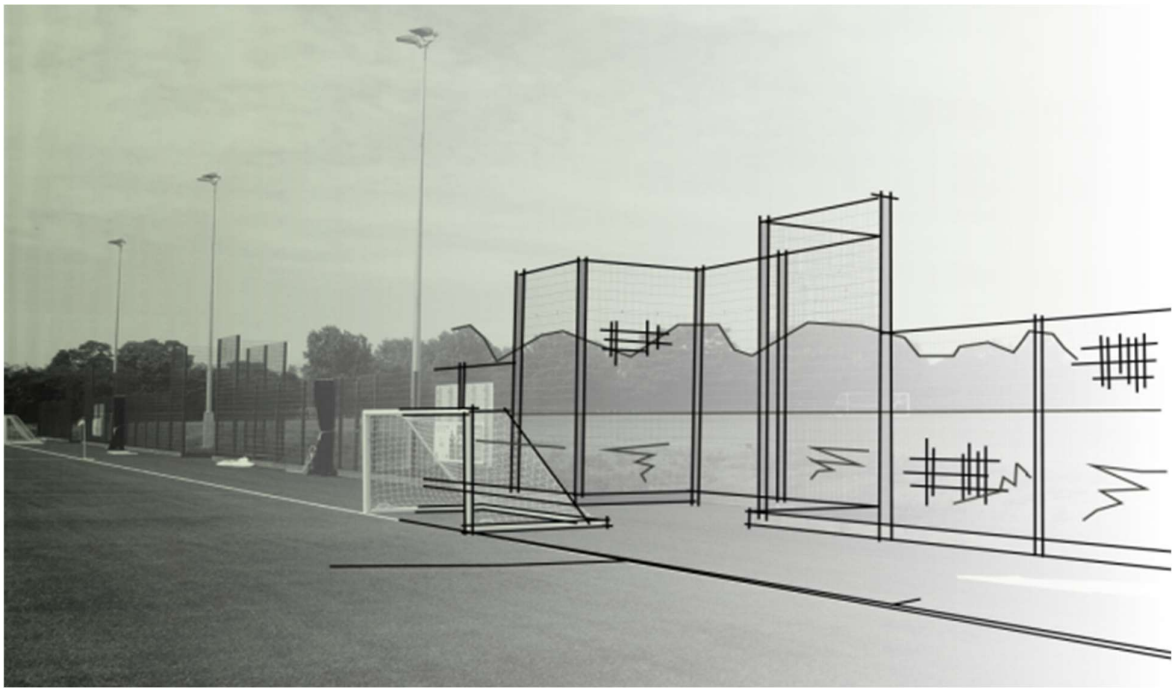
Queen Elizabeth Grammar School

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

Drainage Strategy



Client	Queen Elizabeth Grammar School West St, Horncastle LN9 5AD		
Project	Creation of a 3G Artificial Grass Pitch (AGP) with perimeter fencing, acoustic fencing, hardstanding areas, storage container, floodlights, an access footpath and associated bund		
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Surfacing Standards Limited,
Office 2 Empingham House, Uppingham Gate, Ayston Road, Uppingham, Rutland, LE15 9NY

T. 01536 400012
E. info@surfacingstandards.co.uk

www.surfacingstandards.co.uk

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Surfacing Standards Limited,
Office 2 Empingham House, Uppingham Gate, Ayston Road, Uppingham, Rutland, LE15 9NY

T. 01536 400012
E. info@surfacingstandards.co.uk

www.surfacingstandards.co.uk

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1. Introduction

Surfacing Standards Limited has been appointed to consider and develop an application for full planning permission for the creation of a 3G Artificial Grass Pitch (AGP) with perimeter fencing, acoustic fencing, hardstanding areas, storage container, floodlights, an access footpath and associated bund.

The assessment has been carried out in accordance with the guidance set out in the National Planning Policy Framework (NPPF).

