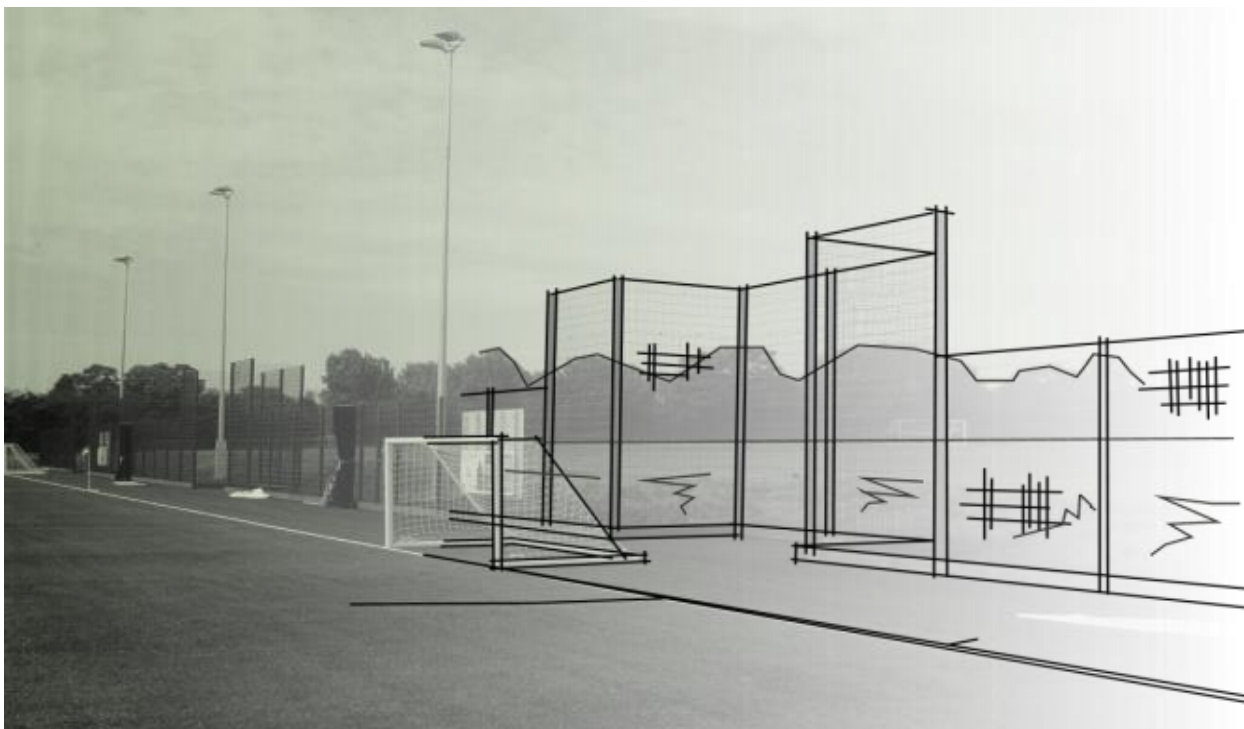


Jubilee Park

Creation of a 3G artificial pitch with perimeter fencing, floodlighting, hardstanding, storage container, car park and access improvements to the Lincombe Road access

Drainage Strategy



Client	Jubilee Park Dinas Lane Huyton Liverpool L36 2NW		
Project	Creation of a 3G Artificial Grass Pitch (AGP) with perimeter fencing, floodlighting, hardstanding, storage container, car park and access improvements to the Lincombe Road access		
SSL project code	LANO-CLS-036		
Document title	Drainage Strategy		
Document control	Revision	By	Date
	First Issue	ME	19 th December 2023

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SSL project code	LANO-CLS-036	1
Client	Jubilee Park	
Document Title	Drainage Strategy	

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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, floodlighting, hardstanding, storage container, car park and access improvements to the Lincombe Road access.

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

2. Site Details

2.1. 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	4,108m ²
Porous Asphalt surfaced areas	416m ²
Proposed Car Parking	1,775m ²
Total Development Area	8,329m²

2.2. Subject Area

The proposed development is situated at Jubilee Park, Dinas Lane, Huyton, Liverpool, L36 2NW.



Figure 1 – Site Location

2.3. Site Description

The proposed pitch development lies within a predominantly grass surface parcel of land towards the western extent of the wider park site. There is a single basketball court and bowls green to the east. The main access to the park is from Lincombe Road. There are residential properties to the north, south and west of the proposed development with a medical centre also to the south. The wider park extends off to the east. Surface levels are relatively flat across the proposed pitch development and wider site.

2.4. Site History

The earliest available maps date back to the late-1800s and shows the wider site as an area of open land (assumed agricultural). A single plot and associated land are recorded beyond the southeastern boundary of the proposed pitch area. By the mid-1900s the site is recorded as Jubilee Park, a defined rectangular area (possible hardstanding sports court) is recorded within the area of the proposed pitch, a small building is also recorded to the north of the pitch. A large building (day nursery) is recorded within the northern central boundary of the wider Jubilee site.

2.5. Site Topography

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The topography over the pitch area shows a fall from the north to the south by approximately 0.6m. Further information on existing levels can be seen within 'LANO-CLS036 01 - Topographical Survey'.

2.6. Local Watercourses

The nearest surface water feature appears to be the River Alt some 725m east of Jubilee Park.

2.7. Existing Drainage

There is currently no existing field drainage.

2.8. Source Protection Zone

The site is not located within a Source Protection Zone.

2.9. Coal Mining

Coal Authority mapping data shows the site does not lie within a Coal Mining Reporting Area, as such we consider the risk of land instability coal mining risk on site to be low.

