

Chatsworth Settlement Trustees

**High Shann**

## Condition 6: Drainage Statement

HSN-ARP-XX-XX-RP-CD-00001

ISSUE | 5 June 2018

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 247008

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Drainage General Arrangement

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# 1 Introduction

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## 1.1 Purpose

The purpose of this Drainage Statement is to provide the necessary information to discharge condition 6 of the following outline planning permission for the ‘construction of up to 135 dwellings with means of access by the provision of two new vehicular accesses from Shann Lane and Broadlands to be considered’ at Shann Lane, Keighley [reference: 12/04674/MAO]. The outline planning permission was granted in September 2013. The wording of condition 6 is as follows:

*‘No phase of the development shall commence until a scheme and programme for the provision of separate foul and surface water drainage works, including details of any balancing and off-site works, have been submitted to and approved in writing by the local planning authority. The surface water works shall maintain Greenfield surface water runoff rates so that it will not exceed the run-off from the undeveloped site and not increase the risk of flooding off site. This applies for up to and including the 1 in 100 year (plus climate change) rainfall event. There shall be no piped discharge of surface water from the development prior to the completion of the approved surface water works, and none of the dwellings in any phase of the development shall be occupied until the drainage scheme has been implemented in respect of that phase. The measures shall be fully implemented prior to occupation of any dwelling within each phase and subsequently in accordance with the timing/phasing arrangements embodied within the scheme or within any other period as may subsequently be agreed in writing by the Local Planning Authority’.*

This document identifies the existing site characteristics, assesses the proposed development and outlines the proposed drainage strategy to mitigate any adverse impacts of the development on the surrounding site. A Reserved Matters application was submitted in April 2018, which is currently being determined by CBMDC. The Reserved Matters submission covered matters of access (other than at Broadway and Shann Lane), appearance, landscaping, layout and scale of the development.

## 1.2 Structure of Report

This report addresses the following:

- Context.
- Site Overview
- Development Proposals
- Existing Surface Water Drainage
- Proposed Drainage Strategy
- Residual Risk
- Off-site Impacts

- Summary

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## 2 Context

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### 2.1 Applicant

The application site is owned by the Trustees of the Chatsworth Settlement (also known as “Chatsworth Settlement Trustees” (CST)).

The Chatsworth Settlement, known internally as the Devonshire Group, owns the land and estates of the Dukedom of Devonshire. Its main estates are in the vicinity of Chatsworth in Derbyshire and Bolton Abbey in North Yorkshire. It also runs visitor and other businesses on these estates, including: hotels; retail and catering outlets; forestry; livestock and arable farming. It employs over 600 full time employees. It is committed to quality in all its activities and takes a responsible approach to development; as such, it measures performance in financial as well as social and environmental terms.

CST’s Yorkshire Estate provides 160 full time equivalent jobs at Bolton Abbey and contributes circa £8m of enabled Gross Value Added to the local economy each year. Its income funds socio-economic facilities (i.e. village shops/post offices) and environmental management activities (i.e. architectural conservation) without grant support. CST thereby provides benefits far beyond “just the estate”.

CST also owns land outside the Bolton Abbey estate, including land in Keighley, and has longstanding interests in the area.

### 2.2 Site context

High Shann is a 4.8 hectare site off Shann Lane, located in north east Keighley. It is bound to the north, east and south by existing residential development. It is bound to the west by Shann Lane and beyond that, open fields.

The site is currently pasture land contained by dry stone walls constructed of local grit stone. One dry stone wall runs north south through the middle for the site and another dry stone wall runs east west and is located towards the eastern site boundary.

There is a Public Right of Way, which runs along the south west boundary of the site before entering the site via a dry stone stile adjacent to the north south dry stone wall. There are a limited number of trees on the site including two mature oak trees adjacent to the east west dry stone wall and mature trees along the eastern perimeter of the site.

The most important aspect of the site is that it slopes steeply from west to east, and this naturally presents topographical challenges in terms of facilitating related development.

The surrounding area to the south, east and north is residential, but agricultural to the east.

## 2.3 Planning policy

Section 38 (paragraph 6) of The Planning and Compulsory Purchase Act 2004 states that:

‘If regard is to be had to the development plan for the purpose of any determination to be made under the planning Acts the determination must be made in accordance with the plan unless material considerations indicate otherwise’.

The High Shann site is allocated in the current Development Plan as a phase 2 housing site by Policies H1 and H2 of the Replacement Unitary Development Plan (RUDP). The principle of development on this site has also been established by the outline planning permission granted in 2013.

## 2.4 Design process and Consultation

Liaison began with City of Bradford Metropolitan District Council (CBMDC) in 2012 to support an outline planning application submitted in November 2012. An outline planning application for the ‘construction of up to 135 dwellings with means of access by the provision of two new vehicular accesses from Shann Lane and Broadlands to be considered’ at Shann Lane, Keighley [reference: 12/04674/MAO] was approved in September 2013. The principle of the development has therefore been established.

A range of design meeting have been held to feed into the final reserved matters application that was submitted in April 2018. The following meetings and discussions have been held in relation to the drainage design of the scheme:

- Formal pre-application feedback from CBMDC and Yorkshire Water.
- Meeting with Edward Norfolk (Principal Engineer Land Drainage, CBMDC), on the 15<sup>th</sup> March 2018
- Meeting with Edward Norfolk (Principal Engineer Land Drainage, CBMDC) and John Wellham (Yorkshire Water) on the 8<sup>th</sup> May 2018.

