

**PROPOSED COMMERCIAL DEVELOPMENT
LAND AT OLDLANDS FARM,
BOGNOR REGIS
WEST SUSSEX**

FLOOD RISK & DRAINAGE ASSESSMENT

HANBURY PROPERTIES LIMITED

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Figure 4 - Extract from Environment Agency Flood Zone Map

1 Introduction

1.1 Scope

- 1.1.1 MJA Consulting has been commissioned by Hanbury Properties Ltd to undertake a Flood Risk Assessment and Drainage Strategy to accompany an outline planning application for the proposed commercial development at Oldlands Farm, Bognor Regis, West Sussex.
- 1.1.2 The land has been allocated for commercial development as part of the Felpham Site 6 Housing Development. The commercial development area covers approximately 16Ha of undeveloped agricultural farmland which is split into two areas. The development area consisting of 12.5 Ha and an area of land covering 3.45 Ha owned by ASDA and not part of this application. Within the application an area of undeveloped agricultural farmland is included for floodplain compensation works located to the north of the Bognor Northern Relief Road. The site area is shown in Appendix A.
- 1.1.3 The proposed commercial development consists of the construction of a Neighbourhood Hub area, together with a number of B1, B2 & B8 units with associated access roads, hardstanding parking areas and soft landscaping. Refer to Appendix B for site preliminary site layout.

1.1 Report Structure

- 1.2.1 The National Planning Policy Framework - *Department for Communities and Local Government (2012)* 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 to be carried out 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 on both the development site and off site parties and land.
- 1.1.2 This report will take the structure of a 'Flood Risk Assessment' in accordance with the Environment Agency's Flood Risk Assessment Guidance, the National Planning Policy Framework and CIRIA Report 624 'Development and Flood Risk – Guidance for the Construction Industry.
- 1.1.3 The purposes of this report are:
- To confirm that the proposed development has a suitable strategy for dealing with potential flood risks.
 - To confirm that a satisfactory strategy for the disposal of surface and foul water from the proposed development is achievable.
 - This development will not increase the risk of flooding to any offsite parties and land.

2 Existing Site

2.1 Site Location and Description

- 3.1.1 The proposed development is located off the A29 Trunk Road and lies between the Southern Cross Industrial Estate and the Bognor Northern Relief Road, currently under construction. The approximate National Grid Reference of the site is SU 94276 01573.
- 2.1.2 The total commercial site area is approximately 16ha of undeveloped agricultural farmland which includes the area of land covering 3.45Ha currently owned by ASDA.
- 3.1.3 The site is bordered by the A29 Trunk Road to the west, the Bognor Northern Relief Road BNRR to the northwest, Southern Cross Industrial Estate to the south, Oldlands Farm Ditch and farmland to the north east, the eastern boundary is the Bognor to Chichester railway.

Figure 1: Site Location



© 2011 Microsoft – Bing Maps



3 Topographical and Geological Information

3.1 Topography

- 3.1.1 The topographical survey of the site shows the existing ground generally falling from the A29 boundary in a typically easterly direction towards the Oldlands Farm Ditch.
- 3.1.2 The site levels range from 4.00m AOD to approximately 1.2m AOD at the watercourse. Refer to Appendix C for the existing Topographical Survey.

3.2 Geology & Hydrogeology

- 3.2.1 The Geological Survey map of the area indicates that the site is underlain by Aeolian Deposits (Brickearth clay) over Raised Beach Deposits (chalk derived sand and gravel) and subsequently the Upper Chalk. The central western part of the site, in the vicinity of the Lidsey Rife, is shown to be underlain by a tract of Tidal River Deposits comprising silty and sandy clays with sand and gravel.
- 3.2.2 Groundwater was encountered within a number of trial holes within the clay / silt layers.
- 3.2.3 Soakage testing was not carried out due to the nature of the sub strata. Infiltration type drainage would not be suitable within this site.
- 3.2.4 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 Oldlands Farm Ditch on the north eastern boundary.

