

# Rain Gardens

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## What are Rain Gardens?

Rain gardens are bio retention systems that are used to treat and manage frequent rainfall events by collecting water on the surface and filtering it through planting and drainage layers into the underlying soil. Alternately if infiltration is not possible or undesirable, then the rain garden can be lined and connected to an underlying drainage system.

A small rain garden can be used by a single property or integrated into public realm as part of new developments or improvements to existing streets. Larger examples can include small trees and shrubs. Rain gardens are usually less engineered than other bioretention systems and serve a small catchment from a road, pavement or roof. Rain gardens vary in scale and design, although they all follow the same design principles. The design and maintenance of rain gardens in public streets and spaces should be discussed with Edinburgh Council at an early design stage.

Although individually rain gardens may provide attenuation for relatively small quantities of surface water run off, wide implementation can cumulatively reduce water quantity while improving water quality. Rain gardens can also provide other amenity and health benefits turning urban rainwater management from a problem to a potential asset.

Pros	Cons
Can be easily retro fitted	Usually small in size and may have a limited individual impact on volume reduction
Can be attractive features within the urban realm	Not suitable for sites with steep slopes
Can reduce runoff rates	Must be regularly maintained to work effectively
Open to creative design options	



Figure 1. Alma Road Rain Garden, London | Susdrain



Figure 2. Nicoll Circus, Millbrook Park | Google Maps 2019

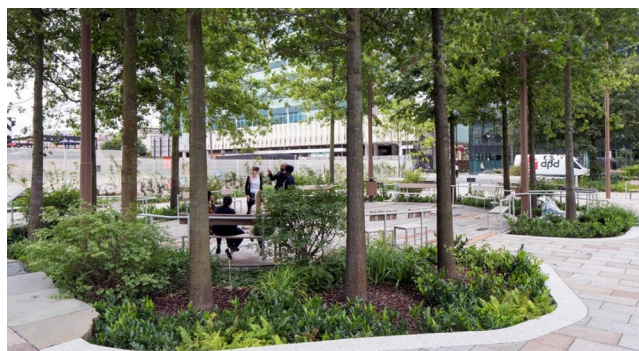


Figure 3. Ruskin Square, Croydon | J & L Gibbons

### Technical references:

- [Edinburgh Design Guide](#)
- CIRIA The SUDS Manual V6: Part D, Technical Detail, Chapter 18 p386
- CIRIA Guidance on the Construction of SUDS C768

# Fitting Rain Gardens into Streets and Urban Spaces

The design of a rain garden is flexible and can be scaled to the space available. This means that they are simple to retrofit into inner city streets revitalising small underused spaces, as part of street improvements or within the street furniture zone of wider pavements.

Rain gardens can also be community assets as part of a school, housing or play area or built in private gardens to manage roof run off.

Guidance on fitting SuDS (including rain gardens) into urban streets can be found in the Edinburgh Design Guidance section 4 and Edinburgh’s Sustainable Rainwater Management Guidance Section B.



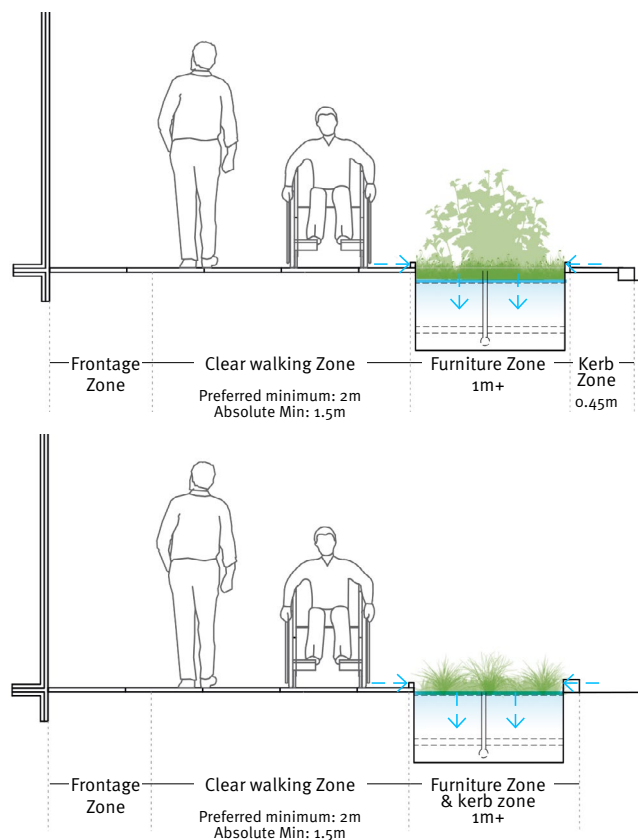
Figure 4. Basic, Levels of intervention | City of Edinburgh Council

