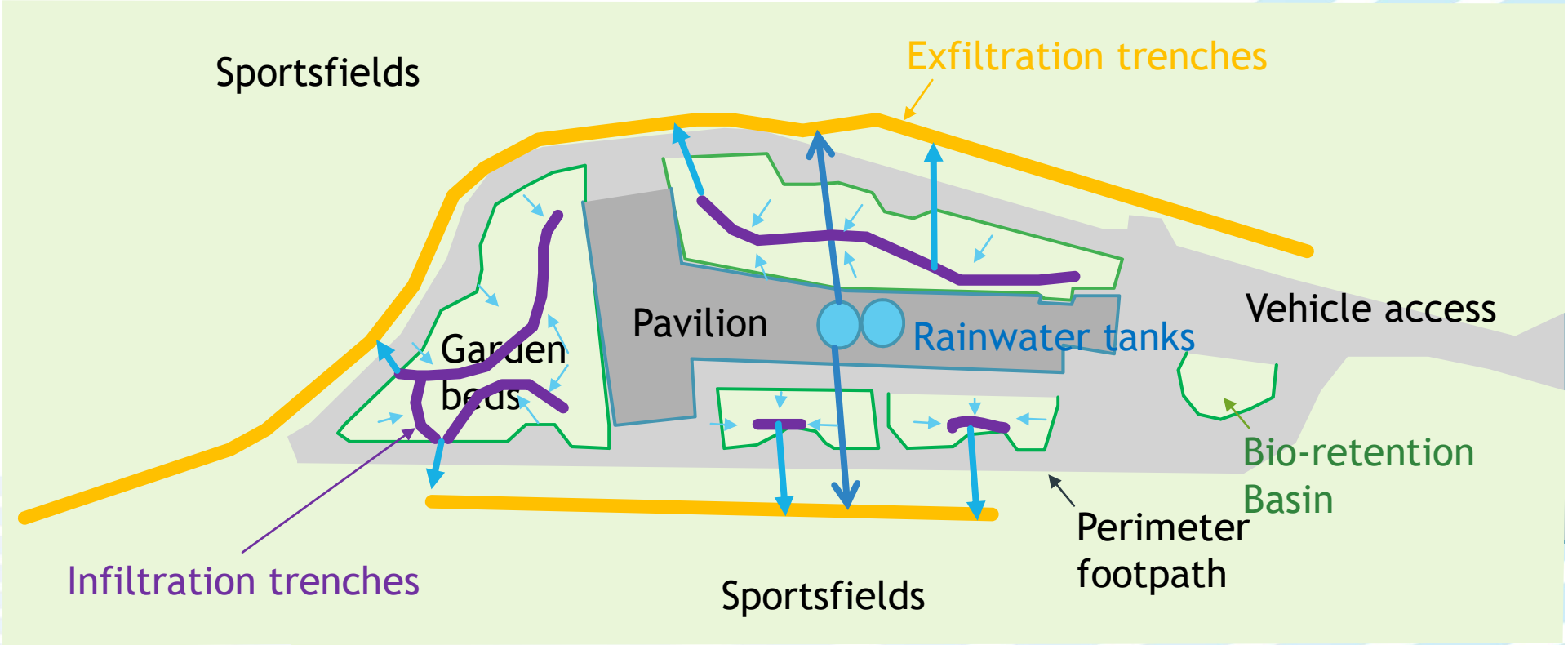
Drainage system operation



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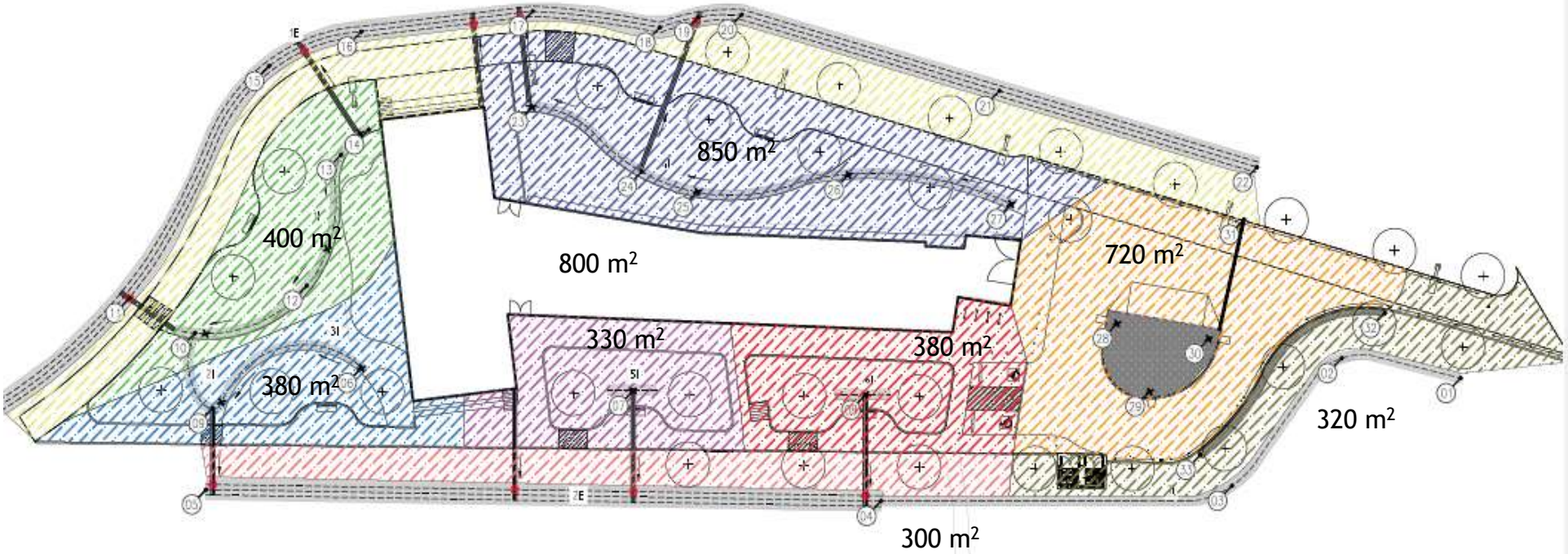
Catchments



Total Area ~ 5100 m²
Impervious Area ~ 50%

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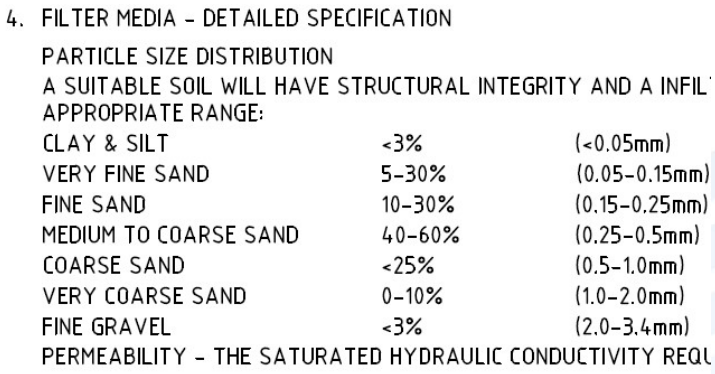
Design considerations

- Capturing fines
- Soil bridging criteria



4. FILTER MEDIA - DETAILED SPECIFICATION

PARTICLE SIZE DISTRIBUTION

A SUITABLE SOIL WILL HAVE STRUCTURAL INTEGRITY AND A INFIL
APPROPRIATE RANGE:

CLAY & SILT	<3%	(<0.05mm)
VERY FINE SAND	5-30%	(0.05-0.15mm)
FINE SAND	10-30%	(0.15-0.25mm)
MEDIUM TO COARSE SAND	40-60%	(0.25-0.5mm)
COARSE SAND	<25%	(0.5-1.0mm)
VERY COARSE SAND	0-10%	(1.0-2.0mm)
FINE GRAVEL	<3%	(2.0-3.4mm)

