MAXIMISING RECYCLING, EFFECTIVE ATTENUATION AND MULTI-STAGE WATER TREATMENT

SUSTAINABLE DRAINAGE AND LOW IMPACT DEVELOPMENT

A CASE EXAMPLE AT MOUNT VERNON HOSPITAL, LONDON

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Mt Vernon Hospital, Hillingdon NHS Trust

- Introduction
  - Spending on civil infrastructure by hospitals is often limited, yet critical to providing an essential facility to those working and visiting. With this in mind, Hillingdon NHS Trust looked to create a new welcoming main hospital entrance, boulevard and car park as **cost effectively and sustainably as possible.**
  - The site was a legacy of WW2 preformed concrete ward buildings
  - The ground was **relatively impermeable with flooding in the vicinity**.
  - The project would provide a practical example of **multistage water treatment**, ahead of the mandatory requirements for such measures. With reference to the Flood and Water Management Act 2010's forth coming implementation.

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KEY PROJECT CHALLENGES

- To produce a material performance specification criteria and design which was achievable using a conventional mobile crushing and screening system and provide the appropriate standard of hydraulic and structural performance to meet the client demands.
- To provide a **multistage treatment** and source control drainage system to reduce flooding, **maximise groundwater recharge** and water quality to the public sewer and resulting local watercourses.
- To provide a design which both provided an attractive environment and had functional performance with opportunity for **greater biodiversity**.
- To maximise the speed to which the works could be constructed, both **reducing construction costs** and site programme through design simplification.
- To provide a **robust design** for the new London Bus Terminal and integrate with the other areas.
- Low impact development – minimise **CO2 footprint** for all components
- To **cut costs against traditional construction** by 40% or greater by innovation

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PERFORMANCE REQUIREMENTS

BOULEVARD and BUS TERMINAL

- Adoptable local authority highway standards, including independent technical review by TFL.
- High number of buses often with tight turning and engines left running.
- Impermeable SMA, to chain of concrete ring and trench soakaways

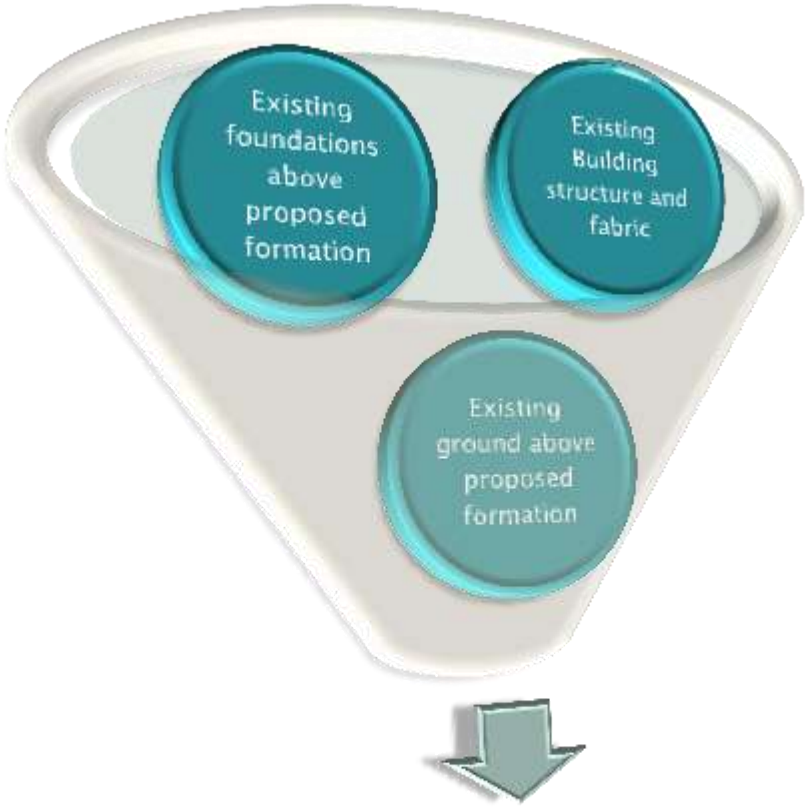
CAR PARK

- Car loading only. It was agreed that the only exceptional loading would be a fire engine, but so long as safe access was afforded any localise failure should not be allowed for.
- MUST be a surfaced based source control solution. Aggregate could not be used due to disability concerns. Permeable block paving was too slow and expensive. Porous offered the ideal solution in cost and time.

