Sandleford Partnership

Land at Sandleford Park, Newbury

Flood Risk and Drainage Assessment

A059486

Date December 09

REPORT CONTROL

Document:	Flood Risk Assessment
Project:	Land at Sandleford Park, Newbury
Client:	Sandleford Partnership
Job Number:	A059486
File Origin:	

Document Checking:

Primary Author	Colin Davidson	Initialled:	CD
Contributor	Richard Winn	Initialled:	RW
Review By	Stefan Morgan	Initialled:	SM

Issue	Date	Status	Checked for Issue
1	21.12.09	First Issue	SM
2			
3			
4			

This report has been prepared for the Sandleford Partnership, and any duty of care to any other party is excluded. Any other party using or intending to use this information for any other purpose should seek the prior written consent of WYG.

The conclusions reached are those which can reasonably be determined from the sources of information referred to in the report and from our knowledge of current professional practice and standards. Any limitations resulting from the data are identified where possible but both these and our conclusions may require amendment should additional information become available. The report is only intended for use in the stated context and should not be used otherwise.

Contents

Appendices

0 EXECUTIVE SUMMARY

Existing Site	The site is located approximately 2km to the South of Newbury town centre. The site is bounded by Monks Lane to the North, River Enborne to the South, Newton Road (A339) to the East and Warren Road to the West. The site comprises arable farmland with various pockets of woodland and covers a total area of 131 ha.
Flood Risk Assessment	The Environment Agency's website flood risk map shows the site to lie almost entirely within Flood Risk Zone 1 (low risk – likelihood of flooding less than 0.1% - 1 in 1000 year return period) with a very small area of flood risk zones 2 and 3a adjacent to the Northern bank of the River Enborne on the Southern Boundary of the site. It can be seen from the proposed land use plan however that the proposed areas of development within the site all fall within Flood Risk Zone 1 and a minimum distance of approximately 500m from the nearest higher flood risk zone. It is considered that the proposed development site is at low risk of flooding from sources including rivers and watercourses, overland flow, sewers and groundwater.
Site Drainage	The site is currently greenfield and the proposed new development will increase the impermeable area. In order to meet EA requirements surface water discharge from the site should not be increased. This will be achieved by the provision of attenuation storage within the site drainage system. This could be in the form of source control car park drainage, swales and detention basins. It is recommended that site investigations and permeability testing is undertaken to determine whether infiltration is feasible means for disposal of runoff.
Flood Risk Management	The proposed development lies in flood risk zone 1 and in accordance with PPS25 is considered suitable for the proposed development. The redevelopment will increase runoff, but through the use of onsite attenuation, surface water discharge from the site will not increase, so flood risk to downstream areas will not be increased.
Conclusions	It is concluded that the site is at low risk of flooding and suitable for the proposed development. A practical means of surface water management for the site can be provided.

1 INTRODUCTION

1.1 Background

This Flood Risk Assessment report has been commissioned by the Sandleford Partnership, which is promoting the site at Sandleford Park for development of up to 2,000 homes through the West Berkshire Local Development Framework (LDF). This Flood Risk Assessment is undertaken in accordance with Planning Policy Statement 25 and the accompanying guidance issued by the Department for Communities and Local Government – Development and Flood Risk: A Practice Guide Companion to PPS25.

1.2 Site Location

The site covers an area of approximately 131 ha, centred on grid reference 446800mE, 164700mN. A location plan, drawing A059486-001, is included in Appendix A.

The site is located approximately 2km to the South of Newbury town centre and lies within the district of West Berkshire Council. The site is bounded by Monks Lane to the North, River Enborne to the South, Newton Road (A339) to the East and Warren Road to the West. Newbury College lies adjacent to the sites North Eastern boundary, Newbury Rugby Club occupies land to the North of the site and Park House School borders the Western boundary of the site.

The site currently comprises arable farmland with various pockets of woodland.

1.3 Data Collection

Data sources that have been used for this flood risk assessment are:

- Site visit and topographical survey
- Environment Agency.
- West Berkshire Strategic Flood Risk Assessment (SFRA)
- Thames Water developer enquiry service.
- British Geological Society maps.