3.3 Catchment Information

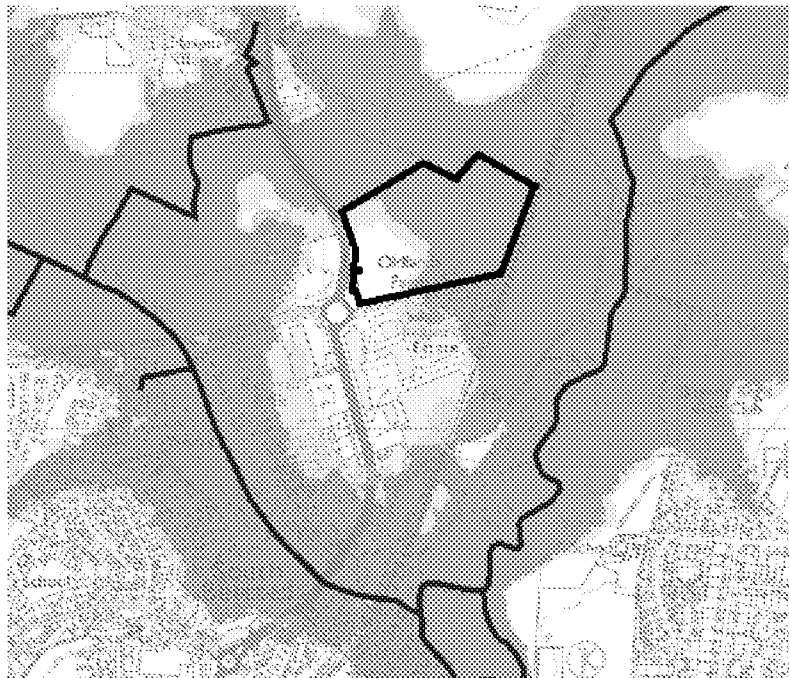
Watercourses

- 3.3.1 The Oldlands Farm Ditch flows easterly along the north eastern boundary of the site and is part of the Internal Drainage Board (IDB) system.
- 3.3.2 The watercourse takes runoff from an area of the village of Shripney together with direct runoff from the surrounding farmland. At the crossing point with the Bognor Northern Relief Road (BNRR) a new culvert together with flood arches has been installed. The ditch runs in open ditch before discharging to a culvert under the Bognor to Chichester railway line. The Oldlands Farm Ditch ultimately discharges to the Lidsey Rife approximately 300m to the east.
- 3.3.3 A small drainage channel runs along the eastern railway boundary which takes runoff from the Southern Cross Industrial Estate and discharges to the Oldlands Farm Ditch prior to the railway culvert.

4 Flood Risk Assessment

4.1 Flood Zone Map

Figure 4: Extract from Environment Agency Flood Zone Map



© Environment Agency 2011

 Main Rivers

 Dark blue 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.
- From a river by a flood that has a 1 per cent (1 in 100) or greater chance of happening each year.

 Light blue 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.

4.2 The Environment Agency's indicative Flood Map shows the site to be currently located within Flood Zones 1, 2 & 3.

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 100 year or greater annual probability of flooding from a river or stream in any year by the Environment Agency.

- 4.3 As stated the Environment Agency Flood Map is indicative only and takes no account of actual ground levels or features. These flood maps are derived from coarse scale JFLOW modelling which bases part of the results on assumptions of hydrology and topography. This does 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.
- 4.4 The Environment Agency has confirmed predicted flood levels within this area which do alter the current flood maps.
- Flood Levels:
The original 100 year fluvial flood level was 1.82m AOD however this was increased to a level of 2.0m AOD to include for climate change and following the results from the Strategic Flood Risk Assessment.
Appendix D shows the actual flood zone when based on the topographical survey.
- 4.5 The flood risk technical Guidance to the National Planning Policy Framework Table 2: Flood Risk Vulnerability classification, classifies commercial developments as 'Less Vulnerable'.

NPPF Table 2 of technical Guidance: Flood Risk Vulnerability classification

Less vulnerable
• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in "more vulnerable", and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).

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.

4.6 Table 2 & 3 of the NPPF would indicate that commercial developments 'less vulnerable' can be located within Flood Zone 2 & 3a and are considered appropriate under the National Planning Policy Framework.

4.7 It is the developer's intention to lift the site out of flood zones 2 & 3 and into flood zone 1 above the 2.0m AOD contour. To do this they intend to provide floodplain compensation within the vicinity of the site.

4.8 Floodplain Compensation

4.8.1 As stated previously the proposed development currently lies partially within flood zones 2 & 3 with existing ground levels ranging from 3m AOD – circa 1.0m AOD. It is proposed to lift the site within Zones 2 & 3 to above the level of 2.0m AOD by using floodplain compensation and relocating the floodplain to adjacent land which currently lies above the 2.0m AOD contour.

4.8.2 The flood compensation has been designed in accordance with the normal Environment Agency policy and Appendix 3 of the CIRIA guide C624 entitled "Development and flood risk - guidance for the construction industry" where compensatory storage is provided on a "volume-for-volume" and "level-for-level" basis (e.g. for each 0.2 m slice of filling there is a slice of excavation at the same level and volume) to ensure no loss of floodplain occurs.