Following the production of pre-application material and discussions with stakeholders CBMDC were comfortable with the proposal for surface water. However, Yorkshire Water requested further justification regarding the use of the field drains located on the site. This justification has been provided in a separate note to discharge condition 7 of the outline permission, which requests further investigation in relation to the field drains.

## 2.5 Development proposal

A Reserved Matters application was submitted in April 2018, which includes details of access (other than at Broadway and Shann Lane), appearance, landscaping, layout, and scale for 130 dwellings at High Shann. The design process has led to the proposal for 130 dwellings, including open space and associated road and drainage infrastructure.

The scheme is based on the following mix of housing types.

House Type	Number of units
5 Bed Detached	14
4 Bed Detached	20
4 Bed Semi-detached	10
4 Bed Semi-detached townhouse	22
3 Bed Terraced townhouse	19
3 Bed Detached	15
3 Bed Detached Wide Plot	8
3 Bed Semi-detached	22
Total Units	130

This equates to 14 five-bed dwellings, 52 four-bed dwellings and 64 three-bed dwellings.

## 2.6 Benefits

The main benefits of the development proposal include:

- Delivery of quality family homes to diversify the housing offer in Keighley.
- A mix of dwelling types to widen the choice of homes and support the five-year land supply for the District.
- Supporting CBMDC to deliver their Core Strategy target of 4,500 new homes in Keighley up to 2030 by efficient delivery of an allocated housing site.
- A development that respects the levels, scale, design and context of the residential areas surrounding the site.
- Provision of a new spine road from Shann Lane to Westway with a specification to allow it to function as a future bus route.
- Provision of an affordable housing contribution.
- A contribution towards educational provision.
- Delivery of off-site highway works.

## 2.7 Summary

In view of the foregoing, it can be seen that:

- The applicant is a responsible landowner committed to both quality and the area concerned.
- The site is 4.8ha and comprises grazing land which slopes steeply from west and east and therefore presents topographical challenges to development.
- National and local planning policy provides for development in line with the local plan (which allocates the site for residential development).
- The principle of development on this site has already been established by way of the extant outline planning permission granted in September 2013.

- The development proposal accords with national and local planning policy, and should therefore be supported in principle.
- The development proposal has been designed in line with officers' comments received at the pre-application stage.
- The development proposal will lead to benefits such as: quality family homes; housing mix; provision of public transport and public open greenspace.
- The development will provide a affordable housing contribution, education and off-site highways improvements as specified in S.106 agreement
- There are no material considerations to suggest that the development proposal should not be supported and granted planning permission without delay.



## 3.2 Site Description

The site covers an area of approximately 4.8 hectares and is currently greenfield comprising three fields used for grazing separated by stone walls.

The Phase 1 Land Contamination and Risk Assessment<sup>[1]</sup> indicates that:  
*“Carboniferous Millstone Grit bedrock is present across the entire site. Geological mapping indicates the East Carlton Grit, a sandstone unit, is expected to cross the site in a narrow band from northwest to southeast, with undifferentiated units across the remainder of the site.”*

The report goes on to say: *“Groundwater is likely to be present within the sandstone units and confined by interbedded mudstones. The site is not located within a source protection zone designated by the EA.”*

Site investigations undertaken in February 2018 confirmed the following stratigraphy:

- 0.0-0.3m: Topsoil
- 0.3-2.0m: Sandy gravelly clay
- >2.0m: weak sandstone.

## 3.3 Topography

The site falls gradually from the southwest to the northeast varying from 231mAOD to 197mAOD.

The western boundary of the site, following Shann Lane falls from 231mAOD to 203mAOD. The northern boundary along the Greenacres Drive residential properties falls from 203mAOD to 197mAOD.

The southern boundary with Westway and Broadlands falls in an easterly direction from 231mAOD to 203mAOD. The eastern boundary falls in a northerly direction from 203mAOD to 197mAOD.

### 3.4 Watercourses

The closest critical ordinary watercourse is River Worth approximately 1.6km to the east of the site. The River Aire is located approximately 1.6km to the northeast of the site.

CBMDC records indicated that there are 2 unnamed watercourses to the east of the development site. The watercourses are identified as draining in an easterly direction and are located beneath third party land.

Consultation with CBMDC confirmed that there are no records relating the line, level, condition or ultimate outfall location of these watercourses. However, they are assumed to discharge to the River Worth.

A Ground Penetrating Radar investigation was undertaken in February 2018 and identified the presence of below ground drainage in the northeast corner of the site. Subsequent intrusive investigations were undertaken to determine if these watercourses extended into the site boundary.

The investigation uncovered 2 shallow land drains constructed of sandstone blocks with a cross sectional area of 200mm x 200mm. 1 of the land drains was silted and not functional.

## 4 Development Proposals

### 4.1 Overview

A Reserved Matters application was submitted in April 2018, which includes details of access (other than at Broadway and Shann Lane), appearance, landscaping, layout, and scale for 130 dwellings at High Shann. The design process has led to the proposal for 130 dwellings, including open space and associated road and drainage infrastructure. Figure 2 below is a sketch showing the Architect’s Masterplan Layout for the development, which has been used as the basis for the drainage design.



Figure 2: Indicative Masterplan

## 5 Existing Surface Water Drainage

### 5.1 Existing Surface Water Drainage Regime

There are no surface water features within the site.

Site investigations identified the presence of drainage locally in the north east of the development site. Trial holes undertaken to verify the depth, size and condition confirmed 2No. 200mm x 200mm masonry drains approximately 400mm below ground level.

Based on the topography and the absence of surface features, surface water falling within the site boundary drains overland and infiltrates to ground, drains to the land drainage on the boundary of the site or drains overland across the site boundary.

