JOHN BURNS PRIMARY SCHOOL

STAGE 2 REPORT

MARCH 2021

ADAPTATION FOR CLIMATE RESILIENCE

version 1.0_Client sign off

Giving our best · JOHN BURNS · Achieving our highest

Green Infrastructure consultancy

GROUNDWORK CHANGING PLACES CHANGING LIVES

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1.0 INTRODUCTION

1.1 John Burns Primary School

John Burns is a single-form entry community school, grant-aided by Wandsworth Borough Council. The school has 220 pupils on their roll, running from nursery age through to Year 6. The area served by the school has a rich cultural diversity, with many pupils joining the school speaking little or no English. Almost half of the pupils are eligible for free school meals.

John Burns is a “good” school according to Ofsted’s last report in January 2018, with an aspiration to move onto ‘Outstanding’ when the school is next assessed. John Burns was in the top 3% of schools in England for progress to Year 6 for maths, reading and writing combined in the 2018/2019 SATs results.

The Governors are ambitious for the school and will support our staff so that:

“Every child can give their best and achieve their highest”

John Burns Primary School motto

1.2 Climate Change impacts at John Burns Primary

John Burns, like many schools of its era, has not been built with suitable measures for climate adaptation, or energy efficiency. For example, there have been significant issues with internal building temperatures during recent heatwaves, such as in May 2018:

Classroom teacher 1:

“The impact on the children is lethargy, sweating, continual thirst and low level feelings of sickness from the heat and stuffiness of the room.”

“I have noticed an understandable dip in presentation, spelling and accuracy across the curriculum.”

Classroom teacher 2:

“When I come into school in the morning, my classroom is already boiling, even though the windows, door and fan is already on by the time I get into school for 7am.

“The children are struggling to focus in class, with many feeling very unwell. We of course fill up the water jug regularly, however I know I am experiencing increased headaches and feelings of discomfort, so I can only imagine how the children are feeling. This makes it hard to encourage the children to work effectively.”

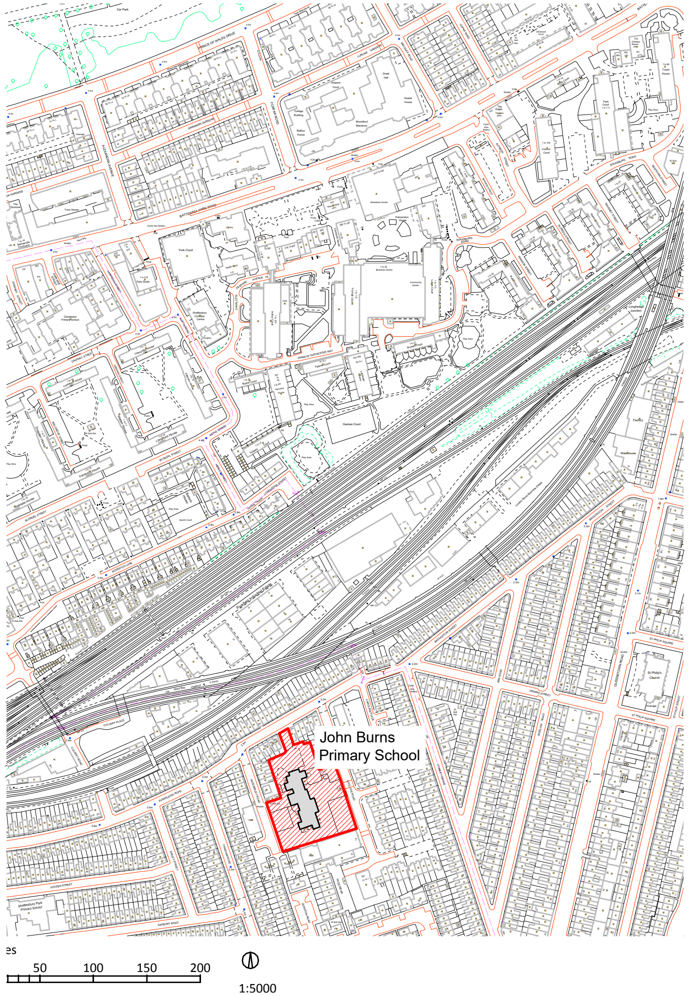


Image 1. *John Burns Primary School is located in a densely built up part of Wandsworth, London*

As a repsonse to these problems, the school has identified an opportunity to undertake a whole school climate change etrofit to improve its environmental performance, and improve the interior and exterior of the school to create an improved educational facility.

The school has appointed Groundwork London and the Green Infrastructure Consultancy to undertake feasibility and options appraisals to assess the options available to school. The main interventions at this stage are as follows:

- Bio-solar roofs
- Green roofs
- Solar-Pagodas
- Sustainable Drainage Systems (SuDS)

A number of actions have already been undertaken, including securing funding from various sources such as the Greater London Authority, the Department for Education, and Thames Water, to deliver feasibilily work, audits and reporting. Smart meters will shortly be installed, and temperature sensors have been installed in key working spaces to track the internal temperatures.

The school also has a clear intention of creating a template that might be folowed by other schools which suffer from the same or similar problems.

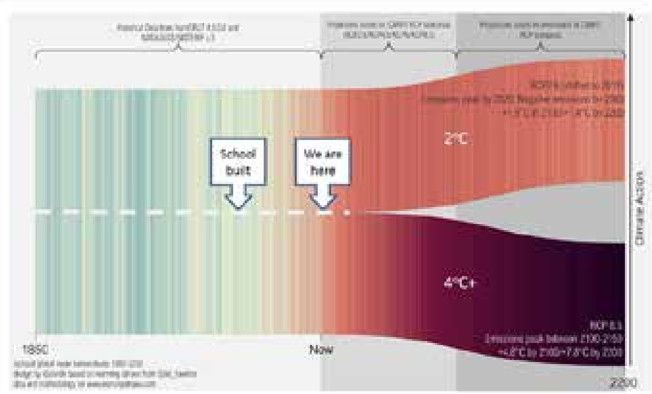


Image 2. *Global temperatures since the school was built have increased significantly and are expected to become greater still in future*

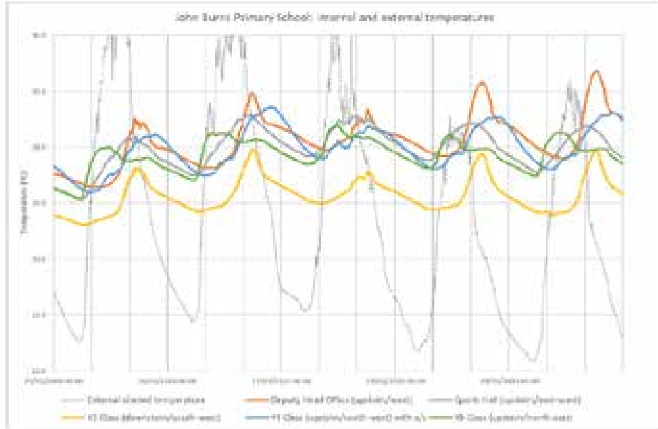


Image 3. *During a warm run of days in May 2020, upstairs rooms never drop below 24 degrees, and they can reach over 30 degrees during the day.*

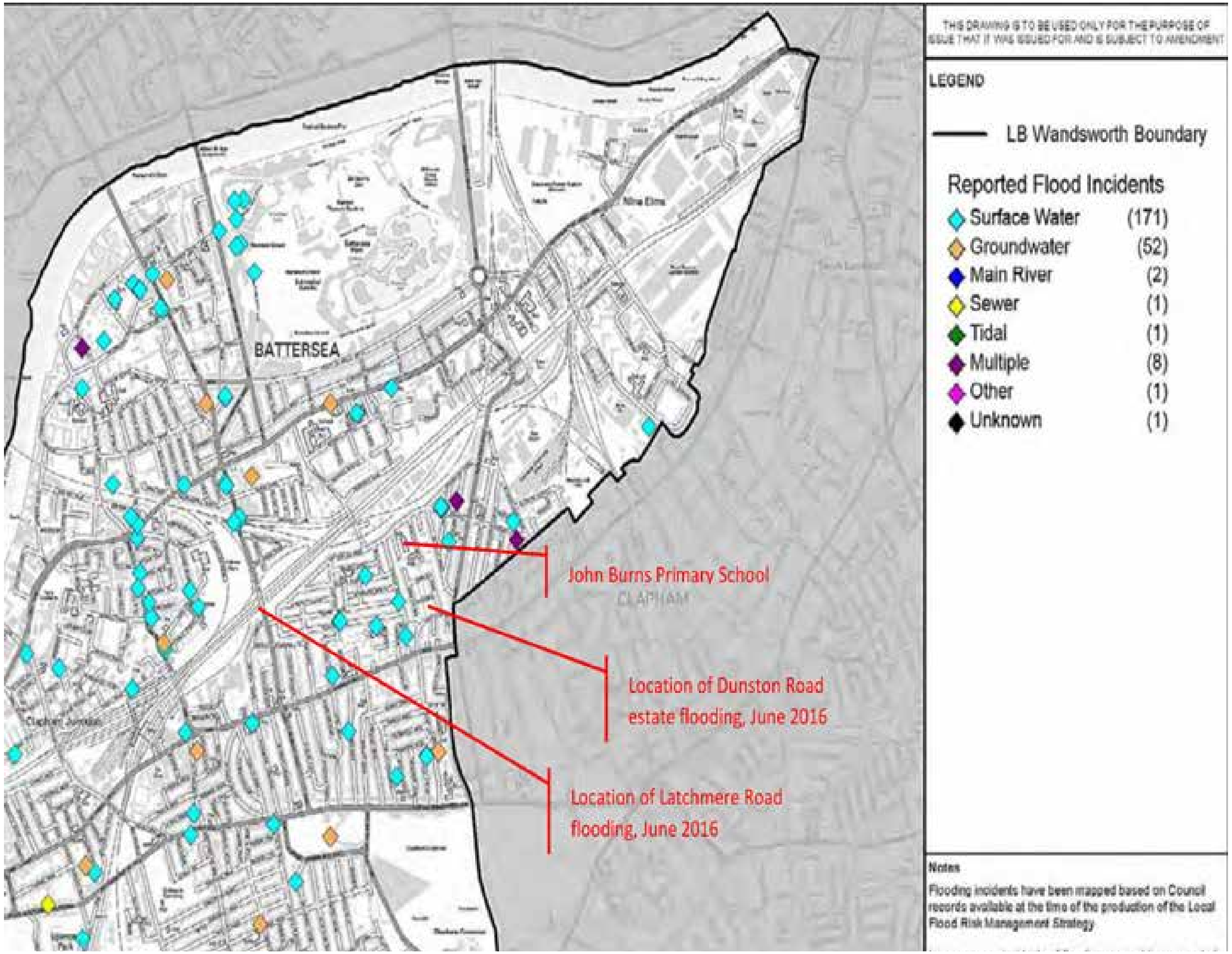
Flood Risk assessment extracts:

The majority of the London Borough of Wandsworth is served by a combined sewer system and it is thought that many parts of the system are only designed to accommodate a rainfall event with a 1 in 15 probability of occurrence in any given year.