1.4 Proposed Development

The proposed development comprises approximately 2,000 residential dwellings. The areas of the site identified for development have been restricted to the Northern and Western parts of the site.

Land which is considered to be of higher landscape importance to the South, together with land currently occupied by pockets of woodland are to be retained, and no development will take place in these areas. Indicative land usage for the new development is shown on the Proposed Land Use Plan (see Appendix A).

2 DATA

2.1 Site Visit & Topographical Survey

Levels generally fall across the site from a highest level of approximately 124m AOD to the North Western boundary down to approximately 85m AOD in the South East where the site meets the River Enborne. The

topography is characterised by two shallow valleys descending in a South Easterly direction across the site, the base of these valleys forms a natural open channel drainage feature which is indicated as a drain on the Ordnance Survey map of the area. These drains transport surface water run-off into the River Enborne South of the site. A further drain conveys surface water runoff from a catchment in the North East of the site and discharges via a short culverted section into the more Easterly of the two main land drains.

There are two detention basins / balancing ponds present on site within the small strip of land to the rear of the household waste amenity site, and to the north of the land proposed for business use. A third balancing pond is present just outside the site boundary in land associated with the college immediately North of the plot proposed for business development.

A number of small, dry, ephemeral water courses were noted. Ponds are present within the hedgerow adjoining, and at the edge of, Waterleaze Copse.

Toward the south-eastern corner of the site (SU 4741 6421), a disused sewage filter bed is present within a fenced enclosure. It is understood that the filter bed was associated with the discharge from the school at Sandleford Priory.

Land beyond Monks Lane to the North of the site falls gently towards the town centre and away from the sites Northern boundary. To the East and West of the site the land lies at similar levels to the site, whereas the Southern boundary of the site lies partly within the base of the shallow valley through which the River Enborne flows.

A copy of the Mitcham Surveys Topographical Survey Plan for the site is presented within Appendix A.

2.2 Environment Agency

The Environment Agency's website flood risk map was consulted and site is found to lie almost entirely within flood risk zone 1 (low risk – likelihood of flooding less than 0.1% - 1 in 1000 year return period). There is a very small area of woodland adjacent to the River Enborne on the Southern boundary of the site which lies within flood risk zone 2 (likelihood of flooding between 0.1% and 1%) and flood risk zone 3a (likelihood of flooding >1%). The EA flood risk map is shown on drawing A059486-002 in Appendix A.

Correspondence from the Environment Agency (EA), dated 13th November 2009 (see Appendix B), provides details of the requirements for the flood risk assessment in terms of surface water management and discharge rates. This is considered further in section 4 of this report.

The EA have identified that the site drains to the River Enborne and have stated that there is a history of flooding affecting Sandleford Place, together with roads and property generally in the Newtown area.

Watercourses, ditches and ponds within the site are discussed within the EAs response, with recommendations that these features should be retained and where appropriate their ecological value should be improved. Buffer zones should be established for the entire length of watercourses within the site, with no development taking place within areas less than 10m from the watercourse (measured from the top of the bank). Where culverted sections of the watercourses exist on the site, the EA would like to see these returned to open ditches in line with its culverting policy.

The EA correspondence states that the EA would support the provision of wetland features such as ditches swales and ponds within open green space. As well as providing habitats, recreation and leisure benefits, it

is considered that wetland features will provide the majority of the surface water runoff attenuation and storage volume for the proposed development.

The Groundwater Vulnerability Map for the site area was also obtained from the EA's website (see Appendix B). The plan indicates that the site lies within Source Protection Zone II (Outer Protection Zone). As a result of these designations there may be restrictions placed on the use of infiltration methods of sustainable urban drainage. This could potentially lead to a need for an increased volume of storage in ponds or tanks on site, in order to adequately attenuate the off site discharge. This will need to be further considered at the planning stage.

2.3 West Berkshire Strategic Flood Risk Assessment

A copy of the West Berkshire Strategic Flood Risk Assessment (SFRA), dated May 2008 has been obtained. The principal urban areas considered by the SFRA are Newbury, Thatcham, Hungerford and the areas of Tilehurst, Purley and Calcot to the west of Reading.

