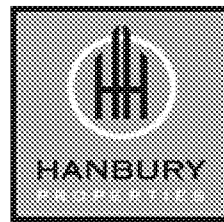


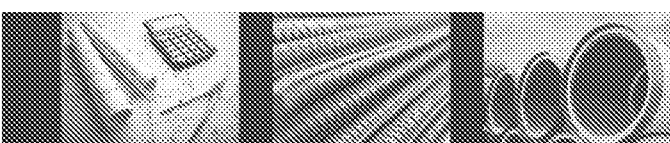
PROPOSED RESIDENTIAL DEVELOPMENT
ON LAND AT PAGHAM SOUTH
WEST SUSSEX

FLOOD RISK ASSESSMENT & DEVELOPMENT DRAINAGE STRATEGY

HANBURY (PM) LTD



Date: 27th October 2016
Ref: AMc/16/0708/5415
Rev: C



DOCUMENT CONTROL RECORD

	Name	Position	Signature	Date
Prepared by:	A McShane	Director		27.10.16
Checked by:				

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A	04/11/16	Updates to Clients comments	A. McShane	
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CONTENTS

	Page
1 Executive Summary.....	1
2 Introduction.....	2
3 The Development Site.....	3
4 Flood Risk Assessment.....	7
5 Existing and Proposed Surface Water Runoff.....	15
6 Surface Water Drainage Strategy.....	18
7 Foul Water Drainage Strategy	23
8 Cumulative Effect of Development.....	24
9 Conclusions.....	25

APPENDICES

- Appendix A - Site Layout (Masterplan)
- Appendix B - Topographical Survey
- Appendix C – Environment Agency Flood Mapping
- Appendix D – Greenfield Runoff & Catchment Areas
- Appendix E – Storm Water Attenuation
- Appendix F – Southern Water correspondence & Records

REFERENCES

Technical Guidance to the National Planning Policy Framework - NPPF (2012)
Department for Communities and Local Government ISBN: 978-1-4098-3410-6

Contains British Geological Survey materials © NERC (2014)

Environment Agency:

- Flood Map Information © and database
- Pagham to East Head Coastal Defence Strategy
- Emsworth to Littlehampton West Bank Coastal Modelling Report: JBA Consulting
- Shoreline Management Plan for Beach Head to Seisey Bill 2006

Arun District Council:

- Strategic Flood Risk Assessment, Level 1 – Final Report (August 2016)
- Strategic Flood Risk Assessment, Level 1 & 2 – Final Report (September 2016)
- Arun Strategic Surface Water Management Study (August & October 2016)

Pagham Parish Council: Neighbourhood Plan

1 Executive Summary

SITE INFORMATION	CLIENT	Hanbury (PM) Ltd
	SITE NAME	Pagham South
	SITE LOCATION	SZ 88851 98283 Land at Pagham South Pagham West Sussex
	SITE AREA	Redline Boundary 22.97 Ha. (Development Area 20.16 Ha. Plus 1.5 Ha Scout Huts & Allotments)
	CURRENT LAND USE	Agricultural field
	PROPOSED LAND USE	Circa 400 No. Residential Dwellings, School and Community Facilities.
	SITE GEOLOGY - Superficial	Sands, silts and clays from River Terrace Formation
	SITE GEOLOGY - Bedrock	London Clay Formation
	SOIL INFILTRATION RATE	Low permeability due to clay ground conditions
	GROUNDWATER LEVELS	T.B.C.
FLOOD RISK	GROUNDWATER SPZ / AQUIFER	Not in SPZ / Unproductive Strata
	GROUND CONTAMINATION	None identified
	ENVIRONMENT AGENCY FLOOD ZONE	Flood Zone 1 - Lowest Risk < 0.1% (<1:1000) Tidal Flood Zone 3 (Un defended) – Located on Southern Boundary.
	FLUVIAL (RIVERS & WATERCOURSES)	Not a risk
	PLUVIAL (SURFACE WATER)	Not a risk
	GROUNDWATER	Not a risk
	EXISTING/PROPOSED SEWERS & MAINS	Not a risk
	ARTIFICIAL	Not a risk
FOUL & SURFACE	TIDAL	Not a risk
	SURFACE WATER STRATEGY	Outfall to existing watercourses
	PROPOSED SUDS TYPE	Swales Attenuation Basins Permeable Paving to drives / parking areas (Tanked)
	EXISTING SW PEAK FLOW RATE	Greenfield Runoff 70.4 l/s QBar
	PROPOSED SW PEAK FLOW RATE	3.5l/sec/Ha – Split over 5 catchment areas
	FOUL WATER STRATEGY	On site pumping station. Flows to be pumped directly to Southern Waters Pagham WWTW's
	EXISTING FW PEAK FLOW RATE	N/A
	PROPOSED FW PEAK FLOW RATE	18.5 l/s (SFA methodology)
	FURTHER INVESTIGATIONS	None

2 Introduction

2.1 Scope

Hanbury (PM) Ltd are seeking outline planning permission for a mixed use development including the construction of up to 400 No residential dwellings with associated access roads, parking areas, domestic gardens and areas of public open space together with provision of a school, care and commercial areas. Refer to Appendix A for Masterplan. The redline boundary covers a total area of 22.97 Ha, while the residential development covers an area of circa 20,160m² (20.16Ha) excluding the 1.5 Ha covering the allotment and scout area located at Pagham South (to the south of Summer Lane) on the western side of Pagham village, West Sussex.

- 2.2 MJA Consulting has been appointed to undertake a Flood Risk Assessment and Development Drainage Strategy to determine the potential flood risk associated with the site and to provide a suitable strategy for the disposal of surface and foul water from the proposed development.

2.3 Report Structure

The National Planning Policy Framework (NPPF) and the Flood Risk and Coastal Planning Practice Guidance (PPG) is the current guidance on development and flood risk in England and Wales. The Flood Risk technical guidance for the National Planning Policy Framework requires a Flood Risk Assessment (FRA) to be carried out on sites over 1ha to consider all potential forms of flooding including that from river, sea, estuarial, land drainage, groundwater, overland flow, surface water run-off, sewer systems, and artificial water bodies (lakes, reservoirs, canals etc.). A Flood Risk Assessment is required to consider the impact of all these potential forms of flooding to both the development site and to offsite parties and land.

- 2.4 This report will take the structure of a 'Flood Risk Assessment' in accordance with the National Planning Policy Framework, the Flood Risk and Coastal Planning Practice Guidance, Environment Agency's Flood Risk Assessment Guidance and CIRIA Report 624 'Development and Flood Risk'.

- 2.5 The objective of this report is:

- To confirm that the proposed development will not be affected by current or future flooding from all potential sources for the lifetime of the site.
- To confirm that this development will not increase the risk of flooding to any offsite parties and land or increase the population within a floodplain.
- To undertake calculations to establish the existing foul and surface water runoff from the site and to assess the potential foul and surface water runoff from the proposed development.
- To detail a suitable strategy for the management of foul and surface water generated from the proposed development allowing for future climate change.
- To satisfy the planning authority that the most sustainable foul and surface water drainage solutions have been considered, in line with Environment Agency guidance, and government legislation such as the Flood and Water Management Act 2010 (Defra) and The National Planning Policy Framework and Guidance (NPPF & PPG).

3 The Development Site

3.1 Site Location and Description

The application site is located to the south of Summer Lane and west of the existing housing which bounds Pagham Road. The site is accessed off Pagham Road to the east.

The Phase 1 development consisting of 90 dwellings lies to the north of Summer Lane and received Outline Planning from Arun DC in September 2016. (P/58/15/OUT).

The site is centred on National Grid Reference SZ 88851 98283.

3.2 The development parcel of land comprises of 3 agricultural fields within one ownership and is roughly rectangular in shape. The site is bisected by an existing watercourse and a Right of Way.

The surrounding land to the south and west is generally agricultural with residential properties and Pagham Road to the eastern boundary and Summer Lane to the north.

Figure 1: Regional site location

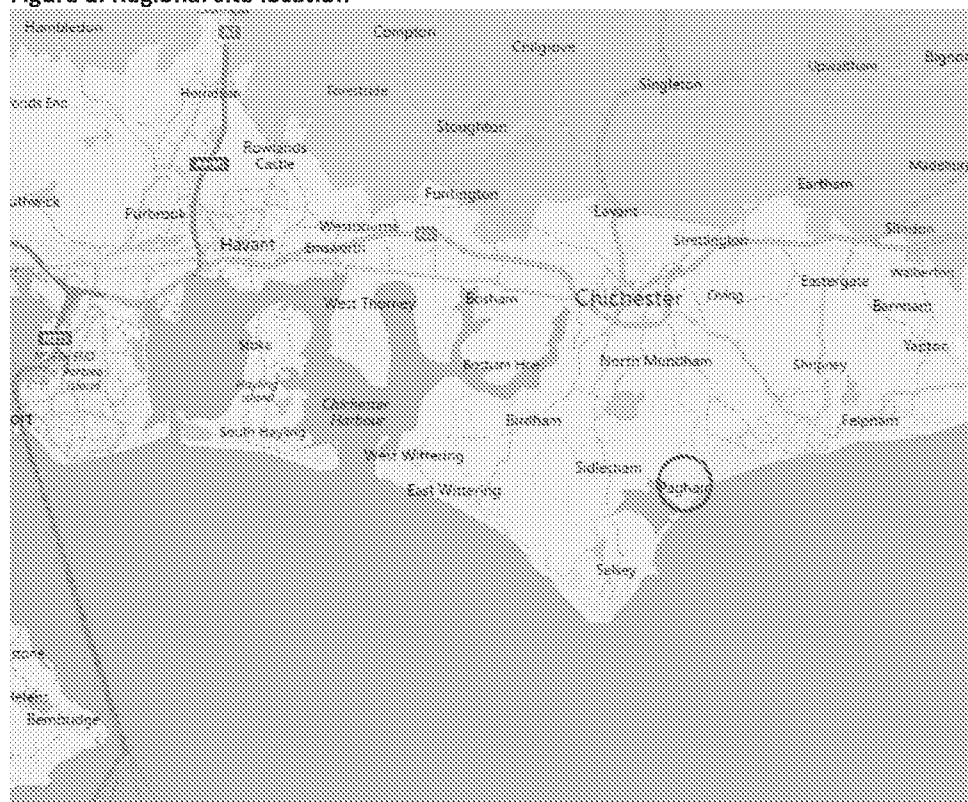


Image courtesy of: ©2016 Microsoft Corporation

Figure 2: Local site location

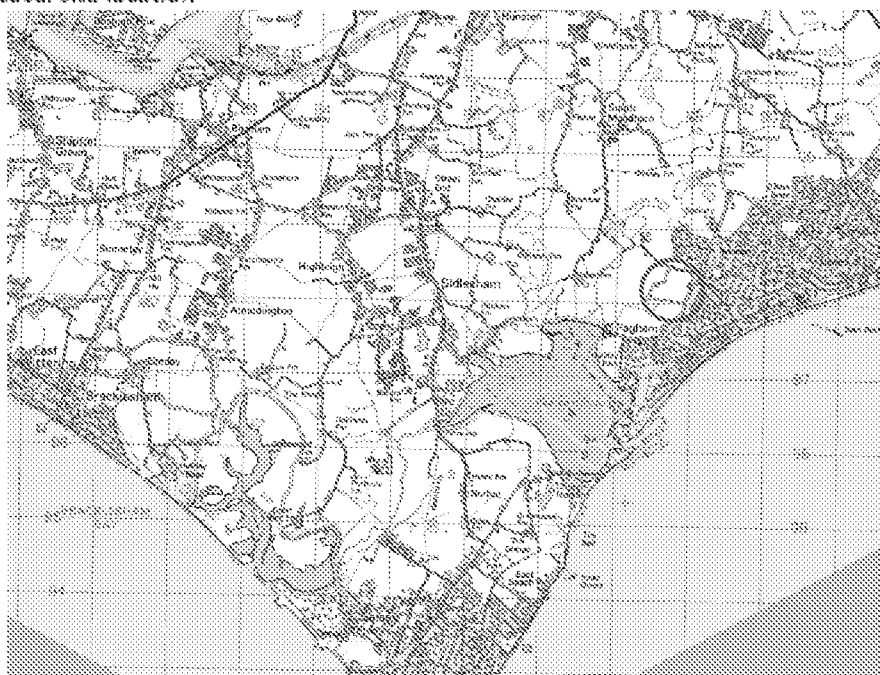
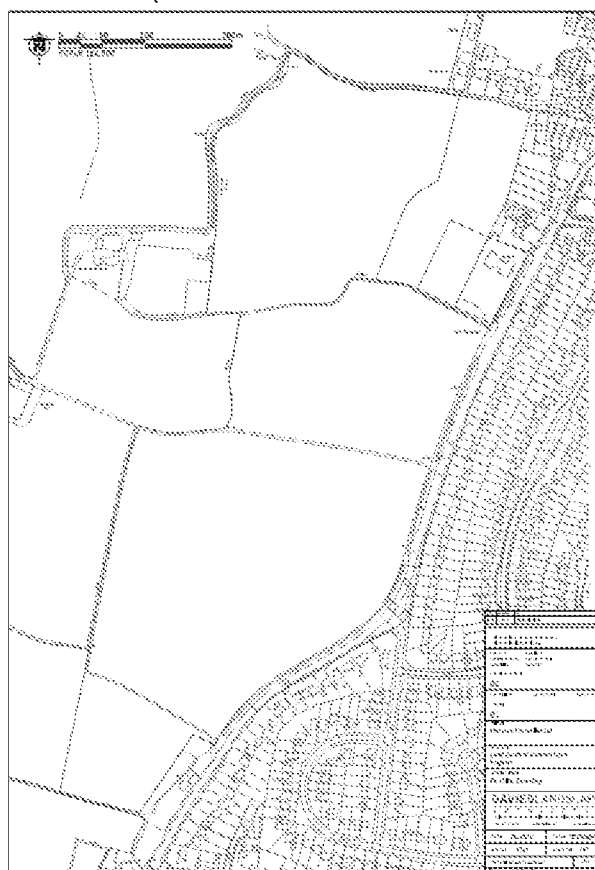


Image courtesy of: ©2016 Microsoft Corporation Image courtesy of Ordnance Survey

Figure 3: Development site boundary



3.3 Topography

The topographical survey of the site shows the existing ground generally falling typically from east to west direction towards the central watercourses and surrounding boundary ditches. The site levels range from 5.75m AOD to approximately 3.50m AOD.

Refer to Appendix B for the existing Topographical Survey.

3.4 Geology

The British Geological Survey map 317/332 1:50,000 of the area indicates that the site is predominantly underlain by sands, silts and clays from River Terrace Deposits formation over sands, silts and clays within the London Clay Formation.

An intrusive ground investigation will be required to confirm the exact make-up of sub strata.

