



A 'How to' Guide

# Play with Rainwater and Sustainable Drainage



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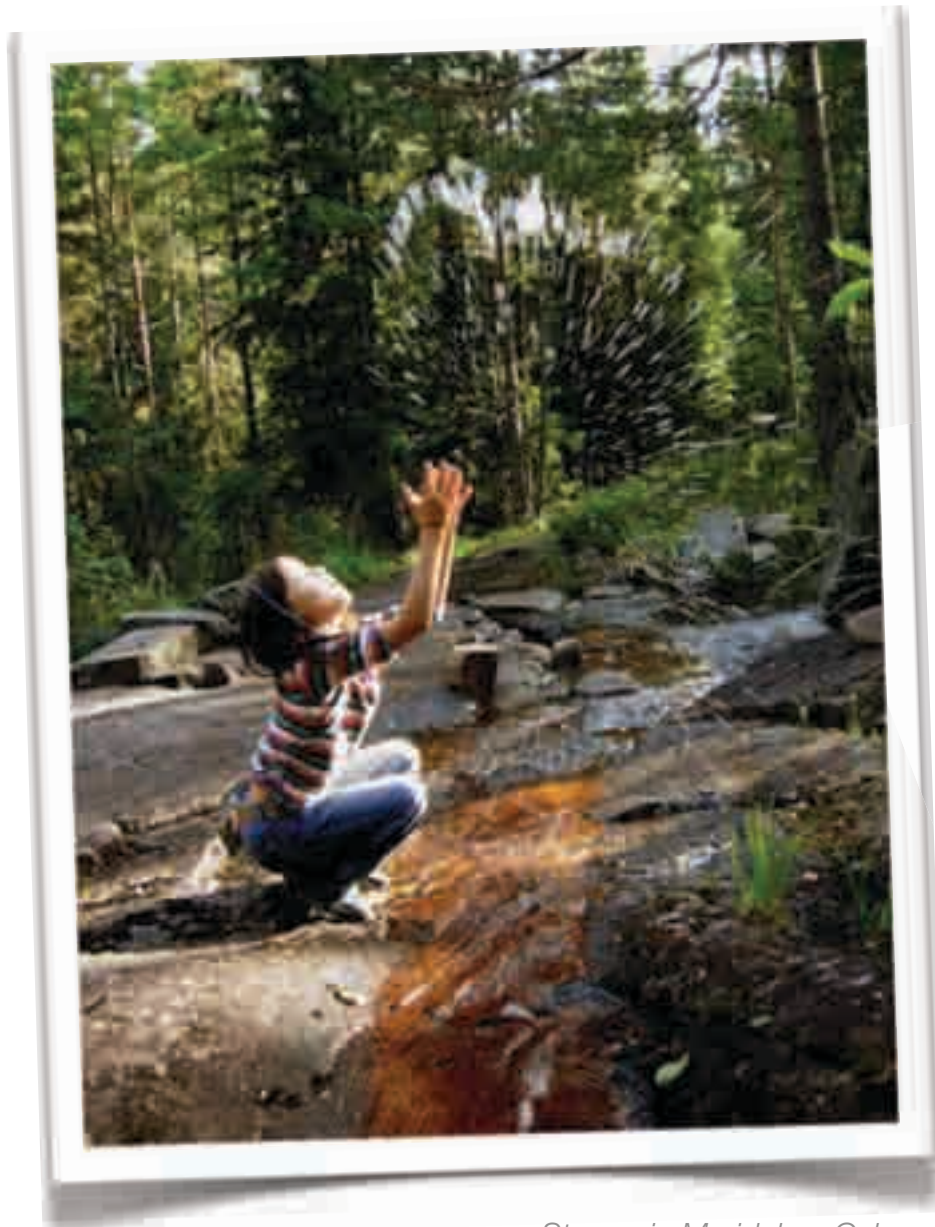
*Stream in Maridalen, Oslo  
Image credit: Frode Svane*

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*"Water offers endless opportunities to explore. It attracts children of all ages to act, to find out what happens if ..."*

Landscapes for Learning; Sharon Stine



*Stream in Maridalen, Oslo  
Image credit: Frode Svane*

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## Introduction

The urban landscape hides processes of daily life so well that the city has become a powerful alternative environment from rural nature. Streets paved with gold allure many to make their fortunes. However, it is nothing more than a gilt surface, hiding beneath it nature's true life and energy, living and breathing below us.