2.10. Ground Conditions Encountered

Ground conditions comprised Topsoil overlying Made Ground within Devensian Till and/or Weathered Chester Formation recorded beneath.

Topsoil was observed between 0.1m and 0.5m in thickness across the site. Topsoil typically comprised grass onto dark brown gravelly sand with rootlets

Made Ground was recorded beneath the Topsoil to depths between 0.7m and 1.3m across the site where proven. The Made Ground typically comprised black very gravelly medium to coarse sand and soft brown slightly gravelly slightly sandy clay beneath. Gravels comprised coal, flint, brick, concrete, glass, tile and sandstone. Towards the south of the proposed pitch development area, a thin layer of grey sandy gravel comprising of brick, concrete, sandstone and clinker-like material was also noted within the Made Ground (0.3m to 0.4m in thickness).

2.11. Groundwater

No groundwater was encountered during the investigation however there is always a potential for perched groundwater within more granular deposits and for shallower groundwater seasonally

2.12. Infiltration Potential

The Devensian Till soils were predominantly encountered as a cohesive material across the site, which typically exhibit low permeability. As such infiltration testing was only undertaken within WS101 targeting the Weathered Chester Formation. Testing was undertaken between depths of 0.7m to 4.45m and two cycles were completed. During the test an infiltration rate between 1.29×10^{-5} m/s and 5.1×10^{-7} m/s was recorded. It is worth noting however that a full test could not be completed during the second cycle owing to time constraints.

Based on the above assessment of the ground conditions, the near surface soils are unlikely to be considered amenable to the use of soakaway type systems, thus an alternative drainage solution will need to be considered.

2.13. Assessment Context

The proposed pitch development area is approximately 0.63ha.

2.14. 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.

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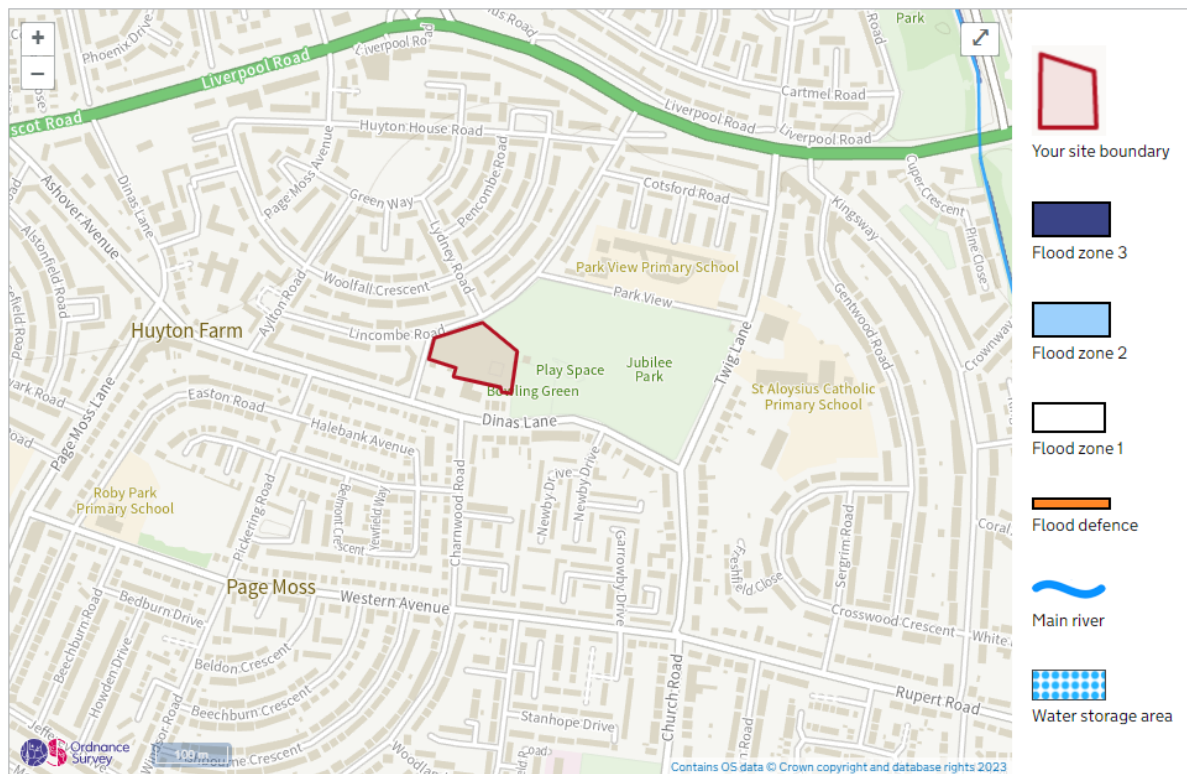


Figure 2 – Flood map for planning

2.15. 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.

2.16. 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.

2.17. 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.

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3. Framework & Flood Risk Policy

3.1. National Planning Policy Framework (2023)

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	

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3.2. 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					

3.3. 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.

3.4. Current Conditions

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

3.5. 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.

3.6. Flood Compensation

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

3.7. 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.

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4. Surface Water Drainage Strategy

4.1. 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.

4.2. Surface Water Disposal Options

A. Soak away

The infiltration testing indicates that infiltration is unlikely to be amenable to use the soakaway type systems due to the low infiltration rates.

B. Surface Water Body

The nearest surface water feature appears to be the River Alt some 725m east of Jubilee Park making a connection unfeasible.

C. Surface Water Sewer

The proposal is to connect into the surface water sewer to the north of the site.

D. Combined Sewer

Not required due to Option C being possible.

4.3. 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 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 and car parks that each have a 37% void space acting as surface water attenuation and the drainage system in the AGP can attenuate an additional 70m3.