The site was observed to be heavily saturated during the site investigations undertaken in February although no rainfall was recorded. The investigation was preceded by a dry period of 5 days.

Anecdotal evidence from neighbouring properties suggests that the northeast of the site (lower section) is routinely saturated. This evidence is supported by the presence of land drainage in the area.

### 5.2 Existing Drainage Permeable/Impermeable Areas

The site is currently undeveloped and is utilised as agricultural grazing land. The permeability of the site is compromised by the underlying geology. Borehole logs suggest that the upper 1 to 2m is clay. This thickness was verified during the infiltration testing identified.

Table 1: Estimate Surface Water Discharges from the Existing Site

Catchment Area	Permeable Area (m <sup>2</sup> )	Impermeable Area – Not drained (m <sup>2</sup> )	Impermeable Area – Positively Drained (m <sup>2</sup> )	Outfall Location	Estimated discharge rate (l/s)
Existing Site	48000	0	0	Infiltration/ Overland flow	6.2l/s
<b>Total</b>	<b>48000</b>	<b>0</b>	<b>0</b>		<b>6.2l/s</b>

### 5.3 Existing Foul Water Drainage Regime

There are currently no foul water drainage networks within the site boundary. The closest foul drainage networks are located in neighbouring developments. These are operated and maintained by Yorkshire Water. The sewers are located at:

- Greenacres Drive (north)
- Glencore Drive (northeast)
- Springfield Road (east)

## 6 Proposed Drainage Strategy

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### 6.1 Surface Water Drainage Strategy

The proposed drainage strategy has considered the following methods of surface water disposal:

1. Discharging to ground through soakaways and infiltration systems;
2. Discharging to local watercourses;
3. Discharging to the public sewer network.

The preferred strategy for this site, following on-site investigations, is to utilise infiltration in combination with traditional drainage network and a positive connection to the Yorkshire Water Sewer network. The rationale for this strategy is outlined in the following section.

### 6.2 Soakaways and infiltration systems

Soakaways and infiltration systems are the preferred method for disposal of surface water flows if feasible. Such systems include detention ponds and surface water swales. Other systems that enable infiltration into the underlying ground include porous paving and infiltration from a tanked system or soakaway beneath the ground.

In February 2018 soakaway tests were undertaken on behalf of CST included 6 No. soakaway tests. Figure 3 below identifies the location of the test pits. 4No. test did not yield a satisfactory result due to the partial collapse of the pit during testing. The remaining 2 tests confirmed the following infiltration rates:

- TP1 –  $2.06 \times 10^{-5}$ m/s
- TP2 –  $1.70 \times 10^{-6}$ m/s

An assessment of the effectiveness of soakaways based on the completed tests has been undertaken. The assessment was undertaken for the M10 and M100 return periods with the following storm durations of 10, 15, 30, 60, 120, 240, 360, 600, and 1440.

The soakaway storage volume was calculated in accordance with the BRE guidance. In addition, a discharge check was undertaken to confirm that the soakaways are capable of discharging from full-to-half volume within 24 hours in readiness for subsequent storms.

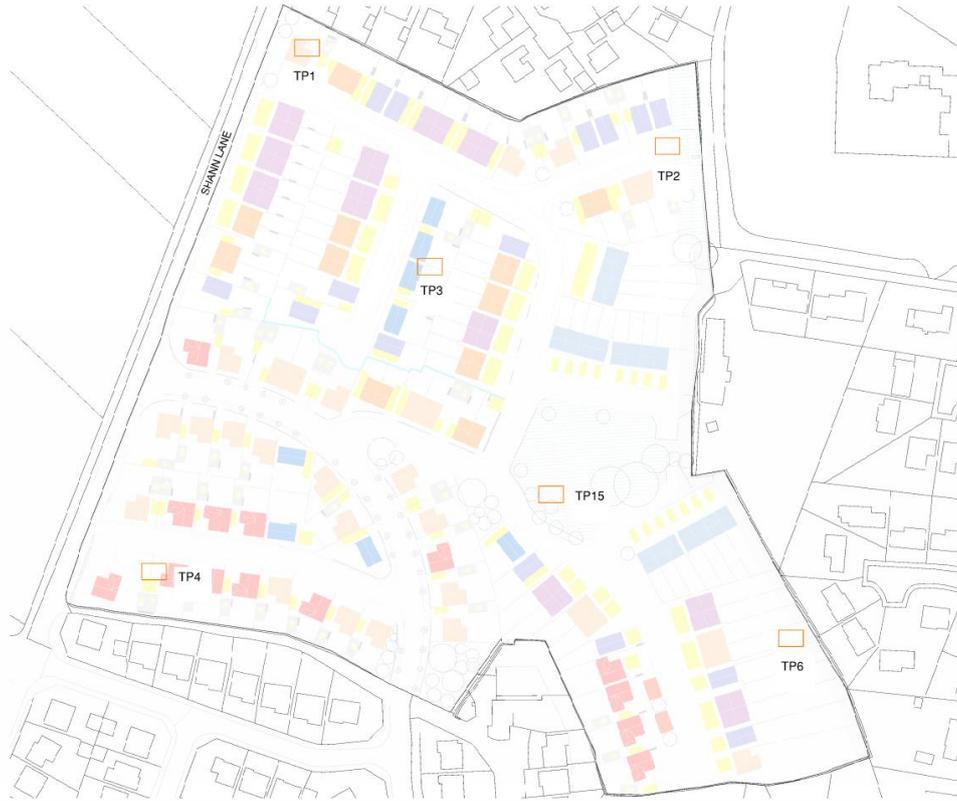


Figure 3: BRE Infiltration Test Locations

For comparative purposes only the table below indicates the approximate size of soakaway, and storage required for the scheme based on the infiltration test results for the M100 return period over the full range of durations.