2. Site Details

The Proposal

The proposed development will include the creation of an Artificial Grass Pitch (AGP) with new fencing and hard standing pathways as shown within table 1.

Table 1 – Area of pitch and associated development

Aspect	Area
3G artificial grass pitch area	5,917m2
Porous Asphalt surfaced areas	1,252m2
Proposed bunding	2,069m2
Total Development Area	**8,518m2**

Subject Area

The proposed development is situated at Queen Elizabeth Grammar School, West St, Horncastle, LN9 5AD.

Figure 1 – Site Location

Site Description

The school buildings are located in the south of the site (to the south east of the proposed pitch) with the playing fields to the north and north west. The playing fields extend further to the north east of the proposed pitch with a surfaced sports court, and some small buildings adjacent to the east of this, located centrally within the playing field adjacent to the north east corner of the proposed pitch. There are trees lining the field boundaries to the north, west and south of the proposed pitch and occasional trees to the east. Directly to the south is an industrial/commercial unit and some hardstanding with shipping containers. Adjacent to the north and west boundaries are residential housing.

Surfacing Standards Limited,
Office 2 Empingham House, Uppingham Gate, Ayston Road, Uppingham, Rutland, LE15 9NY

T. 01536 400012
E. info@surfacingstandards.co.uk

www.surfacingstandards.co.uk

Site History

Historical mapping from the late 1800s and early 1900s show the site to be potentially agricultural, with only a few buildings to the east, southeast and residential housing adjacent to the western site boundary. To the south east some small buildings are recorded as school and the original school is understood to be founded in 1571. There appear to be wells recorded within 2 of the gardens directly to the west of the subject site. The site is divided by a number of field boundaries prior to being school playing fields.

Aerial Imagery from 2003 to 2016 show the site to appear relatively unchanged from present day, except for changes in vegetation. Since 2016, the sand pit is shown and some new school buildings

Site Topography

Topography of the area shows a fall from the northwest to the southeast by approximately 3.44m. Further information on existing levels can be seen within 'SC104 01 - Topographical Survey'.

Local Watercourses

There is a surface water feature that runs along the western boundary of the main school playing field, and is culverted where the field extends out to the west (where the AGP is located).

Existing Drainage

There is currently no formal existing site drainage for the area of the proposed AGP. Currently the surface water has no restriction and flows towards the surface water feature to the south east of the AGP.

Figure 2 – Proposed Line of surface water feature

Source protection zone

The site is not located within a Source Protection Zone.

Coal Mining

Site is not within an area of coal mining.

Ground Conditions Encountered

Topsoil was encountered to depths of between 0.1m to 0.4m bgl. Made Ground was encountered beneath the topsoil in two of the positions, WS02 in the south east corner of the site to a depth of 0.7m bgl and WS05 in the north west corner to a depth of 1.4m bgl. Beneath the topsoil or Made Ground were deposits of Glacial Till generally comprising a sandy slightly gravelly silty clay or clayey silt with frequent chalk and flint. Each of the positions were terminated at between 1.0m

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E. info@surfacingstandards.co.uk

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and 4.0m due to SPT refusal/blows of 50. At the southern end of the site the boreholes were terminated at 1.0m depth due to refusal SPT of 50 and centrally 1.0m and 2.0m. At the northern end of the site, the boreholes refused at 3.0m and 4.0m depth.

Groundwater

Groundwater was encountered in WS04 at 2.5m depth which could be the residing groundwater level on the basis that this is the only position that extended to such depth based on topographical levels. Wet soils were also encountered in the base of boreholes WS01 in the south east corner of the site at 1.0m bgl.

Infiltration Potential

Indicative infiltration testing was carried out in boreholes WS01 and WS03 at 1.0m and 2.0m depth bgl respectively. The testing showed a fall of just 10mm over 155 minutes of monitoring in WS01 and 120mm fall over 180 minutes of monitoring in WS03, remaining more than 50% full, with no movement in water level over the last 80 minutes of monitoring. Based on the testing and ground conditions encountered, we do not consider soakaways are likely to be viable for the surface water drainage.