The Car Parking to the west of the AGP will be attenuated and restricted separately to the Car Park to the north of the AGP, which will be connected and restricted in conjunction with the AGP before it all discharges into the surface water drain. Both restrictions are based off their respective QBAR rates for the greenfield runoff which is shown in Figure 3 for the west Car Park and Figure 4 for the north Car Park and AGP combined.

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Runoff estimation approach **IH24**

Site characteristics
Total site area (ha): 0.1087

Methodology
Q_{BAR} estimation method: Calculate from SPR and SAAR
SPR estimation method: Calculate from SOIL type

Soil characteristics
SOIL type: 4
HOST class: N/A
SPR/SPRHOST: 0.47

Hydrological characteristics
SAAR (mm): 867
Hydrological region: 10
Growth curve factor 1 year: 0.87
Growth curve factor 30 years: 1.7
Growth curve factor 100 years: 2.08
Growth curve factor 200 years: 2.37

Notes
(1) Is Q_{BAR} < 2.0 l/s/ha?
When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.
(2) Are flow rates < 5.0 l/s?
Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.
(3) Is SPR/SPRHOST ≤ 0.3?
Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):	0.67	0.67
1 in 1 year (l/s):	0.59	0.59
1 in 30 years (l/s):	1.15	1.15
1 in 100 year (l/s):	1.4	1.4
1 in 200 years (l/s):	1.6	1.6

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.ukstds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.ukstds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use

Runoff estimation approach **IH24**

Site characteristics
Total site area (ha): 0.5139

Methodology
Q_{BAR} estimation method: Calculate from SPR and SAAR
SPR estimation method: Calculate from SOIL type

Soil characteristics
SOIL type: 4
HOST class: N/A
SPR/SPRHOST: 0.47

Hydrological characteristics
SAAR (mm): 867
Hydrological region: 10
Growth curve factor 1 year: 0.87
Growth curve factor 30 years: 1.7
Growth curve factor 100 years: 2.08
Growth curve factor 200 years: 2.37

Notes
(1) Is Q_{BAR} < 2.0 l/s/ha?
When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.
(2) Are flow rates < 5.0 l/s?
Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.
(3) Is SPR/SPRHOST ≤ 0.3?
Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):	3.19	3.19
1 in 1 year (l/s):	2.77	2.77
1 in 30 years (l/s):	5.42	5.42
1 in 100 year (l/s):	6.63	6.63
1 in 200 years (l/s):	7.55	7.55

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Figure 3 and 4 – HR Wallingford Greenfield runoff rate for the west Car Park (Left) and for the north Car Park and the AGP combined (Right)

The Car Park to the west has a Q_{BAR} of 0.67 l/s and the combination of the Car Park to the north and the AGP has a Q_{BAR} of 3.19 l/s.

Calculations have been based on a 1 in 100 year storm event with a 45% allowance for climate change.

The foundations of the new synthetic turf area includes:

- 200mm deep layer of type 3 stone
- 40mm macadam
- 10mm shockpad
- 30mm infill of sand and rubber on the carpet

The foundations of the new car parking area includes:

- 200mm deep layer of type 3 stone
- 80mm macadam

The minimum 280mm deep aggregate base construction for both the AGP and the Car Parks offers wedges for surface water attenuation prior to filling and flooding the pitch surface, car park surface or surrounding areas. The available volume of each of the the wedges are created through the following calculations:

AGP attenuation

- The pitch layer constructed at a 1 in 300 gradient offers a volume and capacity of 846m³
 - Based on a voidage space of 37% this offers 313m³ of water attenuation.
- The drainage system, shown in drawing 'LANO-CLS036 07 - Proposed Drainage Layout', can also attenuate an additional 70m³

North Car Park attenuation

- The north car park layer constructed at a 1 in 28 gradient offers a volume and capacity of 52m³
 - Based on a voidage space of 37% this offers 19m³ of water attenuation.

West Car Park attenuation

- The pitch layer constructed at a 1 in 175 gradient offers a volume and capacity of 192m³
 - Based on a voidage space of 37% this offers 71m³ of water attenuation.

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The surface water attenuation calculations for the AGP and north Car Park are shown in Figures 5-9.

- The maximum attenuation required is shown in Figure 9
- 1 in 100 year storm event + 45% allowance for climate change at run off restricted to 3.19 l/s (QBAR) - would require 308m³ of attenuation

Minimum Storage Required: **42 m³** incl cc allowance

FACTOR	VALUE	SOURCE
Return Period (yrs):	1	Environment Agency, Water Authority, etc.
Limiting Discharge (l/s):	3.19	Environment Agency, Water Authority, etc.
Contributing Area (ha):	0.5139	Site plans
Impervious, PIMP (%):	100	Site plans
M5-60min (mm):	20	Volume 3 maps and site location
SAAR (mm/yr):	867	Volume 3 maps and site location
Ratio, r:	0.4	Volume 3 maps and site location
Soil Type:	4	Volume 3 maps and site location
SOIL:	0.45	Soil Type and Volume 1, Section 7.4
UCWI:	94	SAAR and Volume 1, Figure 9.7
Calculated PR	80.81	
Percentage Runoff =	80.81	

