

Exercise walk-through

Methods to Reduce Urban Runoff ■ 5.13

eXercise

You must be able to

- describe green infrastructure (**permeable pavement** 透水路面, **rain gardens** 雨水花园, green roofs)
- explain how each reduces runoff and pollution
- link solutions to the problem of impervious surfaces

Method — The problem

Cities' **impervious surfaces** cause heavy runoff that floods and carries pollutants to waterways. Solutions let water **soak in** instead.

Method — Green infrastructure

- **Permeable pavement** — lets water pass through into the ground.
- **Rain gardens** — planted depressions that collect and absorb runoff.
- **Green roofs** — vegetation on roofs that absorbs rain and cools buildings.
- **Retention/detention ponds** — hold runoff and release it slowly.

Method — How they help

They increase **infiltration**, reduce peak runoff (less flooding), and filter pollutants before water reaches rivers.

Method — A worked link

A rain garden collects roof runoff, letting it soak into the soil where plants and soil filter out pollutants — reducing both flooding and water pollution.

Practice 2.1 ■ 1 mark

How does permeable pavement reduce runoff?

Solution 2.1

Method: Green infrastructure

Worked steps

It lets water pass through into the ground instead of running off **B1**.

Practice 2.2 ■ 1 mark

What is a rain garden?

Solution 2.2

Method: A worked link

Worked steps

A planted depression that collects and absorbs runoff **B1**.

Practice 2.3 ■ 1 mark

State one benefit of a green roof.

Solution 2.3

Worked steps

Any one: absorbs rain (less runoff), cools the building, reduces heat island **B1**.

Exam-style 3.1 ■ 1 mark

Permeable pavement reduces flooding by allowing water to

- A** run off faster
- B** soak into the ground
- C** evaporate instantly
- D** freeze

Solution 3.1

Method: Green infrastructure

A run off faster

B soak into the ground



C evaporate instantly

D freeze

Worked steps

B — soak into the ground.

Exam-style 3.2 ■ 3 marks

A city installs rain gardens and permeable pavement.

- (a) Explain how these reduce runoff and pollution.
- (b) State the underlying problem they address.

Solution 3.2

Method: Green infrastructure

Worked steps

(a) They increase infiltration so less water runs off (less flooding), and soil/plants filter pollutants before the water reaches rivers **M1 M1 A1**. (b) Impervious surfaces causing runoff **B1**.

Exam-style 3.3 ■ 2 marks

Explain how green roofs reduce both runoff and the urban heat island effect.

Solution 3.3

Method: Green infrastructure

Worked steps

The vegetation absorbs rainwater (reducing runoff) and cools the air through shade and transpiration, lowering the urban heat island effect **M1** **A1**.