3.5 Soil Permeability

Based on the findings within the Agricultural Land Classification Report and findings within the Phase 1 area it would indicate that the use of infiltration systems will not be feasible and an outfall to a watercourse would be the most suitable means of surface water disposal from the proposed development.

As the existing site has been agriculturally farmed over a number of years the natural drainage regime is for surface water to run directly off the surface impermeable clay soils and directly to the surrounding local field ditches.

3.6 Hydrogeology

The Environment Agency's mapping website confirms that the site is not located within a Groundwater Source Protection Zone for groundwater abstractions.

3.7 Groundwater

No recorded incidents of groundwater flooding within the vicinity of the site have been found during the investigations.

During prolonged periods of heavy rain or typically during the winter months the site and surrounding fields can become waterlogged due to the clay soils becoming saturated which can create areas of surface ponding (standing water) and potentially sheet runoff.

3.8 Local Catchment Information

The development area currently drains to the watercourse running east to west through the site and the adjacent field ditches to the southern and western boundaries these in turn then feed to the Pagham Rife which is designated as Main River and located approximately 550m to the west.

3.13 Existing site drainage characteristics

The site comprises of agricultural fields, rainfall that lands on this site firstly infiltrates directly at source and into the underlying unsaturated layer of topsoils.

Due to the low permeability of the underlying clay mudstone geology, when the soils become saturated and can no longer accept further rainfall, pluvial overland runoff will occur following the topography of the site.

3.14 The impermeable clay / mudstone geology of the site is extremely pertinent to the hydrological response of the site which results in high rates of rainfall runoff, and runoff flows directly into the offsite watercourses.

3.15 The natural drainage pathway for pluvial overland runoff and groundwater is towards the southeast and the southwest following the topography and hydraulic gradient of the site.

3.16 The existing watercourse crossing the site will be maintained as part of the open space area within the site. The Environment Agency will require a minimum 5m maintenance strip either side of the watercourse from top of bank. A single crossing point is proposed for the development road crosses the watercourse, soffit level of the crossing point will be set a minimum of 600mm above top of bank to ensure flood flows can be maintained.

4 Flood Risk Assessment

- 4.1 A Flood Risk Assessment requires that an evaluation of all potential forms of flood risk to the site are considered.

In accordance with the Environment Agency's Flood Risk Assessment Guidance, NPPF, PPG and CIRIA Report 624, sources of flooding to be assessed include tidal, fluvial (rivers, streams and watercourses), pluvial (overland rainfall runoff), groundwater, artificial sources (canals and reservoirs) and existing / proposed sewerage and water mains infrastructure.

4.2 History of Flooding

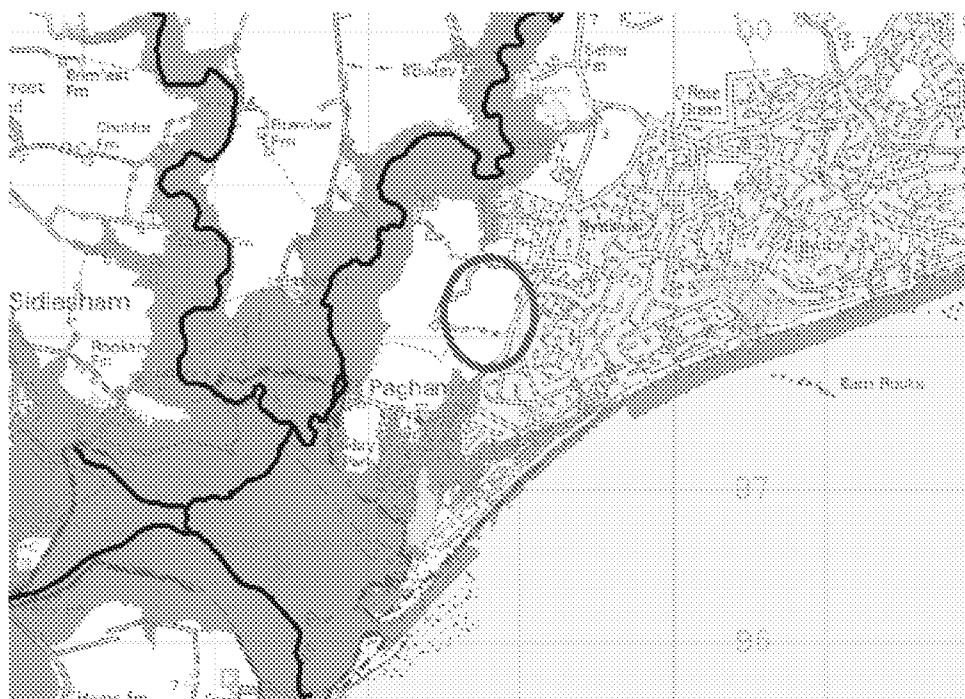
During the data collection process it is important to consider the information which already exists for the site location with respect to flood risk.

The main sources of data for flood risk and recorded incidents of flooding for this site has been the Environment Agency who act as the principal flood risk management operating authority in England, the Arun District Council - Strategic Flood Risk Assessment Level 1 & 2, Final Report (September 2016) and Pagham Neighbourhood Plan.

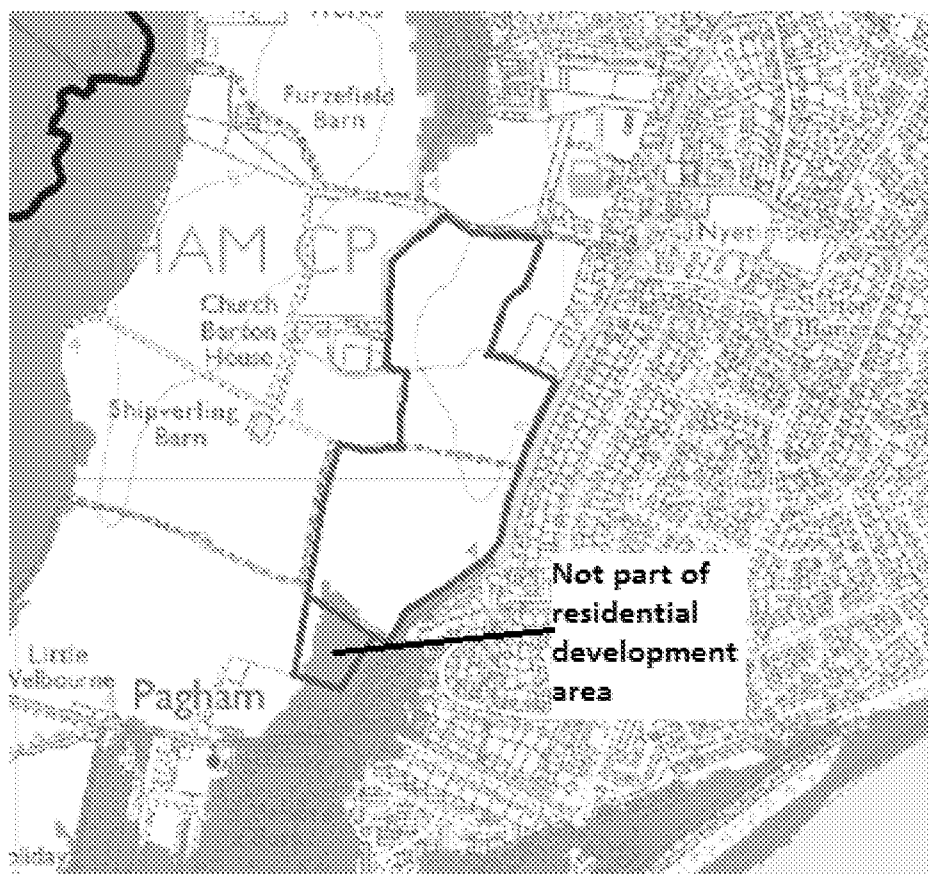
- 4.3 The Environment Agency's map below identifies the Flood Zones for the area surrounding the site.

Flood Zone Map

Figure 4: Extract from Environment Agency Flood Zone Map



Contains Environment Agency information © Environment Agency 2015



Contains Environment Agency information © Environment Agency 2015

Key:
 Main Rivers

Dark Blue : (Flood Zone 3)

Shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded: from the sea by a flood that has a 0.5 per cent (1 in 200) or greater chance of happening each year, or from a river by a flood that has a 1 per cent (1 in 100) or greater chance of happening each year.

Light Blue : (Flood Zone 2)

Shows the additional extent of an extreme flood from rivers or the sea.

These outlying areas are likely to be affected by a major flood, with up to a 0.1 per cent (1 in 1000) chance of occurring each year.

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements.

Clear : (Flood Zone 1)

Shows the area where flooding from rivers and the sea is very unlikely.

There is less than a 0.1 per cent (1 in 1000) chance of flooding occurring each year.

- 4.4 As confirmed by the latest Environment Agency 'Flood Zone Map', the site is located within the lowest risk category - Flood Zone 1. A small area to the south appears to be in the Tidal Flood Zone 3, this area consists of Allotments, open space and Scout hut.

Zone 1 is land assessed as having a less than 1 in 1000 (<0.1%) annual probability of flooding, Zone 2 is land assessed as having between a 1 in 100 year and 1 in 1000 annual probability of flooding, while Zone 3 is land assessed as having between a 1 in 200 year or greater annual probability of flooding from the sea or a 1 in 100 year or greater annual probability of flooding from a river or stream in any year by the Environment Agency.

- 4.5 The Environment Agency Flood Map is indicative only and takes no account of actual ground levels or features. These flood maps tend to be derived from coarse scale modelling which bases part of the results on assumptions of hydrology and topography. This can lead to inaccuracies in the plans and therefore cannot be used as an accurate guide to flooding. However, they are intended to be an indicative measure to flood risk.
- 4.6 The Environment Agency has confirmed that the flood zone to the south of the site is based on an undefended tidal flood level. The site is not affected by the Pagham Rife fluvial flood levels.
- 4.7 Pagham is currently protected by a number of sea defences including the Inland Banks & Pagham Harbour which currently offer 1:200 year storm protection. These flood defences provide a protection to 3.90m AOD which includes some freeboard to allow for wave action but doesn't currently include for climate change.

Figure 5: Extract from Environment Agency Flood Defence Locations



- 4.8 The current sea defences for the coastline of Pagham to East Head is mainly protected by timber, concrete and shingle defences which include large shingle banks which dominate Pagham Beach, Pagham Harbour and Church Norton. From Pagham to the River Arun, there is a mixture of defences, with the land behind consistently low lying.

Flood defences are as follows:

Pagham Harbour:	Embankment, wharf, quaysides
Pagham – Aldingbourne Rife:	Shingle ridge to east of harbour entrance. Section of sea wall (secondary defence)

Flooding from the sea occurs when water levels in the sea rise above ground levels of coastal land. This can occur:

- during normal high tides - where land floods on a regular basis;
- when there are extreme atmospheric effects such as storm surges;
- when wind action causes water levels of the sea to rise.

Where sea defences have been constructed and maintained a residual risks remains which result from a:

- flood of greater magnitude that flood defences were designed; and/or
- breach or failure of flood defence and other assets.

See Appendix C for Environment Flood areas and defence mapping

- 4.9 The Emsworth to Littlehampton West Bank Coastal Modelling report compiled JBA Consulting, April 2016 highlights that Pagham is generally south-east facing and sheltered from Atlantic storms; however it is exposed to swell wave, localised fetch limited storm waves and extreme sea levels. However wave overtopping is not the primary flood mechanism at Pagham. Tidal flooding in the past has been due to beach erosion of the natural sediments, and high water during periods of increased storm surge events.
- 4.10 The Shoreline Management Plan for Beach Head to Selsey Bill (2006) covers the Arun District coastline. The majority of the coastline within the Arun District administrative area is to 'Hold the Line'. However, between Pagham Harbour to Church Norton and Littlehampton to Poole Place the long term policy is Managed Realignment of the shoreline.
- 4.11 Pagham Flood Defence Steering Group (PFDSG) operate on behalf of the local community and Pagham Parish Council to provide a link to Arun District Council and the Environment Agency with regard to liaison over tidal flooding and defence.

Extensive works led by Pagham Parish Council are planned to reinforce and increase tidal protection to Pagham village including for works for a managed breach to the spit at Pagham Harbour.

- 4.12 The Environment Agency have provided modelled extreme water levels the West Sussex coastline which are as follows:

AEP (%)	Littlehampton (mAOD)	Bognor Regis (mAOD)	Pagham (mAOD)
10	3.72	3.52	3.42
2	3.94	3.74	3.64
1	4.04	3.84	3.74
0.5	4.13	3.93	3.83

The extreme water levels for the 5, 0.5 and 0.1 per cent AEP flood events were again provided by the Environment Agency, extracted from study (JBA, 2016) which showed the following for Pagham Harbour:

Location	Extreme Water Level (Undefended)		
	5% AEP	0.5% AEP	0.1% AEP
Pagham Harbour	3.55m	3.63m	3.80m

- 4.13 The National Planning Policy Framework (NPPF) requires that flood risk will be managed now and over the development's lifetime, taking climate change into account. The modelling and mapping completed focused on predicting the flood risk at the following years in the future: 2031, 2061 and 2111 in accordance with the latest guidance.

In February 2016 the Environment Agency/DEFRA released new guidance for flood risk assessments outlining the revised allowances for the impact of climate change on sea levels superseding the previous criteria.

- 4.14 EA/DEFRA sea level allowance: (use 1990 baseline)

Sea level rise in millimetres (mm) per year with cumulative sea level rise in brackets

Area of England	1990 to 2025	2026 to 2055	2056 to 2085	2086 to 2115	Cumulative rise 1990 to 2115 / metres (m)
East, east midlands, London, south east	4 (140 mm)	8.5 (255 mm)	12 (360 mm)	15 (450 mm)	1.21 m
South West	3 (122.5 mm)	8 (240 mm)	11.5 (345 mm)	14.5 (435 mm)	1.14 m
North west, north east	2.5 (87.5 mm)	7 (210 mm)	10 (300 mm)	13 (390 mm)	0.99 m

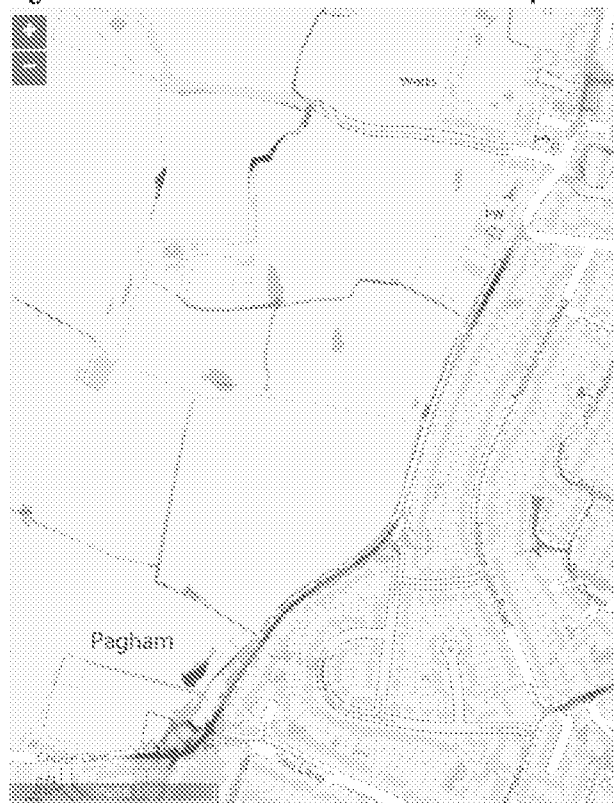
- 4.15 The Environment Agency modelling involved simulating the 100-year and 200-year undefended case events for the fluvial and tidal/coastal models, respectively. In addition, wave overtopping rates were calculated and implemented within the tidal/coastal models for defended case scenarios once offshore wind speed and wave height allowances are increased in line with the guidance.
- 4.16 The EA has confirmed that the predicted undefended 1:200 year flood level for 2115 at Pagham Harbour is **4.70m AOD**.
- 4.17 The Environment Agency flood maps show the extent of flooding to be without tidal defences. Based on the existing sea flood defences a potential for a large breach scenario is low, minor overtopping may occur which could cause localised flooding.