The main areas of fluvial flooding discussed within the Newbury area relate to the flooding from the Rivers Kennet and Lambourne to the North of the town centre, approximately 2km from the site considered. Flooding of these lower lying areas is considered highly unlikely to have any affect on the Sandleford Park site. The flood risk map presented within the SFRA is very similar to the EA's flood risk map, showing a small area to the South of the site adjacent to the Northern bank of River Enborne where fluvial flooding may occur with an annual risk of occurrence of >1% (See Appendix B). The River Enborne demarks the boundary of West Berkshires district, as a result the presence of the West Berkshire district boundary line makes it very difficult to determine the precise extent of flooding in this area. It is clear however that this small area of fluvial flooding is a considerable distance from the areas of the site where development is proposed.

Figure A2 contained within the SFRA (see Appendix B) indicates that there have been a number of recorded flood events within the River Enborne to the South and East of the site. The nearest of these recorded flooding incidents to the site is located on the River Enborne adjacent to Sandleford Place which is situated next to the South Eastern corner of the site. No further detail of the flooding incidents is provided, however there is anecdotal evidence that flooding of River Enborne immediately upstream of the B4640 was the likely cause.

Figure 3 contained within Appendix G of the SFRA (See Appendix B) indicates recorded ground water levels beneath the site ranging between 70 and 75m AOD.

2.4 Thames Water

Thames Water (TW) sewer record plans have been received and are included in Appendix C. The record plans show numerous small diameter foul sewers (typically 150mm) serving the School and residential areas to the East of the site. These sewers flow away from the site into a main sewer running in a Northerly direction under Andover Road.

There are various highway drains and surface water sewers shown within Monks Lane. The plans indicate that one of the highway drains enters the Northern boundary of the site, and drains to Crook's Copse. It is likely that the highway drain discharges to a drainage ditch within the Crook's Copse, although it is recommended that this be formally proven on site. A drainage ditch is shown leaving the southern boundary of the copse on the site topographical plan. There is second location on Monks Lane, adjacent to the entrance of the Rugby club, where highway drainage terminates in an undefined end.

A further surface water sewer enters the site adjacent to the balancing ponds on the Eastern boundary of the site (immediately North of the Household Waste Recycling centre). This sewer is shown as a 375mm in diameter, and flows in a southerly direction through the area of proposed development for employment and finally discharging to the River Enborne near to Sandleford Place. The sewer records indicate a bifurcation at MH reference 3752, where part of the flow continues south as described above, however the other leg terminates abruptly at manhole reference 3651 just south of the balancing ponds.

A 180mm foul pumping main is shown in Newtown Road serving the developed area to the West of the site. The rising main discharges to a manhole adjacent the roundabout to the north east of the site from where foul flows gravitate to the North.

2.5 British Geological Society

Reference to the British Geological Society (BGS) Sheet 267 shows site underlying ground conditions to comprise of an unknown thickness of sand and gravels underlain by Barton, Bracklesham and Bagshot Beds. These beds predominantly comprise alternative beds of sands and clays. These strata are underlain by London Clay and then Chalk.

It is not possible to determine with any certainty from these underlying ground conditions alone, whether infiltration would be a feasible means of disposal of runoff from the site. The presence of clay layers at unknown depth beneath more freely draining soils dictates that intrusive site investigations and percolation testing would be required to assess the suitability of infiltration at detailed design stage. Furthermore the West Berkshire SFRA identifies high ground water levels are present within the county, although the ground water levels within the site appear generally to be more than 10m below ground level (as indicated on the SFRA recorded groundwater plan presented in Appendix A). Notwithstanding this the level of ground water would affect the suitability of the ground for infiltration and monitoring of ground water levels within the site is recommended as the detailed design is developed.

3 FLOOD RISK ASSESMENT

3.1 Fluvial Flood Risk

The Environment Agency's website flood risk map indicates that the site lies almost entirely within Flood Risk Zone 1 with very small areas of flood risk zones 2 and 3a adjacent to the Northern bank of the River Enborne on the Southern Boundary of the site. It can be seen from the development framework plan that these areas where the likelihood of flooding is more probable lie within wooded land approximately 500m from the nearest part of the site proposed for development. It should also be noted that the very lowest level of the land that has been identified for possible future development is approximately 105m AOD compared with river bed levels which lie somewhere in the region of 85m AOD.