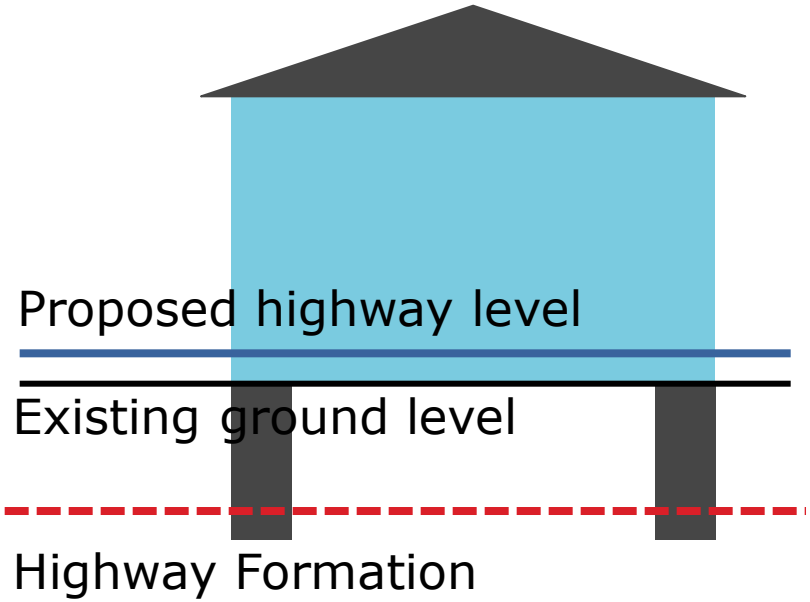
LANDSCAPED AREA

- Provide attractive and cost effective 100 year+ attenuation

MATERIAL SPECIFICATION AND CONTROL SOURCE FROM GROUND AND BUILDINGS



SCREENING STAGES



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MATERIAL SPECIFICATION AND CONTROL

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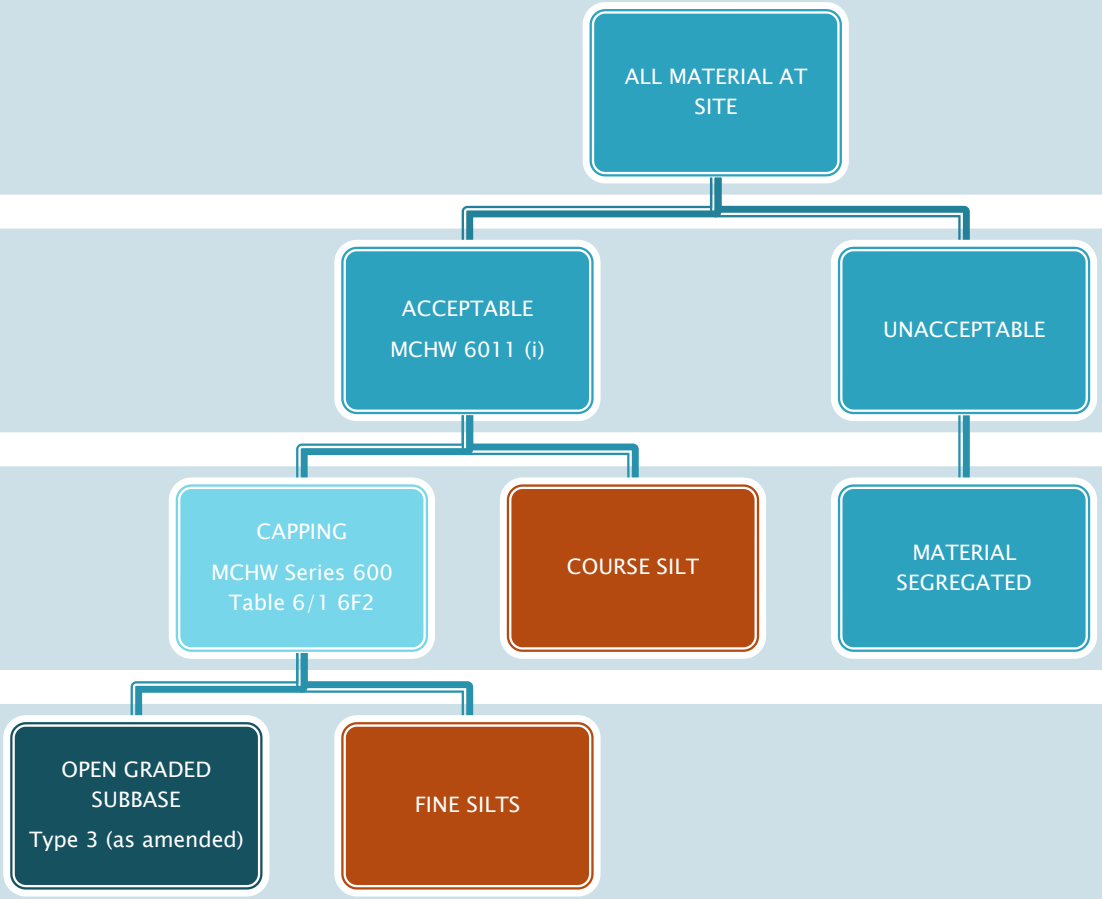
KEY STAGES OF INCLUSIVE DESIGN