### Relevant Factsheets:

[Street Trees \(F5\)](#)

[Footway Zones \(P3\)](#)

Rain gardens can form part of traffic calming, parking bay or cycle lane separation designs. To comply with the clear curb zone set out in the ESDSGF planting in rain gardens adjacent to or within the road edge should not exceed 300mm in height.



[Street Furniture \(F1\)](#)



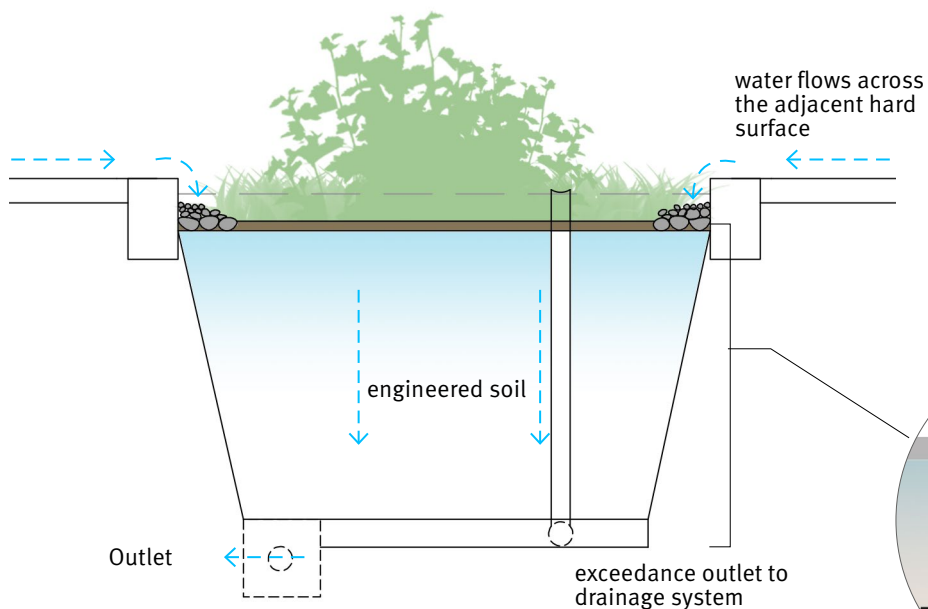
Figure 5. Before - July 2012 Bridge Street, Sheffield | Google Earth



Figure 6. Before - May 2019 Bridge Street, Sheffield | Google Earth

[Street Geometry & Layout \(G1\)](#)

# Construction Methods for Rain Gardens in Hard Landscape



## Soil for Rain Gardens

All rain Gardens should use a proprietary engineered SuDS soil that provides an appropriate balance of particle size, nutrients and organic matter. Ensure there is sufficient soil depth to support the type of vegetation planted.