In many locations, this has decreased due to urbanisation and cross-connection and, as such, it is likely that the sewers across the London Borough of Wandsworth will have varying standards of capacities, particularly in the north of the Borough

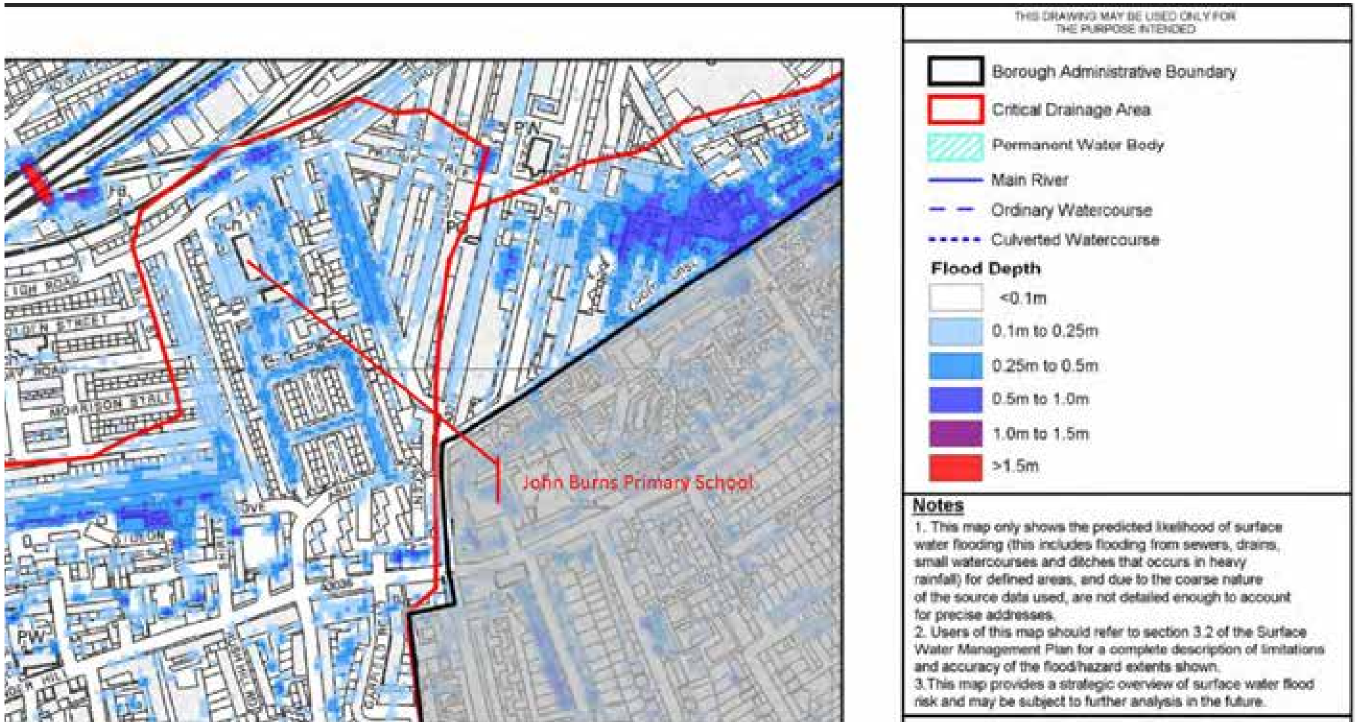
The three images to the right show flooding of the Dunston Road estate, immediately south of John Burns School, June 2016 (source). Flooding of Latchmere Road , to the west of John Burns School (source). The map on the following page shows their location in proximity to the school.

This map shows that floods have affected the streets and housing estates immediately surrounding John Burns Primary School in recent years.



The areas at greatest risk within Wandsworth have been identified as Critical Drainage Areas (CDAs) or flooding hotspots. Thirteen CDAs have been identified across Wandsworth. The area surrounding John Burns School has been classified by Wandsworth Borough Council as a Critical Drainage Area (CDA 0023, 'Lavender Hill')

The map to the right shows the surface water flood depth assessment for north-east Wandsworth within the CDA.



John Burns Primary School, together with the surrounding streets of Wycliffe Road and Dunston Road, is named as at risk within the description of Critical Drainage Area 23 of Wandsworth Borough Council's Surface Water Management Plan

The information presented within the SWMP highlights the wards of Balham, Thamesfield, and Latchmere as having also experienced a greater number of sewer flooding incidents than the rest of the Borough. Sewer flooding is caused by periods of heavy rainfall overwhelming sewer capacities, discharging a mixture of rainwater and untreated sewage into properties and surrounding areas

CDA:Group7 023 (Lavender Hill)	
London Borough:	London Borough of Wandsworth (Lead)
Flood Risk Categorisation:	Surface Water and Sewer
Description:	• Surface water is this CDA flows from south to north, away from Clapham Common. There is some ponding of water to the south of the railway underpass, Elsley Road, Dunston Road and Wycliffe Road; which are all close to schools. • The east of the CDA contains an area of iPEG in permeable superficial deposits.
Critical Infrastructure:	• Lavender Hill Police Station • Elsley School • John Burns Primary School • Stormont Health Clinic
Property Count:	• 2,925 residential and 388 non-residential properties flood to a depth >0.03m • 23 residential and 4 non-residential properties flood to a depth >0.5m
Validation:	• There are records of Elsley School flooding on 20th July 2007. The school was flooded and pupils were evacuated. Floor coverings, skirting and contaminated low-level timber was removed and duct covers lifted. Substantial damage to fittings. There are also records of flooding in Tyneham Close Estate following heavy rain. • There are two recorded incidents of groundwater flooding in the CDA. • There are over 50 sewer flooding incidents within the wider postcode areas, in which the CDA is located.
Local Flood Risk Zones:	• **North of Lavender Hill Road** – pluvial modelling and historic flooding records show that properties to the north of Lavender Hill Road are more susceptible to surface water flooding following heavy rainfall, due mainly to local topography.
Figure 3.8.10a - Group7_023 (Lavender Hill) - Surface Water Flood Depth (1% AEP)	

1.3 Project aims and objectives

Aims	Objectives
Secure funding for capital works	- Design the works to various funder requriements, CIRIA's B£st assessment tool and specific design requirements of Thames Water - Pool resources with other capital works such as replacing waterproofing on the school roof
Create a better learning environment	- Create spaces which increase pupil access to nature and a more stimulating and accessible learning environment
Increase John Burns's resilience to the impacts of climate change	- Design SuDS that will reduce the volume and flows of surface water entering the storm sewer network - Reduce the risk of flooding to the school and local properties - Integrate PV technology into design solutions such as outdoor learning spaces
Provide a template for other schools to follow	- Design in opportunities for improved recreation, amenity and biodiversity in the school - Design with replicable solutions that provide an attractive option for other schools to follow

1.4 The Four Pillars

Sustainable urban Drainage Systems (SuDS) are an ideal solution to begin thinking about how the outdoor environment, and in particular schools, can be re-designed and improved. They provide far more benefits than just reducing flood risk. Whilst this is of course a significant aspect of their use, there are other multifunctional benefits that they will bring to any project. At their core, well designed SuDS will maximise these benefits as laid out in the Four Pillars, shown here. By mimicking natural systems, their benefits far exceed those of many traditional drainage schemes which promote fast conveyance of surface water to closed systems of largely hidden pipework. This increases SuDS importance as a solution to tackle urban (and suburban and rural) climate change impacts, as they provide a far wider solution than this simple conveyance and attenuation of surface water flows. They have been proven to provide an important contribution to our quality of life and wellbeing, as well as that of the planet.

1.5 SuDS: The management chain

Like many urban schools John Burns Primary School has a majority of impermeable hard surfacing, flat roof system, shelters and canopies, meaning surface water runs straight into the local combined sewer. In addition to this, drainage blockages as well as other factors such as ground sinkage, tree root damage, and changes of use such as installation of play equipment or fences, have led to puddling in key areas and disruptions to the flow of water.

How we manage water in the built environment is evolving, and it is changing in ways that largely imitate what happens in the natural environment. SuDS manages surface water runoff by capturing, using, absorbing, storing and transporting rainfall, slowing the flow and reducing the amount of rainfall that drains into sewers, streams and rivers. Used effectively SuDS can also treat and reduce pollutants that occur in runoff, increase biodiversity and habitat, and create, both stimulating and tranquil, sensory green and pleasant spaces.

The soft-landscape focussed SuDS system diverts existing overland flows from impermeable surfaces, channelling it through a series of features aimed at treating/conveying/storing the water before releasing it at a controlled rate back to existing below ground drainage and sewerage networks.

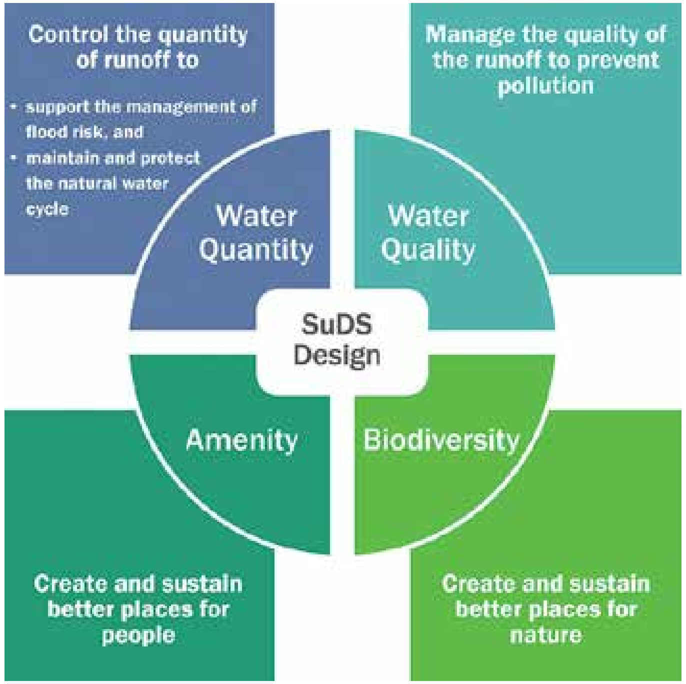


Image 4. *The four pillars of SuDS introduces the idea of multi-functionality and intersectional social and environmental benefits. See CIRIA for more information*

1. COLLECTION

2. FILTRATION

3.CONVEYANCE

Image (group) 5. *SuDS management chain processes*

Collection

Water is collected from existing impermeable surfaces (such as roofs or asphalt playground surfaces), either via existing downpipes, or by placing SuDS in locations that intercept surface water flows. This allows the design to work with as much surface water as possible, increasing benefits and reducing negative impacts of flooding.

