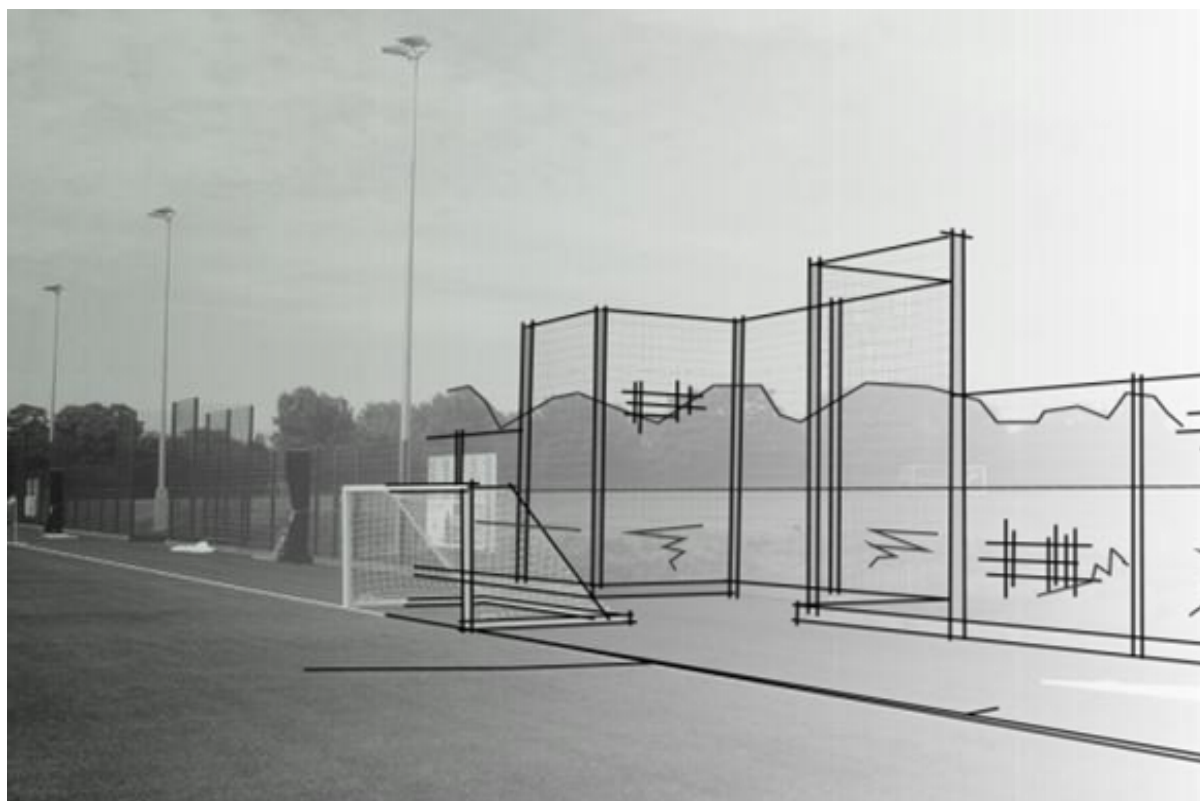


The Highfield School

Creation of a 3G Artificial Grass Pitch (AGP) with perimeter fencing, hardstanding areas, storage container, floodlights and an access footpath

Drainage Strategy



Site	The Highfield School Highfield, Letchworth Garden City, SG6 3QA		
Project	Creation of a 3G Artificial Grass Pitch (AGP) with perimeter fencing, hardstanding areas, storage container, floodlights and an access footpath		
SSL project code	SSL3394		
Document title	Drainage Strategy		
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Client	The Highfield School	
Document Title	Sports Lighting Statement	

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Site Context

Site Location

The site comprises grassed playing fields located within the grounds of The Highfield School in Letchworth Garden City. The proposed pitch is positioned within the southern portion of the school's campus, adjacent to existing informal sports facilities.

The wider site is situated at the western edge of a predominantly residential neighbourhood, with suburban housing to the north, east, and southeast. To the west, the site adjoins expansive arable farmland.

Established tree lines and patches of woodland define the northern and western boundaries of the site, helping to screen the school from the adjacent fields and residential properties. To the south, the site borders a golf course, beyond which is further open space.

Within the site, the main school buildings are located centrally and to the north, with associated car parking and circulation routes accessed via the main school entrance off Highfield to the northeast. This arrangement facilitates safe and managed access for pupils, staff, maintenance crews, and emergency vehicles, while minimising the impact on the residential streets that adjoin the site.



Figure 1 - Site Location

Site History

Historical mapping from the late 1890s shows the site as open land with an old chalk pit recorded to the west of the site. From the 1930s onwards the wider residential area of Letchworth begins developing. From the 1950s onwards the residential houses along Highfield

are present with predominantly open space to the rear of the buildings where the school is currently located. On a snip of a map between 1950 and 1975 some early school buildings can be seen where to the north of where the school land is today.