Table 2: Length of Infiltration Trenches for Impermeable Area of 2.6ha.

Test Location	Infiltration Rate	Effective Depth (m)	Width (m)	Length (m)	Storage (m3)	Total Estd Area (ha)
TP1	$2.0 \times 10^{-5}$ m/s	2.0	2.0	1600	1100	1.1
TP2	$1.7 \times 10^{-6}$ m/s	2.0	2.0	19000	1110	13.3

Table 3 below identifies the size of soakaway required for a typical property with 120m<sup>2</sup> of impermeable area based on the infiltration test results for the M100 return period over the full range of durations.

Table 3: Length of Infiltration Trenches for Individual Property of 120m<sup>2</sup>.

Test Location	Infiltration Rate	Effective Depth (m)	Width (m)	Length (m)	Storage (m3)	Total Estd Area (ha) <sup>1</sup>
TP1	$2.0 \times 10^{-5}$ m/s	2.0	2.0	5.2	5	1.6
TP2	$1.7 \times 10^{-6}$ m/s	2.0	2.0	88	5	15.0

The infiltration rates from the site are low. Whilst the results above illustrate that there is potential for infiltration, the spatial area required for the construction of

<sup>1</sup> Total estimated area has been calculated to include the 5m buffer zone between the infiltration system and adjacent buildings, and a minimum of 5m between infiltration units.

the infiltration systems are considerably large to achieve the 24 hour provided within the site the infiltration rates are low.

The calculations for the individual plot soakaways would require use of the majority of the garden space as a minimum distance of 5m is required between structures and soakaways. As a result, a stand-alone infiltration system is not considered to be viable for this site.

The drainage strategy has therefore considered a positive drainage connection to be provided off-site to provide sufficient resilience for the development.

## **6.3 Discharge into a nearby watercourse**

### **6.3.1 Critical Ordinary Watercourse**

The nearest critical ordinary watercourses to the site are river Worth and the River Aire. These water bodies are located approximately 1.6km to the east and north of the site, respectively. There is no direct connection between the site and these waterbodies.

The construction of a new connection has not been considered due to distance separating the site and the watercourses.

### **6.3.2 Unnamed Watercourse**

CBMDC asset records identified the presence of watercourses to the east of the site. Further desk based research was undertaken but no further information identifying the line, level or condition records for these watercourses were available. The outfall points for these watercourses are not confirmed but may outfall to sewer or the River Worth. Furthermore, there is no information available on the capacity of these systems to accept surface water. Nor is there record information to identify any pre-existing flood risk issues associated with these assets.

Investigations were undertaken by CST in February 2018 to determine if these watercourses extended into the site. The investigation encountered two physical drains on the north eastern boundary of the site. The drains encountered were constructed of sandstone blocks with an external width of 500mm. One of the drains was silted and blocked. The internal dimensions of the functioning drain are approximately 200mm x 200mm. Based on the location and size and depth (400mm) of the drains these are likely to be land drainage and not of sufficient size or condition to accept a new surface water discharge.

The ownership of the watercourse is not known, but it is noted that the indicative alignment provided by CBMDC passes beneath multiple landowners. CBMDC do not undertake asset inspections of these watercourses and the current condition is not known. The extent of rehabilitation cannot be determined.

To enable the discharge of the proposed development to these watercourses the applicant would be required to:

1. determine the line, level, condition and capacity of these watercourses.
2. verify that any surface water discharge did not increase flood risk downstream of the development.

### 3. Agree a connection across third party land

At present, without undertaking extensive site investigations, drainage surveys and flow monitoring between the site and the outfall it would not be possible to establish if the connection of the site would adversely impact on downstream properties. The use of these water courses are not therefore considered practicable or economically justifiable.

For the reasons stated above, the discharge of surface water from the site to these watercourses has not been considered as a viable discharge location for surface water from the site.

### 6.3.3 Discharging flows to Yorkshire Water network

Following submission of the outline planning application further discussions were held with Yorkshire Water to determine if surface water could be discharged to the existing YWS network in the vicinity of the site.

YWS confirmed that only as a last resort and subject to providing satisfactory evidence as to why the other methods of surface water disposal have been discounted, surface water discharges to the public sewer will be restricted to the following levels of run-off. i.e. Surface water run-off from the site to be limited to 5l/s at the Springfield Road / View Road public combined sewer; 5 l/s at the Glenlyon Drive public combined sewer and 5 l/s at the Greenacres Drive surface water sewer. Refer to the Drainage Statement update which is appended to this report Appendix B for the full comments.

Connection into the existing public combined sewers has therefore been considered and incorporated into the drainage strategy.

## 6.4 Proposed Permeable and Impermeable Areas

The proposed assessment of permeable and impermeable areas is based on the architectural layout in figure 2 above. For the purposes of the drainage design it has been assumed that the whole site will be impermeable following completion of the development. This reflects the potential for heavy rainfall events during summer months when the permeable areas provide less potential for infiltration

Proposed impermeable areas are detailed in Table 2 (below). Separate areas have been defined for the purposes of this assessment:

Table 4: Proposed Surface Water Catchments and Estimated Unrestricted Run-off

Catchment Area	Area	Permeable Area (m <sup>2</sup> )	Impermeable Area (m <sup>2</sup> )	Unrestricted flow rate (Rationale Method) (l/s)	Outfall Location
Catchment 1	15100	6000	9100	173	Green Acres
Catchment 2	17800	7100	10700	203	Green Acres
<b>Total</b>	<b>32900</b>	<b>13100</b>	<b>19800</b>	<b>376</b>	

The discharge rates have been calculated using the Modified Rational Method as indicated in Section 2.2 and reflect an average rainfall intensity of 68.84 mm/hr which is based on a 15-minute storm with a return period of 30 years.