**“Engineered soils are designed and manufactured to provide specific drainage and horticultural properties.”**

CIRIA Guidance on the Construction of SuDS p210

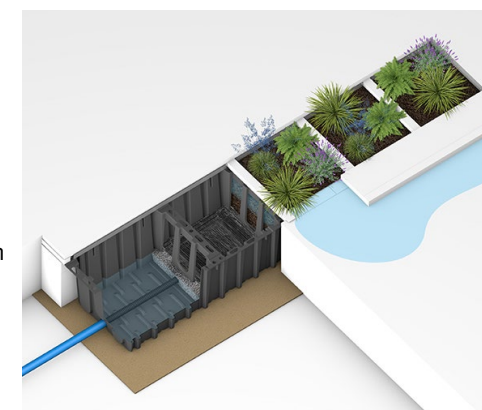
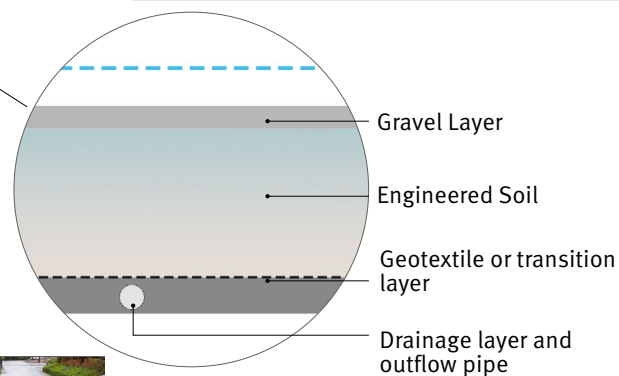


Figure 7. Modular rain garden | GreenBlueUrban

## Examples of Inlets



Figure 8. Examples of kerb inlets - see reference list

## Technical references:

- CIRIA The SuDS Manual V6: Part E, Supporting guidance. Chapter 28: Inlets, Outlets and flow control systems p605
- CIRIA Guidance on the Construction of SuDS C768. Chapter 12 Bioretention System, p187

## Relevant Factsheets:

- Street Trees (F5)
- SuDS Trees (W1)
- Footway Zones (P3)
- Street Furniture (F1)
- Street Geometry & Layout (G1)

## Designing for Resilience

Rain gardens in roads and large hard surface areas will be particularly vulnerable to prolonged periods of water scarcity as our summers become warmer and drier. Designing in capacity to store rainwater for irrigation will improve the resilience of planting and therefore the effectiveness and attractive appearance of a rain garden. To achieve this a rain garden should include:

- filtration features to remove silt
- sufficient volume of a suitable growing medium
- a permeable membrane separating the soil from the irrigation layer
- a reservoir layer which could consist of an aggregate layer, or a proprietary solution such as Hydrorock or shallow irrigation grid.
- a liner or capillary break to prevent water retained for irrigation percolating into the soil below
- the design should include provision for exceedance in heavy rain with outflows above or below ground

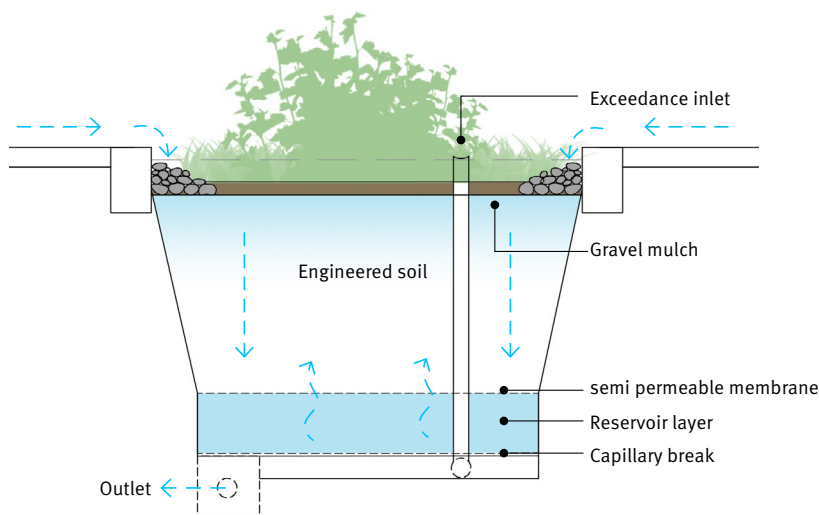
Example of rain garden/swale using a Hydrorock (rock wool) irrigation layer during construction and after establishment.