The earliest freely available aerial imagery dated 2000, shows the wider school in the same layout as the last available historical map, consisting of the main school buildings to the north and open playing fields to the south. Two additional school buildings are developed between 2003 and 2012 to the west and south of the original school location, with the southern playing field remaining open.

Between 2016 and 2018 construction works can be seen around the wider school land. The playing field to the south was utilised as a compound and parking area and was redeveloped and reshaped upon completion. To the school buildings, the western buildings were demolished and replaced with a MUGA, parking and green space.

Site Topography

The topography over the pitch area shows a fall from the west to the east by approximately 0.8m. To the north of the development there is a bank down to the main school leading by approximately 0.74m. Further information on existing levels can be seen within 'SSL3394 01 – Existing Site Plan'.

Local Watercourses and Existing Drainage

The nearest surface water body is an attenuation basin/dry pond on site to the east.

There is currently no existing drainage on site. The land falls towards the dry pond and therefore the surface water currently enters the dry pond without any restriction or control. Therefore, the proposed surface water system for the AGP is to connect into the dry pond with the proposed drainage system shown in SSL3394 08 - Proposed AGP Drainage Layout. The AGP drainage system will include a restricted outfall and provide additional attenuation to the site and therefore better the current provision.

Ground Conditions

Made ground was encountered across the site and generally comprised light yellow slightly gravelly sandy clay with occasional brick fragments (reworked natural strata). The made ground was noted to extend to depths of between 1.00m and 1.50mbgl. Please note that the base of the made ground was not encountered in either of the trial pits which extended to a maximum depth of 2.30mbgl. Suspected buried topsoil comprising light brown sandy clay was encountered at the base of the made ground in WS01 and WS03.

The made ground was generally immediately underlain by natural cohesive deposits comprising firm to stiff light yellow slightly sandy gravelly clay. Occasional soft horizons were noted to the uppermost horizon of the natural deposits (e.g. in WS02 and WS04). The natural strata are considered to be potentially representative of the superficial Lowestoft Formation (Diamicton) which is recorded to underlie the site.

The made ground is anticipated to be from the redevelopment of the site in 2018 when the playing field was completely re-developed following the refurbishment of the school.

Groundwater

Groundwater was not encountered in any of the trial holes.

Infiltration Potential

Whilst infiltration is not suitable or recommended within made ground, indicative infiltration testing was undertaken within WS02, targeting the natural deposits. In summary, insufficient infiltration was recorded and the underlying shallow natural cohesive deposits are considered to be unsuitable for soakaway drainage.

Source Protection Zone

The site **is** located within Source Protection Zone 3.

Coal Mining

Coal Authority mapping data shows the site **does not** lie within a Coal Mining Reporting area.

Flood Risk

The Government websites confirm the proposed development area is located within a flood zone 1.

Flood zone 1 - This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%). The likelihood of flooding from the rivers or the sea at the proposed development site is very low.

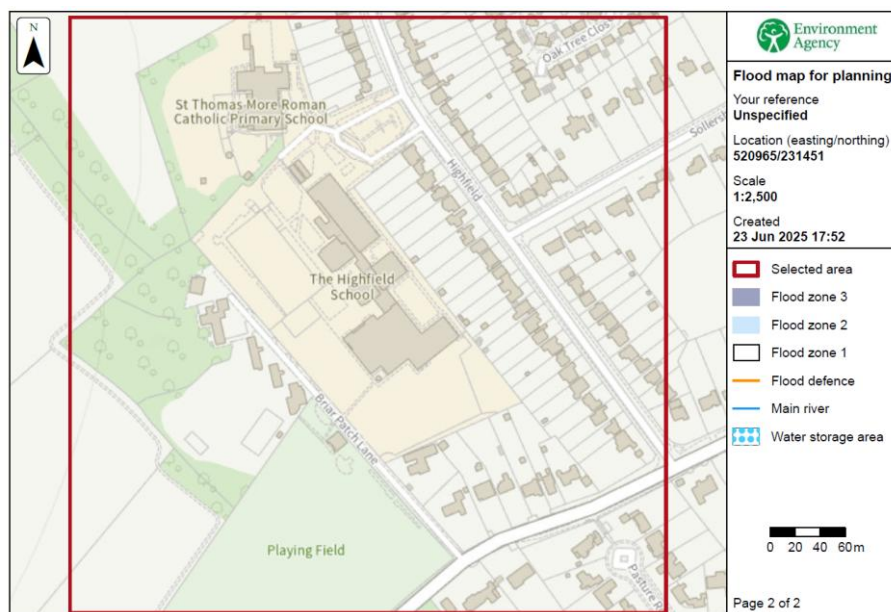


Figure 2 - Flood Map for Planning

Risk of Flooding from Surface Water

The Government website confirms the proposed development area is at low risk of flooding from surface water, which happens when rainwater does not drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead.

Low risk means that each year this area has a chance of flooding of between 0.1% and 1% chance of a flood each year.

Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

Development Proposals and Flood Risk Vulnerability

As the proposal is situated within a flood zone 1, a comparison of the proposal against flood risk vulnerability classifications is not required as the development site is not larger than 1ha.