Screening stages

1st Demolition and manual

2nd Primary crusher run

3rd Secondary crusher run



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CLASSIFICATION OF POROUS SUB-BASE

There remains no UK design standard for the design and specification of sub-base specifically in relation to the use of Porous asphalt on the car park. The following documents were noted in relation to an appropriate standard:

- **TRL Frost Report 45 1986 (also subsequent PPR482 2010)**
- **Interpave Design Guide for Permeable Pavements**, with specific reference to Table 11: Specification for open graded sub-base for use as storage below a pervious pavement.
- **DETR Design Manual for Roads and Bridges** HD23/99, HD35/04, HD25/94

Although the DETR reports, especially HD25/94, provide some sound basic principles, the performance requirements and complete design philosophy is completely different.

However, Interpave Table 11 is written with a waste processing centre or virgin quarry in mind, not to what is realistically achievable on site with conventional crushing plant.

CLASSIFICATION OF POROUS SUB-BASE

The specification therefore was refined to the core elements, with a requirement on the contractor to provide independent test certificates to confirm the materials key properties.

The material closest relative in DMRB is Type 3 but an exact match is not available.

The final mix which afforded the benefit of performance and construction viability was:

Open graded sub base grading 4/20 to BS EN12620

Representative tests to provide material which complies with MS_{18}, f4, FL_{20}, LA_{30}, WA_{24} 2, $M_{DE}20$ to BSEN 13242:2002 or close to for agreement.

Traditional CAR PARK DESIGN

- Ponding and flooding
- Evidence of fuel and oils on surface
- Expensive oil separators with alarms
- Slip hazard at freezing temperatures
- Large storm-water storage volumes created with plastic crates and expensive controls
- Higher oil/virgin aggregate content in asphalt mix

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MULTISTAGE WATER TREATMENT

01
Porous asphalt surface course with open graded asphalt binder course 1:100 fall to kerb

02
10mm maximum height kerb, for retaining asphalt not cars. Allows vehicle overhang reducing total dimensions within asphalt car park area.