Figure 9. Rain garden | Hydrorock



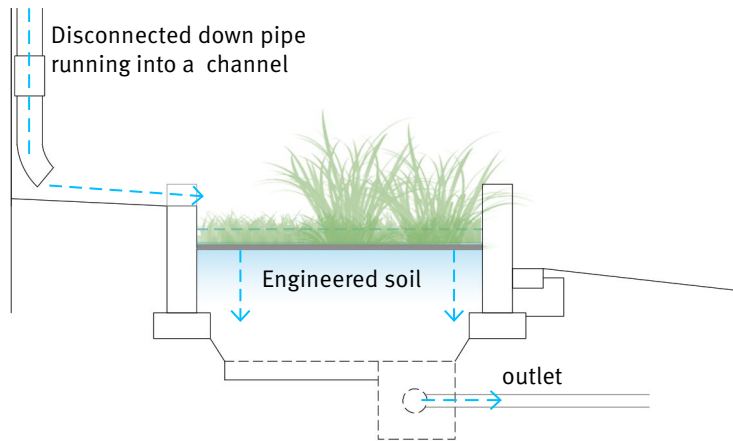
Figure 10. Rain garden under construction | Hydrorock



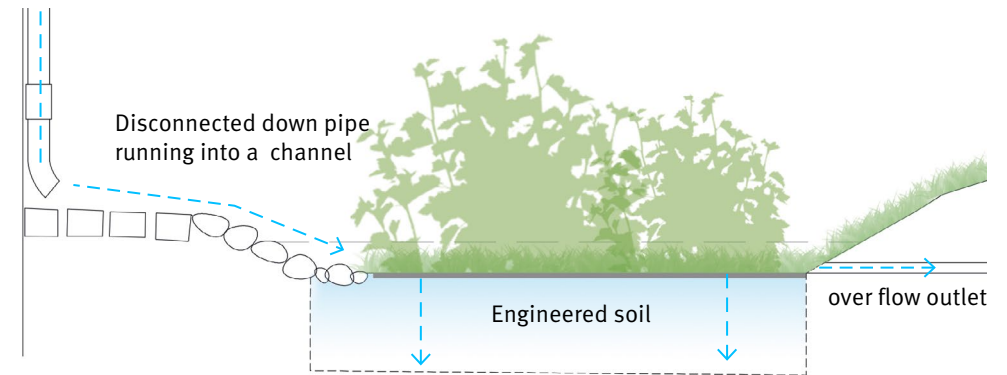
### Reducing Erosion

**Use gravel mulches** to shade the soil surface, help retain moisture, reduce weeds and **resist erosion during high rainfall events**. This is of particular importance for rain gardens on sloping ground.

# Construction Methods for Rain Gardens with Disconnected Downpipes



Rain garden with a disconnected down pipe where infiltration is not possible.



Rain garden with a disconnected down pipe with infiltration into the surrounding ground

## Infiltration close to roads and buildings

- Check soil type and check that infiltration will not adversely affect any adjacent foundations of buildings roads or structures
- If suitable take a cautionary approach and half line the rain garden to drain away from foundations of buildings or structures



Figure 11. Rain garden | Sudsnet, Abertay University



Figure 12. Ashby Grove, London | CIRIA



Figure 13. Queen Caroline Estate, London | Susdrain

- [ESRWMG Section B](#)

- [S.Wilson, Using SuDS close to buildings, Susdrain Fact sheet, September 2012](#)

- [100 Rain gardens, Scotland](#)

# Design Considerations

## Designing a rain garden

- ✓ **DO** design edge protection, typically, a rain garden is set below surface level and can hold standing water. Potential trip hazards or traffic hazards should be avoided.
- ✓ **DO** consider suitable entry and exit points for the water.
- ✓ **DO** consider erosion, control surface water runoff to through the rain garden. E.g. check dams, erosion matting and planting.
- ✓ **DO** consider site conditions in plant selection, including the need for pollution or salt tolerance (for example in road run off).
- ✓ **DO** test soil infiltration on site and ensure it is effective.
- ✓ **DO** consider where water can flow away safely if the rain garden is overwhelmed during heavy storms (exceedance).
- ✓ **DO** establish where water entering an under-drainage system will outfall and ensure you meet with appropriate standards and obtain permissions where necessary.

- ✓ **DO** insure that inlets are placed appropriately in relation to the camber of the road or pavement.
- ✓ **DO** consider the need for routine maintenance from the outset of design to prevent blockage and over sedimentation.
- ✗ **DON'T** specify light organic mulches as they may cause blockages, gravels are more suitable.