SSL project code	SSL3394	6
Client	The Highfield School	
Document Title	Sports Lighting Statement	

Planning Policy Framework

NPPF - Meeting the Challenge of Climate Change, Flooding and Coastal Change

Paragraph 181 sets out:

When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment⁶³. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- (a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
- (b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;
- (c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
- (d) any residual risk can be safely managed; and
- (e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

DEFRA - National standards for sustainable drainage systems (SuDS)

The surface water drainage scheme must be in accordance with the National standards for sustainable drainage systems (SuDS) (June 2025) or any subsequent replacement national standards and unless otherwise agreed in writing by the Local Planning Authority, no surface water shall discharge to the public sewerage system either directly or indirectly.

Flood Risk Vulnerability Classification

To assist the application for full planning permission and to facilitate the satisfactory implementation and delivery of the project; an assessment of flood risk and a sustainable drainage proposal is required in accordance with national policies.

With reference to Annex 3 within the 2024 National Planning Policy Framework, the proposed development for an outdoor sports facility would be classified as Water Compatible Development.

Water-Compatible Development

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence installations.

- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- **Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.**
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan

Based on the above assessment of the site being located within a Flood Zone 1 and classified as a 'water compatible development' and with reference to Planning Practice Guidance for 'Flood Risk and Coastal Change' to the National Planning Policy Framework (Table 3), the proposed development of this site would be considered "appropriate".

Table 1 - Flood Risk Vulnerability and Flood Zone Compatibility

Flood risk vulnerability classification	Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3A	Exception Test required	✓	✗	Exception Test required	✓
Zone 3B	Exception Test required	✓	✗	✗	✗

Key:

✓Development is appropriate

✗Development should not be permitted

Sequential Test

As the site is located within a Flood Zone 1, a sequential test is not required and it is worth noting the site is used (and historically designated) as a sports complex (active playing field) the development can be deemed to have passed the sequential test.

The proposed development will replace part of an existing playing field.

Surface Water Disposal Hierarchy

In accordance with the National Planning Policy Framework (NPPF) and the National Planning Practice Guidance (NPPG), the site should be drained in the most sustainable way. No foul sewage will be created as part of this development.

The National standards for sustainable drainage systems (SuDS) (2025) clearly outlines the hierarchy to be investigated by the developer when considering a surface water drainage strategy. As such, the developer must consider the following drainage options in the following order of priority:

- A. Collected for non-potable use;
- B. Infiltrated to ground;
- C. Discharged to an above ground surface water body;
- D. To a surface water sewer, highway drain, or another piped drainage system;
- E. Discharged to a combined sewer.

This is necessary to promote sustainable development, secure proper drainage and to manage the risk of flooding and pollution. This condition is imposed considering policies within the NPPF and NPPG.

Overland Flow Risk and Compensation Measures

Flood compensation measures will not be required as finished (floor) levels will not affect current flood plain storage onsite.

There is a risk of the critical storm event being exceeded, albeit this risk is considered very low.

In such an event the proposed drainage systems will become overwhelmed and overland flows could occur.

Surface Water Drainage Strategy

Surface Water Disposal Options

The National standards for sustainable drainage systems (SuDS) (2025) clearly outlines the hierarchy to be investigated by the developer when considering a surface water drainage strategy. As such, the drainage options have been considered and followed in the following order of priority:

A. Collected for non-potable use

At the AGP site there is no significant or continuous on-site water demand and therefore there is no scope for the reuse of surface water within the site, and so rainwater re-use is not proposed.

B. Soak away

The soils across the pitch are not considered amenable to the use of soakaway type systems, thus an alternative drainage solution will need to be considered.

C. Surface Water Body

The proposal is to connect into the existing dry pond which the field currently drains into. The proposal will incorporate a restricted outfall to manage the surface water better than at present.

D. Surface Water Sewer

Not required due to Option C being possible.

E. Combined Sewer

Not required due to Option C being possible.

Surface Water Drainage Principle

FIFA's Quality Concept for Football Turf (Handbook of Requirements January 2015 Edition) requires a 3G artificial turf to provide water permeability (for outdoor uses) >180mm/hr and advises that to ensure adequate drainage of a field, all individual elements of the football turf should satisfy this requirement.

A positive drainage scheme (land drainage); shall be installed beneath the Artificial Grass Pitch (AGP) area comprising UPVC perforated carrier and lateral pipe drains.

The granular pitch substrate (typically consisting of Type 3 unbound (SHW 800 Series) to comply with BSEN 13285) is intended to provide onsite containment and attenuation within the granular sub-base, before surface water enters the proposed surface water connection.

The designed surface water drainage solution should be based upon the following criteria, to maintain satisfactory system performance:

- Provide adequate functionality over a period of twenty years.
- Prevent the risk of uncontrolled flooding elsewhere (to land adjacent to the development).