4.8.3 Floodplain compensation has recently been used on the Bognor Northern Relief Road where the road crosses the Oldlands Farm Ditch. The location of this is adjacent to the northern boundary of the road and lies either side of the watercourse.

4.8.4 The proposed floodplain compensation area is to the north of the new Bognor Northern Relief Road (BNRR) the proposal is to extend the existing compensation area as shown in Appendix E.

4.8.5 Flood Compensation areas & volumes.

Existing site area:

Ex Ground Level m AOD	Area of fill (m ²)	Volume of fill (m ³)
2.00	79,400	7,770
1.90	76,000	7,380
1.80	71,600	6,953
1.70	67,450	6,535
1.60	63,250	6,148
1.50	59,700	5,758
1.40	55,450	5,196
1.30	48,475	3,993
1.20	31,375	2,219
1.10	13,000	681
1.00	625	31
Total fill volume		52,663m ³

Flood compensation areas:

Ex Ground Level m AOD	Area of fill (m ²)	Volume of fill (m ³)
2.00	79,400	7,808
1.90	76,750	7,520
1.80	73,650	7,208
1.70	70,500	6,883
1.60	67,150	6,578
1.50	64,400	6,270
1.40	61,000	5,475
1.30	48,500	4,438
1.20	40,250	3,115
1.10	22,050	1,268
1.00	3,300	165
Total cut volume		56,725m ³

4.8.6 The above flood compensation is based on the whole site being developed. It is the developer's intention to phase the construction of the development which will allow the flood compensation works to also be phased. The details of the phasing are outlined later in the report.



4.9 Tidal Flood Risk

- 4.9.1 The Tidal Flood Risk to the site is extremely low. Sea defences are well maintained and provide sufficient defence against the predicted 1:200 year tidal level. If a more extreme event or a localised breach occurred the risk to the site is minimal due to the distance to the sea defence.

4.10 Sequential Test

- 4.10.1 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.
- 4.10.2 Under the requirements of the 'sequential test' and as the proposed commercial development is to be located within an amended 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 Impact of Development on Flood Risk

5.1 This section identifies sources of potential flood risk to the site.

The sources of flooding that could potentially affect the site include flooding from groundwater, rivers (fluvial), overland runoff (pluvial), artificial sources and flooding from overloaded existing and proposed sewer networks.

5.2 History of Flooding

Part of the site is currently within flood zones 2 & 3 and is known to flood from the adjacent watercourse. However, with the proposed flood compensation works the site will move to flood zone 1 with a low risk of flooding.

5.3 Existing Watercourses

5.3.1 Flood water from the watercourse known as the Oldlands Farm Ditch which runs along the north eastern boundary and is the main cause of the on-site flooding. The Environment Agency have acknowledged that the catchment responds slowly and mirrors the flood levels on the Lidsey Rife.

5.3.2 The Lidsey Rife is located approximately 300m to the east and does not directly present a flood risk.

5.4 Waterbodies

An existing highway drainage pond associated with the Bognor Northern Relief Road lies to the north of the site but does not pose a flood risk to the site.

There are no reservoirs or canals or other artificial sources of flooding within a 500m radius of the development area.

5.5 Groundwater

From the Ground Investigation The Environment Agency has confirmed that they have no recorded incidents of flooding to this development site from groundwater.

5.6 Existing Sewers

Southern Water has indicated that there have been no recorded incidents of flooding from public sewers within a 500m radius of the site.

5.7 Tidal Flood Risk

The Tidal Flood Risk to the site is extremely low. Sea defences are well maintained and provide sufficient defence against the predicted 1:200 year tidal level. If a more extreme event or a localised breach occurred the risk to the site is minimal due to the distance to the sea defence.

5.8 Proposed Site Drainage

Artificial drainage systems and infrastructure within, or in close proximity to, the site may present a risk of flooding through the capacity of the systems being exceeded or the structural, hydraulic, mechanical or operational failure of the system occurring.

In the context of the proposed site there are likely to be installed as part of the development, the following systems which may present a flood risk:

- Piped gravity foul/ surface water sewers and a foul rising main.
- SUDS systems for the collection and conveyance of surface water runoff within the site boundary.

- 5.9 The surface water runoff generated on the site as a result of the development will be managed using appropriate SUDS techniques up to the 1 in 100 +30% storm event. This will ensure that the peak rate of surface water leaving the developed site

6 Existing and Proposed Site Runoff

- 6.1 This section aims to calculate the estimated peak runoff rate of surface water leaving the site, for the pre development conditions.
These discharge rates have then been used for the preliminary design of the surface water drainage strategy for the proposed development.