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 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	0.51	81	19.4	0.0	19.4	0.19	1.0	18.4
10	20	0.54	10.8	0.61	6.6	6.6	0.51	81	27.4	0.0	27.4	0.19	1.9	25.5
15	20	0.63	12.6	0.62	7.8	7.8	0.51	81	32.2	0.0	32.2	0.19	2.9	29.4
30	20	0.80	16.0	0.62	10.0	10.0	0.51	81	41.5	0.0	41.5	0.19	5.7	35.7
60	20	1.00	20.0	0.64	12.8	12.8	0.51	81	53.2	0.0	53.2	0.19	11.5	41.7
120	20	1.20	24.0	0.66	15.7	15.7	0.51	81	65.4	0.0	65.4	0.19	23.0	42.4
240	20	1.46	29.2	0.68	19.7	19.7	0.51	81	82.0	0.0	82.0	0.19	45.9	36.0
360	20	1.60	32.0	0.68	21.9	21.9	0.51	81	90.9	0.0	90.9	0.19	68.9	22.0
480	20	1.70	34.0	0.69	23.4	23.4	0.51	81	97.1	0.0	97.1	0.19	91.9	5.3
600	20	1.83	36.6	0.69	25.4	25.4	0.51	81	105.5	0.0	105.5	0.19	114.8	-9.4
720	20	1.85	37.0	0.69	25.7	25.7	0.51	81	106.6	0.0	106.6	0.19	137.8	-31.2
840	20	1.90	38.0	0.70	26.4	26.4	0.51	81	109.8	0.0	109.8	0.19	160.8	-50.9
1440	20	2.28	45.6	0.71	32.5	32.5	0.51	81	134.8	0.0	134.8	0.19	275.6	-140.8
2880	20	2.70	54.0	0.73	39.2	39.2	0.51	81	162.9	0.0	162.9	0.19	551.2	-388.3

Figure 5 – 1 in 1 year attenuation volumes to 3.19 l/s

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

FACTOR	VALUE	SOURCE
Return Period (yrs):	30	Environment Agency, Water Authority, etc.
Limiting Discharge (l/s):	3.19	Environment Agency, Water Authority, etc.
Contributing Area (ha):	0.5139	Site plans
Impervious, PIMP (%):	100	Site plans
M5-60min (mm):	20	Volume 3 maps and site location
SAAR (mm/yr):	867	Volume 3 maps and site location
Ratio, r:	0.4	Volume 3 maps and site location
Soil Type:	4	Volume 3 maps and site location
SOIL:	0.45	Soil Type and Volume 1, Section 7.4
UCWI:	94	SAAR and Volume 1, Figure 9.7
Calculated PR	80.81	
Percentage Runoff =	80.81	

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	0.51	81	46.2	0.0	46.2	0.19	1.0	45.3
10	20	0.54	10.8	1.50	16.2	16.2	0.51	81	67.2	0.0	67.2	0.19	1.9	65.2
15	20	0.63	12.6	1.51	19.1	19.1	0.51	81	79.1	0.0	79.1	0.19	2.9	76.2
30	20	0.80	16.0	1.53	24.5	24.5	0.51	81	101.7	0.0	101.7	0.19	5.7	95.9
60	20	1.00	20.0	1.54	30.9	30.9	0.51	81	128.2	0.0	128.2	0.19	11.5	116.7
120	20	1.20	24.0	1.54	36.8	36.8	0.51	81	153.0	0.0	153.0	0.19	23.0	130.1
240	20	1.46	29.2	1.52	44.3	44.3	0.51	81	184.0	0.0	184.0	0.19	45.9	138.1
360	20	1.60	32.0	1.50	48.1	48.1	0.51	81	199.9	0.0	199.9	0.19	68.9	131.0
480	20	1.70	34.0	1.49	50.8	50.8	0.51	81	211.0	0.0	211.0	0.19	91.9	119.2
600	20	1.83	36.6	1.48	54.2	54.2	0.51	81	225.1	0.0	225.1	0.19	114.8	110.2
720	20	1.85	37.0	1.48	54.8	54.8	0.51	81	227.5	0.0	227.5	0.19	137.8	89.7
840	20	1.90	38.0	1.48	56.1	56.1	0.51	81	232.9	0.0	232.9	0.19	160.8	72.2
1440	20	2.28	45.6	1.44	65.6	65.6	0.51	81	272.4	0.0	272.4	0.19	275.6	-3.2
2880	20	2.70	54.0	1.41	76.0	76.0	0.51	81	315.7	0.0	315.7	0.19	551.2	-235.5

Figure 6 – 1 in 30 year attenuation volumes to 3.19 l/s

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SSL project code	LANO-CLS-036
Client	Jubilee Park
Document Title	Drainge Strategy

Minimum Storage Required: **184 m³** incl cc allowance

FACTOR	VALUE	SOURCE
Return Period (yrs):	30	Environment Agency, Water Authority, etc.
Limiting Discharge (l/s):	3.19	Environment Agency, Water Authority, etc.
Contributing Area (ha):	0.5139	Site plans
Impervious, PIMP (%):	100	Site plans
M5-60min (mm):	20	Volume 3 maps and site location
SAAR (mm/yr):	867	Volume 3 maps and site location
Ratio, r:	0.4	Volume 3 maps and site location
Soil Type:	4	Volume 3 maps and site location
SOIL:	0.45	Soil Type and Volume 1, Section 7.4
UCWI:	94	SAAR and Volume 1, Figure 9.7
Calculated PR	80.81	
Percentage Runoff =	80.81	

FACTOR	VALUE
Additional Inflow (l/s):	0
Calculate/Specify PR:	Calculate
Specify PR:	100
Climate Change Allowance	25