PERMEABILITY - THE SATURATED HYDRAULIC CONDUCTIVITY REQU

- Volumetric requirements and exfiltration rates
- Infiltration rates
- System redundancy
  - Groundwater
  - Soil spatial variability
  - Fines accumulation
- Maintenance
  - Inspection/flush points
  - Compaction
- Safety
  - Batter slopes
  - Bollards

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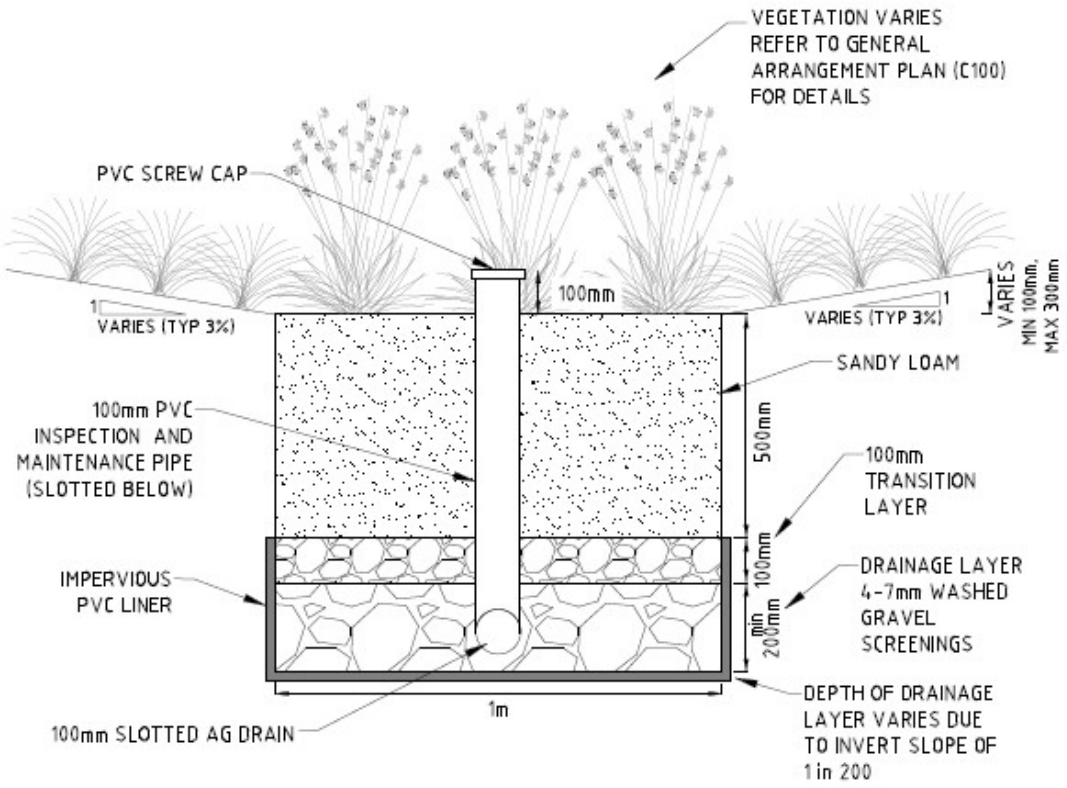
Infiltration trench design



INFILTRATION TRENCH
SCALE 1: 10

- Capture surface and subsurface inflows
- Conveyance to exfiltration trenches
- Landscape integration

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Exfiltration trench design

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Bio-retention basin design

Construction (1-4)

- General facts:
  - Approximately 18 month construction
  - Staged construction of drainage
  - WSUD completed last
  - Drainage/WSUD cost ~$150 K
  - Conventional stormwater drainage system ~$150 – 200K
  - December 2017 flooding