Few will find time to wonder how nature is working to support us in this concrete body amidst the thrall, noise and bustle of our streets. Many of our children are unaware water is actually the lifeblood of our planet. Even less would think that water was sacred. Our effluent is miraculously diverted away, flushed with clean drinking water. Unseen it travels to processing plants and discharged to the sea. And all the while the taps continuously flow with clean water.

Some regions of the UK have ample rainfall, but mains water in London is both scarce and costly. Therefore London Play have commissioned this report to investigate:

- HOW TO enhance children's play using rainwater: demonstrating what can be achieved safely and practically using rainwater in children's play
- 
- HOW TO provide environmental education: demonstrating the potential for educating our children through the responsible care and management of rainwater using SUDS

How beneficial it must be for children to experience above ground what is happening to water, how it flows and sparkles, finds its own level and runs downhill?

How beneficial it must be to design environments that can use rainwater to support lush and luxuriant plant habitats not normally sustainable in an arid, gully-ridden street?

Planet Earth Ltd have been using rainwater in children's play for over 16 years. We have re-visited some of our early projects to see how they have endured and collected information from other sources to find out lessons that can be learned for others.

# The Benefits of Using Rainwater and Incorporating SUDS for Play

Children love playing with water. It can intrigue and captivate imagination, it can offer a sense of freedom and exhilaration. It's fluidity also presents opportunities for children to play creatively of their own accord. Increasingly water play opportunities are incorporated into urban schemes. However the most common route has been through the use of mains fed features such as jets, fountains or paddling pools.

Mains water in London is an expensive and unsustainable resource. Mains fed features also tend to be seasonal and predictable, simply spraying or wetting children during the summer months. Mains fed water can be useful for 'water on demand' play situations, however using rainwater and incorporating SUDS for play offers more diverse opportunities. It can also be simple, cost effective and easy to implement.

## **BENEFITS OF USING RAINWATER AND INCORPORATING SUDS FOR PLAY:**

- LOWER COST lower maintenance opportunities for play with water
- MORE NATURAL and attractive play opportunities to support positive mental health and build resilience to adversity
- MORE INNOVATIVE opportunities for play with water
- EDUCATING CHILDREN about the processes of rainfall and sustainable usage
- ENHANCED BIODIVERSITY in the city that allow children to interact with and learn about wildlife
- ENVIRONMENTALLY RESPONSIBLE design practice



# Understanding SUDS

Incorporating SUDS into new urban schemes can reduce flood risk, prevent pollution to our rivers and fight the effects of climate change. At the same time it can offer more attractive, natural and watery places that enhance biodiversity.

In conventional drainage systems water is collected and conveyed away from where it falls as quickly as possible, causing flooding when the drainage system cannot cope with the large volumes of water entering it or if it is blocked. This can also cause sewer overflows containing foul waste which create a range of additional problems.

A cocktail of oils, sediments, spillage, animal droppings, herbicides, pesticides, road cleaning chemicals and debris picked up from urban surfaces is washed into the drainage system and then directly to streams or treatment works. In times of low flow this causes severe pollution of streams, while in times of high flow streams are damaged through erosion or silt build up.

## **SUDS AIMS TO:**

- slow the flow of water and it's eventual return to streams and rivers thus reducing flood risk
- cleanse and improve the quality of water removing pollution before it eventually returns to streams and rivers

SUDS does this by mimicking the way nature controls water in the landscape. It is helpful to think about the journey of rainfall as part of 'the water cycle', leaving the sky and making its way through the landscape on its way back to the sea.

While it is with us we can observe it on its journey from our roofs and pavements through a series of 'stages' before it leaves us for the stream or sewer and eventually the River Thames. This is done by intercepting rain through natural features that can both store or slow the flow of water whilst cleansing and removing pollutants at the same time. This could be through the use of gravels or soils, vegetation, wetlands, swales or other features.

There are two main aspects to SUDS which are vital to its success:

### **Source Control**

Prevent pollution of rainwater by collecting runoff from surfaces as soon as possible after it rains.

### **Management Train**

Water must flow through a series of SUDS features which slow the flow of water whilst cleansing away any silt or pollutants. It is sometimes possible to cleanse the runoff immediately at source through the use of green roofs or permeable pavements. If not it should be directed through SUDS features such as vegetation or gravel filters.