Filtration

Surface water can contain some pollutants and particulates. SuDS incorporate features that filter and break these down. SuDS also allow water to infiltrate back into groundwater and recharge aquifers.

Conveyance

Surface water is directed across overground channels where water needs to move to the next SuDS element. This is achieved using landscaped channels, or by directing sheet flow over a surface to another collection point/filtration strip. Slowing conveyance between elements promotes infiltration and reduces flood risk.

4. DETENTION

Detention

Basins and rain gardens can also ‘hold back’ surface water, further slowing the flow and allowing more time for infiltration (where this is possible), absorption and evapotranspiration.

These elements are usually empty of any water, only filling to carefully controlled depths in the event of rain, which if exceeded allows flows to move quickly to the next part of the management chain, or is then released back into the main drainage system.

5. RELEASE

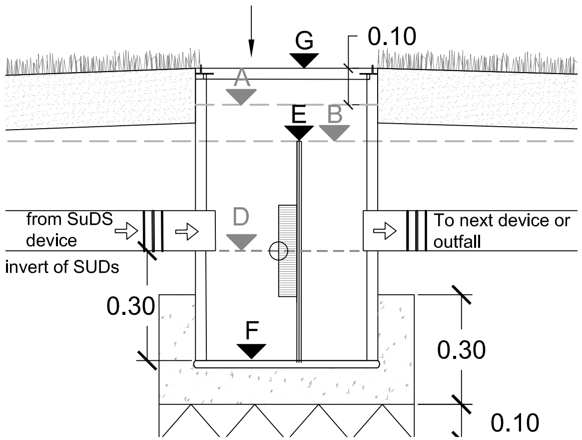


Image (group) 6. SuDS management chain processes

Release

Water held in SuDS is released at a controlled rate. This slows the flow rate of water into the main drainage newtwork, relieving pressure at times of peak demand. Slowing the flow of water means that the water becomes a valuable resource, rather than a problem, and can be used to irrigate plants, replenish water tables, and provide more interesting spaces.

2.0 SITE ASSESSMENT

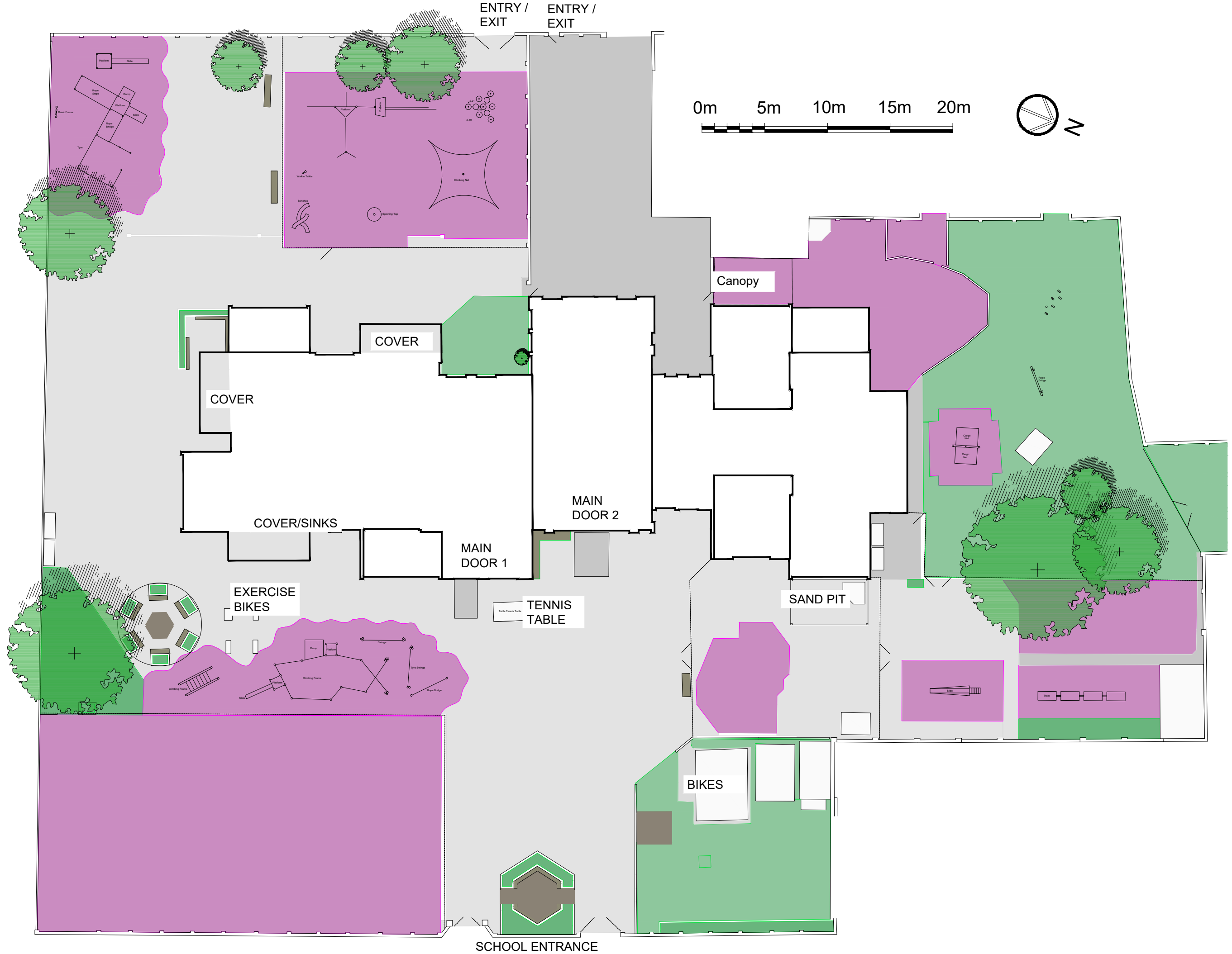
2.1 Existing layout

The following two plans show the basis for the designed approach.

Existing layout

This plan illustrates the current arrangement of surfaces, tree cover and key play equipment. There is limited green space, with most of the school surfaces being impermeable to surface water. Safety surfacing appears to have been installed directly over impermeable surfaces.

There is relatively limted tree cover, mostly to boundaries, with several of those trees beginning to lift surfaces as roots seek out better conditions for growth.



Existing ground surfaces

- Impermeable tarmac
- Impermeable in situ concrete
- Impereable/permeable safety surfacing

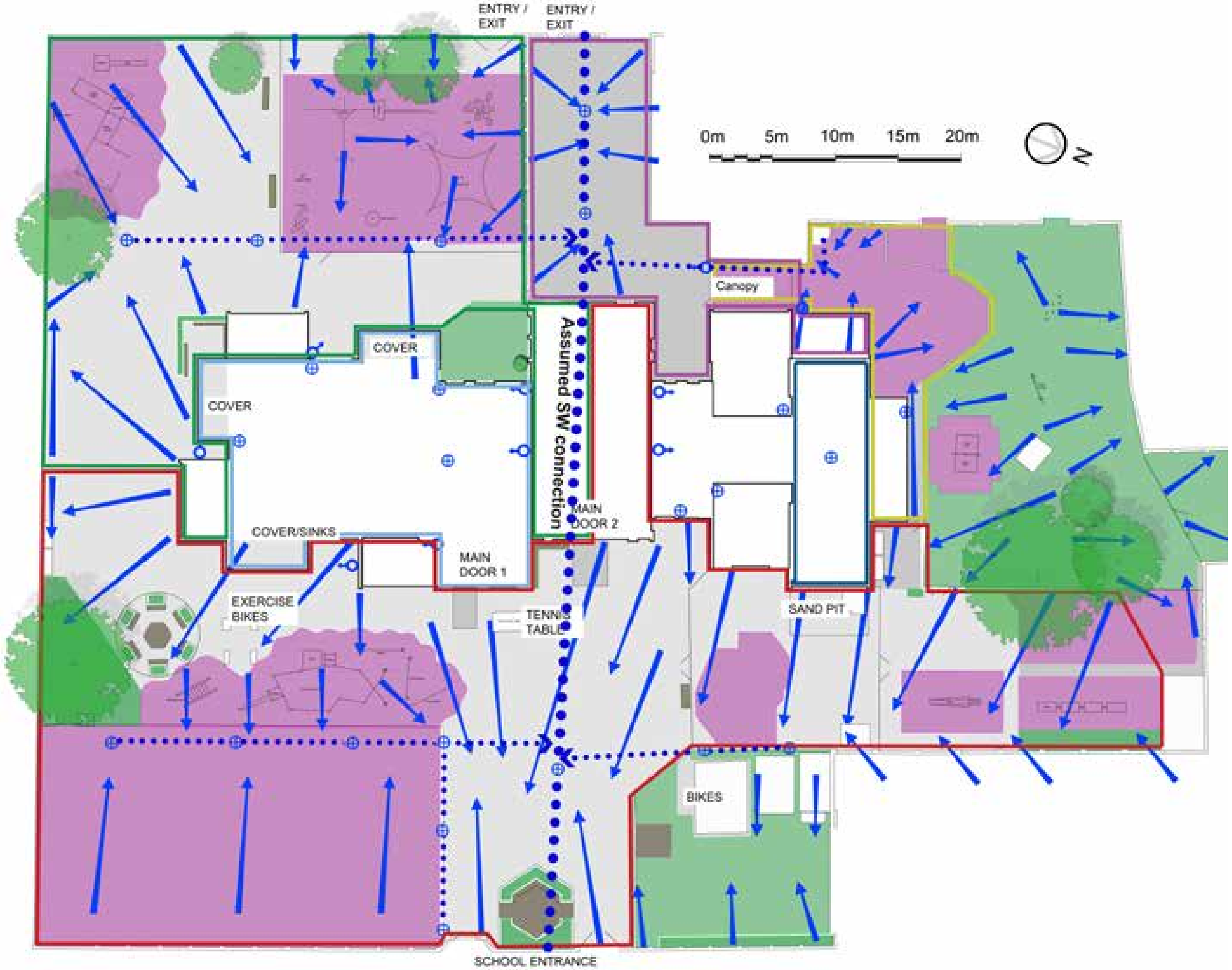
Existing vegetation

- Grassed areas
- Raised planters
- Existing trees

2.2 Unmodified flow plan with sub-catchments

Unmodified flow plan

Using topographic information, supported by a visual site survey, we have plotted the unmodified (existing) surface flow direction, and location of existing drainage. This highlights where interception of surface water is most easily achievable and where puddling is most likely to occur.