- Comply with all applicable Sustainable Urban Drainage System (SUDS) requirements with attenuated flows (containment within the granular pitch sub-base) incorporated wherever necessary, without affecting the performance of the pitch.

This is achieved through the surface water being attenuated / stored within the construction make up of the artificial turf pitch that has 37% void space acting as the surface water drainage.

As shown below the calculated volume for storage to meet a 1 in 100 year storm event + 40% climate change is 208m³. The attenuation calculated within the base of the pitch and proposed drainage system allows the controlled storage onsite up to 333m³ as detailed within SSL3394 08 – Proposed AGP Drainage Strategy.

The proposed development and associated surface drainage strategy from this site is such that the surface water will be managed and disposed of within the existing surface water drainage, thus complying with the Technical Guidance to the National Planning Policy Framework.

Surface water management and disposal performance will be achieved by the following physical implications to the development (the Artificial Grass Pitches):

- Adequate attenuation (water storage) within pitch bases (comprising a permeable granular sub-base) to ensure that excess volumes, which would be experienced during a critical storm event, does not bypass the control system;
- Restricted flow rate to 1.0 l/s before discharging into the existing site drainage system.

The drainage solution is designed to ensure no above ground flooding occurs up to and including the 1 in 100 year event plus a 45% allowance for climate change.

Drainage Calculations and Attenuation Capacity

Minimum Storage Required:			35 m ³		incl cc allowance										
FACTOR	VALUE	SOURCE							FACTOR	VALUE					
Return Period (yrs):	1	Environment Agency, Water Authority, etc.							Additional Inflow (l/s):	0					
Limiting Discharge (l/s):	1	Environment Agency, Water Authority, etc.							Calculate/Specify PR:	Calculate					
Contributing Area (ha):	0.3255	Site plans							Specify PR:	100					
Impervious, PIMP (%):	100	Site plans							Climate Change Allowance	0					
M5-60min (mm):	20	Volume 3 maps and site location													
SAAR (mm/yr):	586	Volume 3 maps and site location													
Ratio, r:	0.4	Volume 3 maps and site location													
Soil Type:	3	Volume 3 maps and site location													
SOIL:	0.4	Soil Type and Volume 1, Section 7.4													
UCWI:	52	SAAR and Volume 1, Figure 9.7													
Calculated PR	76.29														
Percentage Runoff =	76.29														

Duration, D (min)	M5-60 (mm)	Z1 for r=0.40	M5-D (mm)	Z2 for M1	M1-D (mm)	incl climate change	Area C (ha)	PR (%)	Runoff (m3)	Add. Runoff (m3)	Total Runoff (m3)	Limiting Discharge (m3/min)	Limiting Runoff (m3)	Storage Required (m3)
5	20	0.38	7.6	0.61	4.7	4.7	0.33	76	11.6	0.0	11.6	0.06	0.3	11.3
10	20	0.54	10.8	0.61	6.6	6.6	0.33	76	16.4	0.0	16.4	0.06	0.6	15.8
15	20	0.63	12.6	0.62	7.8	7.8	0.33	76	19.3	0.0	19.3	0.06	0.9	18.4
30	20	0.80	16.0	0.62	10.0	10.0	0.33	76	24.8	0.0	24.8	0.06	1.8	23.0
60	20	1.00	20.0	0.64	12.8	12.8	0.33	76	31.8	0.0	31.8	0.06	3.6	28.2
120	20	1.20	24.0	0.66	15.7	15.7	0.33	76	39.1	0.0	39.1	0.06	7.2	31.9
240	20	1.46	29.2	0.68	19.7	19.7	0.33	76	49.0	0.0	49.0	0.06	14.4	34.6
360	20	1.60	32.0	0.68	21.9	21.9	0.33	76	54.3	0.0	54.3	0.06	21.6	32.7
480	20	1.70	34.0	0.69	23.4	23.4	0.33	76	58.1	0.0	58.1	0.06	28.8	29.3
600	20	1.83	36.6	0.69	25.4	25.4	0.33	76	63.1	0.0	63.1	0.06	36.0	27.1
720	20	1.85	37.0	0.69	25.7	25.7	0.33	76	63.8	0.0	63.8	0.06	43.2	20.6
840	20	1.90	38.0	0.70	26.4	26.4	0.33	76	65.7	0.0	65.7	0.06	50.4	15.3
1440	20	2.28	45.6	0.71	32.5	32.5	0.33	76	80.6	0.0	80.6	0.06	86.4	-5.8
2880	20	2.70	54.0	0.73	39.2	39.2	0.33	76	97.4	0.0	97.4	0.06	172.8	-75.4

Figure 3 - 1 in 2 year attenuation volumes to 1.0 l/s

Minimum Storage Required: **99 m³** incl cc allowance

FACTOR	VALUE	SOURCE
Return Period (yrs):	30	Environment Agency, Water Authority, etc.
Limiting Discharge (l/s):	1	Environment Agency, Water Authority, etc.
Contributing Area (ha):	0.3255	Site plans
Impervious, PIMP (%):	100	Site plans
M5-60min (mm):	20	Volume 3 maps and site location
SAAR (mm/yr):	586	Volume 3 maps and site location
Ratio, r:	0.4	Volume 3 maps and site location
Soil Type:	3	Volume 3 maps and site location
SOIL:	0.4	Soil Type and Volume 1, Section 7.4
UCWI:	52	SAAR and Volume 1, Figure 9.7
Calculated PR	76.29	
Percentage Runoff =	76.29	

