



The drainage techniques for this development will seek to include where possible Prevention, Source Control and Site Control measures.

6.5.4 SuDS Site Constraints

SuDS techniques are not suitable for all sites; therefore an assessment of the existing site is required so that SuDS limitations can be determined.

- i. Land Use Characteristics: The significant size and type of development plot enables a range of prevention, source control and site control SuDS devices to be considered both above and below ground.
- ii. Site Characteristics: Local trial pits (R14459/002) indicate soft silty clays and clayey silts with chalks underneath with a high water table and would be unsuitable for infiltration. Furthermore the site is being raised which would make it also unsuitable for an infiltration drainage solution
- iii. Catchment Characteristics: The site is classified as 'greenfield' in terms of drainage. Current guidance would limit the discharge rate from the post-developed site to not exceed existing discharge rates.
- iv. Environmental and Amenity Performance: The inclusion of SuDS within the overall development is a key driver in providing both amenity and habitat creation. These will also assist in offsetting the loss of predeveloped natural habitat. Maintenance plans will be prepared for all SuDS devices.

6.5.5 SuDS Design Philosophy

The SuDS philosophy for the development site is the promotion of Prevention, Source Control and Site Control Techniques:

The following design philosophy is proposed:

- Surface water treatment using the 'Management Train' approach to remove and isolate contamination at all SuDS facilities prior to conveyance to the local watercourse(s).
- Surface water discharge into the local watercourse(s), at the lower point of the site, at a controlled rate.
- Prevention measures by the potential inclusion of rainwater harvesting (TBC).
- Site Control features in the form of open attenuation ponds or below ground oversized pipes to accommodate the additional surface water runoff generated by the development site.



- Provision of suitable oil separators in line with Pollution Prevention Guidance 3 criteria (where applicable)
- Aim to limit where possible the impermeable fraction of development.

6.5.6 SuDS Parameters

It is proposed that the development site has two levels of treatment. Prevention and source control are considered as the first level of treatment and the site control as the second level of treatment.

6.5.7 Prevention and Source Control – Principals and Objectives

The main objective of prevention and source control is treatment and control of runoff as near to source as possible. Application of these techniques will require reduction of impermeable areas and techniques to restrict the runoff rates.

Prevention measures to be considered, where possible, as part of the overall approach to the management train at this site include rainwater harvesting. Typical examples are given in the SuDS Manual (Ciria C697) and are briefly described below. It must be noted that the effectiveness of each system is dependent on the final design as well as the actual site conditions.

Rainwater Harvesting;

Similar to the use of water butts this prevention method stores rainwater runoff from roofs and external areas in below ground tanks. The water can then be used for irrigation purposes to the soft landscaping areas or alternatively pumped to an internal storage tank where the 'Grey' water can be used for WC's and washing machines.

Swales;

Swales are linear grassed ditches that provide conveyance and storage of surface water runoff. They can be inexpensive to construct as they are very similar to normal landscaping areas, but require land.

These features can be directed towards storage features such as detention basins and possibly balancing ponds before discharge to existing watercourse or ditches at controlled rates. Swales can be sized to accommodate a broad variety of flow rates.

They differ from normal drainage channels in that the flow of water is designed to be slower, so filtration, and to a lesser degree sedimentation, may occur as the water flows over and through vegetated soils. They are most effective on shallow gradients where water flow is slowest. On relatively steep sections of land swales are locally deepened at regular intervals, effectively providing on-line detention basins and simple check dams, typically at 15m centres.



6.5.8 Site Control – Principals and Objectives

Site control features such as ponds and basins can be designed to attenuate storm runoff and provide conditions for settlement of suspended solids. The benefits are that they satisfy the full range of SuDS requirements in terms of reducing the quantity of water, improving the quality of water and also providing the bio diversity enhancements.