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	13.9	0.51	81	57.8	0.0	57.8	0.19	1.0	56.8
10	20	0.54	10.8	1.50	16.2	20.2	0.51	81	83.9	0.0	83.9	0.19	1.9	82.0
15	20	0.63	12.6	1.51	19.1	23.8	0.51	81	98.9	0.0	98.9	0.19	2.9	96.0
30	20	0.80	16.0	1.53	24.5	30.6	0.51	81	127.1	0.0	127.1	0.19	5.7	121.3
60	20	1.00	20.0	1.54	30.9	38.6	0.51	81	160.2	0.0	160.2	0.19	11.5	148.8
120	20	1.20	24.0	1.54	36.8	46.1	0.51	81	191.3	0.0	191.3	0.19	23.0	168.3
240	20	1.46	29.2	1.52	44.3	55.4	0.51	81	230.0	0.0	230.0	0.19	45.9	184.1
360	20	1.60	32.0	1.50	48.1	60.2	0.51	81	249.8	0.0	249.8	0.19	68.9	180.9
480	20	1.70	34.0	1.49	50.8	63.5	0.51	81	263.8	0.0	263.8	0.19	91.9	171.9
600	20	1.83	36.6	1.48	54.2	67.7	0.51	81	281.3	0.0	281.3	0.19	114.8	166.5
720	20	1.85	37.0	1.48	54.8	68.5	0.51	81	284.4	0.0	284.4	0.19	137.8	146.6
840	20	1.90	38.0	1.48	56.1	70.1	0.51	81	291.2	0.0	291.2	0.19	160.8	130.4
1440	20	2.28	45.6	1.44	65.6	82.0	0.51	81	340.6	0.0	340.6	0.19	275.6	64.9
2880	20	2.70	54.0	1.41	76.0	95.0	0.51	81	394.6	0.0	394.6	0.19	551.2	-156.6

Figure 7 – 1 in 30 year + 25% CC attenuation volumes to 3.19 l/s

Minimum Storage Required: **194 m³** incl cc allowance

FACTOR	VALUE	SOURCE
Return Period (yrs):	100	Environment Agency, Water Authority, etc.
Limiting Discharge (l/s):	3.19	Environment Agency, Water Authority, etc.
Contributing Area (ha):	0.5139	Site plans
Impervious, PIMP (%):	100	Site plans
M5-60min (mm):	20	Volume 3 maps and site location
SAAR (mm/yr):	867	Volume 3 maps and site location
Ratio, r:	0.4	Volume 3 maps and site location
Soil Type:	4	Volume 3 maps and site location
SOIL:	0.45	Soil Type and Volume 1, Section 7.4
UCWI:	94	SAAR and Volume 1, Figure 9.7
Calculated PR	80.81	
Percentage Runoff =	80.81	

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	0.51	81	58.8	0.0	58.8	0.19	1.0	57.8
10	20	0.54	10.8	1.93	20.8	20.8	0.51	81	86.4	0.0	86.4	0.19	1.9	84.5
15	20	0.63	12.6	1.96	24.7	24.7	0.51	81	102.5	0.0	102.5	0.19	2.9	99.6
30	20	0.80	16.0	2.00	32.0	32.0	0.51	81	132.8	0.0	132.8	0.19	5.7	127.0
60	20	1.00	20.0	2.03	40.6	40.6	0.51	81	168.6	0.0	168.6	0.19	11.5	157.1
120	20	1.20	24.0	2.01	48.3	48.3	0.51	81	200.7	0.0	200.7	0.19	23.0	177.8
240	20	1.46	29.2	1.98	57.8	57.8	0.51	81	239.9	0.0	239.9	0.19	45.9	193.9
360	20	1.60	32.0	1.95	62.5	62.5	0.51	81	259.7	0.0	259.7	0.19	68.9	190.8
480	20	1.70	34.0	1.94	65.9	65.9	0.51	81	273.6	0.0	273.6	0.19	91.9	181.8
600	20	1.83	36.6	1.91	70.1	70.1	0.51	81	290.9	0.0	290.9	0.19	114.8	176.1
720	20	1.85	37.0	1.91	70.8	70.8	0.51	81	294.1	0.0	294.1	0.19	137.8	156.3
840	20	1.90	38.0	1.91	72.4	72.4	0.51	81	300.8	0.0	300.8	0.19	160.8	140.0
1440	20	2.28	45.6	1.84	84.0	84.0	0.51	81	348.8	0.0	348.8	0.19	275.6	73.2
2880	20	2.70	54.0	1.78	96.3	96.3	0.51	81	399.8	0.0	399.8	0.19	551.2	-151.4

Figure 8 – 1 in 100 year attenuation volumes to 3.19 l/s

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Client	Jubilee Park	
Document Title	Drainge Strategy	

Minimum Storage Required: **308 m³** incl cc allowance

FACTOR	VALUE	SOURCE
Return Period (yrs):	100	Environment Agency, Water Authority, etc.
Limiting Discharge (l/s):	3.19	Environment Agency, Water Authority, etc.
Contributing Area (ha):	0.5139	Site plans
Impervious, PIMP (%):	100	Site plans
M5-60min (mm):	20	Volume 3 maps and site location
SAAR (mm/yr):	867	Volume 3 maps and site location
Ratio, r:	0.4	Volume 3 maps and site location
Soil Type:	4	Volume 3 maps and site location
SOIL:	0.45	Soil Type and Volume 1, Section 7.4
UCWI:	94	SAAR and Volume 1, Figure 9.7
Calculated PR	80.81	
Percentage Runoff =	80.81	

FACTOR	VALUE
Additional Inflow (l/s):	0
Calculate/Specify PR:	Calculate
Specify PR:	100
Climate Change Allowance	45