*Spout from Rainwater Harvesting at Red Hill School, Worcester  
Image credit: Bob Bray Associates*

# How to use Rainwater and Incorporate SUDS for Play

**The way in which rainwater can be incorporated for play is dependent upon it's quality, use and perception for use.**

Rainwater, particularly in urban areas, contains atmospheric pollution and picks up contamination as it flows over hard surfaces. Although reasonably clean in many places, play with rainfall should discourage drinking or complete soaking of children. Instead, design should aim to enliven the ephemeral, intermittent and special character of rainfall.

Various scenarios and ways in which to incorporate play and learning are discussed in the following pages:

## Enjoying Rain as it Falls to Earth

Rainwater can be collected in visually exciting ways through the use of:

- Spouts
- Rain chains
- Cascades
- Gutters
- Channels or rills along the ground



*Channelling Rainwater at Orange Park, Westminster  
Image credit: Planet Earth Ltd*





*Collecting Runoff from Roofs at Fort Royal School, Worcester  
Image credit: Bob Bray*

These features provide an opportunity to touch or splash in water as it flows to its first resting place on its journey to the sea.

These initial rain collectors only contain water briefly when it rains and introduce children to the unpredictable effects of rainfall and the fascinating ways it can begin its journey through the landscape. The water is safe for splashing, jumping and hand play as long as it is not swallowed. This is largely because the water has not had time to develop pathogens or go stagnant when it has picked up pollution.

### **Preparing Water for Permanent Play in Open Water Features**

Rainfall used further for play and learning should be reasonably clean to reduce health risks, whilst addressing process of SUDS. This also provides opportunities for amenity and wildlife and for slowed release to the drainage system.

Collected runoff should not flow directly from a pipe, gutter rill etc to a more permanent water feature without passing through at least one cleaning stage. This is the first stage in delivery of a SUDS solution to a site and part of the 'Source Control' mentioned earlier in the report.

It should pass through a filter to remove the majority of silt and pollution from the water. Runoff from roads may need 2 stages of treatment to make sure it is clean enough for use.

The collected run off can be cleaned in a variety of interesting ways:

- Passing through vegetation; grass verges, swales etc
- Passing through a gravel trench or soil filter

- Passing through a permeable pavement

These cleaning techniques can offer opportunities for children to understand about urban drainage issues and experience first hand the waters journey above ground.

Many new developments in London now use permeable surfaces or other landscape features to collect, clean and store water before it leaves the site. Further information can be found in 'Promoting Sustainable Drainage Systems' on the Islington Borough Council website.

### **Storing Water at the Surface for Play and Wildlife**

Water can be temporarily stored to create new play opportunities whilst relieving the immediate and wider area of flood risk.

Simple 'source control' measures remove most of the contaminants from water as it passes through vegetation or crushed stone filters providing relatively clean water for play.

Where water is stored on the surface in pools or wetlands then the combination of initial filtering, sunlight to kill bacteria and regular flushing through with fresh rainwater will keep the water in good condition for play and wildlife.



*Stream into Movatn North, Oslo  
Image credit: Frode Svan*

Ways in which surface water can be temporarily stored:

- Attenuation ponds
- Splash pools
- Shallow flooded landscape space
- Wetlands
- Temporary storage tanks

Simple shallow splash pools need no maintenance or filtration and can be easily built.



*Snow Melting at Kindergarden, Oslo  
Image credit: Frode Svan*

Features can be designed in conjunction with these water storage facilities to further enhance the play experience such as:

- Bridges
- Stepping Stones
- Platforms
- Hand and solar powered pumps

Activities can be encouraged around these features to encourage play and learning such as:

- Wading and paddling
- Learning about wildlife
- Riding bikes and scooters through shallow water
- Playing with buckets and containers
- Splashing and water fights
- Mixing with sand



*Camley Street Nature Reserve, London Wildlife Trust  
Image credit: Francesca McCready*

### Releasing Water

Cleaned and temporarily stored rainwater water can be controlled or released through the use of:

- Dams
- Streams and rivers
- Channels and rills
- Pumps



*Dam Holders in Sand and Water at Flaming Grundschole, Berlin  
Image credits: Frode Svane*



## Storing Rainwater Below Ground for Re-Use

Run off can be captured from buildings and surfaces and stored underground in storage facilities for re-use.