6.2 Catchment Area

- 6.2.1 As stated previously the site consists of two parts. One is the proposed development area the other is land that drains onto the development and owned by ASDA. The whole site is currently used for agriculture and has been assessed as Greenfield.

Development Site Area	12.49 Ha
ASDA Site Area	3.45 Ha
Total Site Area	15.94 Ha

6.3 Existing Surface Water Runoff Rate

- 6.3.1 As the intention is to discharge to a watercourse the minimum requirement is for the proposed peak surface water runoff rate and runoff volume not to exceed pre-development rates. The Greenfield runoff rate has been calculated using the Institute of Hydrology Report 124 methodology to determine the level of acceptable rate of discharge from the site to the receiving watercourse.
- 6.3.2 The natural topography of the site is such that all surface runoff typically flows in a north easterly direction from the A29 boundary towards the Oldlands Farm Ditch.
- 6.3.5 An assessment of the estimated current Greenfield runoff rate has been carried out using the Institute of Hydrology Report 124 methodology using Micro Drainage software. Refer to Appendix F for a summary of results.
- 6.3.6 IH124 mean annual flood flow rate equation:

$$QBAR_{Rural} = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$$

Catchment: 15.94ha

1 in 1 year	47.4 l/sec
1 in 30 year	126.4 l/sec
1 in 100 year	177.9 l/sec
QBar	55.8 l/sec

Based on the above all discharge from the site will be restricted to a maximum discharge of 56 l/sec (QBar) for all storm events.

Typically this equates to a QBar discharge rate of 3.5 l/sec/Ha.

For future development of the ASDA land a maximum runoff of 12 l/sec for all storm events based on the above figure has been allowed for within the surface water assessment.

6.4 Proposed Development Surface Water Runoff Rate

6.4.1 The estimated peak runoff rate from the proposed site is based on 100% runoff from impermeable areas and 0% runoff from permeable areas, in accordance with CIRIA C697 The SUDS Manual & Preliminary rainfall runoff management for Developments (EA/DEFRA W5-074/A).

6.4.2 A suitable method for the estimation of peak flow is the *Rational method*,
 $Q = 2.78 CIA$.

Where:

Q = flow (l/s)

I = rainfall intensity (mm/hr), return period equal to time of concentration
(to include a 30% increase for predicted climate change)

A = Impermeable area drained (ha)

C = runoff coefficient, assumed to be 1.0

Catchment: 9.8ha

1 in 1 year	465 l/sec
1 in 30 year	1130 l/sec
1 in 100 year	1500 l/sec

6.4.3 It can be seen that as a result of this development and the increase in impermeable areas, the peak rate and volume at which surface water could potentially runoff the site if not effectively managed, will be greater than in its Greenfield state.

To mitigate this increase in potential additional runoff due to development the discharge will be constrained to QBar (mean annual peak rate of runoff for the Greenfield site), calculated for this site at 56 l/s.

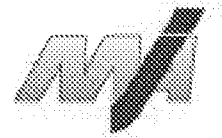
7 Surface Water Drainage Strategy

- 7.1 The National Planning Policy Framework requires that new developments do not exacerbate flood risks elsewhere, which means there is a need to control drainage and runoff to ensure there are no increases in overland flow as a result of the development.

Sustainable Drainage Systems (SuDS) will be incorporated into the surface water drainage strategy to mitigate the additional runoff and reduce flood risk to downstream areas.

The philosophy of the SuDS will be to replicate as closely as possible the natural drainage regime from a site before development, reducing the impact on receiving watercourses.

- 7.2 The Building Regulations Document H (2002) details a hierarchy of potential methods of disposing of surface water from a site:
- An adequate soakaway or some other adequate infiltration system, or where that is not practicable,
 - A watercourse, or where that is not practicable,
 - A sewer
- 7.3 The site investigations have shown that the site is underlain by Brickearth clay soils with a high groundwater content and would be unsuitable for infiltration type SUDS. Furthermore the site is being raised which would make it also unsuitable for a infiltration drainage solution.
- 7.4 Surface water runoff will be managed in accordance with current requirements to mimic the existing runoff to Oldlands Farm Ditch by incorporating Sustainable Urban Drainage (SUDS) into development. The suitability of various techniques has been assessed using the SUDS management train as stated in the CIRIA Manual C697. The various techniques will be reviewed as to their suitability in consideration of the characteristics of the development to manage runoff at source. The use of SUDS systems will provide an improvement to the biodiversity and water quality and a reduction in runoff peak runoff flows.
- 7.5 The surface water runoff from the development for all storm events including the 1-year, 30-year, 100-year and 100-year +30% climate change storms will be attenuated and discharged into the adjacent watercourses at no greater than the mean annual peak runoff rate QBar from the undeveloped Greenfield site of 56l/s.
- 7.6 Appendix G shows the preliminary drainage strategy for the site. Storm water runoff will drain via various SUDS features before outfalling to a final attenuation pond prior to discharging to the watercourse.