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	20.5	0.51	81	85.2	0.0	85.2	0.19	1.0	84.3
10	20	0.54	10.8	1.93	20.8	30.2	0.51	81	125.3	0.0	125.3	0.19	1.9	123.3
15	20	0.63	12.6	1.96	24.7	35.8	0.51	81	148.6	0.0	148.6	0.19	2.9	145.7
30	20	0.80	16.0	2.00	32.0	46.4	0.51	81	192.5	0.0	192.5	0.19	5.7	186.8
60	20	1.00	20.0	2.03	40.6	58.9	0.51	81	244.5	0.0	244.5	0.19	11.5	233.0
120	20	1.20	24.0	2.01	48.3	70.1	0.51	81	291.1	0.0	291.1	0.19	23.0	268.1
240	20	1.46	29.2	1.98	57.8	83.7	0.51	81	347.8	0.0	347.8	0.19	45.9	301.9
360	20	1.60	32.0	1.95	62.5	90.7	0.51	81	376.5	0.0	376.5	0.19	68.9	307.6
480	20	1.70	34.0	1.94	65.9	95.5	0.51	81	396.8	0.0	396.8	0.19	91.9	304.9
600	20	1.83	36.6	1.91	70.1	101.6	0.51	81	421.8	0.0	421.8	0.19	114.8	307.0
720	20	1.85	37.0	1.91	70.8	102.7	0.51	81	426.4	0.0	426.4	0.19	137.8	288.6
840	20	1.90	38.0	1.91	72.4	105.0	0.51	81	436.1	0.0	436.1	0.19	160.8	275.4
1440	20	2.28	45.6	1.84	84.0	121.8	0.51	81	505.8	0.0	505.8	0.19	275.6	230.2
2880	20	2.70	54.0	1.78	96.3	139.6	0.51	81	579.7	0.0	579.7	0.19	551.2	28.5

Figure 9 – 1 in 100 year + 45% CC attenuation volumes to 3.19 l/s

As shown above the calculated volume for storage to meet a 1 in 100 year storm event + 45% climate change for the AGP and north Car Park is 308m³. The attenuation calculated within the base of the AGP, north Car Park and proposed drainage system allows the controlled storage onsite up to 402m³ as detailed within LANO-CLS036 08 – Proposed AGP Drainage Strategy.

The surface water attenuation calculations for the west Car Park are shown in Figures 10-14.

- The maximum attenuation required is shown in Figure 14
- 1 in 100 year storm event + 45% allowance for climate change at run off restricted to 0.67 l/s (QBAR) - would require 65m³ of attenuation

Minimum Storage Required: **9 m³** incl cc allowance

FACTOR	VALUE	SOURCE
Return Period (yrs):	1	Environment Agency, Water Authority, etc.
Limiting Discharge (l/s):	0.67	Environment Agency, Water Authority, etc.
Contributing Area (ha):	0.1087	Site plans
Impervious, PIMP (%):	100	Site plans
M5-60min (mm):	20	Volume 3 maps and site location
SAAR (mm/yr):	867	Volume 3 maps and site location
Ratio, r:	0.4	Volume 3 maps and site location
Soil Type:	4	Volume 3 maps and site location
SOIL:	0.45	Soil Type and Volume 1, Section 7.4
UCWI:	94	SAAR and Volume 1, Figure 9.7
Calculated PR	80.81	
Percentage Runoff =	80.81	

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 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	6.7	0.11	81	4.1	0.0	4.1	0.04	0.2	3.9
10	20	0.54	10.8	0.61	6.6	6.6	0.11	81	5.8	0.0	5.8	0.04	0.4	5.4
15	20	0.63	12.6	0.62	7.8	7.8	0.11	81	6.8	0.0	6.8	0.04	0.6	6.2
30	20	0.80	16.0	0.62	10.0	10.0	0.11	81	8.8	0.0	8.8	0.04	1.2	7.6
60	20	1.00	20.0	0.64	12.8	12.8	0.11	81	11.2	0.0	11.2	0.04	2.4	8.8
120	20	1.20	24.0	0.66	15.7	15.7	0.11	81	13.8	0.0	13.8	0.04	4.8	9.0
240	20	1.46	29.2	0.68	19.7	19.7	0.11	81	17.3	0.0	17.3	0.04	9.6	7.7
360	20	1.60	32.0	0.68	21.9	21.9	0.11	81	19.2	0.0	19.2	0.04	14.5	4.8
480	20	1.70	34.0	0.69	23.4	23.4	0.11	81	20.5	0.0	20.5	0.04	19.3	1.3
600	20	1.83	36.6	0.69	25.4	25.4	0.11	81	22.3	0.0	22.3	0.04	24.1	-1.8
720	20	1.85	37.0	0.69	25.7	25.7	0.11	81	22.6	0.0	22.6	0.04	28.9	-6.4
840	20	1.90	38.0	0.70	26.4	26.4	0.11	81	23.2	0.0	23.2	0.04	33.8	-10.5
1440	20	2.28	45.6	0.71	32.5	32.5	0.11	81	28.5	0.0	28.5	0.04	57.9	-29.4
2880	20	2.70	54.0	0.73	39.2	39.2	0.11	81	34.5	0.0	34.5	0.04	115.8	-81.3

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Document Title	Drainage Strategy

Figure 10 – 1 in 1 year attenuation volumes to 0.67 l/s

Minimum Storage Required:		29 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):	0.67	Environment Agency, Water Authority, etc.	Calculate/Specify PR:	Calculate
Contributing Area (ha):	0.1087	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):	867	Volume 3 maps and site location		
Ratio, r:	0.4	Volume 3 maps and site location		
Soil Type:	4	Volume 3 maps and site location		
SOIL:	0.45	Soil Type and Volume 1, Section 7.4		
UCWI:	94	SAAR and Volume 1, Figure 9.7		
Calculated PR	80.81			
Percentage Runoff =	80.81			