Existing surface flows

Existing surface flows

Existing overflow / gully

Existing downpipe

Sub-catchment A

Sub-catchment B

Sub-catchment C

Sub-catchment D

Sub-catchment E

Sub-catchment F

2.3 Photo assessment - sub-catchment A

Site photos 1, 2, 3, 4 *(clockwise from top left)*

Photo assessment - sub-catchment B

Site photos 5, 6, 7, 8 *(clockwise from top left)*

Photo assessment - sub-catchment C

Site photos 9, 10, 11, 12 *(clockwise from top left)*

Photo assessment - sub-catchment D

Site photos 13, 14, 15, 16 *(clockwise from top left)*

Photo assessment - sub-catchment E

Site photos 17, 18, 19, 20 *(clockwise from top left)*

2.3 Photo assessment - sub-catchment F

Site photos 21

3.0 DESIGN OPPORTUNITIES

3.1 SuDS and climate adaptation at John Burns Primary School.

For schools such as John Burns there are numerous benefits to integrating SuDS into management of rainwater. Aside from the general environmental benefits SuDS can help to create more stimulating, aesthetically pleasing, spaces for students and staff; it can dramatically increase wildlife and nature to otherwise quite harsh "dead" spaces - various interventions can provide shelter, food and breeding opportunities for a variety of wildlife, including amphibians, invertebrates, birds, bats and other small animals.

SuDS can also help to reduce long-term maintenance costs. Many maintenance activities for the upkeep of SuDS can be done by students and teachers as part of the learning environment.

The introduction of SuDS elements also provides the school with an opportunity to re-think its external space as a whole. Practical considerations such as equipment storage, pupil assembling points, divisions of different activities, pick-up and drop-off areas, circulation and safety concerns can all be re-visited as part of the implementation.

In addition, SuDS provide the school with an opportunity to introduce a number of additional, more stimulating, natural play elements, as well as the creation of different types of outdoor "classrooms" or teaching areas. There are also, of course, a wealth of other potential learning methods that could be linked to the curriculum.

John Burns Primary School also hosts 'Forest School' sessions, promoting a learning environment which uses an outdoor setting to develop social, interpresonal and technical skills, often through the process of play and exploration. SuDS, and their link to the natural world, provide yet more opportunities to enrich this learning experience, and to have more 'hands on' access to this type of learning.

For the benefit of analysis these proposed areas of intervention have been broken down into different types of catchment areas: these include in-ground rain gardens (which could include swales and basins); raised flow-through planters (or rain planters); green roofs; and permeable paving. Downpipes from the roofs, underground pipes, and above ground gullies or rills carry the rainwater between the various elements and aim to significantly reduce the flow of water into the main drainage system.

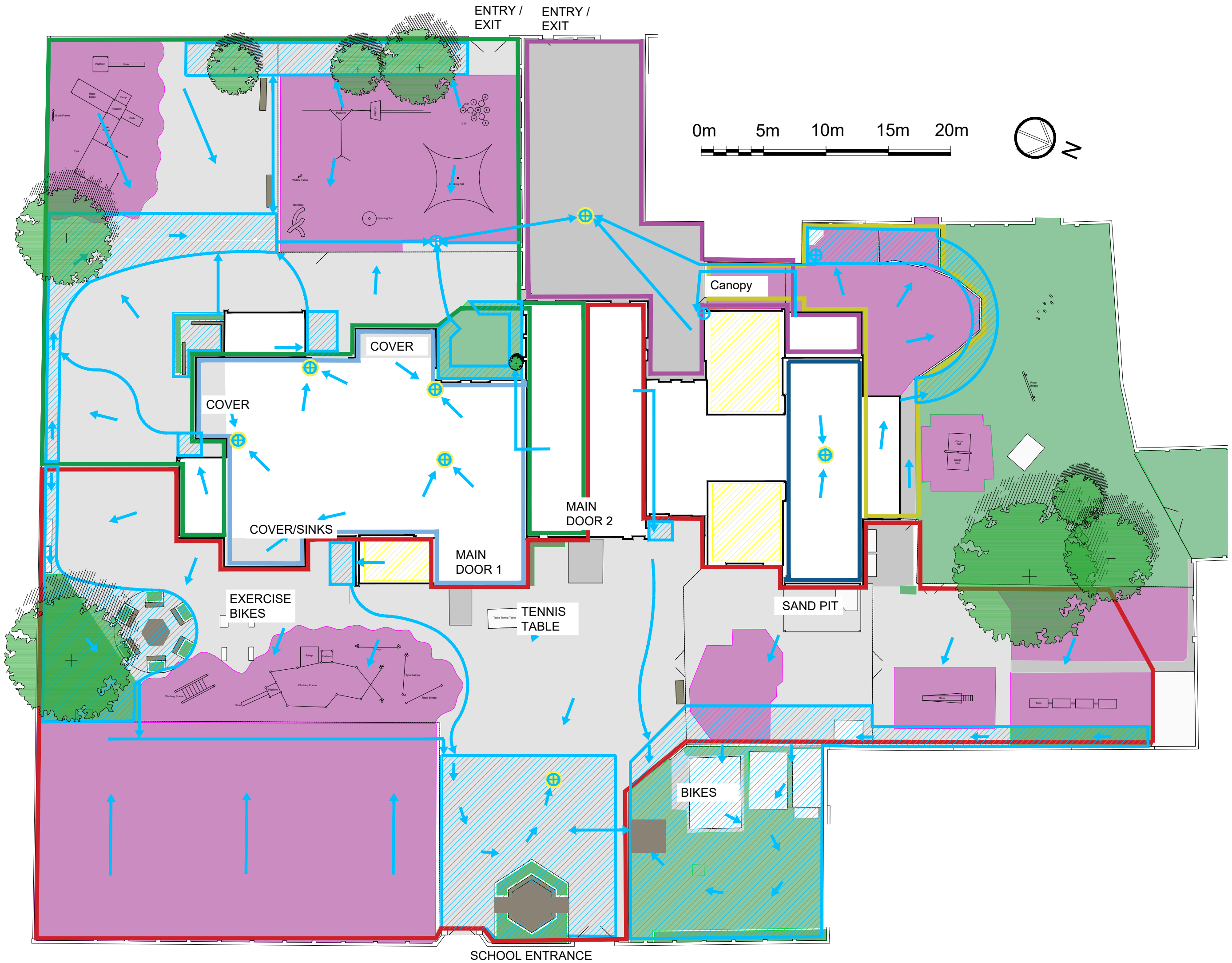
Image 7. *SuDS promote the creative design and use of space; this basin providing an opportunity for exploration and play, as well as habitat. Children have to make eye contact and negotiate use of the balance log, making it a shared experience.*

3.2 Modified flow plan.

This plan builds on the initial unmodified flow plan, and uses interception to show how the management of surface water can be modified within each sub-catchment. Water is moved above and below ground through a series of different SuDS elements such as flow-through planters and rain gardens. It is a schematic view, showing how the space can be linked togther in a simple 'management chain'.

Proposed Management chain

- Sub-catchment
- Piped connection
- Surface/channel connection
- SuDS device/element (volume)
- Control flow
- Overflow/Gully
- Outfall
- Sub-catchment A
- Sub-catchment B
- Sub-catchment C
- Sub-catchment D
- Sub-catchment E
- Sub-catchment F



3.3 Planting and biodiversity in schools

The space available, and creation of new SuDS features, allows for the creation of a number of new areas which, whilst representing relatively subtle changes, can provide huge benefits in terms of attracting and supporting wildlife.

Species selection is important to create robust planting which extends the flowering season to offer a wide range of seasonal interest throughout the year. Focus will be on native and near-native species; in areas with a more domestic/garden feel (such as beds adjacent to buildings) a wider range of flowering plants will be used. Species selection will include plants which are known to support a wide range of pollinating insects, such as those detailed on the RHS plants for pollinators lists.

Opportunities exist throughout the site for the creation of habitats. This is proposed to be done through both creation of additional planting typologies (including a focus on more naturalistic/ native planting), but also through the creation of habitat piles and insect hotels. These can be integrated into design elements throughout the site, offering visual interest in addition to ecological benefits.

Maintenance specifications which encourage the development of a more biodiverse soft landscape will be included in the design proposals.

Maintenance regimes for all areas will be carefully considered to combine a need to create soft landscaped areas which support a wide range of species and habitat creation, yet places as little additional demand on existing maintenance regimes as possible.

__Image 8 (above) and 9.__ The presence of wildlife in schools can be linked to many learning opportunities.

Image 10, 11, 12, 13, 14 (clockwise from top left). *A stumpery - great for invertebrates, an insect hotel, Vipers bugloss, wildflowers in a swale, and an art installation with bird boxes*

3.4 Learning opportunities

SuDS, as well as wider climate change adaptation and careful design, can bring a multitude of learning opportunities to the school environment. The various elements can all be used as learning resources, creating spaces for interacting with and learning about the natural environment, and easily incorporated into most subjects on the curriculum, from the natural sciences, geography, maths, through to creative writing and art.

A "naturalised" learning and play environment can help to mitigate against our disconnectedness with nature. Although we are bombarded with images and films of the natural world, children's experience of the this world is predominately mediated .... by media! Children have become accustomed to think that nature is exotic, awe-inspiring and existing in far away places, beyond their immediate grasp. Many of us have lost the understanding that nature exists in our own gardens, the city and our neighbourhoods. Research is clearly providing us with evidence that children's regular contact with, and play in, the natural world creates an affinity to and love of nature, along with a positive environmental ethic.

The school environment is an ideal arena for creating this positive environmental ethic.

Image: Wendy Allen

Image 15. 16, 17 (clockwise from top left). *A solar pagoda in Vienna, Wendy Allen's wonderfully creative and SuDS at Ramsbury Primary School, and an outdoor shelter and sandpit by Green Roof Shelters.*

These interventions can also help to overcome another problem. Research in the USA has cautioned against introducing "environmental awareness" or notions of "environmental responsibility" into the curriculum too early, before children have been allowed to develop a loving relationship with nature. In trying to teach children at too early an age about abstract concepts such as global warming and rising sea levels we risk asking children to deal with problems that lie beyond their cognitive abilities, understanding and outside of their control. It can lead to anxiety and a sense of disconnectedness - the opposite of what we are trying to achieve. Children's emotional and affective values and nature develop earlier than their abstract, logical and rational perspectives. It is sometimes said that knowledge without love will not stick, but if love comes first, then the knowledge will follow. In other words, we need to allow children to develop their love for the Earth before we ask them to understand it.

This love for the natural world can in large part be enhanced by creating areas that mimic elements of a 'forest school', but within a hard urban space. Here we can produce an learning and play environment that nurtures more self-reliance, risk management, resilence and creativeness amongst the pupil body.