It may be that water can be stored and then pumped back up for play using hand or solar powered pumps or even feed into fountains, jets or other interesting features.

However, storing rainfall below ground is usually for reuse as non-potable water for purposes such as watering plants, toilet flushing or washing purposes. Water stored in pipes and tanks can develop pathogens, particularly in warm weather. Therefore it must be considered that there is a greater risk for contamination when storing water in tanks for longer periods of time. Also, public perception of features such as pumps, fountains, or jets is that water is potable and safe.

Therefore, a UV sterilisation system must be installed to treat the rainwater so that it becomes potable and provides confidence of a clean water source. However, this assurance also relies on regular maintenance and ongoing replacement of the UV light source. A rain harvesting specialist should therefore be consulted to ensure confidence in this source of water for play and regular maintenance must be committed to.

Examples and advice on underground storage tanks and UV sterilisation can be found at:

[www.rainharvesting.co.uk](http://www.rainharvesting.co.uk)

Potable water from the mains may offer a better solution to many 'water on demand' situations.

It may be possible to look at combining the use of underground stored and treated rain water systems with mains top-up to keep play features working in dry periods. However, these should be carefully designed ensuring backflow protection is provided.





## **Sand and Water**

Rainwater moving through the landscape and cleansed through the SUDS process could be channelled or directed into sand.

It may also be possible to release water directly into sand pumped up from an underground storage tank.

Gravel pits and soakaways can be located underneath sandpits to enable water to slowly drain through the sand and back to the water table.

# Health and Safety

The benefits of water play generally outweigh any incidental physical dangers. However in addition to hygiene and water quality, other health and safety issues should be also addressed.

## Hygiene

### Playing with Rainfall in the Landscape

A summary of the key points explained in the previous pages of this report are as follows:

#### **KEY CHECKS FOR RAINWATER PLAY IN THE LANDSCAPE**

- ✓ Rainwater can be captured in interesting ways immediately after it falls. This water is likely to contain contaminants and so play opportunities only arise as it is raining and do not encourage drinking or sustained contact by children.
- ✓ If rainwater is to offer further intermittent play opportunities for slightly longer periods of time after it has rained the water must be cleansed at least once using SUDS cleansing measures such as gravel filters or vegetation filters. If run off is captured from busy roads it must go through at least two cleaning stages before it is suitable for play.

### Harvesting Rainwater

Specific advice from the Water Management Society regarding rainwater harvesting is as follows:

*The collection and storage facility should be designed and constructed to be fit for purpose and should include all appropriate features to guard against undue risk: the WMSoc is not able to comment on matters such as structural strength, precautions against drowning, safe access etc, but would point out that any mains water supply*

which may be installed, for example to ensure continuity of supply in dry spells, must be configured with backflow protection in accordance with the Water Supply (Water Fittings) Regulations 1999.

The stored water is certain to contain some foreign material from the catchment surfaces and this could include guano, plant and animal remains; legionella has also been identified in harvested rainwater. It is therefore a requirement of the Control of Substances Hazardous to Health Regulations 2002 to carry out a suitable and sufficient assessment of the risks constituted by any potentially pathogenic microbes in the context of the installation and its mode of operation. This assessment must be by a competent individual and where this competence is not available within an organisation, it must be obtained from an outside source.

A suitable and sufficient risk assessment would identify risks and assign to each a degree of seriousness which takes account of the severity and likelihood and would also identify means of preventing or controlling the risks so that a scheme of precautions could be drawn up and implemented to ensure that all reasonably practicable steps are taken to protect the health safety and welfare of anyone who could be affected by the installation.

## **The Water Management Society June 2009**

A summary of the key points is as follows:

### **KEY CHECKS WHEN STORING WATER UNDERGROUND AND RE-USING FOR PLAY**

- ✓ Consult a rain harvesting specialist
- ✓ Install and regularly replace a UV filter system
- ✓ Conduct regular risk assessments
- ✓ Ensure regular maintenance
- ✓ Ensure backflow protection if combining with mains water supply
- ✓ Ensure structural stability
- ✓ Ensure the storage tank is at the correct depth to obtain the water pressure required for pumping back up

## Drowning

Careful design to 'manage' risk associated with water is essential. Risks must be assessed individually to each situation.