7.7 The management of the surface water for the site has been split into three distinct areas, main access road, the Retail area and the Employment areas with B1, B2 & B8 units.

7.7.1 Access Road:

Due to the nature of the site with heavy traffic movements the road will be constructed as a standard industrial type road with runoff being drained via gullies. To provide a SUDs element these will drain to a network of road side swales and filter trench. The swales then link through to the attenuation pond. This will provide a first treatment to runoff and improve the downstream water quality.

7.7.2 Retail Area:

Runoff from the roads and parking areas will drain via a permeable paved surface to the sub base below. Storm water will be stored temporarily within the voids with the flow being restricted to a typical Greenfield runoff rate of 9l/sec. This will then link to the main storm system and outfall to the attenuation pond. This will provide a first treatment to runoff and improve the downstream water quality.

Roof runoff will be collected by traditional guttering and downpipe system where it will be discharged to the sub base of the permeable paving structure within the parking areas via permavoid® diffuser cells.

Rainwater Harvesting will be considered for all buildings which will provide an opportunity to recycle rainwater for use in toilet flushing. This will be part of any detailed planning application for the proposed units.

7.7.3 Employment Areas:

Runoff from the roads and parking areas will drain via a permeable paved surface to the sub base below. Storm water will be stored temporarily within the voids with the flow being restricted to a typical Greenfield runoff or a minimum rate of 5l/sec within the prominent car parking areas. This will then link to the main storm system and outfall to the attenuation pond. This will provide a first treatment to runoff and improve the downstream water quality.

Roof runoff will be collected by traditional guttering and downpipe system where it will be discharged to the sub base of the permeable paving structure within the parking areas via permavoid® diffuser cells or to adjacent swales.

Rainwater Harvesting will be considered for all buildings which will provide an opportunity to recycle rainwater for use in toilet flushing. This will be part of any detailed planning application for the proposed units.

7.7.4 Attenuation pond:

The attenuation pond has been designed as a dry landscaped pond and will cater for all storm events up to and including for the 1 in 100 year + 30% climate change events in accordance with Environment Agency requirements. A low flow channel will be incorporated within the base which will allow the pond to act predominantly as open space; the channel will also be planted with reeds or similar to provide a final improvement in water quality.

The discharge from the attenuation pond will be restricted to a maximum discharge of 56l/sec (QBar) to the Oldlands Farm Ditch.

As required by the Environment Agency all surface water attenuation features are above the fluvial flood level of 2.0m AOD and located within Flood Zone 1.

- 7.8 As the site is being raised above the fluvial floodplain with imported fill and due to the nature of the existing sub strata all SUDs features will be sealed with an impermeable membrane. This is to prevent site runoff infiltrating to the made ground and creating stability issues. This will also prevent groundwater entering the pond creating less capacity than required.
- 7.9 Preliminary surface water attenuation calculations have been carried out using the Micro Drainage suite of programs as shown in Appendix H.

The site covers an area of 12.5Ha of which approximately 9.8Ha will be hard paved

Attenuation summary:

Location	Impermeable Area Ha	Discharge Rate	Storage Type	Volume required m ³
Neighbourhood Hub area,	2.4	9 l/sec	Permeable paving	2100
Employment Area 1	0.8	5 l/sec	Permeable paving	525
Employment Area 2	1.0	5 l/sec	Permeable paving	725
Employment Area 3	0.6	5 l/sec	Permeable paving	375
Attenuation Pond	5.0	56 l/sec	Dry Pond	
	9.8			