Figure 14. Engineered soil used in rain gardens for Sheffield Grey to Green Scheme | Sheffield City Council

## Construction checklist

- ✓ **DO** ensure geotextiles have the right level of porosity, if the membrane is too fine it may clog causing waterlogging which will kill the planting.
- ✓ **DO** insure that soil type for the rain garden is a suitable engineered SuDS soil that meets specifications.
- ✓ **DO** ensure the base of the rain garden is free draining before construction and backfilling.
- ✓ **DO** ensure that any under drainage is laid to the correct depth and gradient and meets relevant standards.

## Technical references:

- [ESRWMG Section B](#)
- [Edinburgh Design Guidance](#)
- [ESDG Factsheets](#)
- [Edinburgh's Biodiversity Action Plan](#)
- CIRIA The SuDS Manual (C753), Chapter 18: Bioretention Areas, p332
- Guidance on the construction of SuDS C768, Chapter 31: Bioretention , p186

## Planting Rain Gardens

Engineered soil for rain gardens and bioretention areas are free draining therefore planting needs to be robust, tolerant of dry conditions and occasional short periods of waterlogging.

- Planting schemes should consist of hardy low maintenance plants tolerant of prolonged damp and dry periods.
- Planting along very busy streets watered by road run off may need to have some resistance to pollution, road salt and exposure.



Figure 16. Greener Grange Town Rain Garden Planting | Arup

Depending on the context the planting in a rain garden may have a formal, informal or decorative character. Appropriate planting will also depend on the scale, depth of the rain garden and available light.

- Simple informal schemes might use low maintenance groundcover planting to provide interest and biodiversity value,
- larger schemes may include shrubs and trees, and
- more formal urban schemes may include decorative non-native planting.



Figure 15. Rain garden planting, Sheffield | Sheffield City Council

### Planting for Wildlife Benefits

Where appropriate to location native plants, trees and meadow grasses in rain gardens can provide important natural resources. Ensure the selection of plants is suitable to the levels of light, moisture and exposure available.

Formal or decorative planting schemes can also provide biodiversity benefits by using cultivars of native species and non-native planting that provides flowers and berries.

Native wildflower seed or plug plants should be of Scottish provenance.

#### Planting Specifications

**A wide range of plants could be considered acceptable as part of a wider landscape design if they satisfy the requirements of a rain garden and are appropriate to scale and local context.**

Plant Specification should follow the principles set out in **EDG 3**.

**Use an appropriate professional to design and specify planting or seeding.**

#### Relevant Factsheets:

Street Trees (F5)

SuDS Trees (W1)



# Maintenance

**Routine maintenance of rain gardens will include vegetation or grass management, annual removal of debris, clearing of inlets and the periodic removal of silt (if required).**

Rain gardens on private property or within the grounds of institutions should be cared for as part of part of grounds or garden maintenance. No maintenance plan would be required for a single small domestic rain garden in private gardens.

## The Maintenance Plan

All SuDS features will require a maintenance plan that should include detailed specifications, frequency, timing, equipment and annual costs. SuDS features to be regularly inspected and the maintenance monitored by a competent professional.

For all SuDS elements the contract maintenance period after construction should be 5 years.

## Technical references:

- CIRIA The SUDS Manual (C753), Chapter 18: Bioretention Areas, p332
- Guidance on the construction of SuDS C768, Chapter 31: Bioretention , p186

## Typical Maintenance Requirements for Rain Gardens

Water new planting regularly in dry periods during establishment	Weekly or as required between spring and Autumn
<ul style="list-style-type: none"> <li>• 1 year for meadow grasses and short-lived perennials</li> <li>• 2 years for perennials and small shrubs</li> <li>• 3- 5 years for trees and large shrubs</li> </ul>	
Inspect regularly	3-6 months
Water established vegetation during prolonged dry periods	As required
Clear litter and leaf debris from water inlet channels and mulch	Annually (late November) or as required depending on location and amount of litter
Replace or top up mulch layer (if used)	Annually or as required
Manage vegetation including replacement or reseedling of dead or damaged plants	As required to maintain attractive healthy planting, allow for pruning back shrubs in autumn if required
Remove self-seeded invasive species and woody seedlings	Every 3- 6 months
Scarify and spike topsoil to improve infiltration and break up silt deposits	5 yearly or as required
Removal of silt build up to restore capacity (and if necessary, replant or reseed)	5 yearly or as required