### Specific advice from the HSE regarding splash pools is:

*Shallow splash pools are not considered hazardous by the HSE, their 2005 press release on paddling pools says: - "We recognise the benefits to children's development of play, which necessarily involves some risk, and this shouldn't be sacrificed in the pursuit of the unachievable goal of absolute safety." [www.hse.gov.uk/press/2005/e05005.htm](http://www.hse.gov.uk/press/2005/e05005.htm)*

### General advice regarding risks of drowning is as follows:

- ✓ Shallow water is generally no more than 600mm and would not need to be fenced
- ✓ Deeper water may require toddler proof fences to 600-750mm but generally no high fences
- ✓ No steep or vertical edges to water unless something like a raised pond
- ✓ Level dry and wet benches before entry into water can be used
- ✓ Easy entry into and out of water

### Structural Integrity

Features must be structurally sound for use. Factors such as vandalism or misuse, durability of materials and ongoing maintenance must be taken into account.

### Slip Resistance of Ceramics

Case studies by Planet Earth show the use of colourful ceramic tiles on rainwater channels. Two thirds of any surface that may be walked on must use tiles with slip resistance.

### Client Expectations

Care should be taken to ensure multi-department clients are fully aware about what to expect. A rainwater splash pool on one of our projects was considered unsightly by the Parks Department. They subsequently decided to install bedding plants in it, defeating the original purpose.

## Other Practical Considerations

Important practical considerations to ensure safe and responsible practice need to be taken into account early on in the design and planning process.

### Public access and use

Public access and use must be considered when designing systems for play with rainwater and SUDS. For example a public park or open space will face different constraints than a school playground. Responsibility for the site and levels of supervision will be different. Education of users may also need to be considered. In a public park signs may be the only method to educate users about health and safety risks or how to use the play system or feature, whereas in a school training sessions can take place if necessary.

### Management and Maintenance

The capacity to manage or maintain the play system or feature is another important consideration which may influence the design. Normal landscape techniques can deal with nearly all surface SUDS features and are usually litter removal, vegetation or grass cutting with additional checking of surface control structures.

However for some features such as tanks, pumps etc, there may be requirements such as regular rinsing, checking, testing of water quality.

Each system or feature will have its own needs but care can be undertaken by site staff, caretakers or even volunteers.

### Regulations

The idea of managing rainwater on the surface in cities is relatively new but is promoted by the Environment Agency and recommended by Government through PPS 25: Development and Flood Risk. Many Local Authorities e.g. Islington Borough Council now actively promote SUDS. The new Flooding and Water Bill will further enhance the use of SUDS.

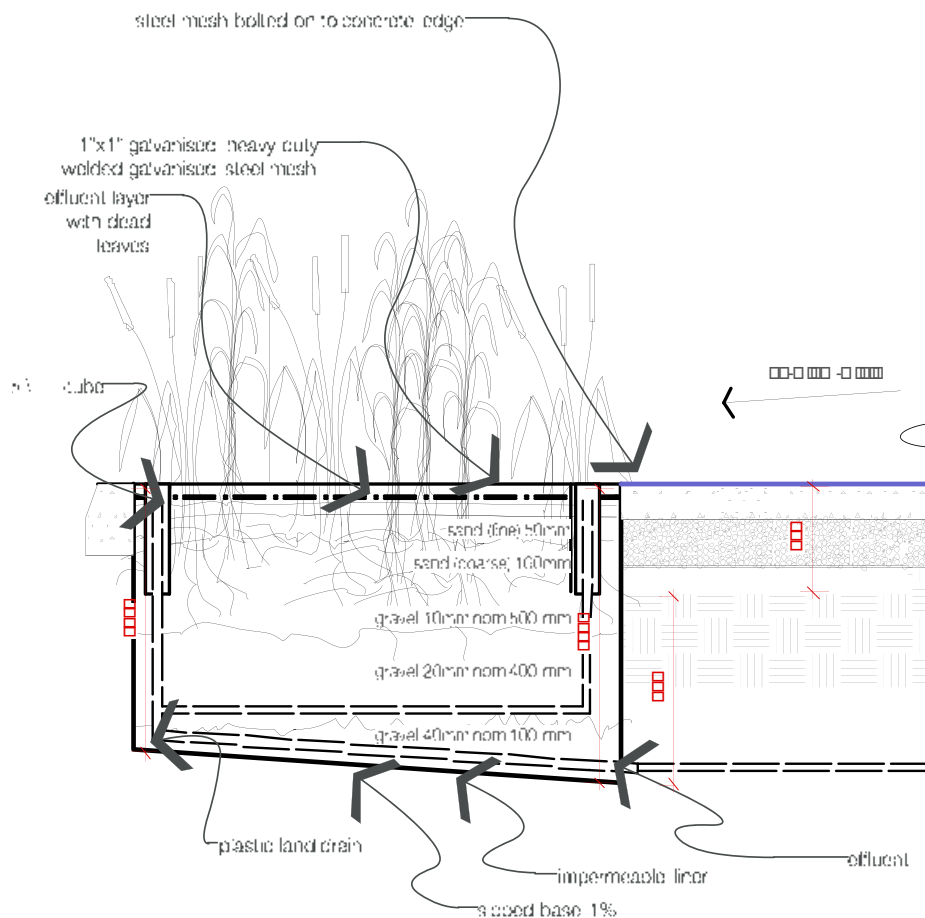
Compliance with drainage by-laws must be checked with the local authority and establishment of any other specific requirements they may have.