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	0.11	81	9.8	0.0	9.8	0.04	0.2	9.6
10	20	0.54	10.8	1.50	16.2	16.2	0.11	81	14.2	0.0	14.2	0.04	0.4	13.8
15	20	0.63	12.6	1.51	19.1	19.1	0.11	81	16.7	0.0	16.7	0.04	0.6	16.1
30	20	0.80	16.0	1.53	24.5	24.5	0.11	81	21.5	0.0	21.5	0.04	1.2	20.3
60	20	1.00	20.0	1.54	30.9	30.9	0.11	81	27.1	0.0	27.1	0.04	2.4	24.7
120	20	1.20	24.0	1.54	36.8	36.8	0.11	81	32.4	0.0	32.4	0.04	4.8	27.5
240	20	1.46	29.2	1.52	44.3	44.3	0.11	81	38.9	0.0	38.9	0.04	9.6	29.3
360	20	1.60	32.0	1.50	48.1	48.1	0.11	81	42.3	0.0	42.3	0.04	14.5	27.8
480	20	1.70	34.0	1.49	50.8	50.8	0.11	81	44.6	0.0	44.6	0.04	19.3	25.3
600	20	1.83	36.6	1.48	54.2	54.2	0.11	81	47.6	0.0	47.6	0.04	24.1	23.5
720	20	1.85	37.0	1.48	54.8	54.8	0.11	81	48.1	0.0	48.1	0.04	28.9	19.2
840	20	1.90	38.0	1.48	56.1	56.1	0.11	81	49.3	0.0	49.3	0.04	33.8	15.5
1440	20	2.28	45.6	1.44	65.6	65.6	0.11	81	57.6	0.0	57.6	0.04	57.9	-0.3
2880	20	2.70	54.0	1.41	76.0	76.0	0.11	81	66.8	0.0	66.8	0.04	115.8	-49.0

Figure 11 – 1 in 30 year attenuation volumes to 0.67 l/s

Minimum Storage Required:		39 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):	0.67	Environment Agency, Water Authority, etc.	Calculate/Specify PR:	Calculate
Contributing Area (ha):	0.1087	Site plans	Specify PR:	100
Impervious, PIMP (%):	100	Site plans	Climate Change Allowance	25
M5-60min (mm):	20	Volume 3 maps and site location		
SAAR (mm/yr):	867	Volume 3 maps and site location		
Ratio, r:	0.4	Volume 3 maps and site location		
Soil Type:	4	Volume 3 maps and site location		
SOIL:	0.45	Soil Type and Volume 1, Section 7.4		
UCWI:	94	SAAR and Volume 1, Figure 9.7		
Calculated PR	80.81			
Percentage Runoff =	80.81			

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	13.9	0.11	81	12.2	0.0	12.2	0.04	0.2	12.0
10	20	0.54	10.8	1.50	16.2	20.2	0.11	81	17.8	0.0	17.8	0.04	0.4	17.4
15	20	0.63	12.6	1.51	19.1	23.8	0.11	81	20.9	0.0	20.9	0.04	0.6	20.3
30	20	0.80	16.0	1.53	24.5	30.6	0.11	81	26.9	0.0	26.9	0.04	1.2	25.7
60	20	1.00	20.0	1.54	30.9	38.6	0.11	81	33.9	0.0	33.9	0.04	2.4	31.5
120	20	1.20	24.0	1.54	36.8	46.1	0.11	81	40.5	0.0	40.5	0.04	4.8	35.6
240	20	1.46	29.2	1.52	44.3	55.4	0.11	81	48.6	0.0	48.6	0.04	9.6	39.0
360	20	1.60	32.0	1.50	48.1	60.2	0.11	81	52.8	0.0	52.8	0.04	14.5	38.4
480	20	1.70	34.0	1.49	50.8	63.5	0.11	81	55.8	0.0	55.8	0.04	19.3	36.5
600	20	1.83	36.6	1.48	54.2	67.7	0.11	81	59.5	0.0	59.5	0.04	24.1	35.4
720	20	1.85	37.0	1.48	54.8	68.5	0.11	81	60.2	0.0	60.2	0.04	28.9	31.2
840	20	1.90	38.0	1.48	56.1	70.1	0.11	81	61.6	0.0	61.6	0.04	33.8	27.8
1440	20	2.28	45.6	1.44	65.6	82.0	0.11	81	72.0	0.0	72.0	0.04	57.9	14.1
2880	20	2.70	54.0	1.41	76.0	95.0	0.11	81	83.5	0.0	83.5	0.04	115.8	-32.3

Figure 12 – 1 in 30 year + 25% CC attenuation volumes to 0.67 l/s

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Minimum Storage Required: **41 m³** incl cc allowance

FACTOR	VALUE	SOURCE
Return Period (yrs):	100	Environment Agency, Water Authority, etc.
Limiting Discharge (l/s):	0.67	Environment Agency, Water Authority, etc.
Contributing Area (ha):	0.1087	Site plans
Impervious, PIMP (%):	100	Site plans
M5-60min (mm):	20	Volume 3 maps and site location
SAAR (mm/yr):	867	Volume 3 maps and site location
Ratio, r:	0.4	Volume 3 maps and site location
Soil Type:	4	Volume 3 maps and site location
SOIL:	0.45	Soil Type and Volume 1, Section 7.4
UCWI:	94	SAAR and Volume 1, Figure 9.7
Calculated PR	80.81	
Percentage Runoff =	80.81	