Image 18, 19, 20 (clockwise from top left). *SuDS and other Green Infrastructure measures present an opportunity to bring inspiration into the school, and into the classroom, with a multitude of curriculum based activities that might be developed.*

3.5 Play and exploration

Throughout most of history, when children were free to play, their first choice was often to run to the nearest wild place—whether it was a big tree or brushy area in the fields, or a nearby watercourse or woodland area. Most children had the freedom to play, explore and interact with the natural world with little supervision. For a variety of reasons childhood and regular unsupervised play in the outdoor natural world became divorced as we became increasingly risk averse and play became highly supervised, compartmentalised and directed. In our urban areas in particular we lost the richness of unsupervised loitering, free wandering and exploring.

To some extent there has been a return to this form of "natural" play and exploration in the way we increasingly design or rejuvenate our parks, public playgrounds, specialist adventure playgrounds, and so on. However, for a variety of reasons, school playgrounds have lagged behind. Traditionally school playgrounds were considered areas where children 'burn off steam', and were largely designed for ease of maintenance and surveillance. They were not necessarily designed as domains of development or as places of learning. Fixed play equipment, often plastic, metal, and brightly coloured, has been traditionally sectioned off or otherwise remained divorced from the broader playground areas. Whilst there is certainly some merit of having, safe, fixed specialist play equipment and a large open space both for organised class activities as well as an

Image 21, 22, 23, 24 (clockwise from top left).
SuDS should drive the creative process, encouraging interaction and engagement with the surroundings

informal run-around space free of obstacles, our understanding of early years development through play has shifted significantly.

There is a slow transformation as the paradigm for playground design, especially for younger children, has moved away from barren areas of grass, asphalt, and safety surfacing with manufactured equipment into more naturalised environments for children's play, exploration and discovery. These new naturalised play environments do not depend on manufactured equipment. Rather than being built, they are planted—they use the landscape and its vegetation and materials as both the play setting and the play materials. They are designed more from a child's perspective as informal, even wild, spaces that respond to children's development tasks and their sense of place, time and need to interact with the nature. They are designed to stimulate children's natural curiosity, imagination, wonder and discovery as well as places that nurture children's connectedness with nature.

With the proposed SuDS interventions providing the catalyst for change we envisage modest, but significant, changes to the outdoor areas of the school and to its roof spaces, both as play resources and as a learning environment.

Image 25, 26, 27 (clockwise from top). *Children develop an attachment and appreciation of outdoor fun when they are given access and time to enjoy it.*

3.6 SuDS elements

The following SuDS elements are key to introducing children to the natural world, providing multiple opportunities for interaction and learning.

Rain gardens & flow-through planters

Proposed rain gardens and raised planters form crucial interventions. Both can be used to improve amenity within the school grounds and provide opportunities for different types of recreational activities in the school. Garden spaces can provide locations for socialising, quiet spaces, games and for different pockets of activity. They can also re-define different areas for different uses and help with managing different year groups within the school. There is, of course, ample opportunity for learning and educational benefit.

Raised planters already exist on site, but are poorly located in terms of capturing water run-off, with most located away from the building. Suitably placed planters have the ability to collect and percolate roof runoff into the soil and layers in the planter. Although the planters themselves would be unable to cope with the amount of water available, especially after heavy rain, excess water then ideally would be diverted into another SuDs feature or, as a last resort, into the main drainage system. Raised planters take up very little space, and, as already seen in the existing playground areas, can be easily integrated into outdoor seating and congregation spaces.

Unlike rain planters (or flow-through planters) a rain garden is located in the ground, and consists of a small planted depression or basin, typically positioned where surface water run-off already falls towards. It can be integrated into other SuDS features, using filter drains, rills or pipes to channel the water into the garden. A rain garden does not consist of standing water, like in a pond, but is designed to effectively clean water run off, and allow

Image 28, 29, 30 (clockwise from top). *Raised flow-through planters are a great method of source control - intercepting and using water as soon as possible.*

the water to filter back into the ground. Appropriate planting increases opportunity for biodiversity within a relatively small area, as well as making the surrounding area a much more attractive and enjoyable space.

Surface filter drains

These are generally stone-filled trenches that collect water runoff from hard surfaces in order to clean and transport it to other locations as part of an integrated SuDS network. Alternatively, they can consist of perforated pipes that slow the flow of water and enable the runoff to soak into the adjacent ground where the ground is sufficiently porous.

Swales and Basins

These are shallow ditches or depressions with gently sloping sides, either of grass or meadow grass, but also a variety of planting. They collect and filter water running off from adjacent surfaces, allowing it to slowly percolate back into the ground much like a rain garden. They could be integrated into already green (grassed) areas of the school, or created, like rain gardens, by digging up areas of hard surfacing.

Image 31(top) and 32. *Two raingardens - the top at the olympic park which conveys water past a playground, and below at Woodberry Down, by Woodberry Wetlands. Incredibly diverse and rich Green Infrastructure.*

Permeable surfaces

Hard impermeable surfaces are ubiquitous in schools, and used to create a relatively cheap, safe, flat, easily maintained smooth surface for both foot traffic, games, assembly, and vehicles. Permeable surfaces, as part of SuDS, are able to fulfil those very same functions, whilst also allowing rainwater to soak directly into the ground, or into underground storage units which help to slow the release of the water runoff during heavier downpours.

Bio-solar and green roofs

Green roofs are often conventional roofs (flat or sloping), adapted to support shallow rooted plants. Like other SuDS elements the roofs can slow the flow of water runoff, reducing the amount of water that is released into the main drainage system, and can easily be integrated into other SuDS elements. Such roofs support biodiversity, improve air quality, improve the efficiency of solar panels that are located on the roofs, and have an overall cooling effect during the warmer summer months.

The use of roof spaces provides significant opportunity to expand the usable footprint of the school, increasing surface area for learning, biodiversity and attenuation within the living roof build-ups. Energy production is also feasible with the use of Bio-Solar technology and the innovative approach of solar pagodas.

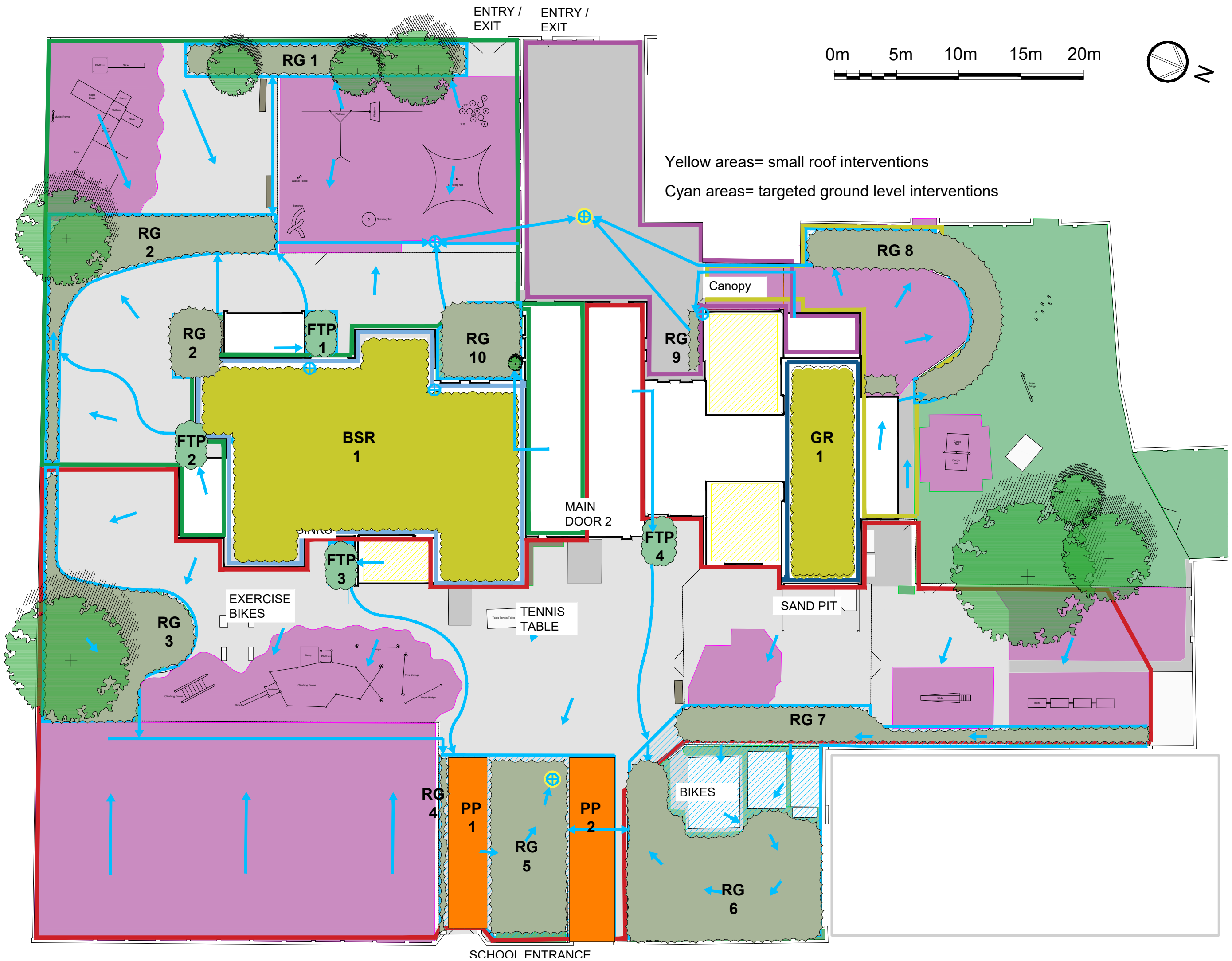
Rainwater harvesting

SuDS harvest rainwater, collecting and storing water run off, mainly from roofs and shelters, that can then be used for a number of purposes around the school and grounds. Like the common garden water butt, the water can be stored and used to water outdoor plants during dry periods, and any indoor plants throughout the year, thus helping to reduce mains water usage and the school's water bills.

Image 33 (right) and 34. *Bio-solar is an increasingly valued technology offering financable solutions for Green Infrastructure installation.*

4.0 DESIGN APPROACH

4.1 Proposed SuDS concept



Proposed Management chain

- Sub-catchment
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- Sub-catchment F

SuDS Interventions

- FTP — Flow-through / rain planters
- RG — Rain gardens, swales & some raised elements
- PP — Permeable paving
- BSR — Bio-solar roof
- GR — Green roof
- Bio-pagoda

Refer to subsequent pages to see how SuDS interventions in these numbered areas could enhance the learning and play experience.

RG1: Running along the western boundary wall, this area crosses the fenced off shared community/school playground and the school playground. The area is largely an unattractive dead space, with the existing trees struggling to thrive beneath the crumbling tarmac. Proposals could be to either retain and free the trees which then become part of an attractive vegetated rain garden, or plant new trees in permeable tree pits to replace the existing.