# Costs

Generally costs over conventional drainage are less when water is kept on the surface and used. Run off from the urban landscape has to be managed and so when this is integrated in site design at the beginning it is nearly always less than conventional drainage.

Otherwise the costs are design dependent. Budget should be allowed for decorating channels and for specialist items such as hand pumps or water spouts and chutes. Additional consultation may also be required. It is possible to provide water features using recycled materials and a very 'low tech approach' which is not possible with conventional drainage. The use of pre-fabricated systems will be more expensive. Maintenance costs must also be considered and whether these can be met.



*Reedbed Construction Drawing  
Image credit: Planet Earth Ltd*

## Case Studies

### **Planet Earth Ltd, Orange Park in the City of Westminster, London**

Planet Earth designed an alternative playground using minimal play equipment. Building from a derelict site in a dense urban area, the practice designed a playground built around a fractal pattern of river channels. Like leaf veins, the colourful ceramic decorated concrete channels stem outward and diversify, leading this way and that, between hills and under bridges.

In rainfall, the rivers capture and channel the rainwater, allowing children to chase, hop and splash in the water until it eventually reaches planting beds with integrated soakaways.



*Rainwater Channeling, Orange Park, London  
Image credits: Planet Earth Ltd*

**Planet Earth Ltd, Argyle School, Camden, London**

At Argyle School, Planet Earth designed a ceramic surface water-system that collected rain water from roofs. Using a hand pump, the children could pump water into the channels and watch it collect in their very own pond with frogs and water plants.



*Rainwater Harvesting, Argyle School, Camden  
Image credits: Planet Earth Ltd*



**Planet Earth Ltd, Sherington School, Greenwich, London**

At Sherington School Planet Earth designed the playground to allow the surface water to meander across 60 metres of school tarmacadum playground surface, breaking a colourful swathe in the blackness. Down it flows, through a wall where it drops from the copper-tongued mouth of a tiger and on along further channels to a boulder-strewn, delightfully boggy wetland with lush biodiversity.



*Capturing Rainwater, Sherington School, Greenwich  
Image credits: Planet Earth Ltd*

## **Planet Earth Ltd, St Mary's Frobisher Park, Peckham, London**

Planet Earth have been transforming this declining pocket park into a playful, magical semi- wooded landscape. Lush woodland planting surrounds a colourful river channel. The river source starts at the 'rocky mountain area' a high point at the back of the site and flows down along the natural levels into a reedbed in the river 'delta' area. In heavy rainfall children will be able to enjoy chasing rainwater running along the river channel and through the site. The reedbed has been given an extra safety precaution to satisfy the local council's peace of mind using steel mesh hidden beneath the reeds that is bolted to the surrounding concrete.



*Capturing Rainwater at St Mary's Frobisher Park, Peckham  
Image credits: Planet Earth Ltd*



## Groundwork, King George's Field Playscape, Hanwell, West London

This innovative design rejects preconceived notions of a playground in favour of a more natural approach to play. All rain water is taken up in grassy mounds, planting beds and sand surface areas. No water is directed to surface water drains. There is no rubber play surfacing on site, and self-binding gravel was used instead of tarmac. There is a main fed water play area whereby the run off is then collected in a hidden french drain and channelled into nearby planting beds.