The site lies approximately 1.6km from Pagham Harbour and has minimal risk of being affected by minor breaches of sea defences.

4.18 Surface Water

The Government Flood Map for Surface Water is a theoretical assessment of potential overland flow paths, ground levels and drainage systems within the area.

Figure 5: Extract from Surface Water Flood Map



Contains Surface Water Flood information © Gov.uk 2016

Key:

-  High (Greater than 1:30(3.3%) chance of flooding)
-  Medium (Between 1:100(1%) and 1:30(3.3%) chance of flooding)
-  Low (Between 1:1000 (0.1%) and 1:100 (1%) chance of flooding)
-  Very Low (Less than 1:1000 (0.1%) chance of flooding)

- 4.19 This indicates that the existing site has a 'very low' (less than a 1:1000 or 0.1%) risk of flooding from surface water runoff.
Potential flow paths have been identified along the existing watercourse and ditch routes, these lie on the western and southern boundaries and the central watercourse.
These potential flow path is associated with normal 'in-bank' flows within the drainage ditches and therefore does not present a flood risk to the development.
- 4.20 **Groundwater**
Available information provided by the Environment Agency, Arun DC and UK Gov websites confirms that no incidents of flooding from groundwater emergence have been recorded at the site or within the wider area of Pagham.
- 4.21 It should be noted that impermeable soils can also prevent the effective infiltration of rainfall during intense or prolonged storm events, potentially causing saturation of the upper soils. When these become saturated and can no longer accept further rainfall, pluvial overland runoff will occur following the topography of the site this can also create perched pockets of shallow groundwater.
- 4.22 In summary, the available sources of information generally indicate the likelihood of flooding on the proposed development site from groundwater to be reasonably low and that the development proposals will not increase the risk of groundwater flooding to any offsite parties or land.
- 4.23 **Existing Sewers & Water Mains**
The site has an existing foul rising main crossing in a south east to north-west direction from Pagham Village pump station to the WWTW. This is a sealed system and should only be considered a flood risk should the pipe burst.

4.24 Overland Flood Flow / Exceedance

The occurrence of overland flooding at the site due to an extreme rainfall event exceeding the design capacity of the drainage system and SuDS, or a failure of the associated flow controls have been considered both during the construction and operational phase of the development.

If SuDS or the piped drainage system becomes overwhelmed by exceptional rainfall then exceedance routes are proposed to protect people and property by providing unobstructed overland flow routes across the development.

4.25 The design levels of hard paved and landscaped areas will aim to contain and convey flood flows through areas of the site to cause minimum flood risk to properties and residents such as parking areas and low lying open space and if necessary, offsite into the existing drainage ditches.

4.26 All proposed attenuation features within the development are designed to manage the 1 in 100 year return storm (0.5% chance of occurrence each year) plus an extra allowance of 40% for the potential increase in peak rainfall predicted up to 2115.
The attenuation basin(s) will incorporate emergency spillways that will safely divert flood flows away from the development.

4.27 The likelihood of a failure with the flow control structures are extremely low.
The proposed hydraulic vortex flow control device consists of a stainless steel unit with no moving parts and operates by directing the flow to rotate inside a cylindrical vessel towards a central outlet. This generates a vortex with an air filled core which allows the openings to be larger than the equivalent conventional orifice, reducing the likelihood of blockages.

All flow control structures will incorporate an overflow so that in the event of a blockage or surcharge water can bypass until conditions return to normal.

4.28 Any residual risk of overland flooding to properties is to be mitigated by the provision of raised property slab levels a minimum of 150mm above surrounding development finished ground level.

4.29 The described protection measures ensure that properties both within the proposed development and any offsite parties and land will not be affected by overland runoff in the event of a reasonably extreme rainfall event exceeding the design storm or a failure or a blockage of the SuDS structures within the system.

4.29 Artificial Sources

There are no artificial sources of flooding within the site boundary or within the vicinity of the site that pose a flood risk.

With reference to the SFRA there have been no recorded incidents of flooding from artificial sources within Pagham.

4.29 Ground Raising and Finished Levels

The proposed residential development area currently lies within Flood Zone 1 while the southern boundary lies within the undefended Tidal Flood Zone 3. The future predicted flood levels for up to 2115 including for climate change move a small area of the site further into the undefended tidal flood zone. However, it is intended to raise ground and finished floor levels in the southern area of the site to protect against future tidal flooding.

All properties within the site will have a minimum slab level 300mm above the 2115 tidal level.

4.30 The Environment Agency has confirmed that as the floodplain is tidal and not fluvial flood compensation works are not required. This will also not increase flood risk elsewhere within Pagham.

4.31 Sequential Test

The flood risk technical Guidance to the National Planning Policy Framework Table 2: Flood Risk Vulnerability classification, classifies residential developments as 'More Vulnerable'. Table 2 & 3 would indicate that 'more vulnerable' developments located within Flood Zone 1 are considered appropriate under the National Planning Policy Framework.

NPPF Table 3: Flood Risk Vulnerability and Flood Zone 'compatibility'

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	*	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	*	*	*

Key: ✓ Development is appropriate.
* Development should not be permitted.

4.32 The National Planning Policy Framework Guidance states that Planning Authorities should complete a risk based 'Sequential Test' at all stages of the planning process, to steer new development to areas with the lowest probability of flooding. Under the requirements of the 'sequential test' and as the proposed development is already located within flood zone 1 (lowest risk), there are no more suitable, developable and deliverable alternative sites, better located from a flood risk perspective, which would accommodate the proposed development.

5 Existing and Proposed Site Runoff

- 5.1 This section outlines the estimated peak runoff rates and volumes of surface water leaving the site for the pre and post development conditions. These discharge rates have then been used for the preliminary design of the surface water drainage strategy for the proposed development.
- 5.2 **Existing Surface Water Peak Runoff Rates (Greenfield)**
Greenfield runoff rates and volumes are calculated to determine the acceptable rate of discharge from the site post development and are used by the environmental regulator to set site-specific drainage constraints.
- 5.3 An assessment of the estimated current Greenfield runoff rate for the 19.75Ha development area has been carried out using the Micro Drainage software.
Refer to Appendix D for a summary of results.

Total Development Area: 20.16ha

	Discharge l/sec
1 year	59.9 l/sec
30 year	159.6 l/sec
100 year	224.7 l/sec
QBar	70.4 l/s

This equates to a QBar discharge of 3.5 l/sec/Ha.

5.4 Catchment Areas

Due to the topography of the site and location of watercourses and field ditches the existing greenfield runoff regime splits into various separate catchments with the runoff assessment based on the discharge per hectare.

Catchments	Development Area Ha	Discharge rate l/sec			
		1 Year	30 Year	100 Year	Q Bar
Catchment 1	1.825 Ha	5 l/sec	14 l/sec	19 l/sec	6 l/sec
Catchment 2	3.325 Ha	10 l/sec	26 l/sec	36 l/sec	11 l/sec
Catchment 3	1.575 Ha	4.5 l/sec	12 l/sec	16.5 l/sec	5 l/sec
Catchment 4	3.575 Ha	10.5 l/sec	28 l/sec	38.5 l/sec	12 l/sec
Catchment 5	9.810 Ha	29 l/sec	78 l/sec	107 l/sec	34 l/sec

Refer to Appendix D for an outline of development catchment areas.

5.5 At the time of writing, the layout of the proposed development is outline only, therefore the proposed impermeable areas are based upon an assumed developed area of between 40 & 45%.

5.6 Post Development Surface Water Runoff Peak Runoff Rate & Volume

The procedure for surface water management in accordance within 'Rainfall runoff management for developments' (DEFRA/EA Report – SC030219 E, 2013) states;

“For the range of annual flow rate probabilities up to and including the one per cent annual exceedance probability (1 in 100 years) event, including an appropriate allowance for climate change the post-developed rate of run-off into a watercourse, sewer, or other receiving water body, should be no greater than the existing pre-developed rate of run-off for the same event”.

5.7 As a result of this development and the increase in impermeable areas, the peak rate and volume of surface water that could potentially runoff the site if not effectively managed, will be greater than in its greenfield state.

To mitigate this increase in peak runoff and additional volume, it is proposed that all surface water runoff from the proposed development will be attenuated on site via the use of sustainable drainage systems (SuDS) with a restricted discharge into the existing watercourses that bound the site.

5.8 The maximum surface water discharge rate into these watercourses from the developed site for all storm events up to the 1:100 +40% event will be restricted to the existing site Greenfield runoff rate QBar for all catchments:

Catchments	Development Area Ha	Discharge rate l/sec Q Bar
Catchment 1	1.825 Ha	6 l/sec
Catchment 2	3.325 Ha	11 l/sec
Catchment 3	1.575 Ha	5 l/sec
Catchment 4	3.575 Ha	12 l/sec
Catchment 5	9.810 Ha	34 l/sec

5.9 This strategy will not only ensure that the peak rate of surface water runoff from the site post development will be no greater than the existing greenfield runoff rate for all equivalent rainfall events, but will also provide a high level of betterment in peak rates of runoff over existing conditions during intense rainfall events.

See Appendix D for Greenfield Runoff assessment and catchment areas.

6 Surface Water Drainage Strategy

- 6.1 The National Planning Policy Framework (NPPF) requires that developments do not exacerbate flood risks both to the development site and to offsite parties and land, which means there is a need to control surface water drainage and overland runoff to ensure there are no increases in peak rates and volumes of runoff as a result of the development.
- 6.2 Environment Agency guidance and government legislation such as the Flood and Water Management Act (Defra 2010) requires surface water drainage strategies for new developments to be in accordance with the ideals of 'sustainable development' via the provision of Sustainable Drainage Systems (SuDS).
- 6.3 SuDS are more sustainable than conventional drainage methods because they can mitigate many of the adverse effects of urban stormwater runoff on the environment. This can be achieved through reducing runoff rates and volumes to sewer networks and watercourses, reducing the risk of downstream flooding. Where appropriate SuDS can reduce pollutant concentrations in stormwater, protecting the quality of the receiving water body.
- 6.4 Current guidance requires that a hierarchy of potential methods for disposing of surface water from a development is followed:
1. A soakaway or some other adequate infiltration system, or where that is not practicable;
 2. A watercourse, or where that is not practicable;
 3. A sewer.
- 6.5 Following a review of the potential site geology and knowledge of the soil permeability testing, infiltration as a method of disposing of the surface water runoff from the proposed development will not be feasible.
- 6.6 Therefore it is proposed that all surface water runoff from the developed site utilises an outfall into the existing watercourses at the eastern and western boundaries of the site. This strategy will mimic the site's existing natural greenfield runoff regime.
- 6.7 Surface water runoff from the site will be fully managed via Sustainable Drainage Systems (SuDS). The SuDS selection process for this site has involved the evaluation of a range of information to enable the feasibility of each SuDS technique to be assessed.

6.8 SUDS Techniques:

SUDS Type	Description	Site Suitability Y/N	Comments
Green Roofs	Green roofs consist of a multi-layered system that covers the roof of a building with vegetated cover over a drainage layer. They are designed to intercept and retain rainfall, reducing the volume of runoff and attenuating peak flows	N	Not appropriate for pitched roofs on residential dwellings and high maintenance costs. Have potential suitability for commercial buildings or retail areas.
Rainwater Harvesting	Re-using rainwater for non-potable uses such as irrigation and toilet flushing	N	Rainwater harvesting cannot be relied upon to guarantee a reduction in volume of runoff. These systems also have a high maintenance cost Have potential suitability for commercial buildings or retail areas
Soakaways	Soakaways provide stormwater attenuation and groundwater recharge	N	Impermeable sub strata prevents the use of this type of SUDs feature.
Filter Strips / Trenches	Filter strips are vegetated strips of land designed to accept runoff as overland flow from impermeable surfaces. Usually located adjacent to parking areas or roads.	Y Non infiltrating	Impermeable soils prevent infiltration therefore suitable as conveyance systems only.
Permeable Paving	Pervious pavements provide a suitable surface for rainfall to infiltrate through to the underlying layers. Water is temporarily stored before infiltrating to ground. This system is also used as a conveyance method to the drainage system.	Y Non infiltrating	Suitable for use on private drives and parking areas with a connection to the piped drainage system. Permeable type paving is not currently considered acceptable for adoption by West Sussex Highway Authority
Bio Retention	Bio retention areas are shallow landscaped depressions which are typically under-drained and rely on engineered soils, vegetation and infiltration to remove pollution. These systems manage and treat runoff from frequent rainfall events	Y Non infiltrating	For attenuation only due to infiltration as a method of disposal not being suitable.
Swales	Swales are linear grassed or vegetated channels with flat bases that collect, treat, store and convey water.	Y Non infiltrating	Impermeable soils prevent infiltration however these are suitable for conveyance structures taking runoff to attenuation basins
Attenuation Pond / Basins	Attenuation basins are landscaped features used to store and treat runoff. Wet ponds have a constant body of water with runoff being additional. Dry ponds are empty during periods of dry weather.	Y	Suitable for attenuation

6.8 Surface Water Drainage Design

The following SUDs techniques are considered suitable for the development site subject to detailed engineering design. The following outlines how the various systems will also link as part of the drainage treatment train.

- Permeable paving / permeable sub base
- Piped storm drains
- Road side swales
- Attenuation / Bio-retention basin

6.8.1 Roof Runoff:-

- Roof runoff will be collected by a conventional system of guttering and downpipes where it will be discharged to a main storm sewer or to a permeable paving stone sub base within the drive or parking courts, which would then connect to the main storm drain.
- Water Butts are to be provided per plot where feasible on a rainwater downpipe to collect roof runoff for re-use.