Detention Basins;

Detention Basins or dry ponds remain dry during periods of low rainfall and are located to receive runoff from conveyance systems prior to discharge the watercourses/ditches at controlled flow rates. Basins can be sized to allow storage of excess flows until they can drain, and should be located to receive runoff from conveyance systems prior to discharge to watercourses/ditches at controlled flow rates. Discharge will generally be controlled via vortex flow control device or reduced sized orifice plate as appropriate. Some removal of pollutants would occur in a detention basin by filtration through vegetated soils.

Conventional piped drainage;

Conventional piped drainage would be in areas of the proposed scheme where 'over-the-edge' drainage is unsuitable. This would typically be at areas where kerbs are required due to road user safety reasons, such a roundabouts or marshalling yards. Surface water run-off would be collected via conventional trapped gullies or combined kerb drainage systems, before discharging appropriately into SuDS units.

Geocellular Systems;

Geocellular Systems can be used to control and manage runoff either as a soakaway or as a storage tank and can be tailored to suit the requirements of most sites. In addition they can be used for storing roof/rainwater before recycling. Geocellular Systems used for storage can be tailored to be used in contaminated land conditions to prevent infiltration.

6.6 Surface Water Drainage Strategy

6.6.1 Surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account. This is line with current guidance and site specific recommendations from the EA.

6.6.2 In light of the findings from the SuDS review in Section 6.5, the following surface water drainage strategy will be implemented.

1. Due to the increase in impermeable areas from the predevelopment situation, the SuDS management train approach will be incorporated.



2. Prevention measures in the form of rainwater harvesting (potentially but to be confirmed) will be the initial means of retaining the runoff. Infiltration is unlikely to be considered feasible at this development site and therefore many source control options will have to be discounted.
3. Rainwater runoff from roofs and hard paved areas will be directed through the prevention measures above and then via a new surface water gravity network within the service yards to an on-site attenuation pond at the eastern boundary. The new on-site pond together with oversized pipes will accommodate the additional surface water runoff generated by the site, and prevent increased discharge to the downstream watercourses, for the extreme events.
4. Discharge from the pond to downstream watercourses will be restricted to greenfield rates for the respective storm events to mimic the pre development scenario.

6.7 Surface Water Drainage Proposals

- 6.7.1 Surface water runoff from the roof and external areas will be directed to the below ground gravity network. This water is considered to be generally clean and with limited contamination, and may be discharged directly to the new drainage infrastructure and SuDS Facilities. Silt is to be prevented from entering the drainage system by the use of trapped gullies, channels with silt traps, infiltration trenches with silt traps or by the use of Sustainable Drainage techniques.
- 6.7.2 A new gravity pipe network will serve the new buildings, service yards and car parks, and direct runoff to the attenuation pond at the eastern boundary. Taking into account the existing greenfield discharge rates, and assuming that no infiltration to ground is possible from the base of the pond, then the worst case attenuation volumes are defined in Table 5 below. Note however that the attenuation volumes shown are conservatively those required to limit the overall maximum peak discharge from the site to 35.3l/s as dictated by the EA QBar rate. This is indicated within the Hydrock hydraulic drainage calculations in Appendix F.
- 6.7.3 A hydraulic model of the site has been created to determine the peak flows generated from the development, and the resulting attenuation volumes required. In order to accurately assess the storage volumes required for the 1:30 year and 1:100 year storm events (including climate change), a hydraulic modelling programme has been used which uses storm hydrographs to assess the inflows and outflows from a restricted system across the entire storm duration, on a minute by minute basis. This method gives confidence that adequate storage volumes have been provided for any particular critical moment during the severe storm event.