FACTOR	VALUE
Additional Inflow (l/s):	0
Calculate/Specify PR:	Calculate
Specify PR:	100
Climate Change Allowance	0

Duration, D (min)	M5-60 (mm)	Z1 for r=0.40	M5-D (mm)	Z2 for M30	M30-D (mm)	incl climate change	Area C (ha)	PR (%)	Runoff (m3)	Add. Runoff (m3)	Total Runoff (m3)	Limiting Discharge (m3/min)	Limiting Runoff (m3)	Storage Required (m3)
5	20	0.38	7.6	1.46	11.1	11.1	0.33	76	27.6	0.0	27.6	0.06	0.3	27.3
10	20	0.54	10.8	1.50	16.2	16.2	0.33	76	40.2	0.0	40.2	0.06	0.6	39.6
15	20	0.63	12.6	1.51	19.1	19.1	0.33	76	47.3	0.0	47.3	0.06	0.9	46.4
30	20	0.80	16.0	1.53	24.5	24.5	0.33	76	60.8	0.0	60.8	0.06	1.8	59.0
60	20	1.00	20.0	1.54	30.9	30.9	0.33	76	76.6	0.0	76.6	0.06	3.6	73.0
120	20	1.20	24.0	1.54	36.8	36.8	0.33	76	91.5	0.0	91.5	0.06	7.2	84.3
240	20	1.46	29.2	1.52	44.3	44.3	0.33	76	110.0	0.0	110.0	0.06	14.4	95.6
360	20	1.60	32.0	1.50	48.1	48.1	0.33	76	119.5	0.0	119.5	0.06	21.6	97.9
480	20	1.70	34.0	1.49	50.8	50.8	0.33	76	126.2	0.0	126.2	0.06	28.8	97.4
600	20	1.83	36.6	1.48	54.2	54.2	0.33	76	134.6	0.0	134.6	0.06	36.0	98.6
720	20	1.85	37.0	1.48	54.8	54.8	0.33	76	136.0	0.0	136.0	0.06	43.2	92.8
840	20	1.90	38.0	1.48	56.1	56.1	0.33	76	139.3	0.0	139.3	0.06	50.4	88.9
1440	20	2.28	45.6	1.44	65.6	65.6	0.33	76	162.9	0.0	162.9	0.06	86.4	76.5
2880	20	2.70	54.0	1.41	76.0	76.0	0.33	76	188.8	0.0	188.8	0.06	172.8	16.0

Figure 4 - 1 in 30 year attenuation volumes to 1.0 l/s

Minimum Storage Required: **146 m³** incl cc allowance

FACTOR	VALUE	SOURCE
Return Period (yrs):	30	Environment Agency, Water Authority, etc.
Limiting Discharge (l/s):	1	Environment Agency, Water Authority, etc.
Contributing Area (ha):	0.3255	Site plans
Impervious, PIMP (%):	100	Site plans
M5-60min (mm):	20	Volume 3 maps and site location
SAAR (mm/yr):	586	Volume 3 maps and site location
Ratio, r:	0.4	Volume 3 maps and site location
Soil Type:	3	Volume 3 maps and site location
SOIL:	0.4	Soil Type and Volume 1, Section 7.4
UCWI:	52	SAAR and Volume 1, Figure 9.7
Calculated PR	76.29	
Percentage Runoff =	76.29	

FACTOR	VALUE
Additional Inflow (l/s):	0
Calculate/Specify PR:	Calculate
Specify PR:	100
Climate Change Allowance	35