# Image References

## Figure 1. Alma Road Rain Garden, London | Susdrain

Susdrain, 2018. Figure:9. p7 [online]

Available at: [https://www.susdrain.org/case-studies/pdfs/suds\\_awards/alma\\_road\\_rain\\_gardens\\_london\\_v2.pdf](https://www.susdrain.org/case-studies/pdfs/suds_awards/alma_road_rain_gardens_london_v2.pdf) [Accessed: 1 November 2019]

## Figure 2. Nicoll Circus, Millbrook Park | Google Maps 2019

Google Maps 2019. Available here: <https://www.google.co.uk/maps> [Accessed: 1 November 2019]

## Figure 3. Ruskin Square, Croydon | J & L Gibbons

Image courtesy of J.L Gibbons / Sarah Blee [taken: n.d.]

Available at: [https://www.susdrain.org/case-studies/pdfs/suds\\_awards/031\\_18\\_04\\_24\\_susdrain\\_suds\\_awards\\_ruskin\\_square\\_croyden.pdf](https://www.susdrain.org/case-studies/pdfs/suds_awards/031_18_04_24_susdrain_suds_awards_ruskin_square_croyden.pdf). [Accessed 1 September 2019].

## Figure 4. Basic, Levels of intervention

Diagram courtesy of Sheffield City Council [taken. n.d.]

## Figure 5. Before - July 2012 Bridge Street, Sheffield | Google Earth

Google Maps, July 2012. Google Street View 2020. Available here: <https://www.google.co.uk/maps> [Accessed: 10 January 2020]

## Figure 6. Before - May 2019 Bridge Street, Sheffield | Google Earth

Google Maps, May 2019. Google Street View 2020. Available here: <https://www.google.co.uk/maps> [Accessed: 10 January 2020]

## Figure 7. Modular Rain garden | GreenBlueUrban

Image courtesy of GreenBlue Urban. [taken n.d.]

## Figure 8. Examples of kerb inlets - see reference list

- A) Alma Road
- B) Ciria
- C) Ciria
- D) Unknown
- E) Grey to Green, Sheffield
- F) Queens Promenade | Atkins <https://atkinsbookoflandscapes.com/posts/kingston.html>
- G) rue Garibaldi, Lyon | <http://www.tdag.org.uk/uploads/4/2/8/o/4280686/garibaldi.pdf>
- H) Grey to Green, Sheffield Figure 9. Rain garden | Hydrorock

## Figure 9. Rain garden | Hydrorock

Image courtesy of Hydrorock Rockflow

## Figure 10. Rain garden under construction | sudsnet, Abertay University

Image courtesy of Hydrorock Rockflow

## Figure 11. Rain garden | sudsnet, Abertay University

Image courtesy of Sudsnet, Abertay University

Alison Duffy, (2016), Rain Garden in Malmö, Sweden [ONLINE]. Available at: <https://www.abertay.ac.uk/business/services/sudsnet/sudsnet-photos/rain-gardens/> [Accessed 1 December 2019].

## Figure 12. Ashby Grove, London | CIRIA

Image courtesy of Susdrain, CIRIA

## Figure 13. Queen Caroline Estate, London | susdrain

Susdrain, (2016), Queen Caroline Estate Image 18 [ONLINE]. Available at: <https://www.flickr.com/photos/139555361@No8/39260445824/in/album-72157689917356882/> [Accessed 1 December 2019]

## Figure 14. Queen Caroline Estate, London

Susdrain (2016), Queen Caroline Estate Image 18 [ONLINE]. Available at: <https://www.flickr.com/photos/139555361@No8/39260445824/in/album-72157689917356882/> [Accessed 1 December 2019]

## Figure 15. Rain garden planting, Sheffield | Sheffield City Council

Image courtesy of Sheffield City Council.[taken. n.d.]

## Figure 16. Greener Gangetown Rain Garden Planting | Arup

Arup. 2020. Available online: <https://my.landscapeinstitute.org/case-study/greener-grangetown/6ebfbcae-c8e5-e911-a812-00224801c242>