Discharge rates & volumes based on 100 year + climate change storm events

8 Foul water drainage strategy

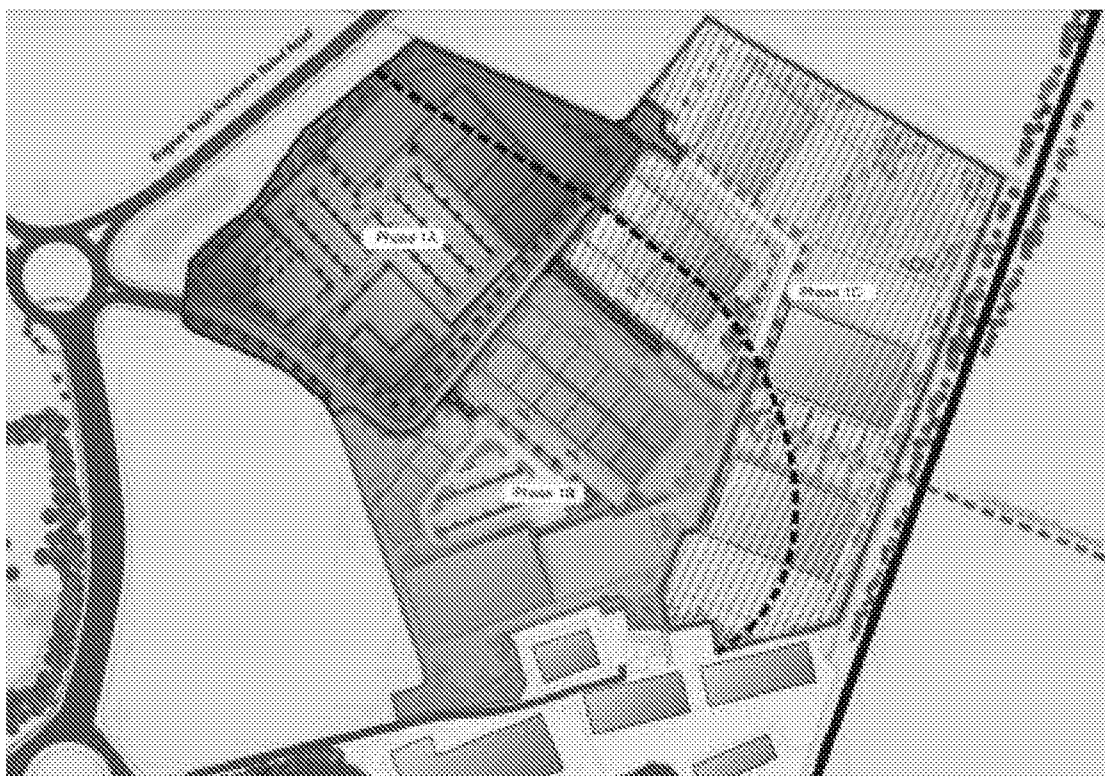
- 8.1 It is proposed that the foul water discharge from each unit will drain via gravity through a piped network before discharging to a sewer system within the development road network.

This sewer will convey flow to a pumping station located at the northwest corner of the site. The station will then pump via a rising main to a point on the existing foul sewer system within Shripney Road as indicated by Southern Water.

The pumping station & rising main to serve the site is being secured under a Section 98 off-site sewer requisition with Southern Water. The design process for this is currently with Southern Water's consultants.

9 Development Phasing

- 9.1 Construction of the development is to be broken up into 3 phases 1A, 1B & 1C as shown below. 1A will be the initial phase which forms the Neighbourhood hub together with the main access road, followed by phases 1B and 1C.



- 9.2 To facilitate the proposed development phasing it is intended to also phase the flood compensation works into two sections. The first phase flood compensation will enable Phases 1A & 1B to be constructed with ground levels brought up to above the 2.0m predicted flood level contour. The second phase of flood compensation will then enable Phase 1C to be constructed.
- 9.3 The proposed floodplain compensation area is to the north of the new Bognor Northern Relief Road (BNRR) and to the east of the Oldlands Farm Stream. The proposal is to extend the existing compensation area as shown in Appendix J. The flood compensation has been designed to provide a "volume-for-volume" and "level-for-level" basis to ensure no loss of floodplain occurs.

9.4 Flood Compensation areas & volumes.

Phase 1A & 1B Existing site area:

Ex Ground Level m AOD	Area of fill (m ²)	Volume of fill (m ³)
2.00	26,300	2,465
1.90	23,000	2,115
1.80	19,300	1,763
1.70	15,950	1,464
1.60	13,325	1,256
1.50	11,800	1,093
1.40	10,050	868
1.30	7,300	550
1.20	3,700	230
1.10	900	46
1.00	15	1
Total fill volume		11,849m ³

Phase 1 Flood compensation area:

Ex Ground Level m AOD	Area of fill (m ²)	Volume of fill (m ³)
2.00	28,500	2,790
1.90	27,300	2,673
1.80	26,150	2,558
1.70	25,000	2,440
1.60	23,800	2,335
1.50	22,900	2,220
1.40	21,500	2,068
1.30	19,850	1,625
1.20	12,650	918
1.10	5,700	443
1.00	3,150	158
Total cut volume		20,225m ³

- 9.5 Surface water runoff & attenuation from the Phase 1A & Phase 1B areas will be restricted and treated as previously outlined within the drainage strategy section. Phase 1A, The Neighbourhood Hub will be treated and attenuated via a permeable paved solution with sub base storage. The areas within Phase 1B will be attenuated via swales and permeable paving. A temporary outfall will be required until the main attenuation basin has been constructed.