6.8.2 Private Drives & Parking Courts:-

All private drives and parking courts will either drain via a traditional gully & piped system or via a permeable block paving stone sub base prior to outfalling to a the main storm drain.

6.8.3 Macadam Access Road:-

Runoff from the highway areas will drain via deep trapped road gullies connecting directly to either the main piped storm drain or into an adjacent conveyance swale.

6.8.4 Attenuation Basin:-

The attenuation basins will be designed to provide final filtration/water cleansing together with the main storage to allow storm water to be temporarily stored within the basin before discharging into the existing watercourse or surrounding ditches to the boundary of the site at a controlled rate (Greenfield QBar) for each catchment via a hydraulic vortex flow control device.

- 6.9 The final surface water runoff from each catchment area will be strictly controlled via Sustainable Drainage Systems (SuDS) in the form of a series of attenuation basins. All main SuDS features will be designed to manage the 1 in 100 year return storm plus an extra allowance of 40% for the potential predicted increase in peak rainfall up to 2115.

6.10 Attenuation Volumes:-

Using the Micro Drainage attenuation estimation tool the storage volume required within the attenuation basin to store the 1:100year+40% storm event required for each catchment within the development with the relevant discharge rate is highlighted within the table below.

Refer to Appendix E for the preliminary Micro Drainage attenuation design.

Catchments	Development Area Ha	Potential Impermeable Area Ha	Discharge rate l/sec Q Bar	Attenuation Volumes m ³
Catchment 1	1.825 Ha	0.80 Ha	6 l/sec	470 – 670m ³
Catchment 2	3.325 Ha	1.30 Ha	11 l/sec	730 – 1,047m ³
Catchment 3	1.575 Ha	0.70 Ha	5 l/sec	415 – 591m ³
Catchment 4	3.575 Ha	1.90 Ha	12 l/sec	1169 – 1663m ³
Catchment 5	9.810 Ha	3.90 Ha	34 l/sec	2,171 – 3,117m ³

- 6.11 The proposed surface water drainage strategy offers a sustainable, safe and robust system which will afford complete flood risk protection to residents within the new site and to existing properties and land within Pagham.

This is achieved by ensuring that the peak rate of surface water runoff from the site post development will be no greater than the existing greenfield runoff rates for the site.

6.12 SuDS Management and Maintenance

The SuDS incorporated at the site will be accompanied by a 'Management Plan' to include maintenance schedules for both surface and sub-surface components, and ensure that all parties involved in the operation and maintenance of SuDS are fully aware of the system requirements.

- 6.18 It is envisage that the piped surface water drainage system serving the development be offered for adoption to Southern Water under a S104 agreement of the WIA1991.

- 6.19 Communal areas of under-drained permeable paving, swales, below ground cellular storage, attenuation basins, flow controls and outfall headwall structures will be maintained by a private management company.

The management company will be entrusted with a robust inspection, de-silting and maintenance programme to ensure the optimum operation of the surface water drainage network is continually maintained for the lifetime of the development.

- 6.20 SuDS located within and that serve individual plot boundaries i.e. under-drained permeable paved drives, will be owned and maintained by the relevant property owner.

6.21 Pollution mitigation

In terms of water quality, the proposed surface water treatment train offers a suitable level of mitigation in accordance with the Environment Agency pollution prevention guidance GP3, CIRIA C753 and DEFRA guidance.

For 'low risk' residential developments where the receiving waterbody is considered non-sensitive, the minimum two treatment process are achieved by the following:

1. Road gullies and catchpit manholes

Offering the first line gravity separation of silt and debris.

2. Vegetated conveyance swales

Aid in removing suspended solids through filtration and sedimentation. The vegetation traps organic and mineral particles that are then incorporated into the soil, while the vegetation takes up any nutrients.

3. Under-drained permeable block paving (tanked)

The permeable block paving system consists of block pavers that allow runoff to flow between the joints laid upon a stone sub-base, the base of which is lined with an impermeable membrane.

The paving consists of an underdrain will collect and direct runoff into the main piped surface water drainage system.

This system offers a high level of improvement to water quality by sediment and pollutant removal through biological uptake mechanisms and the trapping of particulates including hydrocarbons via the filtration of runoff through the upper geotextile membrane and stone media.

4. Attenuation basins

The attenuation basins will incorporate wetland planting such as reed beds, submerged and emergent aquatic vegetation and will be designed to hold a permanent body of water to promote pollutant treatment.

This is achieved through settlement, sedimentation, photosynthesis and biological uptake mechanisms to reduce nutrient concentrations, prior to discharging into the outfall watercourse.

6.22 Access and Egress

It is demonstrated that safe dry pedestrian and vehicular access and egress at the site is achievable for all residents during an extreme flood event for the lifetime of the development, in accordance with DEFRA Report FD2320/TR2 - 'Flood Risk Assessment Guidance for New Developments'.

7 Foul water drainage strategy

- 7.1.1 The foul water flows from each property will drain via gravity through the private house drainage before out-falling to a new sewer located typically within the development road network. The main gravity sewer then conveys flows to an on site pumping station; foul flows will then be pumped directly to Pagham Waste Water Treatment Work's.
- 7.1.2 The predicted peak foul sewer discharge from the site based on the Sewers for Adoption figure (4000 l/dwelling/day) for up to 400 units will be 18.5 l/sec.
- 7.1.3 The development foul drainage network will be offered to Southern Water for adoption under a Section 104 agreement of the Water Industry Act 1991.
- 7.1.4 Southern Water has been consulted on capacity of the local sewage network and confirmed that the main foul sewers within Pagham suffer from surcharge and overloading during rainfall events. Additional flow from development would increase the risk of flooding unless upgrades were undertaken.
- 7.1.5 Southern Water has confirmed that sufficient capacity for the development exists at Pagham WWTW which is located off Summer Lane to the west of the development. This will ensure that the proposed development has a 'no detriment' impact on the existing foul sewer system within Pagham and does not create an additional flood risk.
- 7.1.6 An existing Southern Water DN375 foul pumped main crosses the site from Pagham village to Pagham WWTW's, the existing 8m easement will be maintained throughout the development.

See Appendix F for Southern Water correspondence and records and confirmation of capacity at Pagham WWTW.

8 Cumulative Effect of Development

- 8.1 As part of the Local Plan process Arun District Council are considering potential sites at both North and South Pagham. The Pagham North developments are located at Hook Lane and Sefter Road. The Hook Lane site consists of up to 300 residential dwellings and a 60 bed care home. While the Sefter Road site consists of up to 280 dwelling and community facilities.
- 8.2 Should either or both of the northern sites gain planning permission approval as well as Pagham South there will be a potential cumulative impact on the public foul water system and Pagham Waste Water Treatment Works.
- 8.3 Foul Water:-
Each developer will require confirmation of available capacity within the existing foul network from Southern Water prior to any connection. Due to the location of each development parcel within Pagham the foul outfall and discharge point will be at separate locations within the network as agreed with Southern Water Ltd.
- 8.4 Where existing infrastructure is under capacity or is unsuitable for additional flows the developers will be required to enter into a Section 98 Requisition with Southern Water to deliver infrastructure upgrades to meet the demand or to discharge to a point with sufficient capacity as indicated by the Water Authority.
- 8.5 Southern Water has confirmed that capacity for a direct connection to Pagham WWTW's for this development at Pagham South is available
The development at Hook Lane requires either a tank sewer to be laid adjacent to existing foul sewers within Pagham Village to provide capacity or to pump flows to a point 2.5km away to the east at West Park Bognor Regis WPS where capacity is available. No information has been made available for the Sefter Road site.
- 8.6 It is understood that Pagham WWTW's has sufficient capacity to receive additional flows from the proposed developments. Pagham North developments will discharge to the existing foul network with associated upgrades. As the treatment works receives pumped flows from the surrounding catchments the rate of discharge to the works can be controlled.
- 8.7 Chichester District Council along with Southern Water undertook a Strategic Growth Study which indicated that Pagham WWTW's was not BAT limited and had a significant scope for up-rating the consented DWF. However, with the upgrading of the works and increased inlet flows an updated environmental permit may be required to ensure water quality and environmental limits is maintained within Pagham Rife and Pagham Harbour which is designated as a Special Protection Area and Ramsar site.

- 8.8 Southern Water also has plans to further increase capacity at Pagham WWTW. These proposals are due to be put forward for the next AMP price review with the water regulator OFWAT as part of the overall business plan.
- 8.9 Once the developments are “planned” Southern Water is obliged to provide treatment capacity in line with the projected growth in the area. The timing of any investment will also depend on the rate and scale of development coming forward and ultimately the treatment capacity will be allocated by the local planning authority.
- 8.10 Storm Water:-
Due to the location of the North & South Pagham Developments the cumulative impact on storm water is limited due to the different outfall points to existing watercourses. The National Planning Policy Framework (NPPF) requires that developments do not exacerbate flood risks both to the development site and to offsite parties and land, which means there is a need to control surface water drainage and overland runoff to ensure there are no increases in peak rates and volumes of runoff as a result of the development.
- 8.11 Environment Agency guidance and government legislation such as the Flood and Water Management Act (Defra 2010) requires surface water drainage strategies for new developments to be in accordance with the ideals of ‘sustainable development’ via the provision of Sustainable Drainage Systems (SuDS).
- 8.12 This is achieved through reducing runoff rates and volumes to sewer networks and watercourses, reducing the risk of downstream flooding.
Where appropriate SuDS can reduce pollutant concentrations in stormwater, protecting the quality of the receiving water body.
- 8.13 The proposed surface water drainage strategy for each development will be required to offers a sustainable, safe and robust system which will afford complete flood risk protection to residents within the new site and to existing properties and land within Pagham. This is achieved by ensuring that the peak rate of surface water runoff from the site post development will be no greater than the existing greenfield runoff rates for the site.
- 8.14 Each development will require a full Flood Risk Assessment and drainage strategy to be approved by the Environment Agency and Arun District Council.

9 Conclusions

- 9.1 This assessment has concluded that the development of this site as proposed, would not create or increase the risk of flooding from all potential sources, nor would it increase the risk of flooding to any offsite parties and land for the lifetime of the development.
- 9.2 The residential development area is located wholly within the lowest flood risk category 'Flood Zone 1' for the lifetime of the development, assessed as having a less than 1 in 1000 (<0.1%AEP) annual probability of flooding from a main river in each year.
- 9.3 Separate drainage systems are proposed for the surface water runoff and foul flows generated by the development.
- 9.4 Surface water runoff from impermeable areas at the new development will be managed via the use of Sustainable Drainage Systems (SuDS) with a controlled discharge from the site into the existing watercourses that bound the site. The peak rate of surface water runoff from the site will be restricted to a maximum of the existing greenfield runoff rate.
- All storm attenuation volumes have been designed to accommodate the 100year+40% storm event required for each catchment within the development area.
- 9.5 This strategy will not only ensure that the peak rate of surface water runoff from the site post development will be no greater than the existing greenfield runoff rate for all equivalent rainfall events, but will also provide a high level of betterment in peak rates of runoff over existing conditions during intense rainfall events.
- 9.6 The proposed residential development area currently lies within Flood Zone 1. However, the predicted flood levels for 2115 including for climate change increase the tidal floodplain into an area within the southern end of the site. It is intended to raise ground and finished floor levels in the southern area of the site to protect against future tidal flooding. All properties will have a minimum slab level 300mm above the 2115 tidal level.
- 9.7 Foul flows will discharge from the site via a pumped main directly to Pagham WWTW's. This will ensure that the proposed development has a 'no detriment' impact on the foul sewer system within Pagham and does not create a flood risk and surcharge.

APPENDIX A

SITE LAYOUT - MASTERPLAN



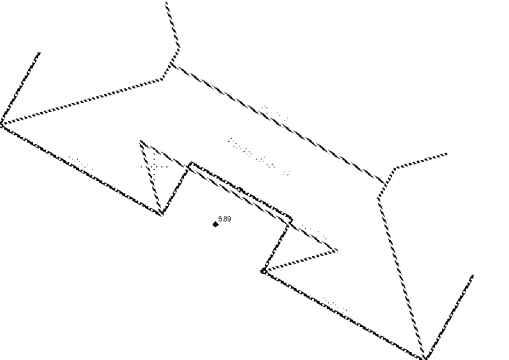
CLIENT:	Hanbury (PM) Ltd		
PROJECT:	Proposed Mixed Use Development at Pagham South		
DRAWING TITLE:	Red Line Boundary		
DAVIESLANDSCAPE ARCHITECTS Suite F1, Stroud House, Russell Street, Stroud, Gloucestershire, GL5 3AN L 01453 760380 a. info@dl-a.co.uk w. www.dl-a.co.uk			
DATE:	25.11.16	SCALE:	1:2500@A3
JOB NO.:	1731	DRAWN BY:	NP
DWG NO.:	DLA-1731-L003.01	REV.:	-
W:\Server\Drawings\Planning\1731 - Red Line Application 2: DaviesLandscapes\Planning\1731.dwg			