Table 5: Outline Attenuation Volumes Attenuation Volumes based on Return Period Storm Events with Allowable discharge rate in Brackets		
QBar (35.30l/s)	30 Year (35.3l/s)	100 Year + 30% Climate Change (35.3l/s)
784m ³	2530m ³	5530m ³

- 6.7.4 It is a requirement of building regulation guidance that the drainage systems be designed not to flood any part of the site in a 1 in 30 year return period design storm (3.33% annual probability of occurrence). The below ground surface water design may require that some areas of car park or the hard standing areas experience minor flooding in extreme conditions beyond the 30 year design criteria. This is classed as Exceedance flooding or Secondary Storage and is common for this type of development. Any such flood water will be directed away from door thresholds to the periphery of the site, where it will discharge into the drainage infrastructure as water levels recede.

All exceedance flood water will be retained on site up to the 100 year return period to prevent flood impact to the adjoining neighbours. All drainage designs will include the appropriate climate change allowance, in this case a 20% increase in rainfall. Refer to Appendix E for details of the Hydrock proposed drainage strategy layout.

6.8 Foul Water Drainage Strategy and Proposals

- 6.8.1 The foul water drainage strategy is to construct a separate foul water drainage network serving the whole development. This will drain by gravity, to the new pumping station, indicated on the Drainage Strategy drawing (14443/210). This will then be pumped to the Southern Water Apparatus on Shripney Road under a Section 98 Agreement with Southern Water.



7.0 Management Measures, Off Site Impacts and Residual Risk

7.1 Flood Risk Management Measures

- 7.1.1 The report has determined that the site is at low risk from all forms of flooding.
- 7.1.2 The surface water drainage strategy for the new development site is to direct all the surface water runoff from the new development plots to new surface water networks that flow to the east to correspond with the new topography of the site. The Flood risk management for this development is to locate the site out of flood zone 2 and 3, and to provide flood compensation to allow this. A detention (attenuation) pond and below ground oversized pipes will be situated on the network to retain the excess rainwater due to the outflow restriction set by the predevelopment greenfield runoff rates. The new private surface water networks will be designed in line with current British Standard guidance up to the 100 year storm return period including an allowance for climate change. Beyond the 30 year criteria, minor surface flooding may occur with flood water contained in low lying external areas where it will then drain back in to the drainage network as the pipe water levels recede. No flood water will be allowed to discharge off the development site. A full hydraulic model has been prepared to prove this scenario.
- 7.1.3 The use of SuDS such as rainwater harvesting and an attenuation pond with controlled (restricted) outflow to the local watercourse in line with the required runoff rates will help mitigate any flood risk impact to the surrounding areas.
- 7.1.4 There will be a site management health and safety document prepared in respect of the final development. This will include the required maintenance regime for the on-site drains and drainage facilities such as the channels, gullies, pipes, manholes and all SuDS facilities.
- 7.1.5 The respective site users will be responsible for site cleanliness, gully emptying and drain cleansing to ensure that the surface water drainage system will always operate at its maximum efficiency.
- 7.1.6 Access and egress arrangements to and from the new development should exceedance flooding occur will be through the proposed main access off the A29 roundabout.

7.2 Off Site Impacts

- 7.2.1 The report has justified that the risk of flooding to the new development layout is low. Thus the development site has a very low risk of flooding from fluvial or by all other sources of flood risk due to the flood compensation proposals.
- 7.2.2 By including SuDS into the drainage system, this will reduce surface water flooding impact onto the downstream catchments.



- 7.2.3 By mimicking the predevelopment peak runoff at its point of discharge into the receiving watercourse by the inclusion of SuDS, this will reduce surface water flooding impact onto the downstream catchments.

7.3 Residual Risk

- 7.3.1 Flood risk to people and property can be managed but it can never be completely removed; a residual risk remains after flood management or mitigation measures have been put in place. This relates to a rainfall event beyond what can be fully quantified. Should this occur then some flooding of external areas could occur.