10 Summary & Conclusions

- 10.1 The land has been allocated for commercial development as part of the Felpham Site 6 Housing Development. The proposed commercial development consists of the construction of a Neighbourhood Hub, together with a number of B1, B2 & B8 units with associated access roads, hardstanding parking areas and soft landscaping.
- 10.2 The Environment Agency's indicative Flood Map shows the site to be currently located within Flood Zones 1, 2 & 3.
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 100 year or greater annual probability of flooding from a river or stream in any year by the Environment Agency.
- 10.3 No other sources of flooding were identified on or within the vicinity of the site including that from groundwater, tidal, overland runoff (pluvial), artificial sources and flooding from overloaded existing and proposed sewer networks.
- 10.4 The areas within the development currently within flood zones 2 & 3 will be filled to take the site out of the known flood area and into flood zone 1 by using floodplain compensation and relocating the floodplain to adjacent land which currently lies above the 2.0m AOD contour.
- 10.5 The flood compensation has been designed in accordance with the normal Environment Agency policy and Appendix 3 of the CIRIA guide C624 entitled "Development and flood risk - guidance for the construction industry" where compensatory storage is provided on a "volume-for-volume" and "level-for-level" basis (e.g. for each 0.2 m slice of filling there is a slice of excavation at the same level and volume) to ensure no loss of floodplain occurs.
- 10.6 The existing sub strata consists on an impermeable clay with existing runoff discharging to the adjacent Oldlands Farm ditch. With infiltration techniques being unsuitable the runoff from the development will mimic the existing and will be restricted to a maximum Qbar discharge of 56l/sec for all storm events.
- 10.7 Surface water runoff will be managed in accordance with current requirements to mimic the existing runoff to Oldlands Farm Ditch by incorporating Sustainable Urban Drainage (SUDs) into development. The suitability of various techniques has been assessed using the SUDS management train as stated in the CIRIA Manual C697. The various techniques will be reviewed as to their suitability in consideration of the characteristics of the development to manage runoff at source. The use of SUDS systems will provide an improvement to the biodiversity and water quality and a reduction in runoff peak runoff flows.



-
- 10.8 The surface water runoff from the development for all storm events including the 1-year, 30-year, 100-year and 100-year +30% climate change storms will be attenuated and discharged into the adjacent watercourses.
- 10.9 The phasing of the flood compensation works into two Phases will allow the Phase 1A retail area and access road to be constructed at an early stage of the development which would be followed by the Phase 1B Employment area.
- 10.10 Foul drainage for the development is a traditional gravity system which will discharge to a pumping station. The pumping station & rising main is being secured under a Section 98 requisition with Southern Water, the design of which is currently underway.



Appendix A Site Plan



Appendix B

Preliminary Site Layout



NOTES:

SUBJECT TO STATUTORY CONSENTS
SUBJECT TO SURVEY

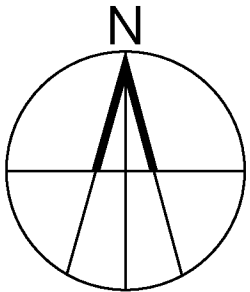
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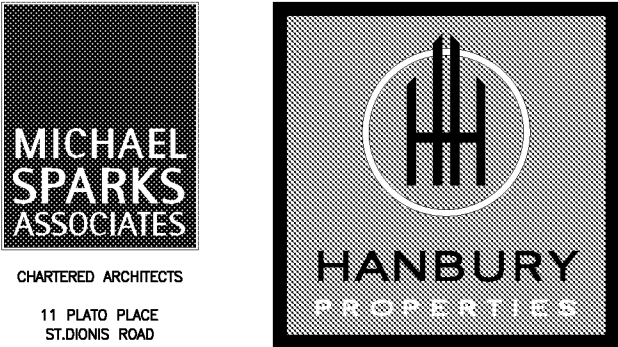
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INDICATIVE PEDESTRIAN / CYCLE ROUTE

A	24/05/2013	Amended cycle route and northern site boundary;	DEI	DE
..	29/05/2013	First issue	DEI	DE
REV	DATE	NOTE	DRAW	CHECK