## 6.5 Drainage Network

It is proposed to divide the drainage into two catchments as indicated in figure 4 below. Catchment 1 will serve west of the site. Catchment 2 will serve the eastern portion of the site.

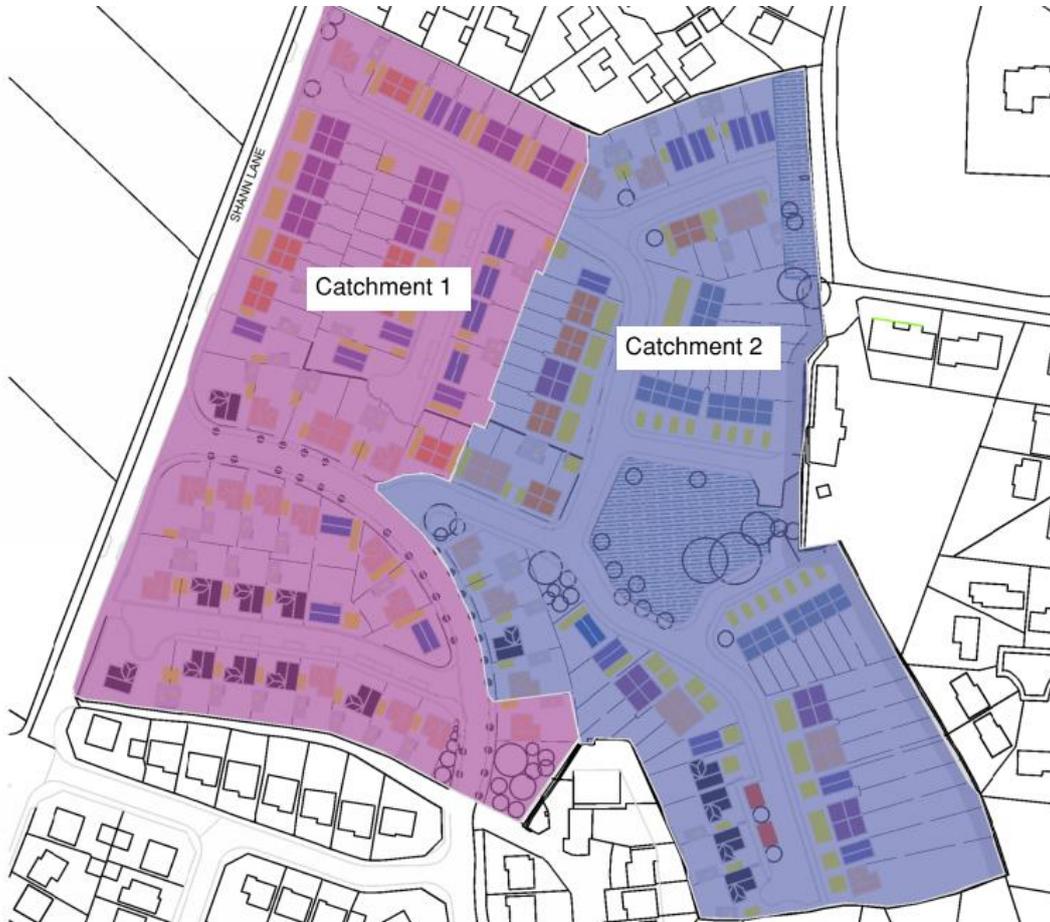


Figure 4: Proposed Drainage Catchments

### 6.5.1 Catchment 1

A separate surface water drainage network will drain the western portion of the site. Surface water from the residential properties will drain via a separate network and discharge to the attenuation tank in the northeast corner of the site.

Run-off from the surface of the adopted highway will drain to roadside gullies and in turn to a below ground piped network and passed through a petrol interceptor to the attenuation system.

The drainage network has been designed to not surcharge during a 1 in 2-year rainfall event and so that no part of the highway or site floods during a 1 in 100-year rainfall event, plus a 30% allowance for the effects of climate change.

The attenuation volume may be accommodated in box culverts beneath the highway and in swales along the North Eastern boundary.

## 6.5.2 Catchment 2

A separate surface water drainage network will eastern, lower portion of the site. Surface water from the residential properties will drain via a separate network and discharge to the attenuation tank in the northeast corner of the site.

Run-off from the surface of the adopted highway will drain to roadside gullies and in turn to a below ground piped network and passed through a petrol interceptor.

The drainage network has been designed to not surcharge during a 1 in 2-year rainfall event and so that no part of the highway or site floods during a 1 in 100-year rainfall event, plus a 30% allowance for the effects of climate change.

The below ground piped network would discharge to an attenuation tank. detention basin has been designed to provide attenuation for rainfall events up to and including 1 in 100 years plus a 30% allowance for the effects of climate change. Discharge from the attenuation tank would be restricted pumped at a rate of 3.0l/s to Network 1 and drained to Greenacres drive.

An infiltration trench would be constructed along the eastern boundary of the site intercept exceedance flows from the site.

## 6.6 Foul Drainage Proposals

In line with the surface water drainage proposals, the foul drainage would be split into two discrete catchments.

Catchment 1 would drain by gravity and connect to the existing Yorkshire Water Sewer into Greenacres Drive.

Catchment 2 would drain to a new pumping station. The pumping station will convey foul water to Greenacres Drive via Network 1.