Duration, D (min)	M5-60 (mm)	Z1 for r=0.40	M5-D (mm)	Z2 for M30	M30-D (mm)	incl climate change	Area C (ha)	PR (%)	Runoff (m3)	Add. Runoff (m3)	Total Runoff (m3)	Limiting Discharge (m3/min)	Limiting Runoff (m3)	Storage Required (m3)
5	20	0.38	7.6	1.46	11.1	15.0	0.33	76	37.3	0.0	37.3	0.06	0.3	37.0
10	20	0.54	10.8	1.50	16.2	21.8	0.33	76	54.2	0.0	54.2	0.06	0.6	53.6
15	20	0.63	12.6	1.51	19.1	25.7	0.33	76	63.9	0.0	63.9	0.06	0.9	63.0
30	20	0.80	16.0	1.53	24.5	33.0	0.33	76	82.1	0.0	82.1	0.06	1.8	80.3
60	20	1.00	20.0	1.54	30.9	41.7	0.33	76	103.5	0.0	103.5	0.06	3.6	99.9
120	20	1.20	24.0	1.54	36.8	49.7	0.33	76	123.5	0.0	123.5	0.06	7.2	116.3
240	20	1.46	29.2	1.52	44.3	59.8	0.33	76	148.5	0.0	148.5	0.06	14.4	134.1
360	20	1.60	32.0	1.50	48.1	65.0	0.33	76	161.3	0.0	161.3	0.06	21.6	139.7
480	20	1.70	34.0	1.49	50.8	68.6	0.33	76	170.4	0.0	170.4	0.06	28.8	141.6
600	20	1.83	36.6	1.48	54.2	73.2	0.33	76	181.7	0.0	181.7	0.06	36.0	145.7
720	20	1.85	37.0	1.48	54.8	74.0	0.33	76	183.6	0.0	183.6	0.06	43.2	140.4
840	20	1.90	38.0	1.48	56.1	75.7	0.33	76	188.0	0.0	188.0	0.06	50.4	137.6
1440	20	2.28	45.6	1.44	65.6	88.6	0.33	76	219.9	0.0	219.9	0.06	86.4	133.5
2880	20	2.70	54.0	1.41	76.0	102.6	0.33	76	254.8	0.0	254.8	0.06	172.8	82.0

Figure 5 - 1 in 30 year + 35% CC attenuation volumes to 1.0 l/s

Minimum Storage Required: **138 m³** incl cc allowance

FACTOR	VALUE	SOURCE
Return Period (yrs):	100	Environment Agency, Water Authority, etc.
Limiting Discharge (l/s):	1	Environment Agency, Water Authority, etc.
Contributing Area (ha):	0.3255	Site plans
Impervious, PIMP (%):	100	Site plans
M5-60min (mm):	20	Volume 3 maps and site location
SAAR (mm/yr):	586	Volume 3 maps and site location
Ratio, r:	0.4	Volume 3 maps and site location
Soil Type:	3	Volume 3 maps and site location
SOIL:	0.4	Soil Type and Volume 1, Section 7.4
UCWI:	52	SAAR and Volume 1, Figure 9.7
Calculated PR	76.29	
Percentage Runoff =	76.29	

FACTOR	VALUE
Additional Inflow (l/s):	0
Calculate/Specify PR:	Calculate
Specify PR:	100
Climate Change Allowance	0

Duration, D (min)	M5-60 (mm)	Z1 for r=0.40	M5-D (mm)	Z2 for M100	M100-D (mm)	incl climate change	Area C (ha)	PR (%)	Runoff (m3)	Add. Runoff (m3)	Total Runoff (m3)	Limiting Discharge (m3/min)	Limiting Runoff (m3)	Storage Required (m3)
5	20	0.38	7.6	1.86	14.2	14.2	0.33	76	35.1	0.0	35.1	0.06	0.3	34.8
10	20	0.54	10.8	1.93	20.8	20.8	0.33	76	51.7	0.0	51.7	0.06	0.6	51.1
15	20	0.63	12.6	1.96	24.7	24.7	0.33	76	61.3	0.0	61.3	0.06	0.9	60.4
30	20	0.80	16.0	2.00	32.0	32.0	0.33	76	79.4	0.0	79.4	0.06	1.8	77.6
60	20	1.00	20.0	2.03	40.6	40.6	0.33	76	100.8	0.0	100.8	0.06	3.6	97.2
120	20	1.20	24.0	2.01	48.3	48.3	0.33	76	120.0	0.0	120.0	0.06	7.2	112.8
240	20	1.46	29.2	1.98	57.8	57.8	0.33	76	143.4	0.0	143.4	0.06	14.4	129.0
360	20	1.60	32.0	1.95	62.5	62.5	0.33	76	155.3	0.0	155.3	0.06	21.6	133.7
480	20	1.70	34.0	1.94	65.9	65.9	0.33	76	163.6	0.0	163.6	0.06	28.8	134.8
600	20	1.83	36.6	1.91	70.1	70.1	0.33	76	173.9	0.0	173.9	0.06	36.0	137.9
720	20	1.85	37.0	1.91	70.8	70.8	0.33	76	175.8	0.0	175.8	0.06	43.2	132.6
840	20	1.90	38.0	1.91	72.4	72.4	0.33	76	179.8	0.0	179.8	0.06	50.4	129.4
1440	20	2.28	45.6	1.84	84.0	84.0	0.33	76	208.6	0.0	208.6	0.06	86.4	122.2
2880	20	2.70	54.0	1.78	96.3	96.3	0.33	76	239.0	0.0	239.0	0.06	172.8	66.2

Figure 6 - 1 in 100 year attenuation volumes to 1.0 l/s

Minimum Storage Required: **208 m³** incl cc allowance

FACTOR	VALUE	SOURCE
Return Period (yrs):	100	Environment Agency, Water Authority, etc.
Limiting Discharge (l/s):	1	Environment Agency, Water Authority, etc.
Contributing Area (ha):	0.3255	Site plans
Impervious, PIMP (%):	100	Site plans
M5-60min (mm):	20	Volume 3 maps and site location
SAAR (mm/yr):	586	Volume 3 maps and site location
Ratio, r:	0.4	Volume 3 maps and site location
Soil Type:	3	Volume 3 maps and site location
SOIL:	0.4	Soil Type and Volume 1, Section 7.4
UCWI:	52	SAAR and Volume 1, Figure 9.7
Calculated PR	76.29	
Percentage Runoff =	76.29	