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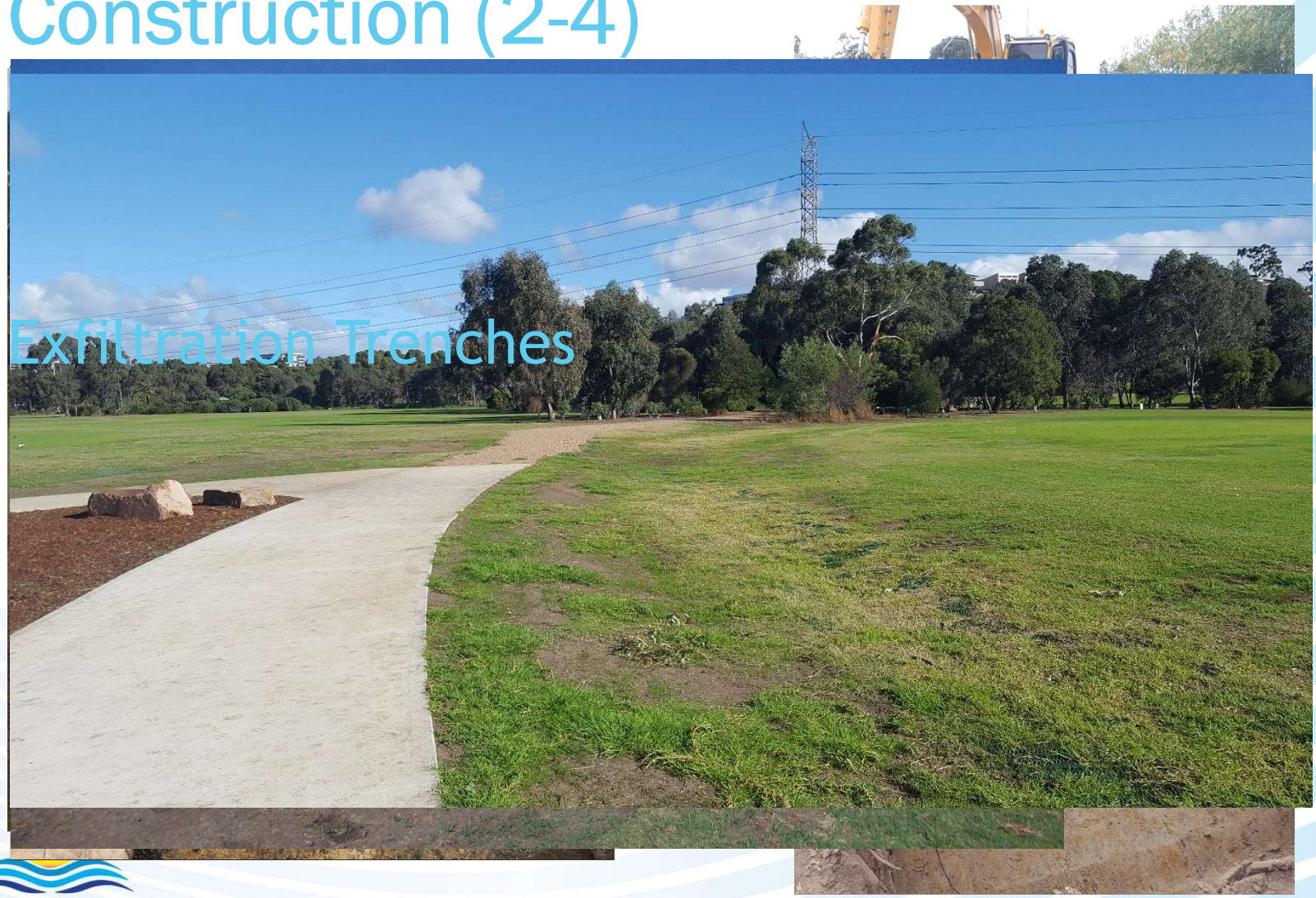
Construction (2-4)



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Construction (3-4)

Infiltration Trenches

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Construction (4-4)

Bio-retention Basin

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Applicability to other areas (1-1)

- Look for opportunities to disconnect impervious areas on all projects
  - Other places around Australia and the world relying on this method for drainage.
- Extent of implementation could consider factors including:
  - Soil type
    - Effectiveness of solution
    - Maintenance / asset life
  - Potential for downstream impacts
    - Groundwater flow changes
    - Subsurface pollutant transfer
  - Sensitivity of receiving waterways

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Questions?

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