There are two land drains conveying surface water flows from the Northern and Western parts of the site where future development is proposed, down to the River Enborne in the South. Flooding at the head of these drains within the area of proposed development is considered unlikely as a result of the distance from the River and the rise in land levels.

The site is therefore considered to be at low risk of fluvial flooding.

3.2 Tidal Flood Risk

The site is approximately 80km from the coast and intermediate areas are at lower levels than the site so the site is not considered to be at risk of tidal flooding.

3.3 Overland Flow

The proposed redevelopment of the site will not significantly alter ground levels and the site is at a similar level to the surrounding areas to the North, East and West, with areas to the South lower than the site, therefore overland flow is not considered to pose a significant risk.

3.4 Groundwater

No site investigation data is available at present, however comparing groundwater table levels of 70 – 75m AOD in the area of the site (as presented in Appendix G of the SFRA) with ground surface levels ranging from 85 – 125m AOD , it is considered unlikely that groundwater will pose a significant flood risk to the site.

3.5 Sewer Flooding

The sewers to the West of the site are small diameter and any overland flows would be channelled along the highways and follow a Southerly route dictated by the general fall of land towards the River Enborne.

A highway drain located within Monks Lane is shown to outfall into the site in the vicinity of Crook's Copse. Furthermore it is considered likely that a second highway drain in Monks Lane will also discharge into the site drainage from the Rugby Club on the Northern boundary. It is recommended that the outfall of these sewers is proven, and the suitability of the receiving ditches / watercourses assessed as part of the detailed design. Further investigation would also be recommended in relation to the purpose and destination of the branch leading from the 375mm surface water sewer within the site area proposed for employment use.

Having confirmed the existing arrangements for surface water draining into the site from the surrounding areas, it is considered that suitable arrangements can be made in the design of the site drainage to accommodate these flows. The new development will be drained by sewers designed in accordance with current best practice so the risk of flooding from sewers is considered to be low.

3.6 Artificial Sources

There is a risk of flooding to the land proposed for business development within the East of the site as a result of balancing ponds present to the North of this area overtopping during heavy rainfall. It should be noted however that there is no evidence of previous flooding from these ponds, and no recorded incidents of flooding in this area are highlighted within the plans accompanying the SFRA. Furthermore, land occupied for business use would be considered as a less vulnerable use under the sequential test described in PPS25. Provided that finished office floor levels are raised above the surrounding ground and associated parking levels, the risk of flooding from the ponds is not considered to be significant.

3.7 Climate Change

In accordance with PPS25, the effects of future climate change have been considered. The effects of climate change are likely to increase flood risk but as the site is considered to be at low risk at present the residual risk after taking into account climate change will remain low. The site drainage will be designed taking climate change into account thereby minimising the risk both to the site and the wider catchment.

4 SITE DRAINAGE

4.1 Existing site drainage

The existing site comprises arable farmland with several pockets of woodland and can be considered as greenfield. The EA has requested that calculations are undertaken to determine the existing site runoff rates using the Institute of Hydrology Report 124 method. Calculations undertaken using this method (see Appendix D) provide the following results:

Return period event	Discharge rate	Unit discharge rate
1 in 1 year	147.5 l/s	2.6 l/s/ha
1 in 30 year	381.9 l/s	6.8 l/s/ha
1 in 100 year	561.0 l/s	9.9 l/s/ha

Table 1 – Estimation of existing site runoff rates.

The soil runoff coefficient used in the existing site runoff calculations has a value of 0.37 and is derived from the Winter Rainfall Acceptance Potential map within the Wallingford Procedure. The value of 0.37 corresponds to W.R.A.P. Class 3 i.e. mixed areas of permeable and impermeable soils, in approximately equal proportions. This is consistent with the details obtained from the BGS sheet which indicates a potentially permeable superficial layer over impermeable strata.

4.2 Proposed new development drainage

In accordance with the recommendations in PPS25, the design of the new development will adopt measures to reduce the impact of surface water runoff through the use of sustainable drainage techniques.

The EA require the assessment of the use of sustainable drainage systems using the following hierarchy of techniques.