APPENDIX B

EXISTING SITE TOPOGRAPHICAL SURVEY



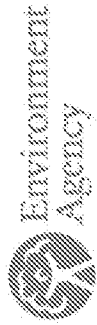




APPENDIX C

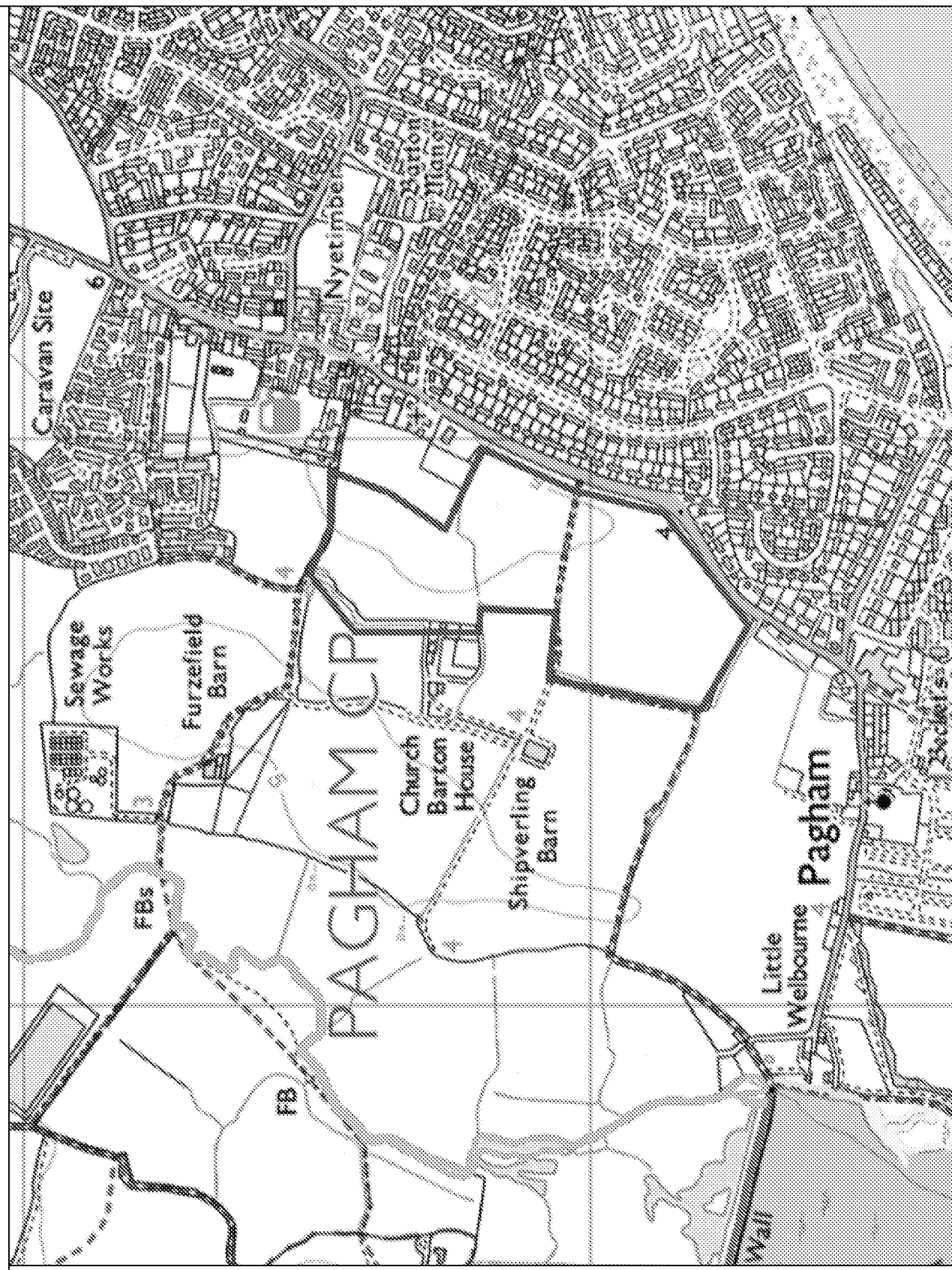
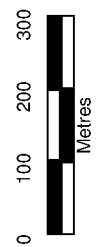
ENVIRONMENT AGENCY FLOOD & FLOOD DEFENCE MAPPING

Flood Defence Locations



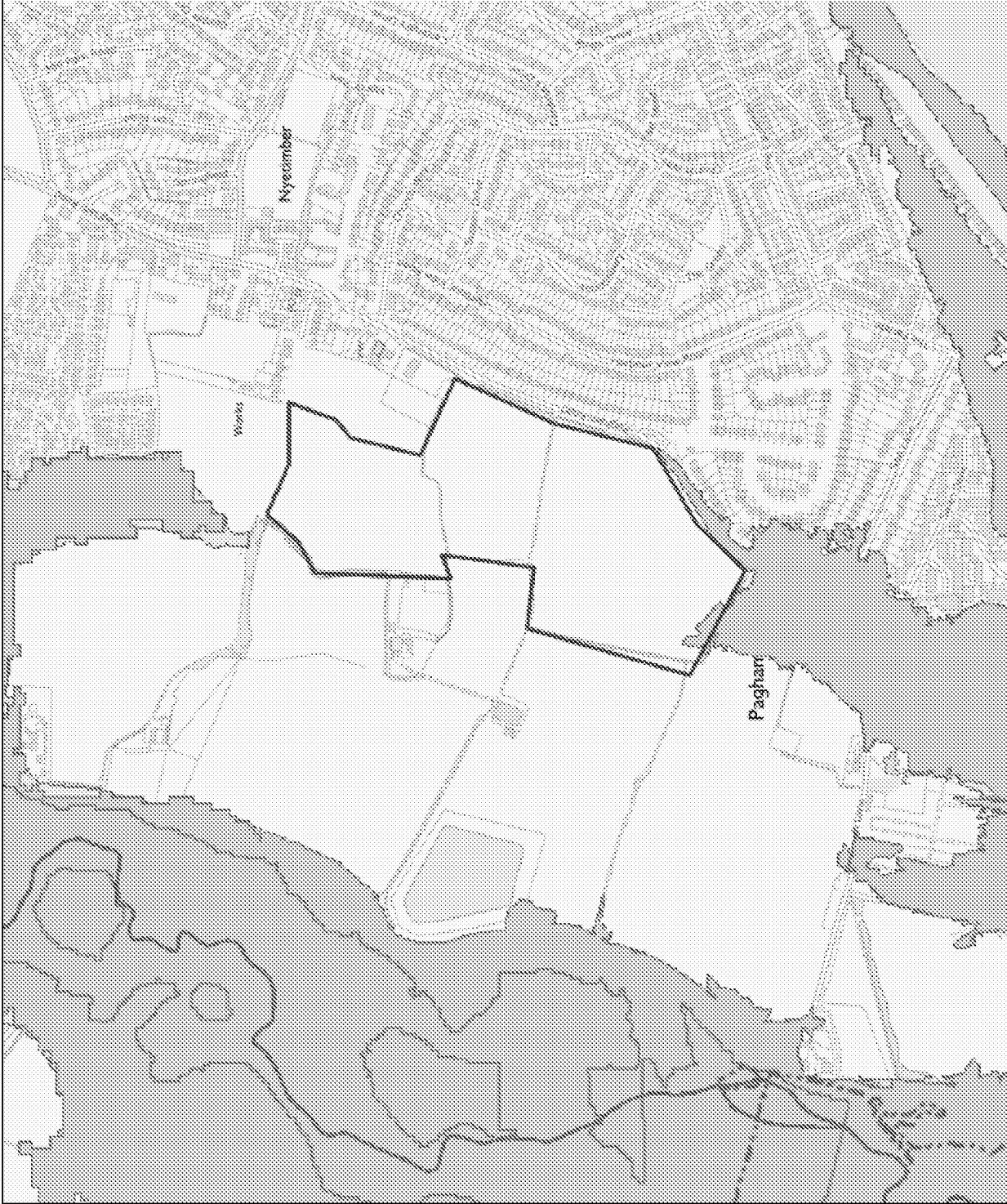
Legend

- Defences**
- Embankment
 - Wall
 - Flood Gate
 - Demountable Defence
 - Bridge Abutment
 - High Ground
 - Beach
 - Barrier Beach
 - Promenade
 - Quay
 - Cliff
 - Dunes
 - Culvert



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Risk of Flooding (Rivers and Sea)



Scale 1:10,000

Likelihood of Flooding from Rivers and the Sea

- Sealed Main Rivers
- Defences
- Flood Storage Areas
- Areas benefiting from flood defences
- Flood Zone 3
- Flood Zone 2

Likelihood of flooding from Rivers and the Sea (taking into account defences)

High: Greater than or equal to 1 in 30 (3.3%) chance in any given year

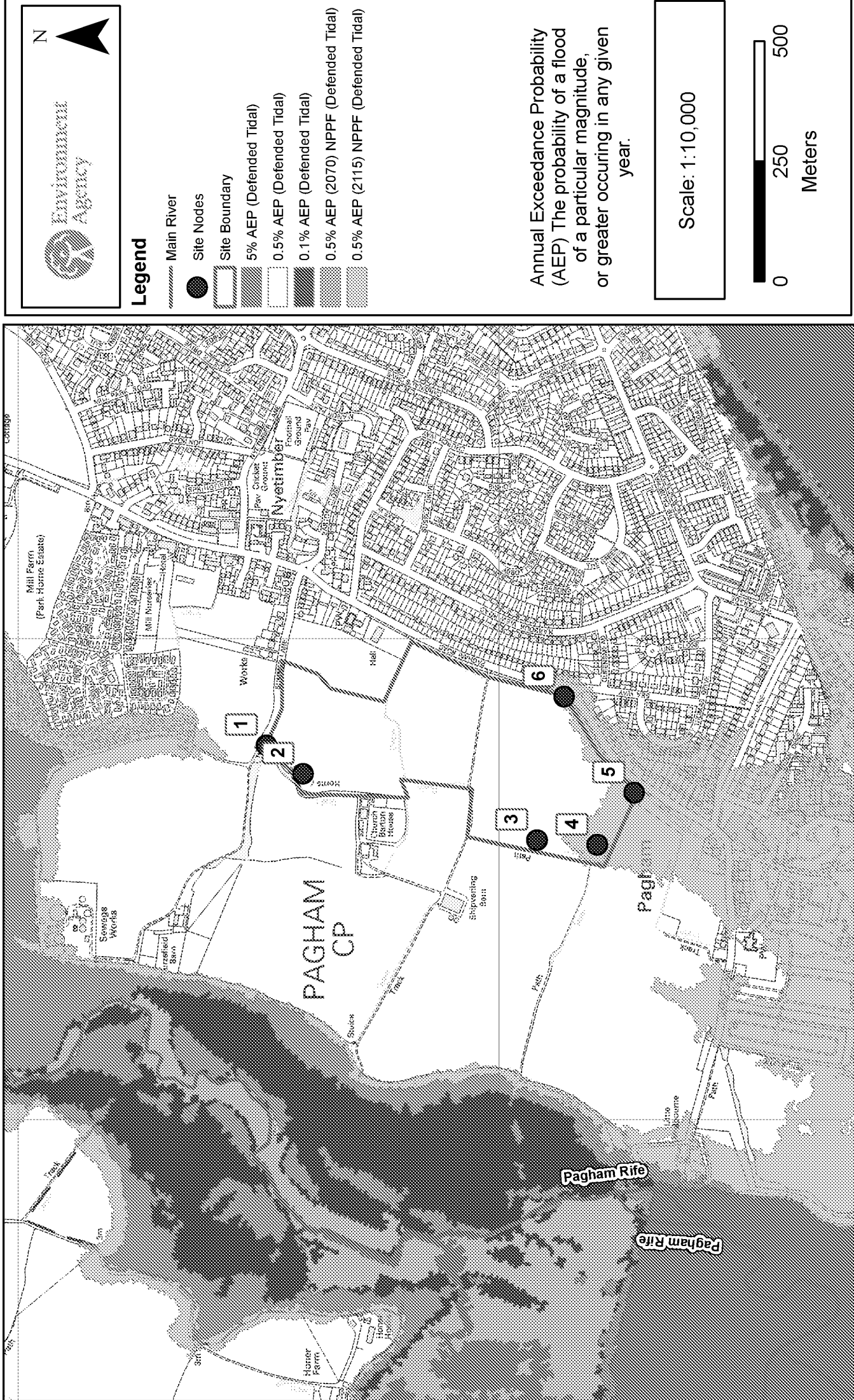
Medium: Less than 1 in 30 (3.3%) but greater than or equal to 1 in 100 (1%) chance in any given year

Low: Less than 1 in 100 (1%) but greater than or equal to 1 in 1,000 (0.1%) chance in any given year

Very Low: Less than 1 in 1,000 (0.1%) chance in any given year

This information is shown on the Risk of Flooding from Rivers and the Sea map on our website.

Modelled Flood Outlines centred on Pagham Development. Created 20/09/2016 (Ref: SSD/21449)



Modelled Flood Outlines centred on Pagham Development.
Created 20/09/2016 (Ref: SSD/21449)



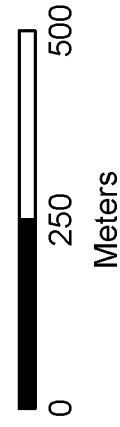
Environment
Agency

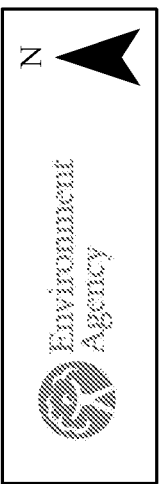
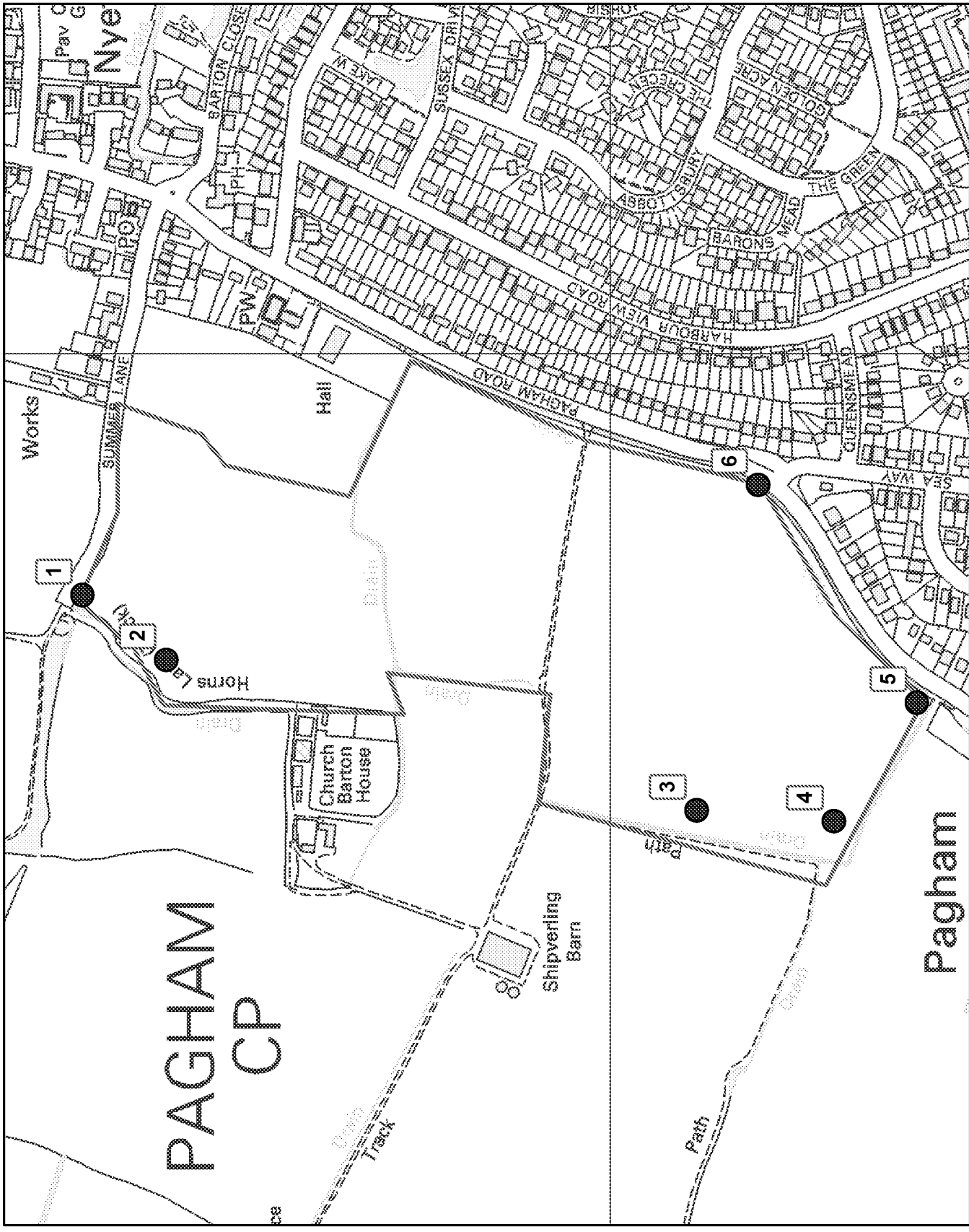
Legend