APPENDIX A – ARCHITECTURAL SITE PLAN

CONTENTS	
Identifier	Name
Michael Sparks Architects	Proposed Location Plan – 30699-PL-100 Revision B
Michael Sparks Architects	Proposed Site Layout – 30699-PL-101 Revision A



01 SITE LOCATION
1:2500

NOTES:

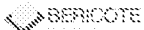
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TRANSFORMATIONAL SURVEY (CONVEYANCE NO. 2013/15)
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REV	DATE	NOTE	DRAWN	CHECK
D	23.06.14	10% SCALE AMENDMENTS	PF	NSC
A	20.06.14	OTHER AMENDMENTS	PF	NSC



CONSULTANT
10, FORT ROAD
BRIGHTON BN1 6DA
01273 513111
www.msparks.co.uk

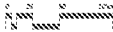


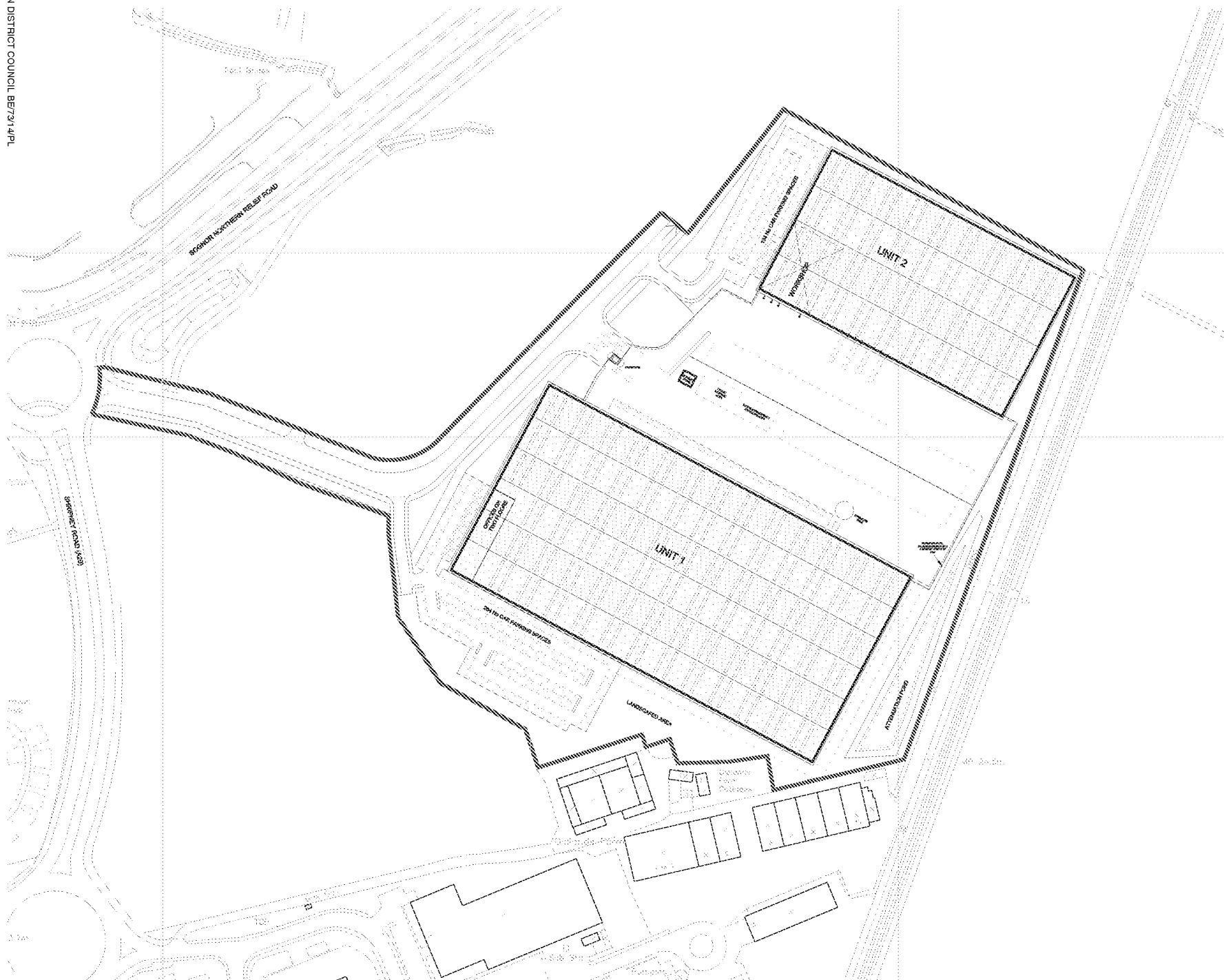
THE
OLDLANDS FARM, BOGNOR REGIS
1000000
SITE LOCATION PLAN