RG 2: Here we could create an exciting rain garden, with bridges, above ground tunnels, or stepping stones to be used to cross between the various spaces, and to bring the tree back to within a more natural setting. The design would provide adventure and interest, linking the various spaces, whilst keeping them distinct, and run east along the southern boundary wall. Notwithstanding the murals, this intervention would help to visually soften this southern boundary. These elements could be connected to flow-through planters.

RG3: This area includes both an active play/exercise space, a quieter area of outdoor undercover seating with raised planters, and a small under-utilised green space surrounding the large tree. Like RG2 above, by installing a variety of SuDS interventions, and "greening up" the area as a whole, we could start to create more distinct spaces for the different activities.

RG 4 & 5, PP 1 & 2: Integrating the lowest points of the open playground space into the SuDS network could create a fascinating, inviting and lush entrance area, soften the fence boundary to the MUGA, and incorporate a variety of features to give a very different first impression of the school. This could include a new type of shelter or other structures that can more easily be integrated in the system of water management, as well as new fresh permeable paving on both sides of this new garden. A bold intervention in this space could be used to give a statement of what the school is about, and how this will be replicated throughout the school grounds, without detracting from the need to retain a large assembly and run-around space.

RG 6: The existing, mostly green, space to the north of the entrance could be rejuvenated as it becomes integrated into the SuDS network. Creating an extensive system of rain gardens as well as growing areas, and potentially a wetland/pond area, a re-worked area could create greater opportunities for the children to engage with the natural environment.

RG 7: This proposed rain garden runs along the bottom of the two partitioned play spaces for the smaller children, and could be used to create a much more inviting and interesting backdrop to the existing play elements such as the train and slide areas.

RG 8: For the reception area, capturing water run-off from the roofs could be used to enhance the toddlers' first experience of water management and sensory interaction with rain water. Here we could integrate the presently divided soft (grassy) and hard areas in order to create a seamless adventure place for exploration, and natural play, using level changes, smooth clambering boulders, willow tunnels, stepping stones, and fun play elements such as a "natural" sandpit integrated into the space.

RG 9: Lying in the car park and utility area this small SuDS intervention could be integrated with the roof-top planting and pagoda structure, and used to filter and slow the progress of water from the roof areas into the main drainage system without eating into the current workable space at the ground level.

RG 10: Like RG 9, above, the existing small garden area is an ideal place to capture water run off from the roof, and to create a tranquil space.

FTPs: Raised "flow-through", planters create immediate opportunities for the children and staff to interact with rainwater using items such as waterwheels, pipe work, and other fun inventions They also have a role in capturing smaller rainfall events, filtering water of unwanted particulates.

4.2 Proposed Solar Pagodas

Three of the raised patios on the main school building have been indicated as possible locations for the installation of bespoke external Solar Pagodas. These structures combine the benefits of an outdoor learning environment with a location for Photovoltaic panels to contribute towards the school energy strategy, as well as options for seating, rainwater harvesting and additional habitat.

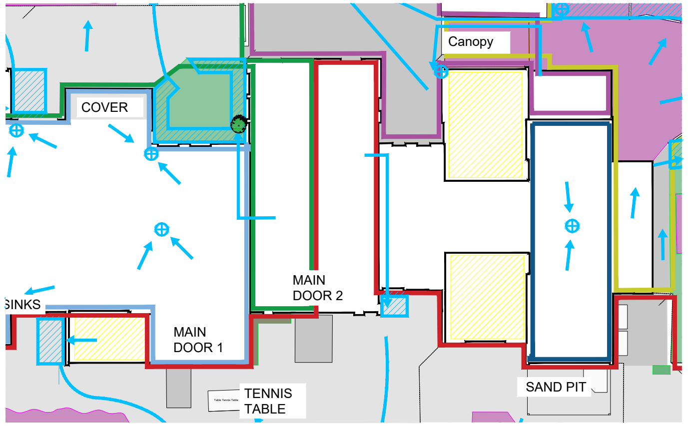


Image 32 (top) and 33. *Plan view of the three accesible patios that might have Solar Pagodas built on them, and an example of a Solar Pagoda in Vienna.*

As extensions to the classroom, they can also be designed to incorporate Green Infrastructure components such as green roofs and living walls to increase pupils' understanding of and interaction with the natural environment.

Image 35. *A Solar pagoda in Vienna providing a sociable space for people to enjoy*

Rainwater harvesting can be achieved by redirecting water captured from integrated guttering, through a series of raised planters. This provides year round irrigation for plants, as well as an element of flood risk reduction as part of SuDS strategy for the school. Furthermore, water can be stored at the base of the pagodas before it is discharged into the existing roof outlets.

Seating can be integrated into the structure of the Solar Pagoda, providing space for pupils to take part in lessons.

The pagodas help shade the school building and will replace areas of hardstanding which currently absorb large amounts of heat which is radiated down into the clasrooms below, thus contributing to thermal improvement.

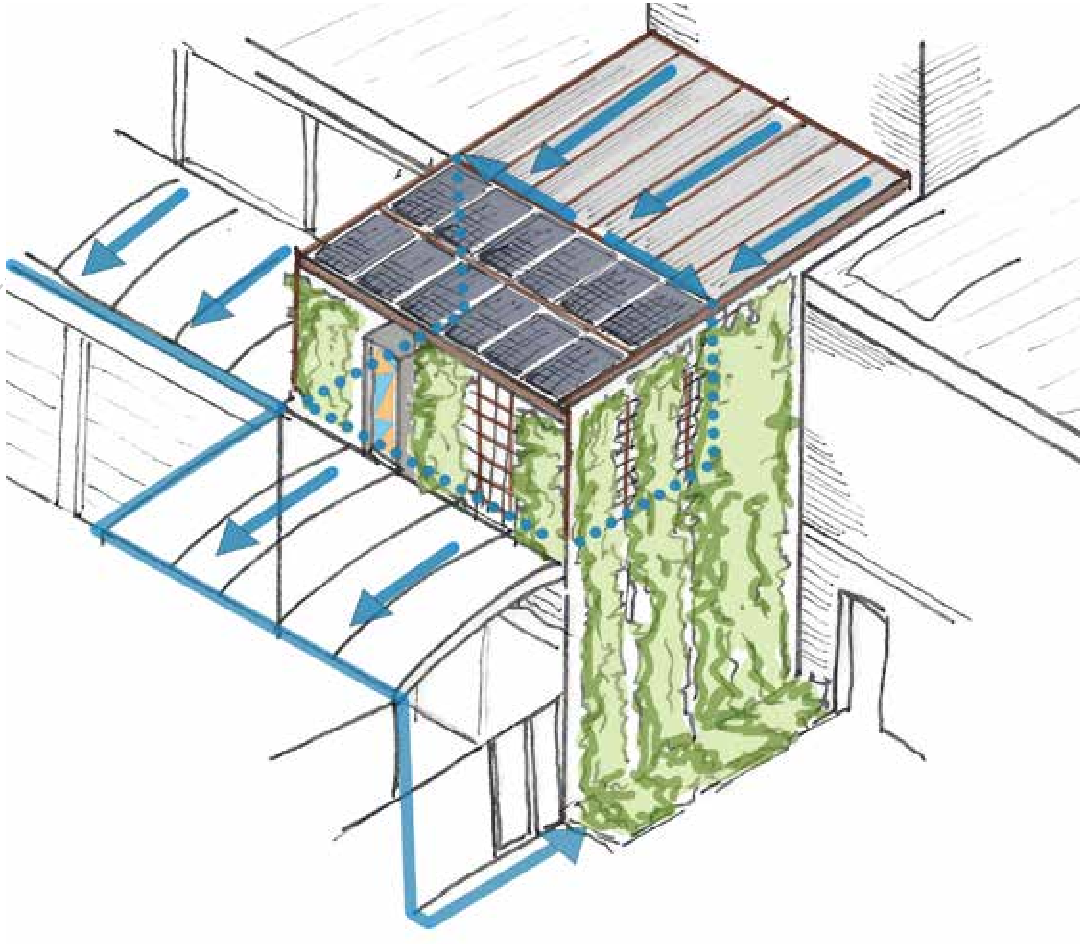
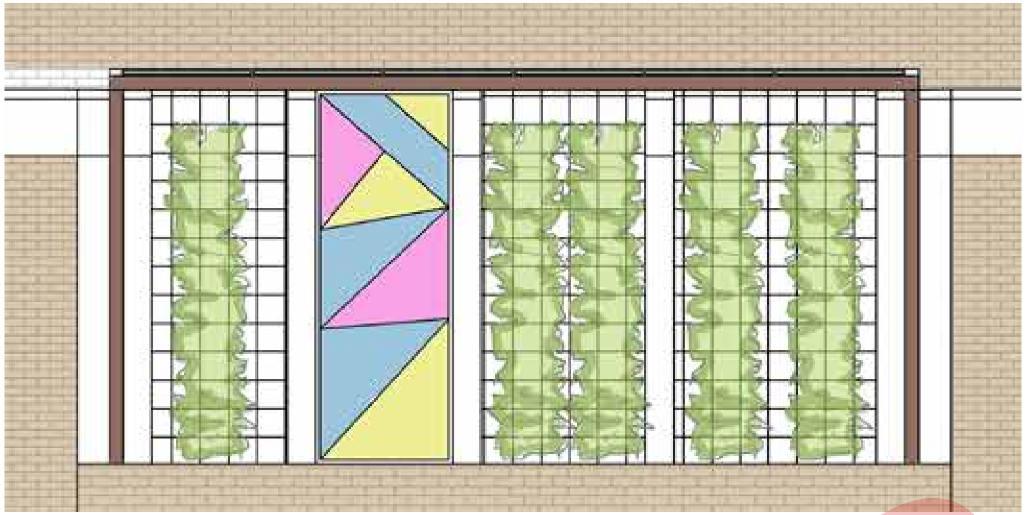


Image 36 (above), and 37 (group). *Sketch showing how a Solar pagoda could be built with living walls to the sides, PV provision on the roof and a lightweight roof structure. Rainwater can be intercepted from adjacent roofs, and used to feed the base of the living wall.*