-  Main River
 Site Nodes
 Site Boundary
 5% AEP (Undeformed Tidal)
 0.5% AEP (Undeformed Tidal)
 0.1% AEP (Undeformed Tidal)
 0.5% AEP (2070) NPPF (Undeformed Tidal)
 0.5% AEP (2115) NPPF (Undeformed Tidal)

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:10,000

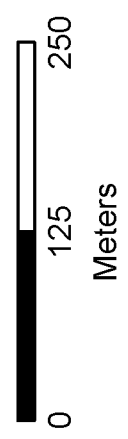




Legend

- Main River
- Site Nodes
- Site Boundary

Scale: 1:5,000



APPENDIX D

PRE-DEVELOPMENT RUNOFF & CATCHMENT AREAS

MJA Consulting		Page 1
58-62 Ock Street Abingdon Oxon OX14 5BZ	Pagham South Development	
Date 28/11/2016 15:01 File	Designed by mcshane Checked by	
Micro Drainage Source Control 2016.1		

ICP SUDS Mean Annual Flood

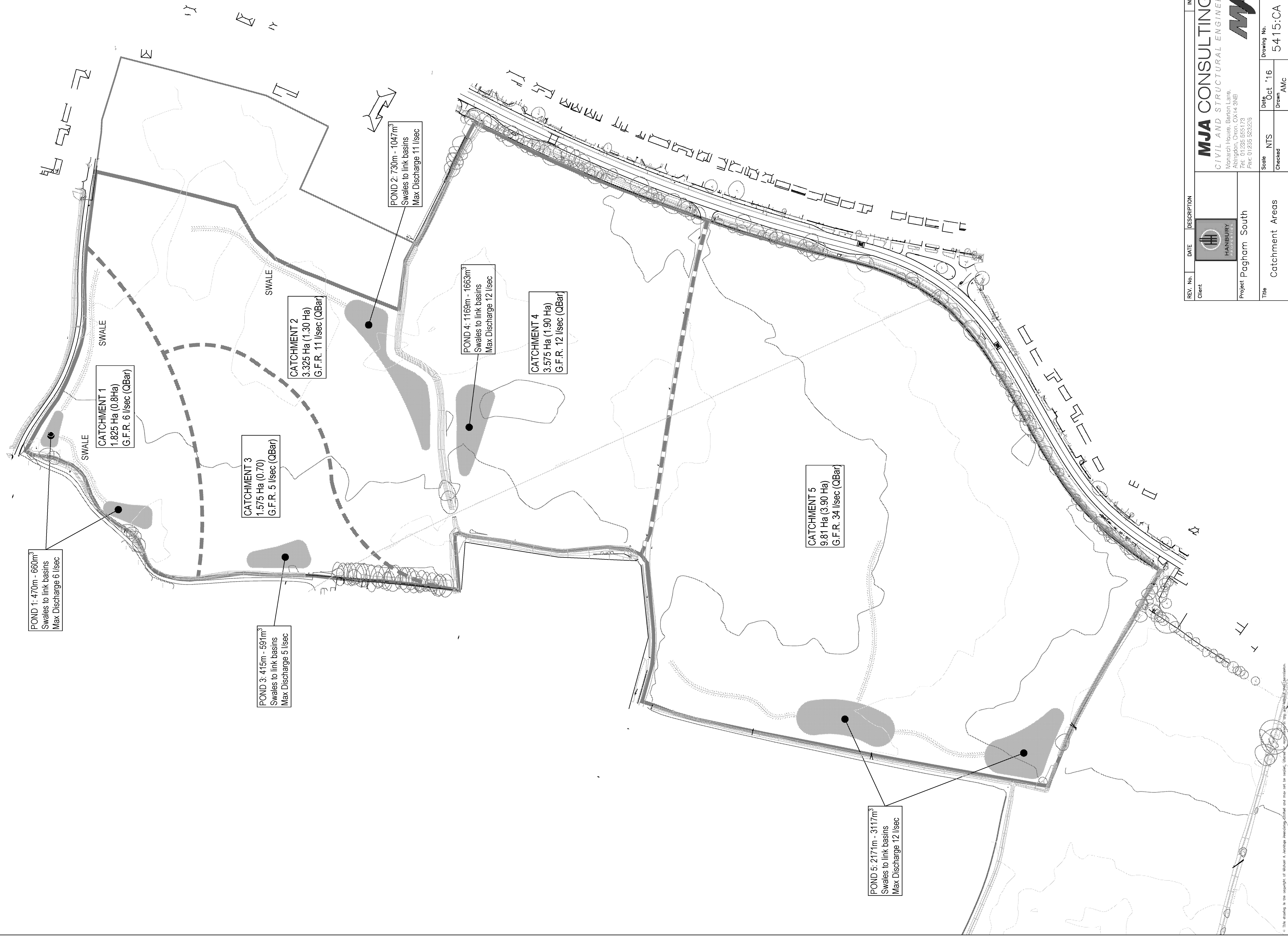
Input

Return Period (years)	1	Soil	0.400
Area (ha)	20.160	Urban	0.000
SAAR (mm)	716	Region Number	Region 7

Results l/s

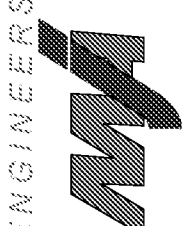
QBAR Rural	70.4
QBAR Urban	70.4
Q1 year	59.9
Q1 year	59.9
Q30 years	159.6
Q100 years	224.7

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REV. No.	DATE	DESCRIPTION	INITIALS
Client			
Project	Pagham South		
Title	Catchment Areas		
Scale	NTS	Checked	Revised
Date	Oct '16	Drawn	5415:CA
	AMC		

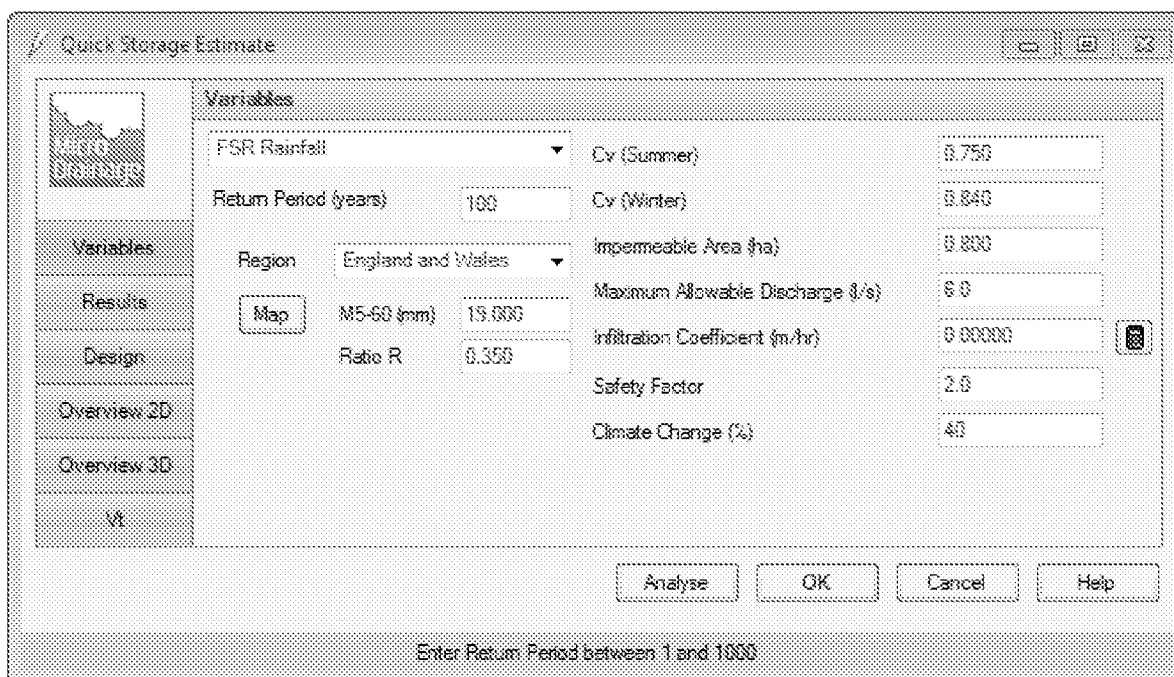
MJA CONSULTING
CIVIL AND STRUCTURAL ENGINEERS
Mansfield House, Bedford Lane,
Aldershot, Dorset, GU11 3NB
Tel: 01235 555123
Fax: 01235 523259



APPENDIX E

STORM WATER ATTENUATION CALCULATIONS

Catchment 1:



Quick Storage Estimate

Variables

FSR Rainfall: [Dropdown]

Return Period (years): 100

Region: England and Wales [Dropdown]

Map: M5-60 (mm) 19.000

Ratio R: 0.350

Cv (Summer): 0.750

Cv (Winter): 0.840

Impermeable Area (ha): 0.800

Maximum Allowable Discharge (l/s): 6.0

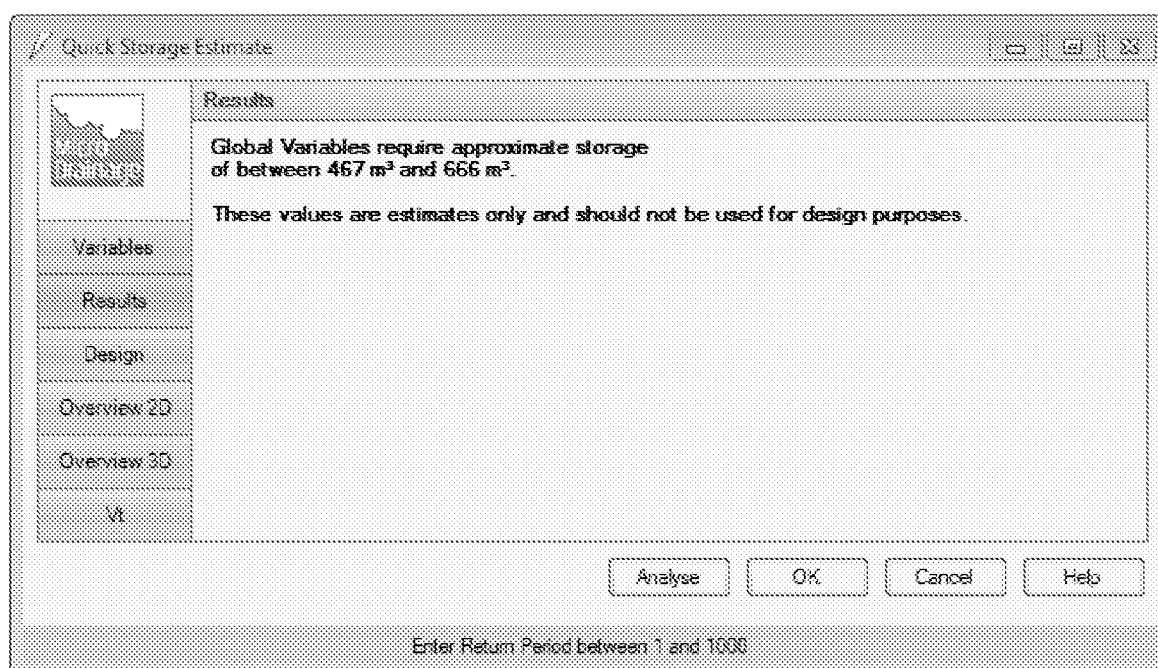
Infiltration Coefficient (m/hr): 0.00000

Safety Factor: 2.0

Climate Change (%): 40

Buttons: Analyse, OK, Cancel, Help

Enter Return Period between 1 and 1000



Quick Storage Estimate

Results

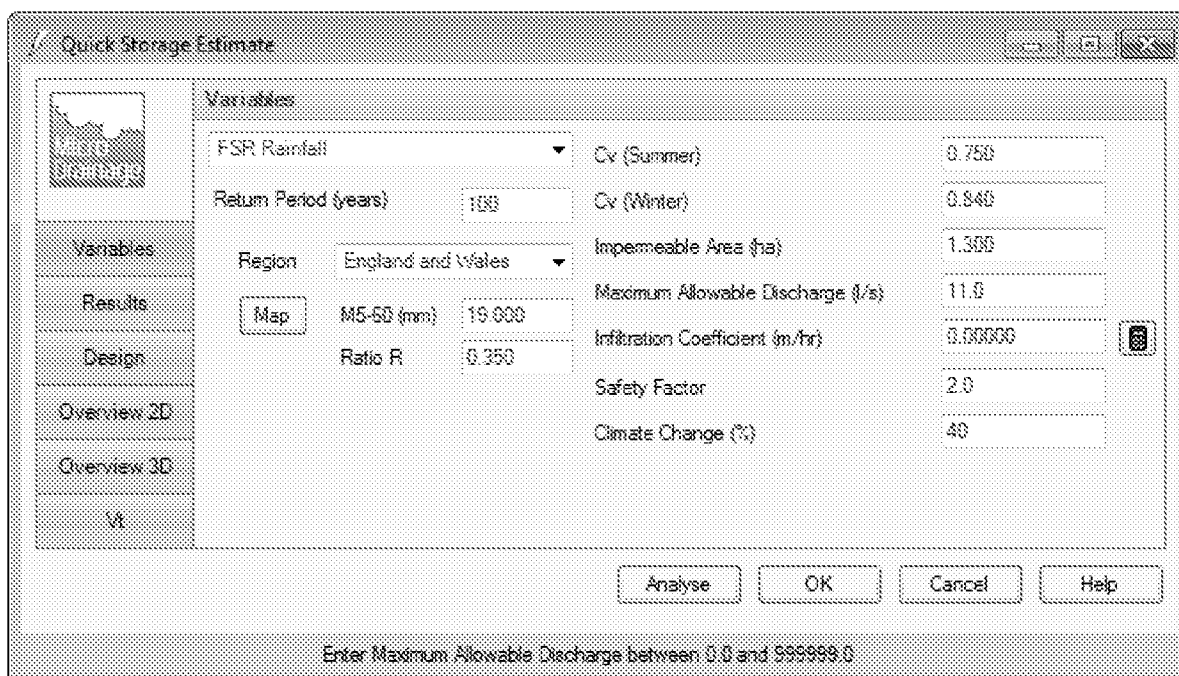
Global Variables require approximate storage of between 467 m³ and 666 m³.