Assessment Context

The proposed pitch development area is approximately 0.64ha. The total development context is 0.92ha.

Flood Map

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.

Risk of Flooding from Rivers and Sea

The Government website confirms the proposed development area is at no risk of flooding from rivers or sea, which happens when there are high tides and stormy conditions.

Risk of Flooding from Surface Water

The Government website confirms the proposed development area is at very 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.

Very low risk means that each year this area has a chance of flooding of less than 0.1%.

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

Whilst the proposal is situated within a flood zone 1, a comparison of the proposal against flood risk vulnerability classifications is required as the development site is larger than 1ha.

3. Framework & Flood Risk Policy

National Planning Policy Framework (2021)
Section 14 – Meeting the Challenge of Climate Change, Flooding and Coastal Change

Policy extract:

Paragraph 167:
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 assessment55. 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.

Department for Environment, Food and Rural Affairs
Sustainable Drainage Systems
Non-statutory technical standards for sustainable drainage systems
March 2015

The surface water drainage scheme must be in accordance with the Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) 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.

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 Table 2 of Planning Practice Guidance to the National Planning Policy Framework, the proposed development for an outdoor sports facility would be classified as Water Compatible Development.

Table 2 - Extract from Table 2 of the PPG for Flood Risk and Coastal Change is replicated below in Table 2.

Flood Risk Vulnerability Classification	
Vulnerability	**Development types**
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 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
Source: Planning Practice Guidance - 2014	

Flood Risk Vulnerability and Flood Zone Compatibility

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".

A copy of Table 3 is presented below to confirm the assessment above.

Table 3 - No exception test

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.

Current Conditions

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

Surface Water Disposal Requirements

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 NPPG 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. Into the ground (infiltration);

B. To a surface water body;

C. To a surface water sewer, highway drain, or another drainage system;

D. 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.

Flood Compensation

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

Overland Flows

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.

4. Surface Water Drainage Strategy

Surface Water Disposal Solution

In accordance with the National Planning Policy Framework (NPPF) and the National Planning Practice Guidance (NPPG), the site should be drained on a separate system with foul water draining to the public sewer and surface water draining in the most sustainable way.

The NPPG clearly outlines the hierarchy to be investigated by the developer when considering a surface water drainage strategy in the following order of priority:

A. Into the ground (infiltration);

B. To a surface water body;

C. To a surface water sewer, highway drain, or another drainage system;

D. To a combined sewer.

Surface Water Disposal Options

A. Soak away

Indicative infiltration testing and ground conditions encountered suggest that soakaways are not likely to be a viable.

B. Surface Water Body

The proposal is to connect into the surface water body to the south east of the proposed AGP.

C. Surface Water Sewer

Not required due to option B being possible.

D. Combined Sewer

Not required due to option B being possible.

Surface Water Drainage Strategy

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 soakaway solution.

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 471m3. The attenuation calculated within the base of the pitch and proposed drainage system allows the controlled storage onsite up to 482m3 as detailed within SC104 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):

1. 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;

2. Restricted flow rate to Qbar rates of 1.02 l/s, as calculated by the HR Wallingford method, 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 40% allowance for climate change.