TITLE
OLDLANDS FARM, BOGNOR

DRAWING
ILLUSTRATIVE SITE LAYOUT PLAN
OPTION 11

CLIENT
HANBURY PROPERTIES

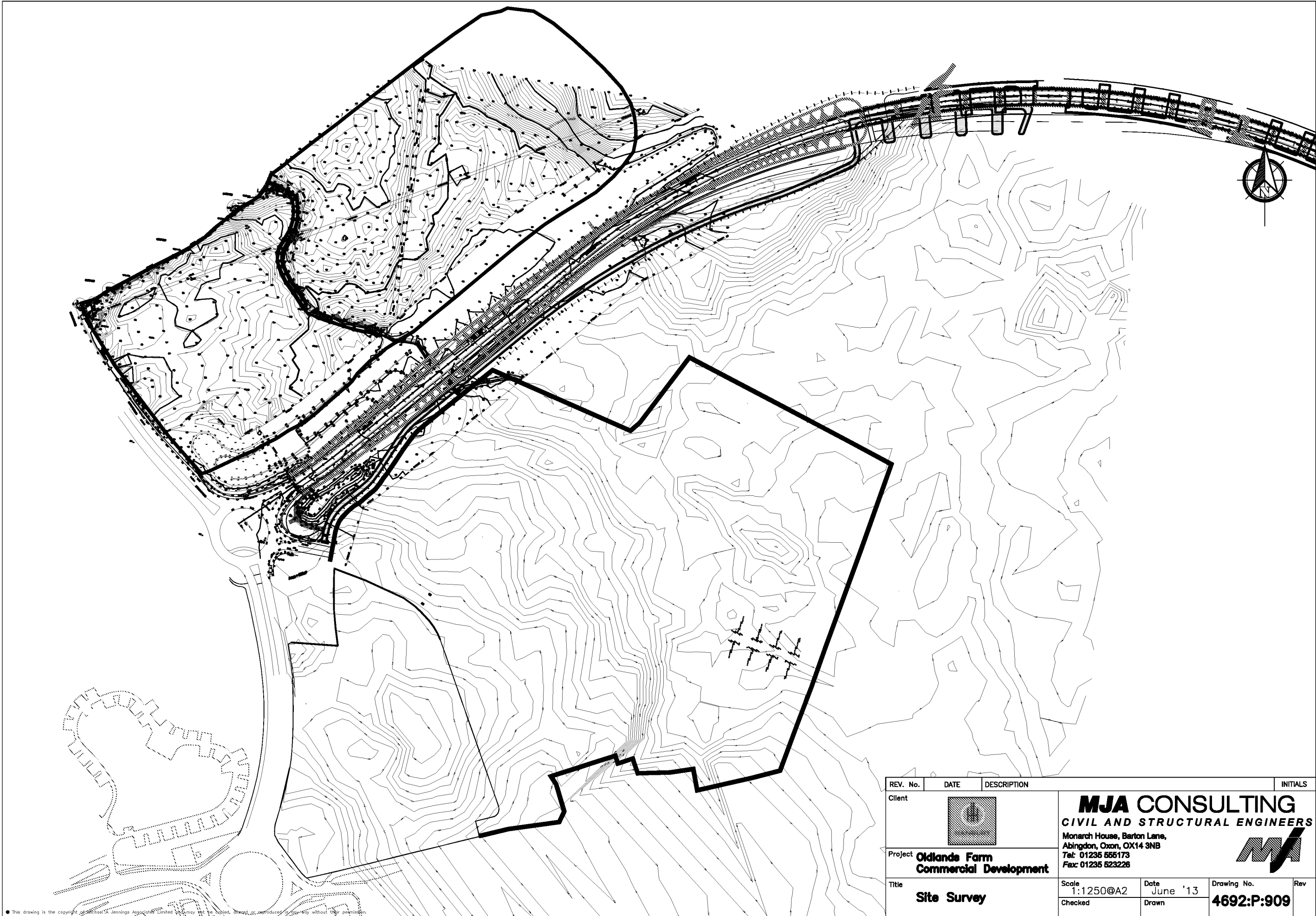
DATE MAY 2013	SCALE 1:1000 @ A1	DRAWN DEI
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DRAWING NUMBER
30603-FE-011 A

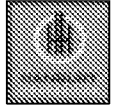


Appendix C

Topographical Survey



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REV. No.	DATE	DESCRIPTION	INITIALS
Client			
Project		Oldlands Farm Commercial Development	
Title		Site Survey	
Scale		1:1250@A2	Date
Checked			June '13
Drawn			
Drawing No.		4692:P:909	Rev

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Appendix D

Existing Floodplain Plan