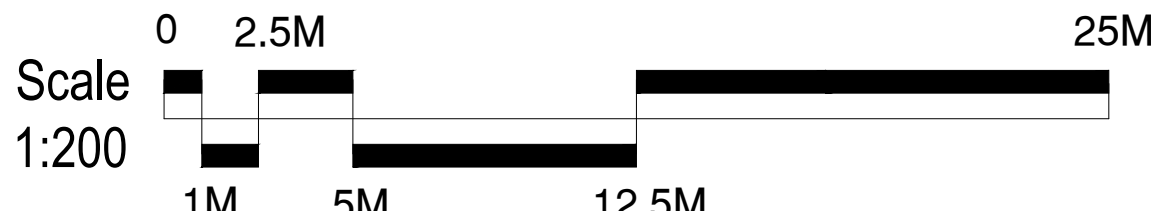
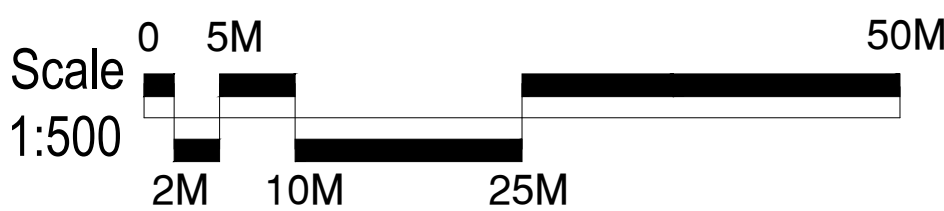


Knowsley MBC - Jubilee Park

Creation of an Artificial Grass Pitch



CONSULTANTS
Surfacing Standards Ltd
Office: 1, Elmfield House,
Waterhead, Warrington, LE12 9BY
01508 400 912



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Attenuation			
Number	Minimum Elevation	Maximum Elevation	Colour
1	0.00	0.05	
2	0.05	0.10	
3	0.10	0.15	
4	0.15	0.20	
5	0.20	0.25	

Surface Water Drainage Design

The proposed design of the AGP and Car Park developments are for a permeable surface construction. The AGP surface of the synthetic turf area shall be permeable with the underlying stone sub-base acting as an attenuation/storage area for surface water. The stone base for both the AGP and the Car Park will act as an attenuation system to increase attenuation capabilities of the playing field area. This is combined with a perforated drainage system being installed underneath the pitch base and Car Park to connect to the existing surface water drain to the north of the site.

It is intended that a positive drainage scheme (land drainage); shall be installed beneath the development 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 an outfall.

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.
- Ensure that surface water is removed from the surface area at a rate necessary to prevent surface flooding experienced during acute rainstorms and to ensure the facility will not be lost through rain at the highest intensity which may be expected to occur either once every five years or through continuous rainfall of 50mm over a 24 hour period.
- Ensure that surface water is effectively removed from the facility construction to ensure that load bearing capacity of the substrate is not weakened by an increase in moisture content or becomes more susceptible to frost damage.
- Protect the installation from influences of groundwater or surface water from surrounding areas.
- 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.

Only natural surface water is being dealt with. The new development will not increase to the volume of water that the existing site area is currently subjected to. The area is in a Category 1 flood zone and as such is at a low risk of flooding.

Surface water discharge rate will be restricted and the installation of the new drainage system to this area of the site will provide a more careful, managed control of discharge than the current arrangement.

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 Appendix F - Drainage Strategy.

The Car Park to the west has a QBAR of 0.67 l/s and the combination of the Car Park to the north and the AGP have a QBAR 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.

The surface water attenuation calculations for the AGP and north Car Park, as per the table below, shows the following:

- 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

The surface water attenuation calculations for the west Car Park, as per the table below, shows the following:

- 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

The attenuation provided by the AGP (383m²) and north Car Park (19m³) design will cater for a 1 in 100 storm event + 45% (308m³) without flooding either the pitch surface, car park surface or surrounding areas.

The attenuation provided by the east Car Park AGP (71m²) design will cater for a 1 in 100 storm event + 45% (65m³) without flooding either the car park surface or surrounding areas.

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
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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 (m ³)	Add. Runoff (m ³)	Total Runoff (m ³)	Limiting Discharge (m ³ /min)	Limiting Runoff (m ³)	Storage Required (m ³)
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

AGP & North Car Park Surface Water Attenuation Calculations

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	

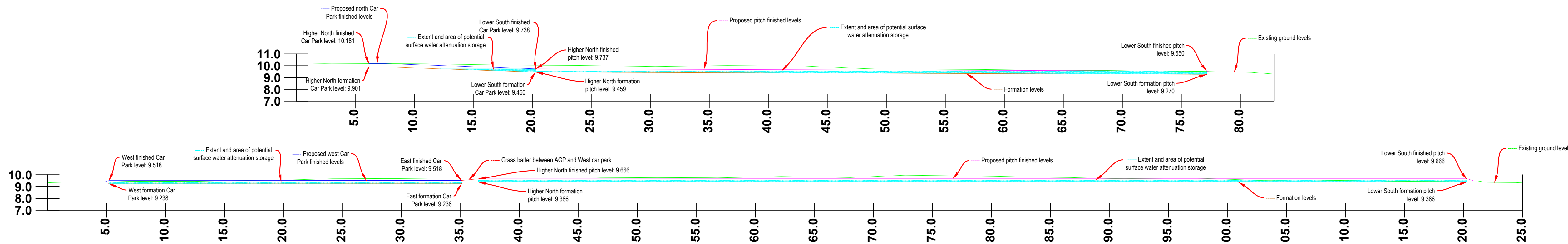
FACTOR	VALUE
Additional Inflow (l/s):	0
Calculate/Specify PR:	Calculate
Specify PR:	100

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 (m ³)	Add. Runoff (m ³)	Total Runoff (m ³)	Limiting Discharge (m ³ /min)	Limiting Runoff (m ³)	Storage Required (m ³)
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

West Car Park Surface Water Attenuation Calculations

Attenuation Scheme - Scale 1:500



Section A-AA Showing Surface Water Attenuation Storage - Scale 1:200

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Surfacing Standards Limited
SPORTS PITCH CONSULTANTS

AUTHOR
ME

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Proposed Drainage Strategy

PROJECT LANO-CLS036	SCALE Varies	SIZE A1
DRAWING No 08	REVISION 00	