Minimum Storage Required: 84 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):	1.02	Environment Agency, Water Authority, etc.	Calculate/Specify PR:	Calculate
Contributing Area (ha):	0.638	Site plans	Specify PR:	100
Impervious, PIMP (%):	100	Site plans		
M5-60min (mm):	20	Volume 3 maps and site location	Climate Change Allowance	0
SAAR (mm/yr):	627	Volume 3 maps and site location		
Ratio, r:	0.4	Volume 3 maps and site location		
Soil Type:	2	Volume 3 maps and site location		
SOIL:	0.3	Soil Type and Volume 1, Section 7.4		
UCWI:	62	SAAR and Volume 1, Figure 9.7		
Calculated PR	74.55			
Percentage Runoff =	74.55			

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	0.64	75	22.2	0.0	22.2	0.06	0.3	21.9
10	20	0.54	10.8	0.61	6.6	6.6	0.64	75	31.4	0.0	31.4	0.06	0.6	30.8
15	20	0.63	12.6	0.62	7.8	7.8	0.64	75	36.9	0.0	36.9	0.06	0.9	36.0
30	20	0.80	16.0	0.62	10.0	10.0	0.64	75	47.5	0.0	47.5	0.06	1.8	45.6
60	20	1.00	20.0	0.64	12.8	12.8	0.64	75	60.9	0.0	60.9	0.06	3.7	57.2
120	20	1.20	24.0	0.66	15.7	15.7	0.64	75	74.9	0.0	74.9	0.06	7.3	67.5
240	20	1.46	29.2	0.68	19.7	19.7	0.64	75	93.9	0.0	93.9	0.06	14.7	79.2
360	20	1.60	32.0	0.68	21.9	21.9	0.64	75	104.1	0.0	104.1	0.06	22.0	82.1
480	20	1.70	34.0	0.69	23.4	23.4	0.64	75	111.3	0.0	111.3	0.06	29.4	81.9
600	20	1.83	36.6	0.69	25.4	25.4	0.64	75	120.8	0.0	120.8	0.06	36.7	84.1
720	20	1.85	37.0	0.69	25.7	25.7	0.64	75	122.1	0.0	122.1	0.06	44.1	78.1
840	20	1.90	38.0	0.70	26.4	26.4	0.64	75	125.8	0.0	125.8	0.06	51.4	74.4
1440	20	2.28	45.6	0.71	32.5	32.5	0.64	75	154.4	0.0	154.4	0.06	88.1	66.3
2880	20	2.70	54.0	0.73	39.2	39.2	0.64	75	186.6	0.0	186.6	0.06	176.3	10.3

Figure 3 – 1 in 1 year attenuation volumes to 1.02 l/s

Minimum Storage Required: 224 m^3 incl cc allowance

FACTOR	VALUE	SOURCE	FACTOR	VALUE
Return Period (yrs):	30	Environment Agency, Water Authority, etc.	Additional Inflow (l/s):	0
Limiting Discharge (l/s):	1.02	Environment Agency, Water Authority, etc.	Calculate/Specify PR:	Calculate
Contributing Area (ha):	0.638	Site plans	Specify PR:	100
Impervious, PIMP (%):	100	Site plans		
M5-60min (mm):	20	Volume 3 maps and site location	Climate Change Allowance	0
SAAR (mm/yr):	627	Volume 3 maps and site location		
Ratio, r:	0.4	Volume 3 maps and site location		
Soil Type:	2	Volume 3 maps and site location		
SOIL:	0.3	Soil Type and Volume 1, Section 7.4		
UCWI:	62	SAAR and Volume 1, Figure 9.7		
Calculated PR	74.55			
Percentage Runoff =	74.55			