03
Hydrocarbon treating bark for peak storm flows

04
Landscaping area used for flood storage.
French drain (located under landscaping area)

01

02

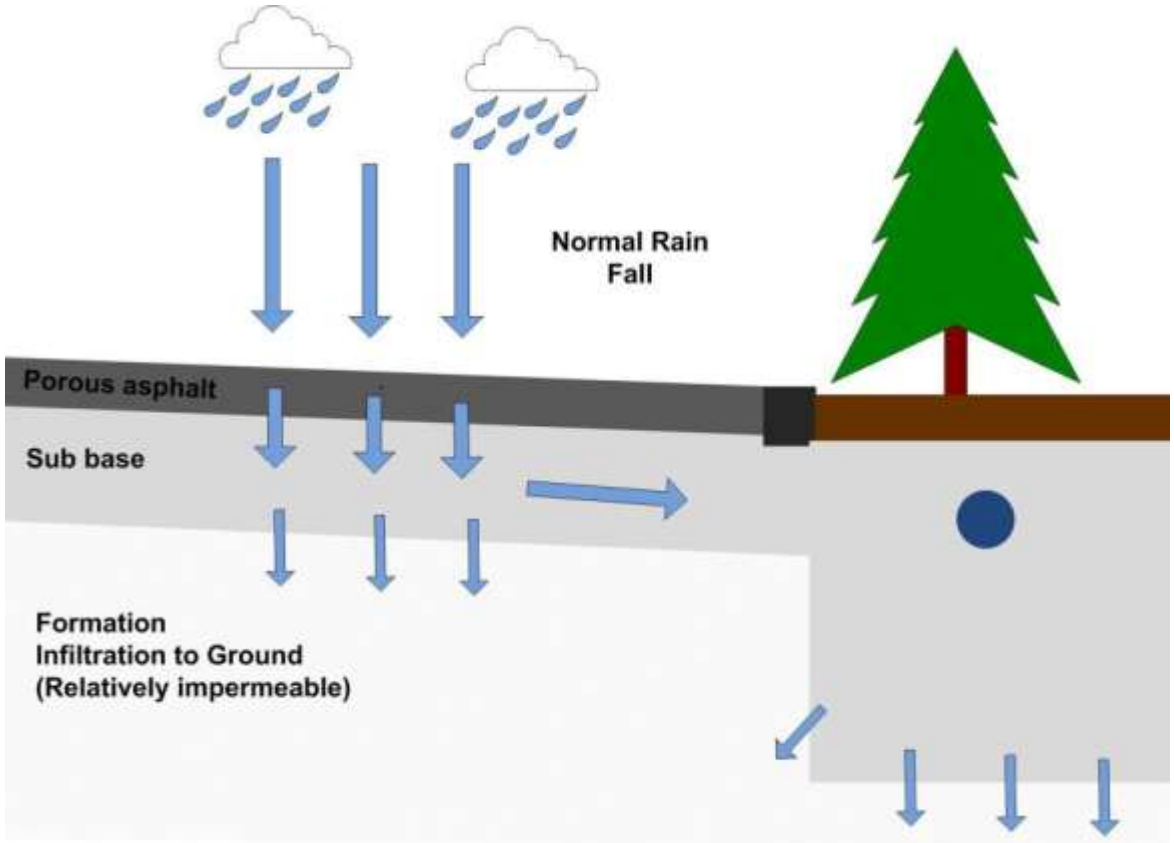
03

STORM WATER STORAGE

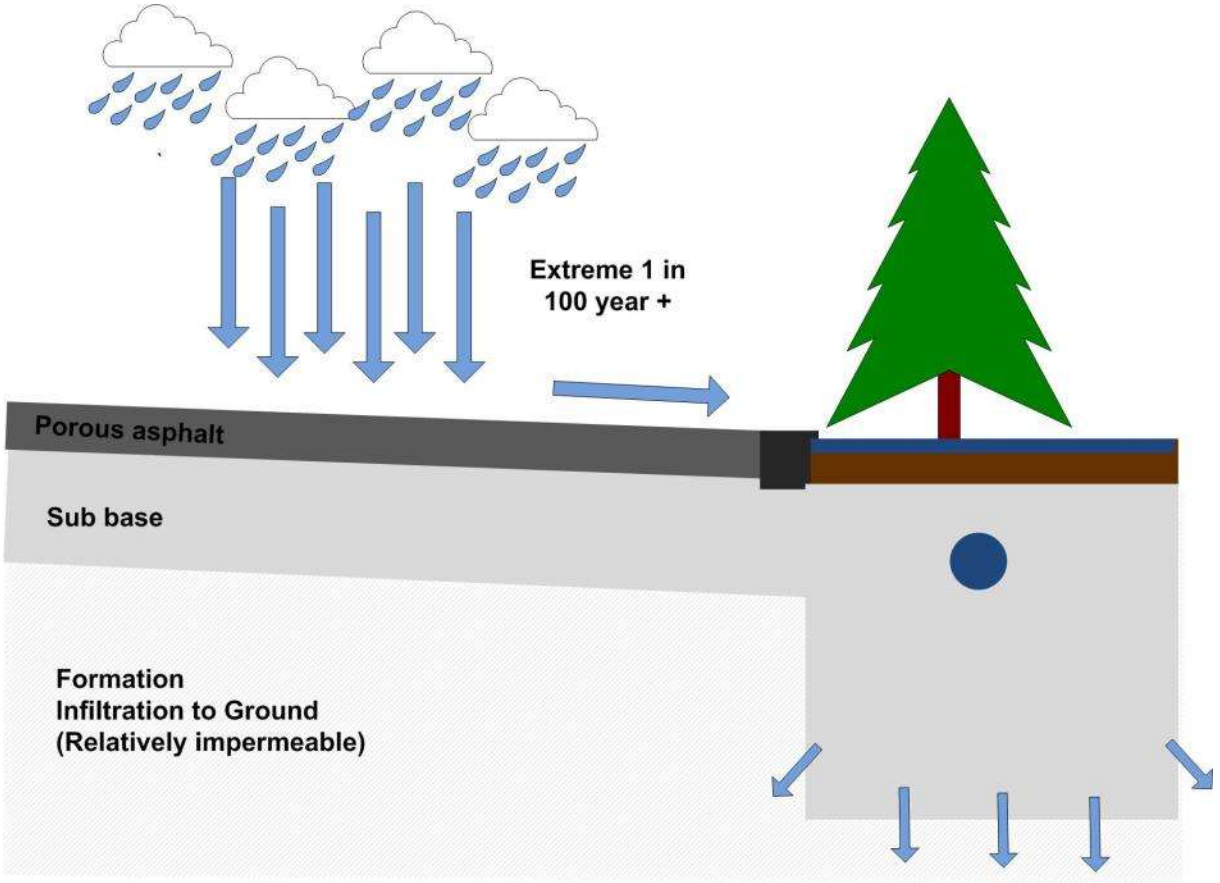
01
Porous asphalt surface course with open graded asphalt binder course 1:100 fall to kerb

02
Grassed swale
Special seed mix

03
Easy maintenance



Given the maximisation of the wetted perimeter and acceptance of short term saturation of the subbase low permeability with sandy clay ground still makes infiltration (with high level outlet) a viable solution