CLIENT
BERICOTE PROPERTIES LTD

DATE	SCALE	SCALE
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STATUS	PLANNING	NSC

PROJECT NUMBER
30699-PL-100B





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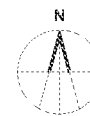
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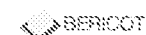
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REV	DATE	NOTE	DRWS	QTY



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1.33 1.34 (3)

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302
OLDLANDS FARM, BOGNOR REGIS
POWELL
SITE LAYOUT PLAN

CLIENT
BERICOTE PROPERTIES LTD

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	ISOLS	CHAZEN
	PLANNING	NSC

DOWNED WAGON
30699-PL-101A

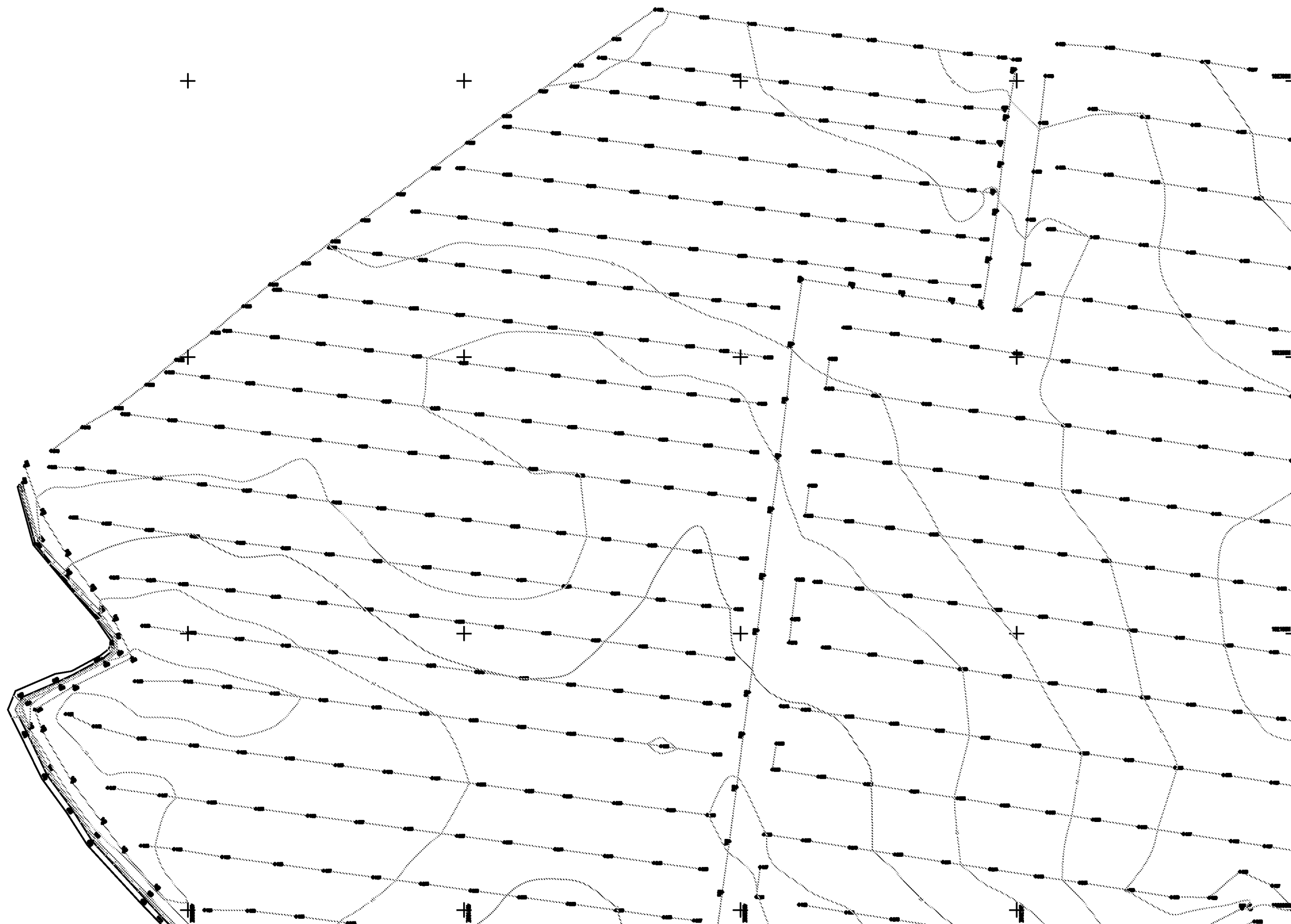


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APPENDIX B – TOPOGRAPHICAL SURVEY

CONTENTS	
Identifier	Name
Malcolm Hughes Land Surveyors	Topographical Survey Drawing No. 16473/1-3



Drawing No. 16473 / 1



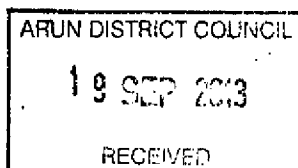
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APPENDIX C – STATUTORY AUTHORITY CORRESPONDANCE

CONTENTS	
Identifier	Name
Environment Agency	Correspondences and guidance notes
Southern Water	2013 Preplanning correspondence for a previous planning application

Planning and Development Services
Arun District Council
Arun Civic Centre
Maltravers Road
Littlehampton
West Sussex
BN17 5LF



Your Ref
BE/61/13
Our Ref
PLAN-004026
Date
17/09/2013

Dear Sir

Proposal: HYBRID APPLICATION. 1: Full planning application for Access and road and Flood compensation area. 2: Outline application for 33116 sq m of mixed commercial and industrial uses, comprising A1, A3, A5, B1, B2 and B8, with associated works and landscaping.