These values are estimates only and should not be used for design purposes.

Buttons: Analyse, OK, Cancel, Help

Enter Return Period between 1 and 1000

Catchment 2:



Quick Storage Estimate

Variables

FSR Rainfall: [Dropdown]

Return Period (years): [100]

Region: [England and Wales]

Map: [M5-60 (mm) 19 000]

Ratio R: [0.350]

Cv (Summer): [0.750]

Cv (Winter): [0.840]

Impervious Area (ha): [1.300]

Maximum Allowable Discharge (l/s): [11.0]

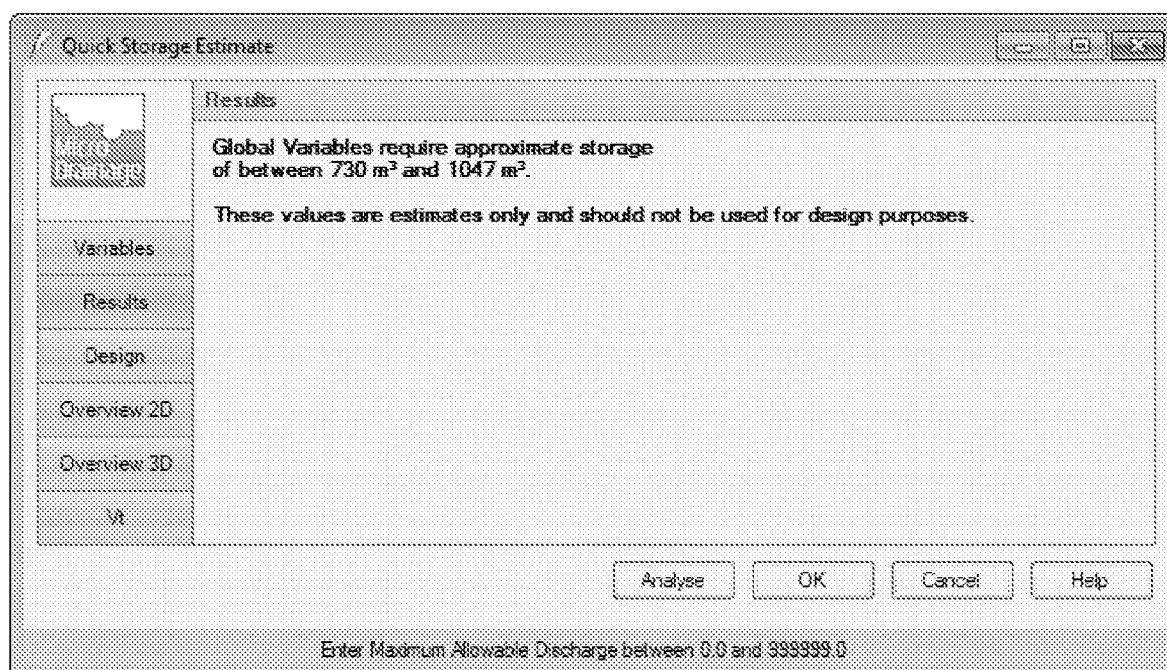
Infiltration Coefficient (m/hr): [0.00000]

Safety Factor: [2.0]

Climate Change (%): [40]

[Analyse] [OK] [Cancel] [Help]

Enter Maximum Allowable Discharge between 0.0 and 999999.0



Quick Storage Estimate

Results

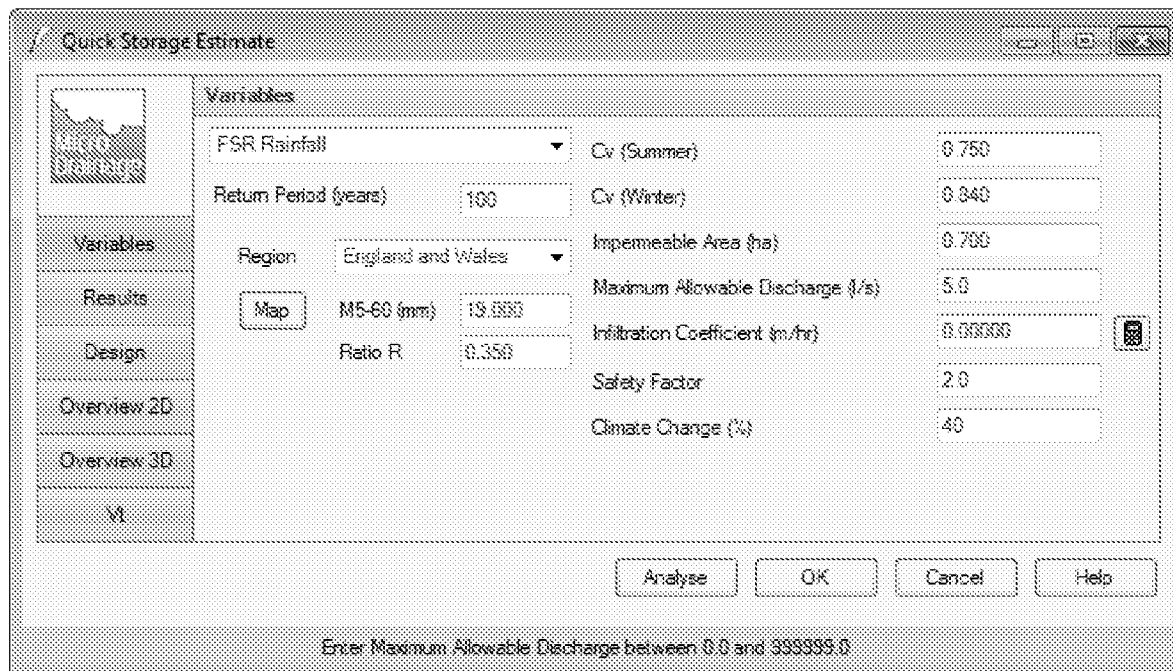
Global Variables require approximate storage of between 730 m³ and 1047 m³.

These values are estimates only and should not be used for design purposes.

[Analyse] [OK] [Cancel] [Help]

Enter Maximum Allowable Discharge between 0.0 and 999999.0

Catchment 3:



Quick Storage Estimate

Variables

FSR Rainfall: England and Wales

Return Period (years): 100

Region: England and Wales

Map: M5-60 (mm) 15.000

Ratio R: 0.350

Cv (Summer): 0.750

Cv (Winter): 0.840

Impervious Area (ha): 0.700

Maximum Allowable Discharge (l/s): 5.0

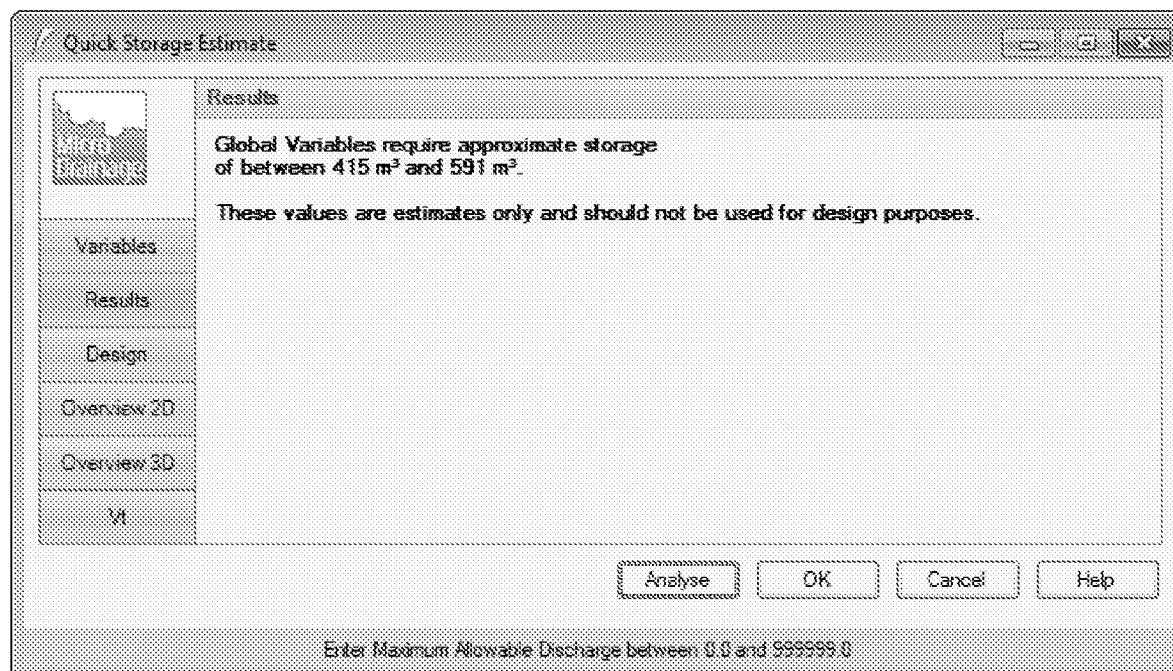
Infiltration Coefficient (m/hr): 0.00000

Safety Factor: 2.0

Climate Change (%): 40

Buttons: Analyse, OK, Cancel, Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0



Quick Storage Estimate

Results

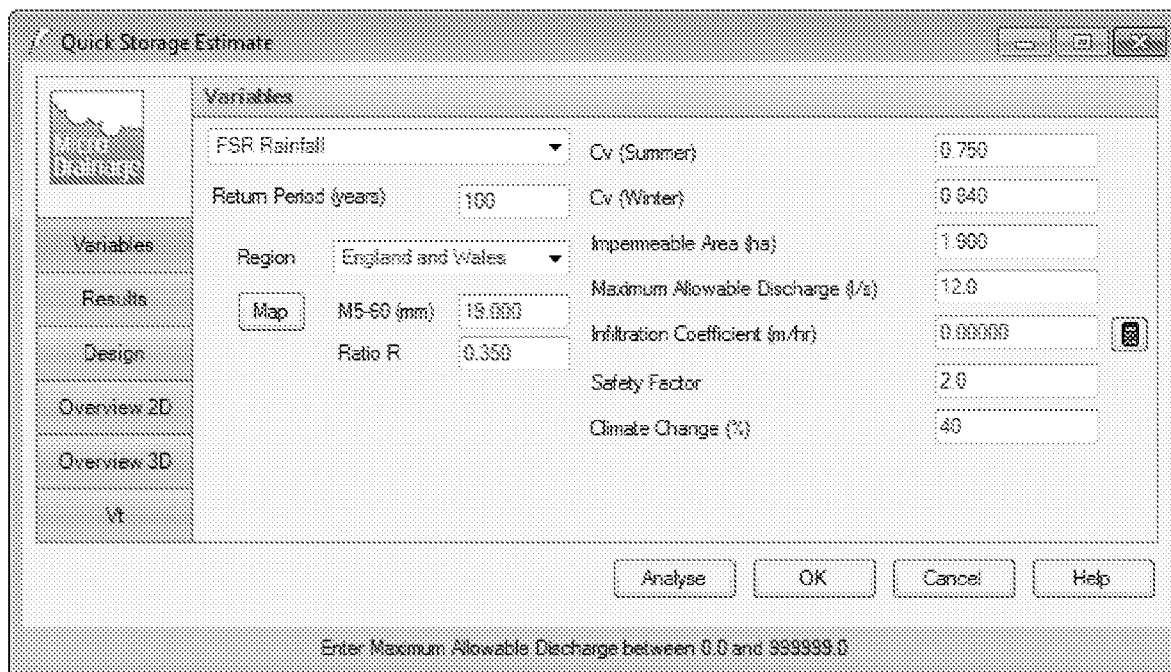
Global Variables require approximate storage of between 415 m³ and 591 m³.

These values are estimates only and should not be used for design purposes.

Buttons: Analyse, OK, Cancel, Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0

Catchment 4:



Quick Storage Estimate

Variables

FSR Rainfall: England and Wales

Return Period (years): 100

Region: England and Wales

Map: M5-60 (mm): 18.000

Ratio R: 0.350

Cv (Summer): 0.750

Cv (Winter): 0.840

Impervious Area (ha): 1.900

Maximum Allowable Discharge (l/s): 12.0

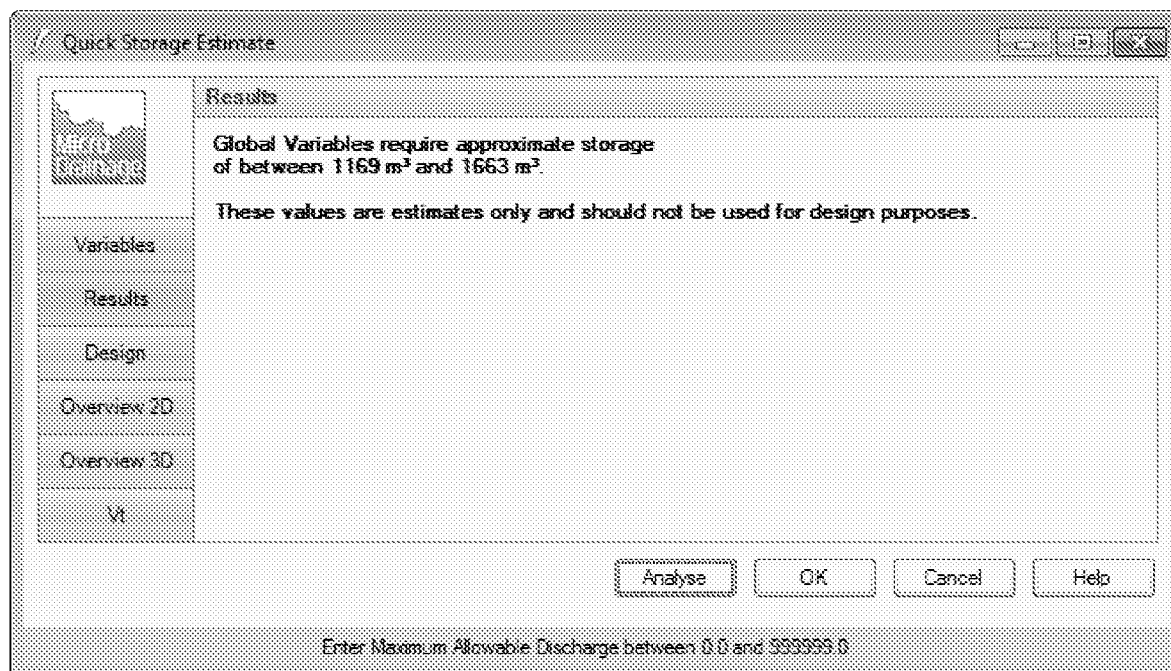
Infiltration Coefficient (m/hr): 0.000000