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	0.64	75	52.9	0.0	52.9	0.06	0.3	52.6
10	20	0.54	10.8	1.50	16.2	16.2	0.64	75	76.9	0.0	76.9	0.06	0.6	76.3
15	20	0.63	12.6	1.51	19.1	19.1	0.64	75	90.6	0.0	90.6	0.06	0.9	89.7
30	20	0.80	16.0	1.53	24.5	24.5	0.64	75	116.4	0.0	116.4	0.06	1.8	114.6
60	20	1.00	20.0	1.54	30.9	30.9	0.64	75	146.8	0.0	146.8	0.06	3.7	143.1
120	20	1.20	24.0	1.54	36.8	36.8	0.64	75	175.3	0.0	175.3	0.06	7.3	167.9
240	20	1.46	29.2	1.52	44.3	44.3	0.64	75	210.7	0.0	210.7	0.06	14.7	196.0
360	20	1.60	32.0	1.50	48.1	48.1	0.64	75	228.9	0.0	228.9	0.06	22.0	206.9
480	20	1.70	34.0	1.49	50.8	50.8	0.64	75	241.7	0.0	241.7	0.06	29.4	212.3
600	20	1.83	36.6	1.48	54.2	54.2	0.64	75	257.7	0.0	257.7	0.06	36.7	221.0
720	20	1.85	37.0	1.48	54.8	54.8	0.64	75	260.6	0.0	260.6	0.06	44.1	216.5
840	20	1.90	38.0	1.48	56.1	56.1	0.64	75	266.8	0.0	266.8	0.06	51.4	215.4
1440	20	2.28	45.6	1.44	65.6	65.6	0.64	75	312.0	0.0	312.0	0.06	88.1	223.9
2880	20	2.70	54.0	1.41	76.0	76.0	0.64	75	361.6	0.0	361.6	0.06	176.3	185.3

Figure 3 – 1 in 30 year attenuation volumes to 2.28 l/s

Surfacing Standards Limited,
Office 2 Empingham House, Uppingham Gate, Ayston Road, Uppingham, Rutland, LE15 9NY

T. 01536 400012
E. info@surfacingstandards.co.uk

www.surfacingstandards.co.uk

Minimum Storage Required: 311 m^3 incl cc allowance

FACTOR	VALUE	SOURCE	FACTOR	VALUE
Return Period (yrs):	100	Environment Agency, Water Authority, etc.	Additional Inflow (l/s):	0
Limiting Discharge (l/s):	1.02	Environment Agency, Water Authority, etc.	Calculate/Specify PR:	Calculate
Contributing Area (ha):	0.638	Site plans	Specify PR:	100
Impervious, PIMP (%):	100	Site plans		
M5-60min (mm):	20	Volume 3 maps and site location	Climate Change Allowance	0
SAAR (mm/yr):	627	Volume 3 maps and site location		
Ratio, r:	0.4	Volume 3 maps and site location		
Soil Type:	2	Volume 3 maps and site location		
SOIL:	0.3	Soil Type and Volume 1, Section 7.4		
UCWI:	62	SAAR and Volume 1, Figure 9.7		
Calculated PR	74.55			
Percentage Runoff =	74.55			

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	0.64	75	67.3	0.0	67.3	0.06	0.3	67.0
10	20	0.54	10.8	1.93	20.8	20.8	0.64	75	98.9	0.0	98.9	0.06	0.6	98.3
15	20	0.63	12.6	1.96	24.7	24.7	0.64	75	117.3	0.0	117.3	0.06	0.9	116.4
30	20	0.80	16.0	2.00	32.0	32.0	0.64	75	152.0	0.0	152.0	0.06	1.8	150.2
60	20	1.00	20.0	2.03	40.6	40.6	0.64	75	193.1	0.0	193.1	0.06	3.7	189.4
120	20	1.20	24.0	2.01	48.3	48.3	0.64	75	229.9	0.0	229.9	0.06	7.3	222.6
240	20	1.46	29.2	1.98	57.8	57.8	0.64	75	274.7	0.0	274.7	0.06	14.7	260.0
360	20	1.60	32.0	1.95	62.5	62.5	0.64	75	297.4	0.0	297.4	0.06	22.0	275.4
480	20	1.70	34.0	1.94	65.9	65.9	0.64	75	313.4	0.0	313.4	0.06	29.4	284.0
600	20	1.83	36.6	1.91	70.1	70.1	0.64	75	333.2	0.0	333.2	0.06	36.7	296.5
720	20	1.85	37.0	1.91	70.8	70.8	0.64	75	336.8	0.0	336.8	0.06	44.1	292.8
840	20	1.90	38.0	1.91	72.4	72.4	0.64	75	344.5	0.0	344.5	0.06	51.4	293.1
1440	20	2.28	45.6	1.84	84.0	84.0	0.64	75	399.5	0.0	399.5	0.06	88.1	311.4
2880	20	2.70	54.0	1.78	96.3	96.3	0.64	75	457.9	0.0	457.9	0.06	176.3	281.6