Table 5: Proposed foul water discharge rates

Catchment	Peak Foul Discharge Rate (l/s)	Comments	Discharge
<i>Catchment 1</i>	15.1	Based on Discharge Unit Method as described BS EN 12056	Greenacres Drive
<i>Catchment 2</i>	12.1	Based on Discharge Unit Method as described BS EN 12056	Pumping Station and Rising Main to Greenacres Drive
<i>Combined Site</i>	<b>19.51</b>	Based on Discharge Unit Method as described BS EN 12056	Greenacres Drive

It is proposed that the pumping station will be offered to Yorkshire Water for adoption. In line with Sewers for Adoption 7<sup>th</sup> Edition an emergency storage volume of 160 litres per dwelling (22m<sup>3</sup>).

If the system is not adopted, the pumping station will be required to provide emergency for 24 hours. This would be 28m<sup>3</sup> based on a population of 485 persons (full development capacity) and a daily usage of 160 l/p/d.

## 7 Residual Risk

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### 7.1 Surface Water

The residual surface water risk to the proposed residential properties is deemed to be low. However, there is a risk of surface water exceedance flows during extreme pluvial events (in excess of 1 in 100 years).

Exceedance flows will be directed away from the building thresholds. Surface water will continue to drain to the surface water drainage network.

### 7.2 Foul Water

A foul storage tank associated with the on-site pumping station will ensure foul discharges from the site can be controlled and in an emergency scenario held on site. The storage volume may be offered for adoption discussions with Yorkshire Water or retained in private ownership. The required storage volume<sup>2</sup> will range from vary depending on the maintainer but may vary between 22m<sup>3</sup> and 28m<sup>3</sup> based on the anticipated population of the development.

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<sup>2</sup> Storage volume for adopted pumping stations based on 160l/p/d. Non-adopted pumping stations to provide 24-hour storage for the design population in accordance with Building Regulations Part H.

## 8 Off-site Impacts

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### 8.1 Surface Water

High Shann is located on an elevated site above neighbouring properties to the east of the site boundary. The proposed drainage network will divert surface water run-off from the site to attenuation tanks. As outlined, these will be designed to accommodate 1 in 100-year storm events with an allowance for 30% climate change.

To manage the risk of surface water run-off at greater return periods (exceedance events) the development has been set back from the eastern boundary of the site. A linear infiltration swale will be installed to intercept exceedance flows and provide additional attenuation. It is proposed to provide a connection to the pre-existing land drainage.

### 8.2 Foul Drainage

The development will incorporate a new separate foul water network. This will be discharged to the existing Yorkshire Water foul sewer at Greenacres drive subject to agreement with Yorkshire Water.

The off-site impacts are therefore considered negligible.

## 9 Summary

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### 9.1 Surface Water

The development site is currently a greenfield site. Surface water infiltrates, or flows overland towards the eastern boundary. Anecdotal evidence suggests that the northeast of the site is prone to saturation. Site investigations identified a number of shallow land-drains on this boundary.

Site infiltration tests undertaken in February suggest that a low rate of infiltration is possible but is not sufficient to cater for needs of the full development site. The preferred surface water strategy is to provide a sewer network with infiltration and a positive discharge to sewer to manage greater intensity storms.

Discharge to the watercourses to the west of the site have been excluded due to the complexity of verifying line, level and condition of these watercourses, the unknown existing flood risk associated with the asset and the lack of an asset owner. Discharging to the River Worth and River Aire are not considered feasible due to their distance from the site.

It is proposed to provide 2 surface water networks. Network 1 will the western portion of the site. The network will drain by gravity to an attenuation tanks with a permeable base. An overflow will connect the system to Greenacres Drive. The lower eastern portion of the site will drain to Network 2. This will incorporate a pumping station and rising main to convey flows to Network 1. An attenuation tank with permeable base will be incorporated to reduce the volume discharge off site.

The proposed surface water drainage for the site will discharge to Greenacres Drive at a maximum rate of 5 l/s. The flow will be controlled by a hydro-brake or similar control feature.

The proposed surface water networks will be designed to prevent flooding on-site up to a 1 in 30-year storm event and to prevent flooding off-site up to a 1 in 100-year event.

The surface water network serving the highways will be passed through a petrol interceptor to mitigate the risk of pollution prior to draining to the attenuation tanks.

There is potential for localised flooding during extreme events (greater than 1 in 100 year) if the drainage system is surcharged. Surface water will be directed away from building thresholds. An infiltration swale will be provided along the eastern boundary to intercept overland flows. The infiltration ditch will connect to the existing land drainage connections off site.

### 9.2 Foul Water

The site will be served by 2 drainage networks. The upper catchment (western) will drain to Greenacres Drive by gravity.