FACTOR	VALUE
Additional Inflow (l/s):	0
Calculate/Specify PR:	Calculate
Specify PR:	100
Climate Change Allowance	40

Duration, D (min)	M5-60 (mm)	Z1 for r=0.40	M5-D (mm)	Z2 for M100	M100-D (mm)	incl climate change	Area C (ha)	PR (%)	Runoff (m3)	Add. Runoff (m3)	Total Runoff (m3)	Limiting Discharge (m3/min)	Limiting Runoff (m3)	Storage Required (m3)
5	20	0.38	7.6	1.86	14.2	19.8	0.33	76	49.2	0.0	49.2	0.06	0.3	48.9
10	20	0.54	10.8	1.93	20.8	29.1	0.33	76	72.3	0.0	72.3	0.06	0.6	71.7
15	20	0.63	12.6	1.96	24.7	34.5	0.33	76	85.8	0.0	85.8	0.06	0.9	84.9
30	20	0.80	16.0	2.00	32.0	44.8	0.33	76	111.1	0.0	111.1	0.06	1.8	109.3
60	20	1.00	20.0	2.03	40.6	56.8	0.33	76	141.1	0.0	141.1	0.06	3.6	137.5
120	20	1.20	24.0	2.01	48.3	67.7	0.33	76	168.0	0.0	168.0	0.06	7.2	160.8
240	20	1.46	29.2	1.98	57.8	80.9	0.33	76	200.8	0.0	200.8	0.06	14.4	186.4
360	20	1.60	32.0	1.95	62.5	87.5	0.33	76	217.4	0.0	217.4	0.06	21.6	195.8
480	20	1.70	34.0	1.94	65.9	92.2	0.33	76	229.1	0.0	229.1	0.06	28.8	200.3
600	20	1.83	36.6	1.91	70.1	98.1	0.33	76	243.5	0.0	243.5	0.06	36.0	207.5
720	20	1.85	37.0	1.91	70.8	99.1	0.33	76	246.2	0.0	246.2	0.06	43.2	203.0
840	20	1.90	38.0	1.91	72.4	101.4	0.33	76	251.8	0.0	251.8	0.06	50.4	201.4
1440	20	2.28	45.6	1.84	84.0	117.6	0.33	76	292.0	0.0	292.0	0.06	86.4	205.6
2880	20	2.70	54.0	1.78	96.3	134.8	0.33	76	334.7	0.0	334.7	0.06	172.8	161.9

Figure 7 - 1 in 100 year + 45% CC attenuation volumes to 1.0 l/s

A hydraulic model has not been developed to simulate the flows within and flooding from the piped drainage network. It is not possible to simulate the pitch drainage within the hydraulic modelling software to accurately simulate the flow within a perforated pipe network which uses the pitch sub-base as attenuation and storage, as is the case with this particular drainage network.

The design of the pitch sub-base and the associated drainage network is such that additional surface water flows that cannot be accommodated within the piped drainage network will enter the pitch sub-base via the perforated pipe network, and will be attenuated in the sub-base until such a time and the flows within the piped network have subsided to a level which will allow the surface water to re-enter the piped network and discharge downstream into the drainage ditch.

As such, in the case of surface water networks for pitches, which use the sub-base as a storage area, it is accepted that confirming that there is adequate storage within the pitch to accommodate any flooding, is an acceptable work-around for the shortfall.

Further information on the design and attenuation volumes within such events can be seen within:

- SSL3394 07 – Proposed AGP Drainage Layout
- SSL3394 08 – Proposed AGP Drainage Strategy

Foul Water Drainage Strategy

There will be **no foul water** produced as part of the site development.

Surface Drainage Maintenance

The drainage system will be designed to minimise maintenance requirements; however, a full maintenance scheme will be established for those elements not being offered for adoption.

Maintenance operations will be carried out by The Highfield School in perpetuity post development and the Drainage Management & Maintenance is outlined within the below section.

Construction Surface Water Management

The existing surface is permeable, and the principal of the sports pitch uses the pitch sub-base as attenuation and storage.

Due to the nature of the construction works, little onsite material storage is required. During the processes when it is required it will be for relatively short periods of time.

Below is a brief description of the key construction works for an Artificial Grass Pitch and associated activities:

- Topsoil strip and a cut and fill undertaken across the site.
- Installation of the new drainage system, with the process taking approximately 3 days to complete. The materials largely involve the delivery of pea shingle material stockpiled within the development footprint with 80mm and 150mm Ø UPVC perforated corrugated plastic carrier drainage pipes to EN1401-1:1998 laid into geotextile lined, gravel-filled trenches. The UPVC perforated corrugated plastic carrier pipes shall be stored onsite within the designated fenced and enclosed storage areas prior to being securely laid and covered within the ground.
- The boundary of the development shall be lined with PCC kerb edging detail and the necessary fence posts, floodlighting foundations that involves concrete foundations. These materials will be stored within the designated storage area in bulk delivery with each being heavily weighted with minimal risk of movement.