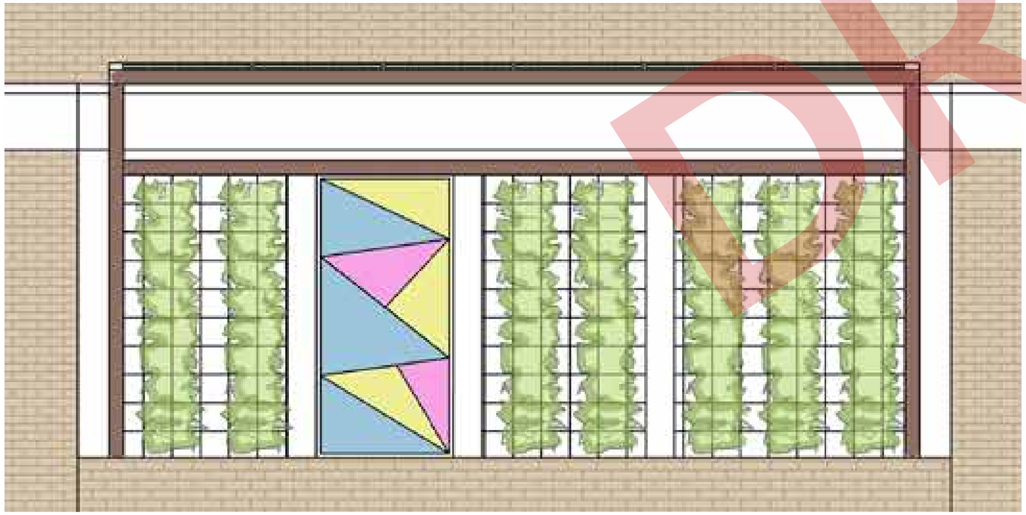


Image 40 (top left) and 41 (bottom left) and 42 (top right), 43. *An end elevation of a solar pagoda, shown here with living walls, and an interactive light box built into the frame for addtional learning and educational content. The lower design shows a wider space above the living wall that might increase light levels or be used for insect hotels and wildlife elements.*

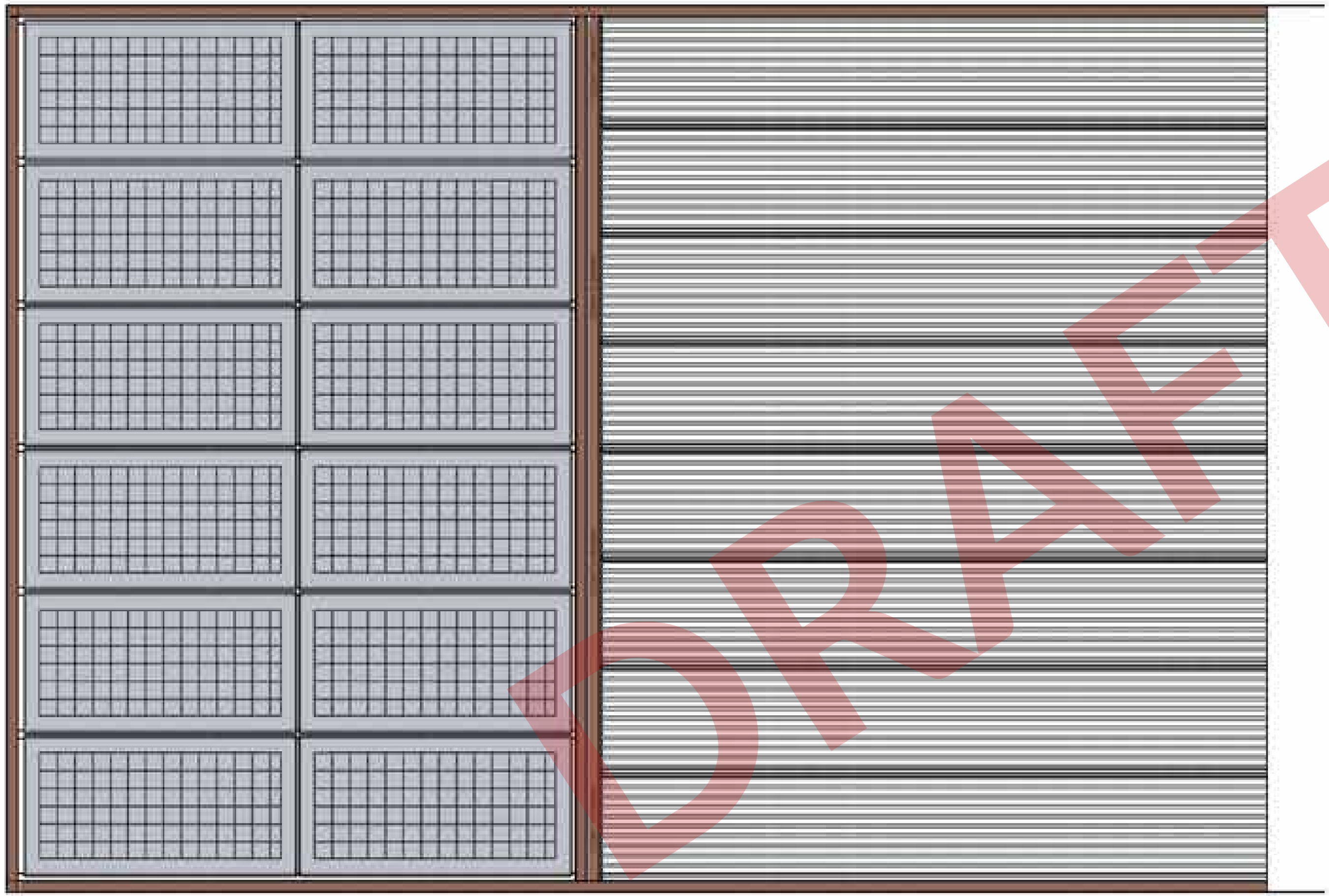


Image 44 (left) and 45 (top right), 46. *A plan view showing an arrangment of Bi-facial PV and polycarbonate roof as a possible structure. Alternatively a lightweight perforated or decorative sheet material could be used to make the space more attractive or let in more light.*

Image 47 (top left) and 48 (bottom left) and 49 (above).
Both solar pagoda arrangements use raised perimeter planters to create an attractive 'edge' to the learning space. Benches provide seating for classroom of children.

Image 47 matches construction shown in images 39 and 40, and assumes bi-facial (translucent) PV laid flat onto the pagoda structure.

Image 48 shows a multifunctional arrangement, using living walls with integrated 'bug hotels' for a variety of invertebrates/wildlife. This would provide great opportunity to link with the school curriculum. Bi-facial panels have been replaced with angle mounted standard PV to increase solar gain. The PV are installed over a reservoir which captures rain run off, increasing reflective light back to the panels. All water is harvested through the pagoda, irrigating plants to keep them healthy, storing water in the deck and contributing to the SuDS management chain, and slowing the flow rates.

5.0 PERFORMANCE

5.1 SuDS performace

The performance of the project shows that there is scope for improvement across a range of different climate change impact areas. Different assessment tools have been used.

Modelled hydraulic performance, undertaken by the Environmental Protection Group Ltd, shows that there is potentially significant betterment of flood risk performance against existing brownfield run off rates for the site, across a range of different critical duration events. This existing brownfield rate gives an indication of actual, current discharge rates back to the Thames Water system. Existing infiltration of soils and subsoils has been assumed as very poor, due to its clay based content.

This comparable view, which projects a potential 'before and after' dataset, has been rationalised into these critical duration events which are shown as 1 in 2, 1 in 10, 1 in 30 and 1 in 100. These are an indication of probability that a storm event of a certain magnitude will occur in any given year. For instance, smaller and more frequent events are shown as '1 in 2' – i.e. there is a 1 in 2 probability that particular magnitude of rainfall will happen that year – in other words really quite likely. Larger events such as 1 in 30 and 1 in 100 are less frequent yet much more severe in their impact, and can readily cause flooding events to different degrees.

The six sub-catchments shown on the unmodified flow plan in chapter 3, have been simplified into two larger catchment areas, 'East catchment' and 'West catchment', each correlating to one of two assumed Outfalls that connects back to the main drainage network.

Notes	Sub catchment		Impermeable catchment in designed area	
East playground, sport pitch and some roof area. Can also receive semi permeable garden space not included within impermeable catchment m2		A	2183	m2
South west playground and some raised pato and roof area. Can also receive small garden area not included within the impermeable catchment m2		B	1162	m2
Much of this catchment possibly inaccessible - heavily trafficked with vehicles, concrete construction and low visibility. Partial catchment more likely.		C	282	m2
Reception/early years. Wetpour installed over impermeable paving. Some roof area included wihtin catchment with downpipe connection.		D	190	m2
Bio-Solar roof		E	380	m2
Green roof		F	99	m2

Hydraulic modelling for the northern and southern catchment area

The performance assumes the following storage capacities for the different elements:

- Raingardens (400mm blended soil over 150mm angular stone base free from fines 'type 3')
- Raised Flow Through Planters (400mm blended soil over 200mm angular stone base free from fines 'type 3')
- Bio-solar roof (100mm aggregate substrate)
- Green roof (100mm aggregate substrate)
- Permeable Paving (80mm wearing course 225mm angular stone base free from fines 'type 3')

Area	Catchment (m2)*	Greenfield Qbar (l/s)	Greenfield 30 yr (l/s)	Greenfield 100yr (l/s)	Existing Brownfield Flow 2yr (l/s)**	Existing Brownfield Flow 10yr (l/s)**	Existing Brownfield Flow 30yr (l/s)**	Existing Brownfield Flow 100yr (l/s)**	Proposed Outflow 2yr (l/s)**	Proposed Outflow 10yr (l/s)**	Proposed Outflow 30yr (l/s)**	Proposed Outflow 100yr (l/s)**	Proposed Flow Increase or Decrease Percentage - 2 Year to Ex Brownfield (%)	Proposed Flow Increase or Decrease Percentage - 10 Year to Ex Brownfield (%)	Proposed Flow Increase or Decrease Percentage - 30 Year to Ex Brownfield (%)	Proposed Flow Increase or Decrease Percentage - 100 Year to Ex Brownfield (%)
Western Catchment	1634	0.7	1.6	2.2	26.9	47.5	62.7	80.5	5.7	7.9	9.6	11.6	-78.81	-83.37	-84.69	-85.59
Eastern Catchment	2183	0.9	2.1	3.0	36.4	61.2	80.2	96.2	7.3	10.2	12.7	16.0	-79.95	-83.33	-84.16	-83.37
Bio-Solar Roof	380	0.2	0.4	0.5	5.7	9.0	11.2	13.2	1.1	2.0	2.9	4.1	-80.70	-77.78	-74.11	-68.94
Green Roof	99	0.0	0.1	0.1	1.7	3.0	4.1	5.4	0.3	0.5	0.7	1.0	-82.35	-83.33	-82.93	-81.48

Total Catchment	4296
Total existing Brownfield 2yr	70.7
Total existing Brownfield 10yr	120.7
Total existing Brownfield 30yr	158.2
Total existing Brownfield 100yr	195.3
Total proposed flow 2yr	14.4
Total proposed flow 10yr	20.6
Total proposed flow 30yr	25.9
Total proposed flow 100yr	32.7
Total Agg Betterment to Ex Brownfield (2yr)	**-79.63**
Total Agg Betterment to Ex Brownfield (10yr)	**-82.93**
Total Agg Betterment to Ex Brownfield (30yr)	**-83.63**
Total Agg Betterment to Ex Brownfield (100yr)	**-83.26**

* Catchment 100% impermeable
** Output calculated on Microdrainage - See calcs for detail
*** Output from HR Wallingford

Developed Site - Therefore, brownfield rates applicable and match the existing rates discharging to the Thames Water system.