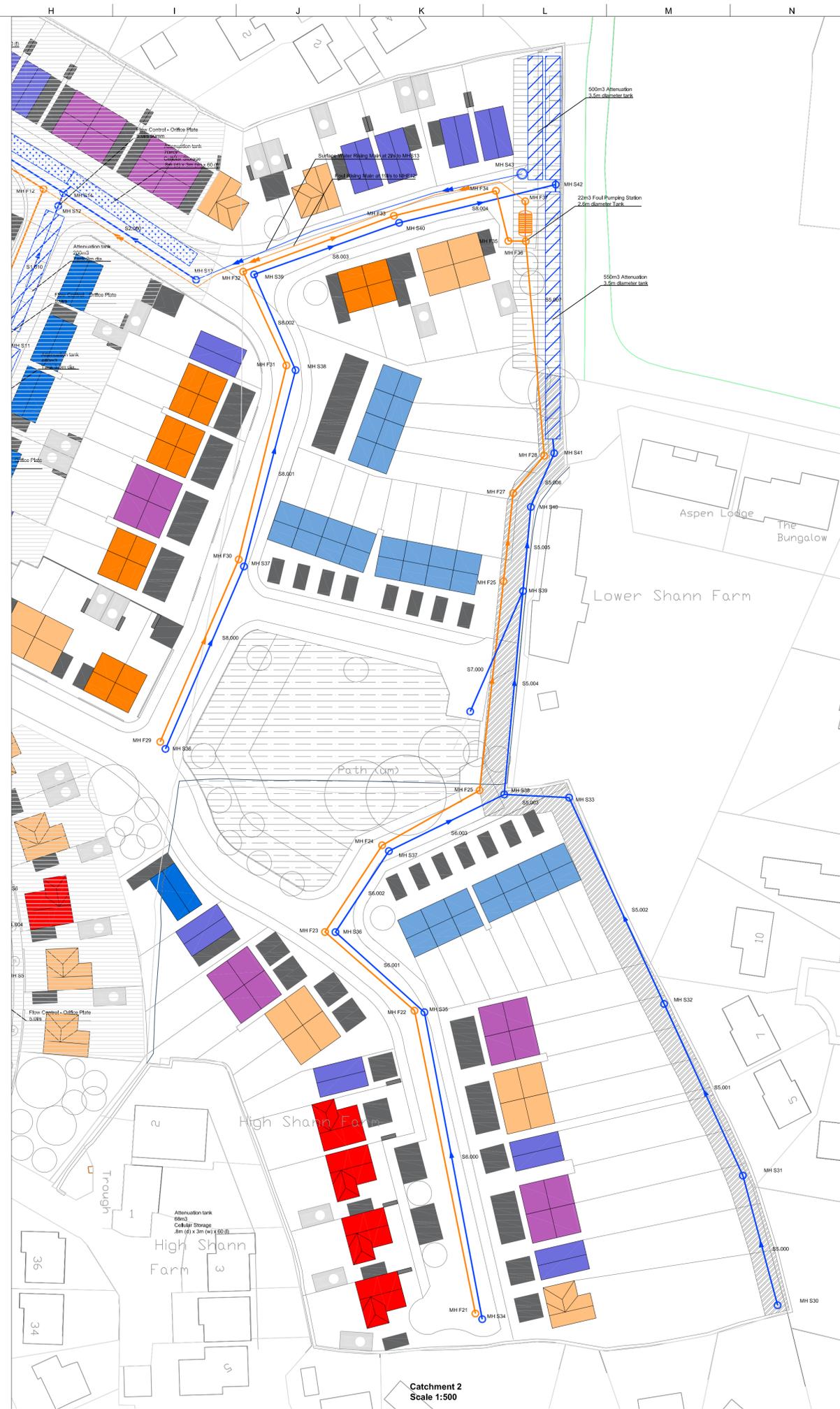
The lower catchment will drain by gravity to a pumping station. This pumping station will convey foul flow to the Greenacre Drive sewer. Emergency storage will be incorporated into the pumping station in line with the requirements of Yorkshire Water, if adopted, or Building regulations, if the pumping station remains private.

## **Appendix A**

### **Drainage General Arrangement**



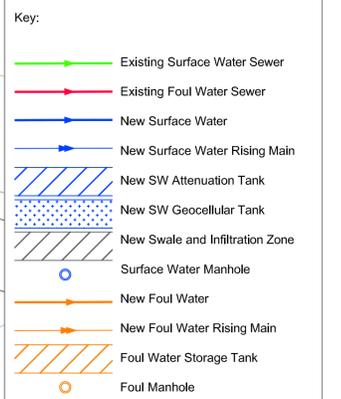
Catchment 1  
Scale 1:500



Catchment 2  
Scale 1:500

- Notes:
- This drawing is not for construction
  - Do not scale
  - This drawing to be read in conjunction with the Surface Water Drainage Strategy.
  - Surface water to discharge to YWS sewer in Greenacres Drive at maximum rate of 5.0l/s.
  - Discharge to sewer subject to agreement with Yorkshire Water Services Ltd.
  - Surface Water Network designed to provide:
    - No flooding from Manholes 1:30 year + 30% climate change allowance.
    - No flooding off-site up to the 1 in 100 year +30% climate change allowance.
  - Network 1, drains by gravity to YWS Sewer.
  - Network 2, drains by gravity to new pumping station at MHS13. Surface Water conveyed to MHS13 at maximum rate of 2.0l/s.
  - Arrangement of surface water storage areas subject to design development.
  - Hydro-brake, or similar, to be installed to control discharge to YWS to S1/s.
  - Orifice Plates, or Hydro-brakes, required downstream of attenuation tanks to utilise storage volumes in the upper catchment areas
  - Swale and infiltration trench to be provided along the eastern boundary 2m (w) x ppxroximately 2m (d) to top of rock head for exceedence flows. Check dams to be provided for every 1m loss in elevation.
  - Foul Drainage pumping station to be designed to adoptable standards (Sewers for Adoption 7th Edition)
  - Indicative Foul Pumping station indicated is sized for 24hour storage at 1600p/day. Emergency Storage to be agreed with adopting authority.

- Risks:
- Discharge rates to be agreed with Yorkshire Water Services.
- Health and Safety:
- Due to the topography of the site, there are a number of deep sewers and tanks.