Safety Factor: 2.0

Climate Change (%): 40

Analyse OK Cancel Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0



Quick Storage Estimate

Results

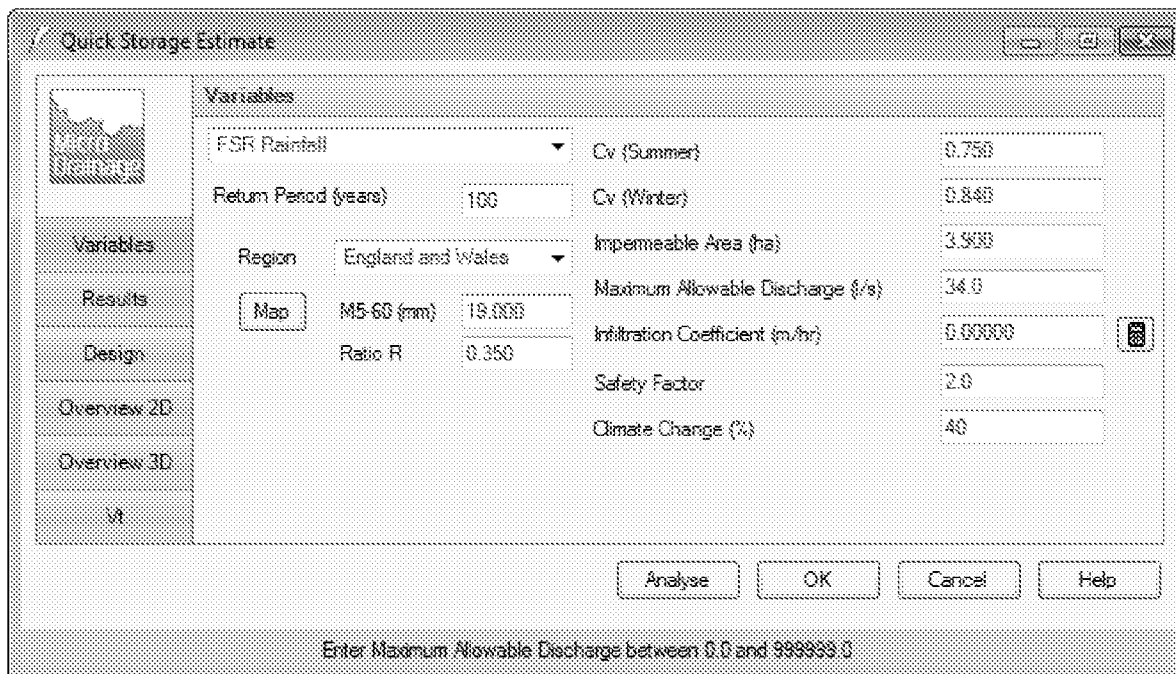
Global Variables require approximate storage of between 1169 m³ and 1663 m³.

These values are estimates only and should not be used for design purposes.

Analyse OK Cancel Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0

Catchment 5:



Quick Storage Estimate

Variables

FSR Rainfall: [Dropdown]

Return Period (years): 100

Region: England and Wales

Map: M5-60 (mm): 19.0000

Ratio R: 0.350

Cv (Summer): 0.750

Cv (Winter): 0.840

Impermeable Area (ha): 3.500

Maximum Allowable Discharge (l/s): 34.0

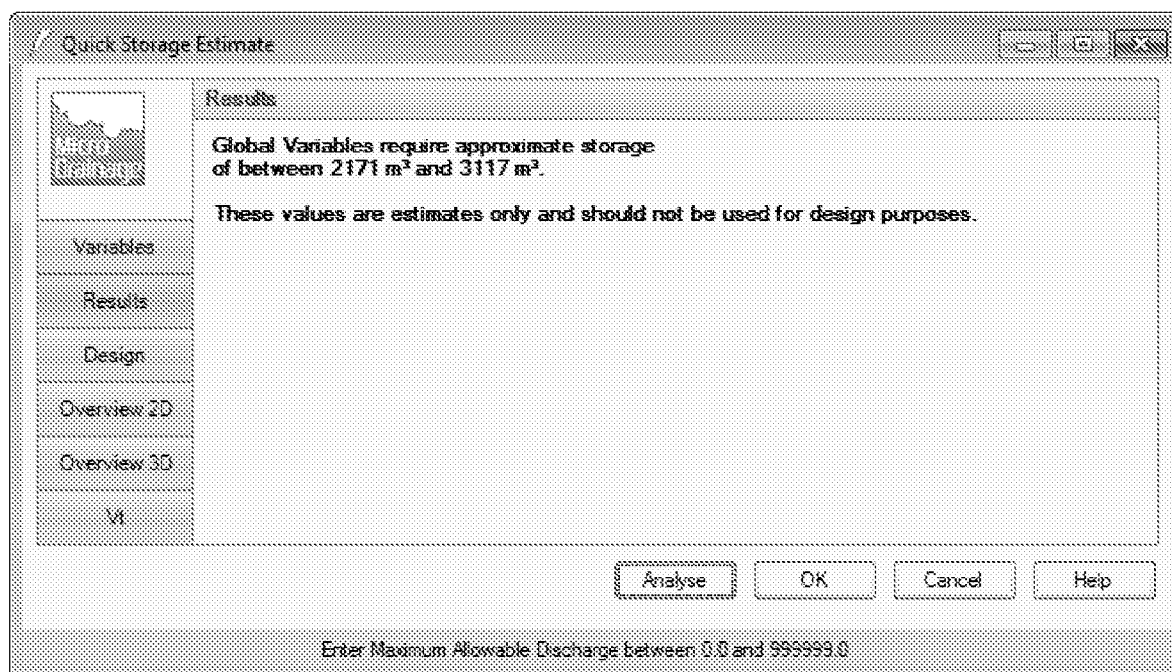
Infiltration Coefficient (m/hr): 0.00000

Safety Factor: 2.0

Climate Change (%): 40

Buttons: Analyse, OK, Cancel, Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0



Quick Storage Estimate

Results

Global Variables require approximate storage of between 2171 m³ and 3117 m³.

These values are estimates only and should not be used for design purposes.

Buttons: Analyse, OK, Cancel, Help

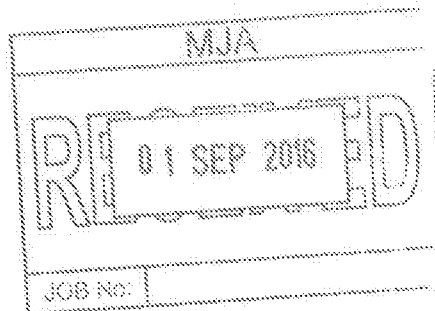
Enter Maximum Allowable Discharge between 0.0 and 999999.0

APPENDIX F

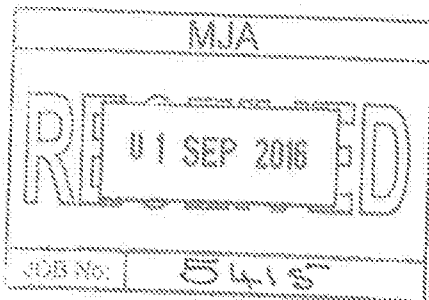
SOUTHERN WATER CORRESPONDANCE & RECORDS



MJA Consulting
Monarch House
Barton Lane
Abingdon
Oxon
OX14 3NB



Developer Services
Southern Water
Sparrowgrove House
Sparrowgrove
Otterbourne
Hampshire
SO21 2SW



Tel: [REDACTED]
Email: [REDACTED]

Your Ref:

Our Ref:
CC-SUSS-00417

Date:
31 August 2016

F.A.O: Mr. Alistair McShane

Site: Pagham Phase 2, Land to the South of Summer Lane, Pagham PO21 4NG.

Dear Sirs,

Further to your recent application for a level 2 enquiry regarding the above development site.

FOUL WATER

Please find enclosed the capacity assessment recently undertaken for your proposed development site. As you are aware the owner or occupier of the premises or private sewer or drain must give the sewerage undertaker notice of the proposed works. Upon receipt of the notice the undertaker may, within 21 days, refuse to allow him to make the connection if it considers that the mode of construction or the condition of the connecting sewer or drain either does not satisfy the standards reasonably required by the undertaker, or is such that the making of the communication would be prejudicial to its sewerage system.

The right of refusal is limited to these criteria alone and the undertaker cannot refuse to allow the connection on the grounds that the sewerage system is inadequate to take the extra liquid that the connection will discharge into it. This is a matter that should be dealt with at the planning stage.

Yours faithfully



David Akehurst
Developer Services

Please note: The information provided above does not grant approval for any designs/drawings submitted for the capacity analysis. The results are an indicative hydraulic assessment and should not be used as a basis for design. The results quoted above are only valid for 12 months from the date of issue of this letter.



INFRASTRUCTURE ASSESSMENT FOR
FOUL DRAINAGE AT
PAGHAM PHASE 2
LAND TO THE SOUTH OF SUMMER LANE
PAGHAM
WEST SUSSEX
PO21 4NG

31 AUGUST 2016

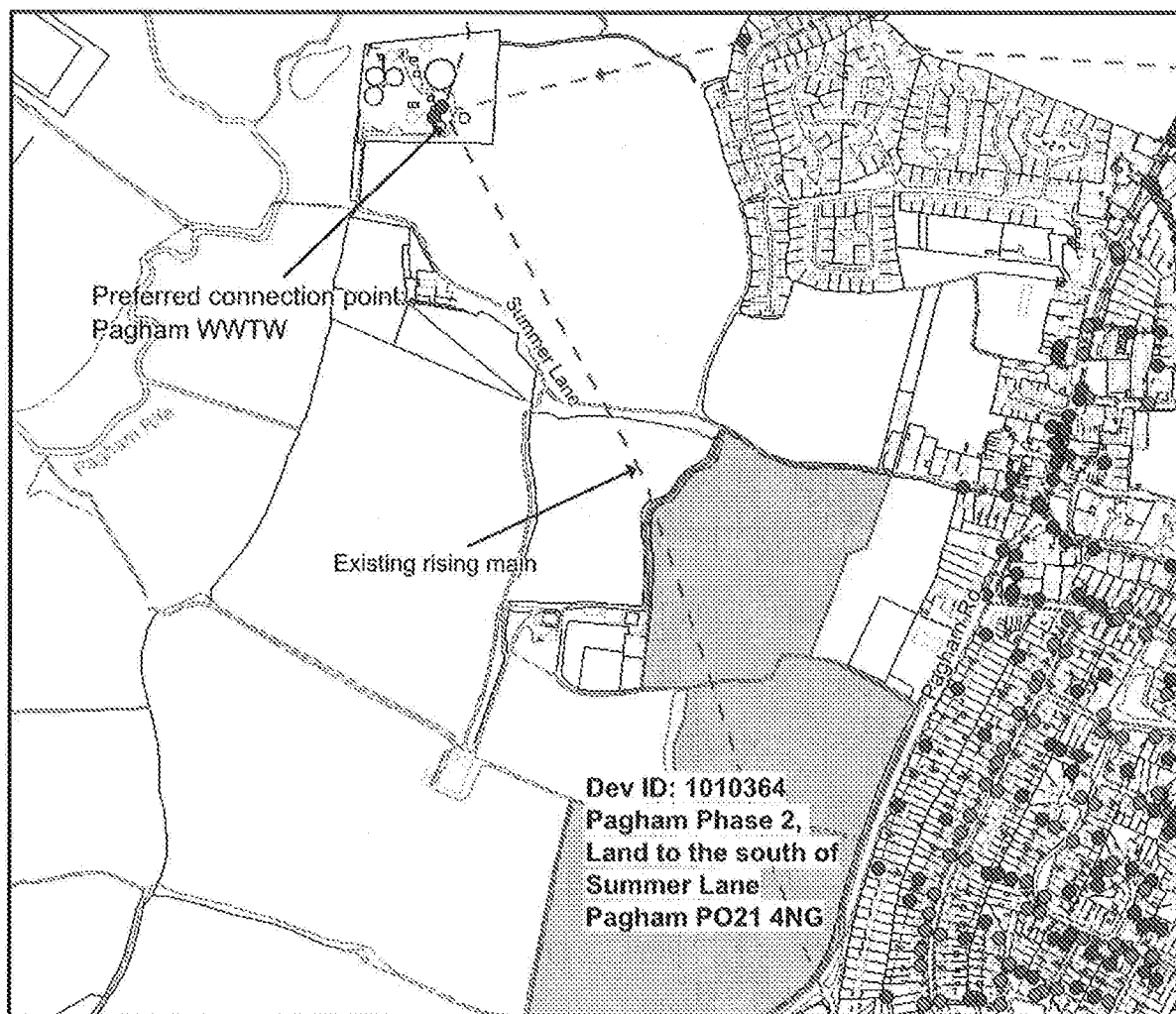
REQUESTED:
MJA Consulting

Infrastructure Assessment for Foul Drainage at to the south of Summer Lane, Pagham

1. Development Details:

The proposal is to discharge foul flows to the local sewerage systems. The preferred point of connection for the foul flows is at Pagham WWTW.

Figure 1 - Proposed Development- Foul Water System



Results:

Foul Water:

There is currently adequate capacity within the local sewerage network to accommodate the proposed foul flows at Pagham WwTW. The proposed development does not significantly increase flows to the local network so no additional surcharge or flooding to the existing system is predicted. Therefore, no remedial work is required to accommodate the proposed development.

Surface Water System:

As a surface water capacity check has not been requested it is assumed that surface water will be disposed of by alternative means e.g. soakaway or any local drainage watercourses, subject to all interested parties' approval.

Before any connections are made, an application form needs to be completed and approved by Southern Water Services.

Please note: - The information provided above does not grant approval for any designs /drawings submitted for the capacity analysis. The results are an indicative hydraulic assessment and should not be used as a basis for design. The results quoted above are only valid for 12 months from the date of issue of this letter.

PUBLIC SEWER RECORD

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Scale: 1:1250

Southern Water MapGuide Browser

Requested By: sewer record extract

Date: 17-8-2025



The map is a technical site plan for a residential development. It features a grid of streets including 'HONEYCREEK DRIVE' and 'LAWRENCE DRIVE'. Numerous rectangular shapes represent individual lots, many of which are numbered (e.g., 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100). A dashed line runs diagonally across the map, likely representing a boundary or a proposed path. In the bottom left corner, a 'Sewage Works' facility is depicted with several circular tanks and rectangular buildings. The map is oriented with North at the top.

①

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Sewer Plot

Printed By: peachia

Southern Water MapGuide Browser

Requested By: sewer record extract

Date: 17-8-2016



Southern Water

MJA CONSULTING

Civil & Structural Engineers

Monarch House • Abingdon Science Park
Barton Lane • Abingdon • Oxon • OX14 3NB