- Following the PCC kerb installation, the crushed stone is installed and rolled to form the sub-base to the development.
- At this stage the fencing system shall be erected and in place around the development footprint and any/all materials within the development will be safely secured.
- The development area shall then be surfaced with tarmacadam on top of the stone sub-base. The process of tarmac surfacing requires material to be delivered and laid at set temperatures and therefore no materials will be storage onsite for this process and works and shall take approximately 5 days to complete.
- Upon completion of the base works the artificial surfacing shall be delivered in bulk to the pitch base within the secure fenced area. The material is rolled out and laid with the boundary of the surfacing being clamped and secured to the edging detail so that the material stays insitu and cannot be removed during any flood event or otherwise.

The development location itself acts as a sediment trap / barrier that retains surface water within the site boundary with any/all surface water run off going through the existing infrastructure of the hard-standing surfacing, stone foundation, geotextile membrane and entering into the existing and proposed drainage network that is lined with a geotextile membrane, pea shingle and drainage channels that each connect to a silt trap inspection chamber. This process will adequately trap and retain sediment throughout the construction process.

The existing and proposed levels and gradients of the site lead across the sports pitch. Whilst travelling across the development through the natural fall of levels the surface water will infiltrate through the stone foundation, geotextile membrane and entering into the existing and proposed drainage network that is lined with a geotextile membrane, shingle and drainage channels that each connect to a silt trap inspection chamber. This process will adequately trap and retain sediment throughout the construction process. Any run off that travels through the site prior to naturally infiltrating through the base would be retained within the development boundary. Surface water would sit within the development area until it naturally infiltrates through the existing hard-standing surfacing, stone foundation, geotextile membrane and entering into the existing and proposed drainage network that is lined with a geotextile membrane, shingle and drainage channels that each connect to a silt trap inspection chamber.

Throughout the development works the areas and development footprint will be cleared, cleaned and jet washed with the silt traps collecting all sediment and being emptied as / when required until all construction works are completed.

Run-off rates from the site will be managed so they are no greater than pre-development or in keeping with the best practice guidance to minimise risk of blockage.

Run-off control will include provision of appropriate levels / grading to direct any water from the construction site to remain on site.

Site Drainage Proposals Conclusions

- The proposed development includes the creation of a new external artificial grass pitch with perimeter ball-stop fencing, and clean accesses.
- The proposed development area will occupy land and replace an existing sports area.
- Surface water is to be disposed of into a surface water drain;
- Adequate attenuation within pitch base and upper surface (comprising a permeable granular sub-base) to ensure that excess volumes, which would be experienced during a critical storm event, does not bypass the control system.
- This drainage strategy is designed to ensure no above ground flooding occurs up to and including the 1 in 100 year event + 40% allowance for climate change.
- The surface water drainage from this site, post development, is such that the surface water will be managed and disposed of within the site boundary, thus complying with the Planning Practice Guidance for 'Flood Risk and Climate Change' to the National Planning Policy Framework.
- Based on the above and providing the above strategies are adopted; the developed site will not contribute further to flood risk thus satisfying the principles of the National Planning Policy Framework.

Drainage Management & Maintenance

Gullies, Pipework, Inspection Chambers and Controls

Required Action	Frequency
Regular Maintenance	
Remove cover and inspect chambers and pipework ensuring water is flowing freely and that the exit route for water is unobstructed.	Annually
Undertake inspection after leaf fall in autumn, remove leaves from gullies, chambers and pipes.	Every autumn
Inspect silt traps and clear of silt	Every 6 months or as required
Inspect catchpits and clear of silt	Every 6 months or as required
Remedial work	
Remove debris, silt and leaves from inspection chambers and flow control chambers.	As required
Remove debris and silt from pipework through high pressure jet washing.	As required
Repair physical damage if necessary.	As required
Monitoring	
CCTV survey to establish condition of pipe runs. Cleansing or repair of physical damage to be conducted if necessary	Every 5 years or as required

Permeable and Porous Surfaces

Required Action

Frequency

Regular Maintenance

Brushing and vacuuming (standard cosmetic sweep over whole surface)

Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment

Occasional Tasks

Stabilise and mow contributing and adjacent areas

As required

Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying

As required and in accordance with manufacturer's recommendations

Remedial Work

Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost material.

As required

Rehabilitation of surface and upper substructure by remedial sweeping

Every 10 to 15 years or as required

If efficiency of water percolating to the sub-base drops, jet washing and suction cleaning could substantially reinstate paving to 90% efficiency (as per recent experience).

As required

Monitoring

Initial inspection	Monthly for three months after installation
Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48h after large storms in first six months
Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
Monitor inspection chambers	Annually