Issue	Date	By	Chkd	Appd

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 Client

Chatsworth Settlement Trustees  
 Job Title  
**High Shann**

Drawing Title  
**Drainage  
 General Arrangement**

Scale at A1 1:1000  
 Plot ID  
 Drawing Status  
**For Information**  
 Job No **259524** Drawing No **DR-CD-00006** Issue **P01**

## **Appendix B**

### Drainage Statement Update

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Project title    High Shann, Keighley

Job number

225836

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cc

File reference

0-12-8

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Prepared by    Nick Ferro

Date

27 March 2013

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Subject         Drainage Statement Update

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The proposed housing development at High Shann, Keighley was recommended for approval at the Bradford Council regulatory and appeals committee on the 21<sup>st</sup> February 2013. At this meeting, members of the committee requested “details of drainage to demonstrate that there would be no adverse ground or surface water flood risk on the local area as a result of the development”.

Following a meeting with the City of Bradford Metropolitan District Council planning officer on the 20<sup>th</sup> March 2013, it was agreed that a technical note would be produced summarising recent information and consultations pertaining to flood risk and surface water drainage in support of the planning application (12/04674/MAO) for the proposed scheme.

In short, we have determined that the proposed development is **viable** in terms of surface water drainage, we have put measures in place to ensure **no increased flood risk** to neighbouring people and properties, and the proposals have been **accepted by all three key stakeholders**; Yorkshire Water, the Environment Agency and CBMDC Drainage Section.

In allaying concerns raised, the following statements summarise the developer’s commitment to ensuring flood risk and drainage are adequately addressed:

1. We are following the recognised hierarchy of preferred options for discharge of surface water: (i) by infiltration, (iii) to watercourse, (iii) to sewer. There is a commitment to investigate the opportunity to infiltrate surface water to ground at the design stage. If this turns out to be unfeasible, there is a commitment to investigate whether culverted watercourses exist and could be used as a discharge point for surface water. If these options are not feasible Yorkshire Water has quantified an allowable rate of discharge from the site to the public sewer network.
2. If required, the allowable rates of discharge to sewer are low, and would require peak flows to be attenuated within the development site by means of storage. Given the size of the site and the relatively low density of development, there is space to accommodate attenuation storage of surface water prior to discharge.
3. There are accounts from neighbouring residents of flooding to gardens from overland flow arising from the existing greenfield site, principally at the downslope boundary of the site. This situation will be improved, since the proposed development will intercept ‘natural’ overland flow paths to a large degree, collecting runoff and managing it in the positive drainage system that will be designed. Residual surface

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water runoff from green spaces will be suitably managed at the downslope boundary to ensure flood risk on and off the site does not increase.

4. The Environment Agency's interests associated with flood risk are safeguarded by the following proposed condition:

*“Prior to any development commencing, further investigation shall be carried out to establish whether there are any culverted watercourses passing through the site and the results of such investigation together with proposed mitigation measures including details of timing and phasing shall have been submitted to and have been approved in writing by the Local Planning Authority. The approved mitigation measures shall be fully implemented prior to occupation in accordance with the timing/phasing arrangements embodied within the scheme or within any other period as may subsequently be approved in writing by the Local Planning Authority.*

*Reason: In the interests of satisfactory and sustainable drainage and to accord with policies UR3 and NR16 of the Replacement Unitary Development Plan.”*

5. Subsequent to the original application, Yorkshire Water has accepted that the public sewer network could be an acceptable discharge point for surface water provided the adherence of the following two conditions:

1. *“An assessment of the need for petrol/oil interceptors designed to intercept all surface water from areas to be used by vehicles and any other areas potentially to be subject to contamination shall be submitted to and approved in writing by the Local Planning Authority prior to the commencement of development. Any required interceptors shall be provided before the development is brought into use and they shall thereafter be maintained.*

*Reason: To prevent pollution of the watercourses and to protect the environment.*

2. *Development shall not begin until a detailed surface water drainage scheme for the site has been submitted to and approved in writing by the Local Planning Authority. The scheme shall subsequently be implemented in accordance with the approved details before the development is completed. The scheme shall include:*

- i. Sufficient storage to accommodate surface water runoff from a 1 in 30 year rainfall event without the site flooding, to include an allowance of 30% to take into account climate change;*
- ii. The design should ensure that storm water from a 1 in 100 year event again to include an allowance for climate change and surcharging the drainage system can be stored on site without the risk to people or property and without overflowing to the watercourse;*
- iii. Detailed flow calculations for all phases of the development;*
- iv. Details of how the scheme will be maintained and managed after completion.*
- v. The investigation of surface water drainage options will be based on the Flood Risk Assessment and Drainage Statement. However only as a last resort and subject to providing satisfactory evidence as to why the other methods of surface water disposal have been discounted, surface water discharges to the public sewer will be restricted to the following levels of run-off. i.e Surface water run-off from the site to be limited to 5l/s at the Springfield Road / View Road public combined sewer; 5 l/s at the Glenlyon Drive public combined sewer and 5 l/s at the Greenacres Drive surface water sewer;*
- vi. Through exceedance analysis, the scheme should also take in account the consequences on flood risk of extreme rainfall events or failure of the installed surface water system. The mitigation measures to respond to the failure of the surface water system should also be detailed.*

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*Reason: This condition is imposed to prevent the increased risk of flooding and ensure future maintenance of the surface water drainage system.”*

6. The City of Bradford Metropolitan District Council flood and drainage department provided information pertaining to the site in September 2007. Pre-application dialogue with the planning officer took place between August 2012 and October 2012, and in November 2012 further discussions with the council regarding the surface water drainage strategy revealed a general agreement with the proposed strategy. Details of site investigations and the proposed drainage system and are to be submitted at the design stage for approval prior to construction.

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## DOCUMENT CHECKING (not mandatory for File Note)

	Prepared by	Checked by	Approved by
Name	Nick Ferro	Dom Ainger	Nicole Harrison
Signature			