The results at this stage are promising and demonstrate potential for a significant reduction in pressure to the Thames Water network.

1 in 2: 79% betterment

1 in 10: 83% betterment

1 in 30: 83% betterment

1 in 100: 83% betterment

Hydraulic summary demonstrating 'betterment' against Greenfield equivalent flow rates

5.2 B£ST performance

B£ST guidance - Coarse

Coarse Assessment

Export Coarse Asmnt. Info

PROJECT DETAILS - No.: TBC, Name: John Burns Primary School, Assmt. Version: 1, Date: Mar 2021.

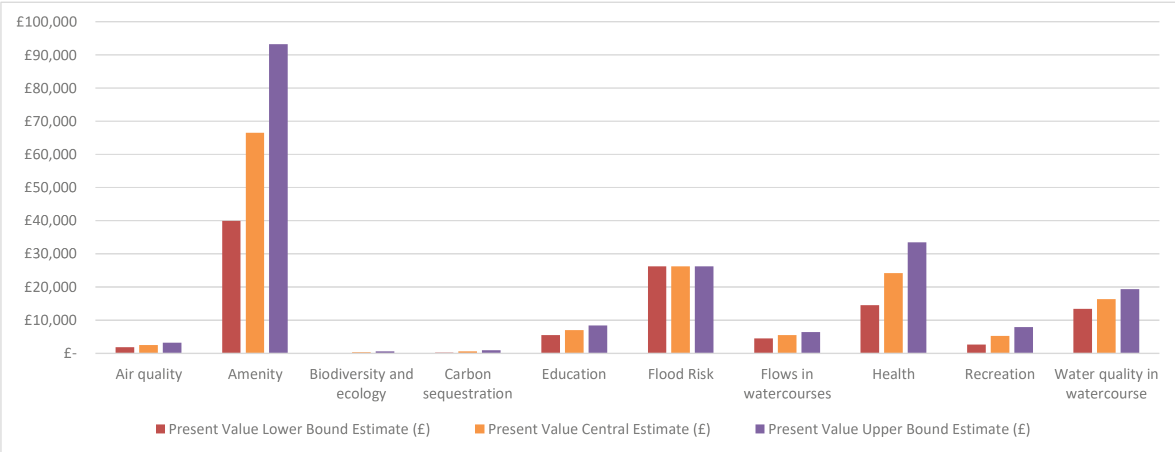
Notes:

This part of the tool gives you an indicative range of benefit values that your scheme may provide. This should not be used to support a business case for investment or to support a funding application. In such case, a detailed assessment using the complete tool should be undertaken.
Whilst we have aimed to keep this part of the tool as simple as possible, please read the questions carefully as the estimates you make have a significant impact on the indicative values. The assumptions used are included in the Technical Guidance.
We have adjusted the values to consider the potential confidence that a coarse assessment can provide, and this is already included within the calculation. These are fixed values.
The timescale for the assessment is over a 40 year period starting from 2020.

Coarse Assessment Results Summary Table

Benefit category	Present Value Lower Bound Estimate (£)	Present Value Central Estimate (£)	Present Value Upper Bound Estimate (£)
Air quality	£ 1,807	£ 2,478	£ 3,149
Amenity	£ 39,943	£ 66,572	£ 93,200
Biodiversity and ecology	£ 69	£ 288	£ 508
Carbon sequestration	£ 122	£ 496	£ 815
Education	£ 5,487	£ 6,940	£ 8,392
Flood Risk	£ 26,205	£ 26,205	£ 26,205
Flows in watercourses	£ 4,481	£ 5,442	£ 6,428
Health	£ 14,490	£ 24,132	£ 33,457
Recreation	£ 2,605	£ 5,217	£ 7,829
Water quality in watercourse	£ 13,442	£ 16,327	£ 19,283
TOTAL	**£ 108,651**	**£ 154,097**	**£ 199,266**

Coarse Screening Results Summary Graph



B£ST tool summary draft results, early April. Still under review with CIRIA.The results will be refined as discussions with CIRIA are undertaken, with anticipated improvements in performance against a range of criteria.

5.3 Energy performace and savings

As well as the various initiatives discussed in the design proposals of this report, John Burns Primary School has continued to work alongside the London Borough of Wandsworth to upgrade and improve various school facilities, as a means to understand their energy output and ways that this might be improved.

An energy audit is shown here, with the project annual saving in both kWh and £, as well as tC02e/. A simple indication of capital expenditure and corresponding payback period is also shown.

For instance, alongside the main biosolar roof proposal, LED lighting was installed in 2020, with the school also considering ceiling fans, replacement low-g glazing and better insulation on pipework and below window panels. A recommendation was also made to replace the two existing gas fired boilers, and installing 'point of use' hot water boilers for sinks. However, the payback period for these elements is 15+ years which will take us into the mid 2030's, by which point replacement would be needed again to take the school into a Net Zero.

A total of 30kWp of solar PV panels are planned for the solar green roof and biosolar pagodas, to match the peak electricity use in the school. A financial model has also been created that investigates the benefits of energy storage, allowing the school to buy and sell power to the grid when prices are advantageous.

Project Name	Core or Alternative Project	Annual kWh saving	Annual Total £ saving[1]	Annual tCO2e saving	Capital Expenditure £	Simple Payback (years)
Boiler Replacement	Core	82,396	2,060	15.1	34,130	16.6
Implementation of POU Boilers	Core	76,891	1,922	14.1	32,241	16.8
Sedum Roof Deployment	Core	46,898	6,210	12.0	35,450	5.7
PV array	Core	19,585	2,374	5.0	31,512	13.3
LED Lighting	Alternative	15,602	2,184	4.0	8,684	4.0
Plantroom Pipework Insulation	Core	9,331	233	1.7	923	4.0
PVC Panel insulation	Core	4,092	102	0.8	1,851	18.1
Bris-Soleil	Core	2,962	415	0.8	10,800	26.0
Installation of Ceiling Destratification Fans	Core	1,646	230	0.4	1,530	6.6
Brick Cavity Insulation	Alternative	54	1	0.0	22	16.3
Living Wall Deployment	Alternative	7	1	0.0	500	NA
Low Emissivity films	Core	55	8	0.0	68	8.7
Total ('Core' projects only)		**243,856**	**13,554**	**49.9**	**148,504**	**11.0**

John Burns Primary School, with the London Borough of Wandsworth, have committed to a range of infrastructure improvements to the school. These initiatives should be seen as a holistic approach that build towards a more sustainable, cost effective and resilient facility.

6.0 SUMMARY

Funding:

The multifaceted nature of Landscape-led Green Infrastructure opens up a variety of possible funding routes. It would seem that the LB Wandsworth has a vested interest and vision to respond to the Climate Emergency, as well as looking to invest in more energy efficient facilities. The positive connections to improved education and flood risk reduction, as well as the option of maximising asset renewables and maintenance investment, make this a helpful source of funds. The Environment Agency, DEFRA and the Department for Education are all also potential funding sources through their links to environmental quality, smart energy investment, and improved educational outputs. Natural England provide a similar if slightly removed viewpoint, focusing on biodiversity quality and the protection of the natural world. The GLA has shown support for the project and continues to make a strong case for projects that provide a response to climate change as well as supporting other positive environmental and social outcomes. Thames Water, as the statutory undertaker and as part of their 2020-2025 business plan, have committed to investment in SuDS and to protect and enhance the environment. Their current plan makes provision for the funding of SuDS schemes that contribute to that aim.

Learning:

Aside from the educational benefits of having better indoor temperature control the proposed external interventions can provide greater opportunities for learning about the natural environment. By harnessing surface water run-off from its many flat surfaces the SuDS elements will be able to provide a wider variety of exciting opportunities to learn about nature, the environment, climate risks and adaptation, and provide a resource for teachers working across all areas of the curriculum. Roof top interventions create further spaces for teaching in the warmer months, as well as being an educational resource in their own right.

The introduction of more natural elements into the outdoor playground areas also provides opportunities to re-think how the various spaces can be used. The aim is to create spaces that nurture the exploratory and inquisitive nature of children, enhance the play experience, and provide more opportunities to interact with those natural elements that enrich the child’s imagination.

Climate Change resilience:

Combining the retrofitting of a Sustainable Drainage System to a school like John Burns with the introduction of other above ground interventions such as green roofs, solar panels, roof top pagodas and screening offers the school numerous benefits; these include reduced energy and water bills, better temperature control both inside and outside of the building, and reduced levels of pollution. In addition, such interventions help to reduce flood risk, ease the pressure on storm sewers, and make an important contribution towards achieving greater climate resilience within the broader community.

Replication:

Whilst we realise that a retrofit of SuDS at John Burns School is not part of a “one-size-fits-all” solution to managing surface water runoff for all schools, we feel that the school can stand as an example from which other schools can learn.

Appendix A - developed playground designs

Design Approach - summary

The design utilises two main areas for attenuation, one to the south west of the site, and one to east adjacent to the main entrance.

The west catchment design makes play and socialising central themes, using a shallow sunken basin made from permeable safety surfacing. Glacial boulders are used as seating and stepping stone to contribute to a more naturalistic theme, and accompany robust, simple planting and increased tree planting.

The east catchment adjacent to the main entrance replaces the current covered seating area with a new, slightly sunken seating area, using oversized decked benches at alternate levels. This creates an enclosed learning space, socialable area during breaktime aswell as somewhere for parents to wait and collect their children. Seating is located beneath a PV covered shelter similar to solar pagodas, linked to a covered walkway as you enter the school, creating a more welcoming experience. The current garden area will still be a space for growing food and learning about wildlife, but re-imagied using a combination of raised beds to the perimeters, and sunken wildflower gardens within a decked area, linked to a long wall mounted bug hotel. A long raingarden collects rainwater from the playground to the north, which will feed the garden area.

Design Approach - flows

The modified overground surface water flows are shown here again, with a simple indication of new pipework to the two main outfalls.

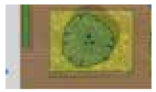

Above ground surface flow


Piped connection


Outfall (local sewer connection)


Attenutating play basin, with boulders, robust grass and tree planting (p 43)


Seating at main entrance, permeable paving and pagoda (p 42)


Learning garden, with food growing, wildflower meadow and bug hotel


Raised flow through planter adjacent to school

Alternate plan views of east catchment raingarden and seating. The top plan shows the proposed covered solar pagoda