Figure 4 – 1 in 100 year attenuation volumes to 1.02 l/s

Minimum Storage Required: 471 m^3 incl cc allowance

FACTOR	VALUE	SOURCE	FACTOR	VALUE
Return Period (yrs):	100	Environment Agency, Water Authority, etc.	Additional Inflow (l/s):	0
Limiting Discharge (l/s):	1.02	Environment Agency, Water Authority, etc.	Calculate/Specify PR:	Calculate
Contributing Area (ha):	0.638	Site plans	Specify PR:	100
Impervious, PIMP (%):	100	Site plans		
M5-60min (mm):	20	Volume 3 maps and site location	Climate Change Allowance	40
SAAR (mm/yr):	627	Volume 3 maps and site location		
Ratio, r:	0.4	Volume 3 maps and site location		
Soil Type:	2	Volume 3 maps and site location		
SOIL:	0.3	Soil Type and Volume 1, Section 7.4		
UCWI:	62	SAAR and Volume 1, Figure 9.7		
Calculated PR	74.55			
Percentage Runoff =	74.55			

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	0.64	75	94.2	0.0	94.2	0.06	0.3	93.9
10	20	0.54	10.8	1.93	20.8	29.1	0.64	75	138.5	0.0	138.5	0.06	0.6	137.9
15	20	0.63	12.6	1.96	24.7	34.5	0.64	75	164.3	0.0	164.3	0.06	0.9	163.4
30	20	0.80	16.0	2.00	32.0	44.8	0.64	75	212.9	0.0	212.9	0.06	1.8	211.0
60	20	1.00	20.0	2.03	40.6	56.8	0.64	75	270.3	0.0	270.3	0.06	3.7	266.7
120	20	1.20	24.0	2.01	48.3	67.7	0.64	75	321.9	0.0	321.9	0.06	7.3	314.5
240	20	1.46	29.2	1.98	57.8	80.9	0.64	75	384.6	0.0	384.6	0.06	14.7	369.9
360	20	1.60	32.0	1.95	62.5	87.5	0.64	75	416.4	0.0	416.4	0.06	22.0	394.3
480	20	1.70	34.0	1.94	65.9	92.2	0.64	75	438.8	0.0	438.8	0.06	29.4	409.4
600	20	1.83	36.6	1.91	70.1	98.1	0.64	75	466.5	0.0	466.5	0.06	36.7	429.7
720	20	1.85	37.0	1.91	70.8	99.1	0.64	75	471.6	0.0	471.6	0.06	44.1	427.5
840	20	1.90	38.0	1.91	72.4	101.4	0.64	75	482.3	0.0	482.3	0.06	51.4	430.9
1440	20	2.28	45.6	1.84	84.0	117.6	0.64	75	559.3	0.0	559.3	0.06	88.1	471.2
2880	20	2.70	54.0	1.78	96.3	134.8	0.64	75	641.0	0.0	641.0	0.06	176.3	464.8

Figure 5 – 1 in 100 year + 40% CC attenuation volumes to 1.02 l/s

Surfacing Standards Limited,
Office 2 Empingham House, Uppingham Gate, Ayston Road, Uppingham, Rutland, LE15 9NY

T. 01536 400012
E. info@surfacingstandards.co.uk

www.surfacingstandards.co.uk

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:

SC104 07 – Proposed AGP Drainage Layout
SC104 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 Queen Elizabeth College in perpetuity post development and the 5. Drainage Management & Maintenance is displayed below within ***section 5***.

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.

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5. 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

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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 glyphospate 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

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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