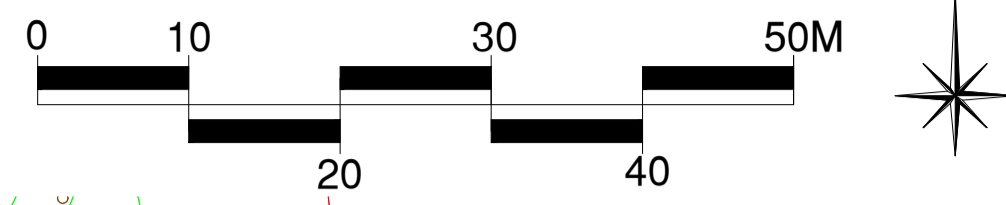


Royal Military Academy Sandhurst



FILL Depth Bands			
Band 1	0.00 -	0.05	
Band 2	0.05 -	0.10	
Band 3	0.10 -	0.15	
Band 4	0.15 -	0.20	
Band 5	0.20 -	0.25	
Band 6	0.25 -	0.30	
Band 7	0.30 -	0.35	
Band 8	0.35 -	0.38	

Surface Water Drainage Design

The proposed design of the AGP development is for a permeable surface construction. The 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 will act as an attenuation system to increase attenuation capabilities of the playing field area. The pitch base will be permeable allowing the entire area to naturally infiltrate through to the underlying soils. This is combined with a perforated drainage system being installed underneath the pitch base to connect to the proposed soakaway to the south east of the development site as an additional measure.

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 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 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 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. Water discharging from the playing field area currently infiltrates through the existing soils, without any control or restrictions. Therefore, the proposal for a permeable pitch with voids within the sub-base will increase the attenuation capabilities of the site.

Infiltration testing has been undertaken over the proposed pitch area and has derived an infiltration rate of 8.16x10⁻⁶ m/s which has been used in the soakaway calculations to the right.

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 foundations of the new synthetic turf area includes:

- 300mm deep layer of type 3 stone
- 40mm macadam
- 40mm infill of sand and rubber on the carpet

The minimum 380mm deep aggregate base construction offers a wedge for surface water attenuation prior to filling and flooding the pitch surface or surrounding grassed areas. The available volume of the wedge is created through the following calculations:

- The pitch layer constructed at a 1 in 100 gradient offers a volume and capacity of 455m³
- Based on a voidage space of 40% this offers **182m³** of water attenuation.
- The drainage system, shown in drawing 'SSL3159 03 - Proposed Rugby Drainage Layout', can also attenuate an additional **95m³**
- The 10x3x1m soakaway can also attenuate **30m³**

The surface water attenuation calculations as per the table right shows the following;

- 1 in 100 year storm event + 40% allowance for climate change would require **303m³** of attenuation

The attenuation provided by the pitch design (306.5m³) will cater for a 1 in 100 storm event +40% (303m³) without flooding either the pitch surface or surrounding areas.

Consider Area to be drained = 10080 m²

Discharge through entire pitch sub-base and external soakaway

100 year + 40% climate change

Flow	Time (min)	M5-D 20mm x Z1	Z2 factor	M100-D (mm)	Inflow M3	Outflow M3	Storage M3
	5	7.6	1.862	14.2	199.7	24.7	174.99
	10	10.8	1.926	20.8	293.5	49.4	244.11
	15	12.6	1.958	24.7	348.2	74.1	274.01
	30	16.0	1.998	32.0	451.1	148.3	302.84
	60	20.0	2.030	40.6	572.9	296.6	276.36
	120	24.0	2.014	48.3	682.1	593.2	88.94
	240	29.2	1.978	57.8	815.1	1186.3	0
	360	32.0	1.954	62.5	882.4	1779.5	0
	600	36.6	1.914	70.1	988.6	2965.9	0
	1440	45.6	1.842	84.0	1185.3	7118.1	0

Ratio r = 0.4 (For locality) Climate change allowance = 40%

Outflow Infiltration through pitch sub-base

Infiltration rate: 0.0004896 m/min

Soakaway details: 80 m wide 126 m lloennggth 0.38 m deep
 Assume void ratio 0.4 : 1532 m³

Available storage under pitch (based on 1:100 fall): 182.00 m³

Available storage within drainage system: 95.00 m³

Available storage area = 277.00 m³

Surface area: 10080 m²

Additional external soakaway

Infiltration rate: 0.0002652 m/min

Soakaway details: 10 m wide 3 m lloennggth 1 m deep
 Assume void ratio 0.95 : 29 m³

Surface Area: 30 m²

Eff volume: 307.00 m³ > 302.84 m³ OK

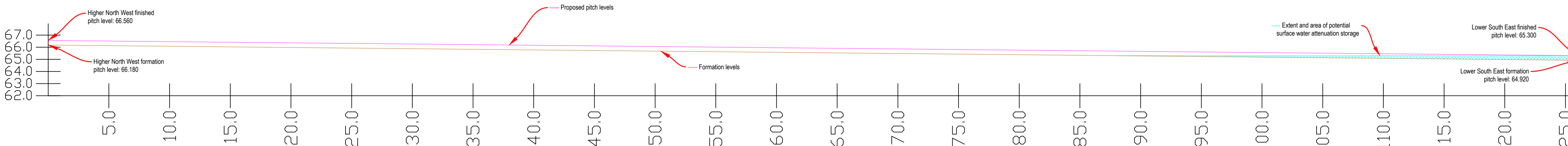
Additional storage volume required: -4.16 m³

Half drain down time 3681.8 secs 1.02272 hours (soakaway only):

Total Storage required = approx. 303m³. Storage provided under the pitch = 277m³. Approximately 26m³ of additional storage will be required.
 An external soakaway to the south of the pitch with dimensions 10m x 3m x 1m depth with 95% void ratio provides sufficient additional storage to accommodate the additional flows.
 This volume will accommodate flows from all modelled 1 in 100 year + 40% climate change events. In order to meet building regulation stanards, a half drain-down time of 24 hours should be achieved. This requirement is met at the site.

Rugby Attenuation Volume Calculations

Attenuation Scheme - Scale 1:500



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

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REV	DESCRIPTION	REV	CK	DATE
SSL Surfacing Standards Limited SPORTS PITCH CONSULTANTS				
AUTHOR ME				
TITLE Royal Military Academy Sandhurst Proposed Rugby Drainage Strategy				
PROJECT	SSL3159	SCALE	Varies	SIZE A1
DRAWING No	04	REVISION	00	