*Integration of SUDS Methods, King Georges Field Playscape, Hanwell  
Image credits: Groundwork London*

### **Bob Bray, Red Hill School, Worcester**

The runoff from the school is dealt with in different ways. Car park runoff is collected, cleaned and stored in permeable block paving. Playground, roof and access road runoff flows across filter strips or through swales before it enters a swale maze used as an outdoor teaching and play area by the school. The swale maze is usually dry with some water in the swales after heavy rain and the basin fills in exceptional storms providing protection to people and property downstream.



*Playing and Learning in a Swale Maze, Red Hill School, Worcester  
Image credits: Bob Bray Associates*

## Fort Royal School, Worcester

This is a special school with many different needs. Runoff from the upper car park is cleaned through a permeable pavement and released through a rain chain. Open rills carry water through a small courtyard and sett channels take water to the school green space. A formal pond with a glass window allows pupils to look into the pond safely. A habitat pond will allow pond dipping and act as a home for wildlife with balance beams over water and access to moving water provide further understanding of what happens when it rains



*Demonstrating SUDS for Play and Learning, Fort Royal School, Worcester  
Image credits: Bob Bray Associates*



## Springhill Housing, Stroud

This is a housing site where water is visible and contributes to the landscape in every possible way including:

- Rills and open channels
- Cascades of water down a tile faced retaining wall
- A small raised formal pool
- A detention basin that is multifunctional for informal play when it does not need to store water

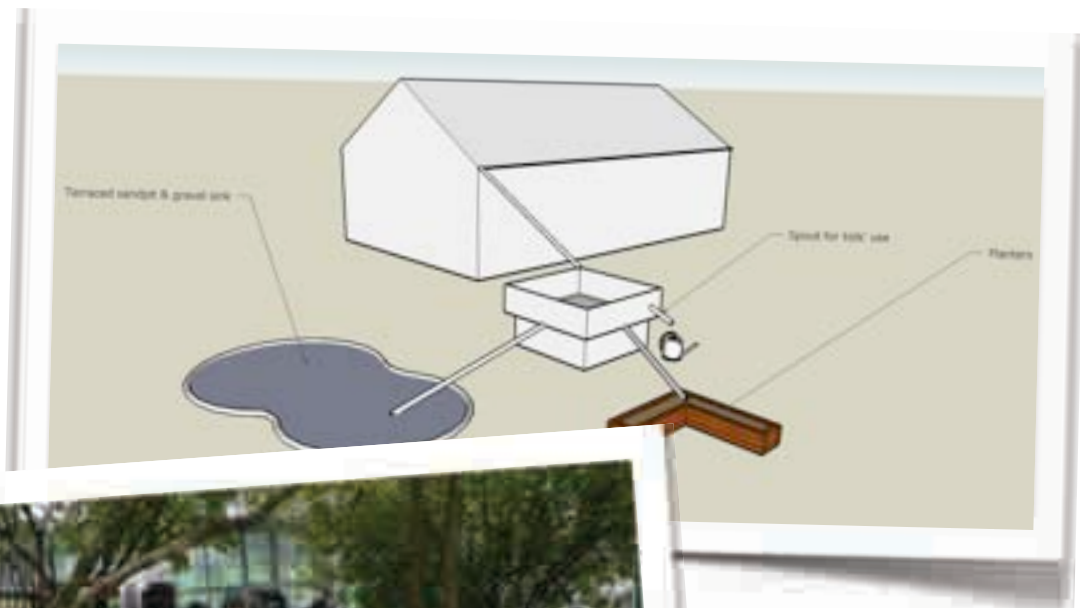


*Integrating SUDS with Play, Stroud  
Image credits: Bob Bray Associates*

## Islington Play Association, Proposal for Water and Sandpit at Toffee Park, Islington, London

The schematic diagram shown covers the initial ideas and a general principle for a sand and water pit fed by run off from a nearby building. The filtration (cleaning) stage is missing from the diagram. This would need to take place before the water reaches the storage tank that would hold rainwater temporarily after it has rained. The tank would need regular checking and cleaning to ensure water safety. Storage of cleansed rainwater could be for no more than a few days to prevent bacteria build up.

The sandpit will feature terraces for children to create their own streams and channels, much like the example shown which is at Paradise Park. A gravel soakaway is constructed under the surface for the water to drain away slowly to the water table.



*Integrating SUDS with Play, Islington  
Image credits: Islington Play Association*



# Credits

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