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	0.11	81	12.4	0.0	12.4	0.04	0.2	12.2
10	20	0.54	10.8	1.93	20.8	20.8	0.11	81	18.3	0.0	18.3	0.04	0.4	17.9
15	20	0.63	12.6	1.96	24.7	24.7	0.11	81	21.7	0.0	21.7	0.04	0.6	21.1
30	20	0.80	16.0	2.00	32.0	32.0	0.11	81	28.1	0.0	28.1	0.04	1.2	26.9
60	20	1.00	20.0	2.03	40.6	40.6	0.11	81	35.7	0.0	35.7	0.04	2.4	33.3
120	20	1.20	24.0	2.01	48.3	48.3	0.11	81	42.5	0.0	42.5	0.04	4.8	37.6
240	20	1.46	29.2	1.98	57.8	57.8	0.11	81	50.7	0.0	50.7	0.04	9.6	41.1
360	20	1.60	32.0	1.95	62.5	62.5	0.11	81	54.9	0.0	54.9	0.04	14.5	40.5
480	20	1.70	34.0	1.94	65.9	65.9	0.11	81	57.9	0.0	57.9	0.04	19.3	38.6
600	20	1.83	36.6	1.91	70.1	70.1	0.11	81	61.5	0.0	61.5	0.04	24.1	37.4
720	20	1.85	37.0	1.91	70.8	70.8	0.11	81	62.2	0.0	62.2	0.04	28.9	33.3
840	20	1.90	38.0	1.91	72.4	72.4	0.11	81	63.6	0.0	63.6	0.04	33.8	29.9
1440	20	2.28	45.6	1.84	84.0	84.0	0.11	81	73.8	0.0	73.8	0.04	57.9	15.9
2880	20	2.70	54.0	1.78	96.3	96.3	0.11	81	84.6	0.0	84.6	0.04	115.8	-31.2

Figure 13 – 1 in 100 year attenuation volumes to 0.67 l/s

Minimum Storage Required: **65 m³** incl cc allowance

FACTOR	VALUE	SOURCE
Return Period (yrs):	100	Environment Agency, Water Authority, etc.
Limiting Discharge (l/s):	0.67	Environment Agency, Water Authority, etc.
Contributing Area (ha):	0.1087	Site plans
Impervious, PIMP (%):	100	Site plans
M5-60min (mm):	20	Volume 3 maps and site location
SAAR (mm/yr):	867	Volume 3 maps and site location
Ratio, r:	0.4	Volume 3 maps and site location
Soil Type:	4	Volume 3 maps and site location
SOIL:	0.45	Soil Type and Volume 1, Section 7.4
UCWI:	94	SAAR and Volume 1, Figure 9.7
Calculated PR	80.81	
Percentage Runoff =	80.81	

FACTOR	VALUE
Additional Inflow (l/s):	0
Calculate/Specify PR:	Calculate
Specify PR:	100
Climate Change Allowance	45

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	20.5	0.11	81	18.0	0.0	18.0	0.04	0.2	17.8
10	20	0.54	10.8	1.93	20.8	30.2	0.11	81	26.5	0.0	26.5	0.04	0.4	26.1
15	20	0.63	12.6	1.96	24.7	35.8	0.11	81	31.4	0.0	31.4	0.04	0.6	30.8
30	20	0.80	16.0	2.00	32.0	46.4	0.11	81	40.7	0.0	40.7	0.04	1.2	39.5
60	20	1.00	20.0	2.03	40.6	58.9	0.11	81	51.7	0.0	51.7	0.04	2.4	49.3
120	20	1.20	24.0	2.01	48.3	70.1	0.11	81	61.6	0.0	61.6	0.04	4.8	56.7
240	20	1.46	29.2	1.98	57.8	83.7	0.11	81	73.6	0.0	73.6	0.04	9.6	63.9
360	20	1.60	32.0	1.95	62.5	90.7	0.11	81	79.6	0.0	79.6	0.04	14.5	65.2
480	20	1.70	34.0	1.94	65.9	95.5	0.11	81	83.9	0.0	83.9	0.04	19.3	64.6
600	20	1.83	36.6	1.91	70.1	101.6	0.11	81	89.2	0.0	89.2	0.04	24.1	65.1
720	20	1.85	37.0	1.91	70.8	102.7	0.11	81	90.2	0.0	90.2	0.04	28.9	61.3
840	20	1.90	38.0	1.91	72.4	105.0	0.11	81	92.3	0.0	92.3	0.04	33.8	58.5
1440	20	2.28	45.6	1.84	84.0	121.8	0.11	81	107.0	0.0	107.0	0.04	57.9	49.1
2880	20	2.70	54.0	1.78	96.3	139.6	0.11	81	122.6	0.0	122.6	0.04	115.8	6.8

Figure 14 – 1 in 100 year + 45% CC attenuation volumes to 0.67 l/s

As shown above the calculated volume for storage to meet a 1 in 100 year storm event + 45% climate change for the west Car Park is 65m³. The attenuation calculated within the base of the west Car Park allows the controlled storage onsite up to 71m³ as detailed within LANO-CLS036 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.

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

1. Adequate attenuation (water storage) within sub-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 3.19 l/s to the AGP and north car park and 0.67 l/s to the west car park (as calculated by the HR Wallingford method) before discharging into the surface water sewer to the north of the site.

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

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:

LANO-CLS036 07 – Proposed AGP Drainage Layout
LANO-CLS036 08 – Proposed AGP Drainage Strategy

4.4. Foul Water Drainage Strategy

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

4.5. 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 Huyton Jubilee Community Sports Hub CIO (Charitable Incorporated Organisation) in perpetuity post development and the 5. Drainage Management & Maintenance is displayed below within **section 5**.

4.6. 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 + 45% 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.

4.7. 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.

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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:

- Once the base is put into place the new drainage system shall be installed 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.
- 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. 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.

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5. Drainage Management & Maintenance

GULLIES, PIPEWORK, INSPECTION CHAMBERS AND CONTROLS	
<u>Required Action</u>	<u>Frequency</u>
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	
<u>Required Action</u>	<u>Frequency</u>
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	

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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

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