Site: Oldlands Farm, Steyning Way, Bognor Regis, PO22 9NN
BE/61/13

Thank you for your letter of 27/08/2013.

Following initial investigations, there is currently inadequate capacity in the local network to provide foul sewage disposal to service the proposed development. The proposed development would increase flows to the public sewerage system, and existing properties and land may be subject to a greater risk of flooding as a result. Additional off-site sewers, or improvements to existing sewers, will be required to provide sufficient capacity to service the development. Section 98 of the Water Industry Act 1991 provides a legal mechanism through which the appropriate infrastructure can be requested (by the developer) and provided to drain to a specific location.

Should this application receive planning approval, please include, as an informative to the permission, the following requirement:

"The applicant/developer should enter into a formal agreement with Southern Water to provide the necessary sewerage infrastructure required to service this development. Please contact Atkins Ltd, Anglo St James House, 39A Southgate Street, Winchester, SO23 9EH (Tel [REDACTED]), or www.southernwater.co.uk"

Our initial investigations indicate that Southern Water can provide surface water disposal to service the proposed development. Southern Water requires a formal application for a connection to the public sewer to be made by the applicant or developer.

We request that should this application receive planning approval, the following informative is attached to the consent:

"A formal application for connection to the public sewerage system is required in order to service this development. To initiate a sewer capacity check to identify the appropriate connection point for