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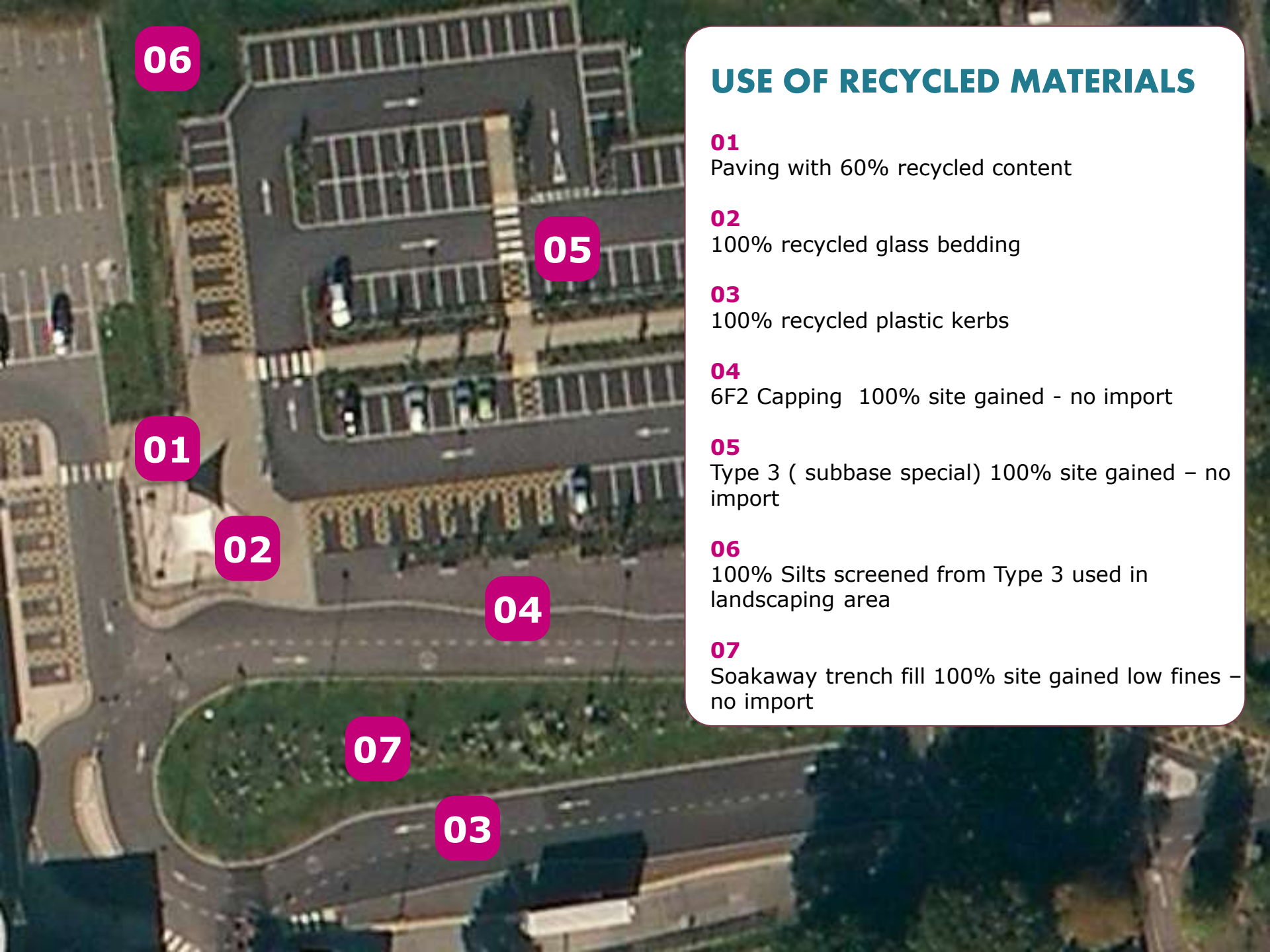

USE OF RECYCLED MATERIALS

01
Paving with 60% recycled content

02
100% recycled glass bedding

03
100% recycled plastic kerbs

04
6F2 Capping 100% site gained - no import

05
Type 3 (subbase special) 100% site gained – no import

06
100% Silts screened from Type 3 used in landscaping area

07
Soakaway trench fill 100% site gained low fines – no import

KEY PROJECT BENEFIT SUMMARY

£200k cost saving against budget

Main works finished ahead of programme

Avoidance of exporting existing materials and importing of virgin aggregates.

Low impact development. Reduced CO2 impact compared to traditional construction.

Improved water quality discharge

Reduced on site flood risk for clients and staff (less ponding)

Reduced flooding for local community from previous development

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THANK YOU

ON-GOING RESEARCH IS CURRENTLY BEING UNDERTAKEN BY GEORGIOS ROSINAS AND THE UNIVERSITY OF PORTSMOUTH INTO THE "FATE OF HYDROCARBON POLLUTANTS IN SOURCE AND NON-SOURCE CONTROL SUDS SYSTEMS.

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