1. Surface water drainage attenuated through the use of infiltration methods such as soakaways unless ground conditions are proven to be inappropriate due to insufficient porosity or if gross contamination is present.

2. Surface water drainage attenuated through the use of above ground sustainable drainage techniques such as swales, attenuation ponds (both formal and informal as part of the general landscaping design), green detention areas and/or areas of permeable paving (especially within parking and pedestrian areas). All these methods can be designed into site layouts without the need for permeable ground conditions or where ground contamination is present and would still meet most of the core principles as set out in the Interim Code of Practice and CIRIA609 (p.29).

3. If the above cannot contain the full attenuation volumes required, then consideration will be given to their use in a combined system with other attenuation storage techniques.

Generally the EA requires that source control techniques such as permeable paving, swales and attenuation ponds are considered for inclusion in the site design.

No ground investigation data is available at present and no permeability testing has been undertaken, however, reference to British Geological Society (BGS) Sheet 267 shows site underlying ground conditions to comprise of an unknown thickness of sand and gravels underlain by Barton, Bracklesham and Bagshot Beds. These underlying conditions indicate that infiltration could potentially be a feasible means for disposal of runoff from the site, but intrusive site investigations and percolation testing would be required to confirm this at detailed design stage.

Should infiltration prove infeasible then it is proposed that surface water runoff from the developed site is discharged to the River Enborne via the existing open watercourses running from the Northern areas of the site to the River on the Southern boundary. At this early stage of the development it is suggested that a drainage system for the new development comprises a network of ponds, swales and open ditches within open green spaces, fed by piped systems serving individual areas.

The Environment Agency states that the discharge rate from the developed site should not exceed the current site discharge. Based on the Proposed Land Use Plan (see Appendix A) the impermeable area of the new development is estimated to be approximately 50% of the total site area which is an increase in impermeable area over the existing site. In order to meet the restricted discharge rate attenuation storage will be required. This could be provided in the form of source control car park drainage such as permeable paving; and swales and detention ponds within the site drainage system. Detention basins are vegetated depressions below surrounding ground that are dry except during and immediately after storm events. The outlets to flood storage attenuation structures are restricted via the use of flow control devices such as Hydro-brakes.

Preliminary surface water runoff calculations have been undertaken for a variety of storm durations and return period events (see Appendix D) and the estimated maximum storage volume required is 13,490m^3

for the 2 hour storm duration and 1 in 100 year plus climate change return period event. This attenuation storage volume is based on restricting the discharge rate to the existing site runoff rate of 561 l/s (1 in 100 year return period). The allowance for climate change includes a 30% increase in rainfall intensities (see table B2 in PPS25).

The attenuation storage could be provided by a network of ponds interlinked by a combination of existing and new drainage ditches. The new system of open ditches and watercourses would discharge to the River Enborne, as shown on the Indicative Drainage Layout drawing in Appendix D. Attenuation water levels within the ponds could be controlled by a combination of throttle pipes and weirs.

Foul Drainage

It is anticipated that foul flows generated by the proposed development will be discharged into the public foul sewerage network. TW have indicated that their existing infrastructure would not have sufficient capacity to accept the additional foul flow, and that significant upgrades would be required.

5 FLOOD RISK MANAGEMENT

PPS25 recommends that a risk-based approach and sequential test are used in order to determine whether a site is suitable for a particular development. The assessment of risk and sequential test are considered as follows:

The proposed development within the site is shown to be located within Flood Risk Zone 1, therefore, in accordance with PPS25, the site is considered suitable for the proposed development. This is backed up by the plans presented within the West Berkshire SFRA.

The redevelopment of the site will increase the impermeable area, but runoff will be restricted to existing rates by the use of infiltration, should it prove feasible; and source control and attenuation storage techniques.

Finished floor levels for the proposed new development should be set a minimum of 150 mm above surrounding ground levels in accordance with the Building Regulations so the future risk of flooding from surface water run-off or overland flow will be minimal.

6 CONCLUSIONS

It is concluded that the areas of proposed development are at low risk of fluvial flooding and in accordance with the requirements of the sequential test in PPS25: Development and Flood Risk, the site is suitable for the proposed development.

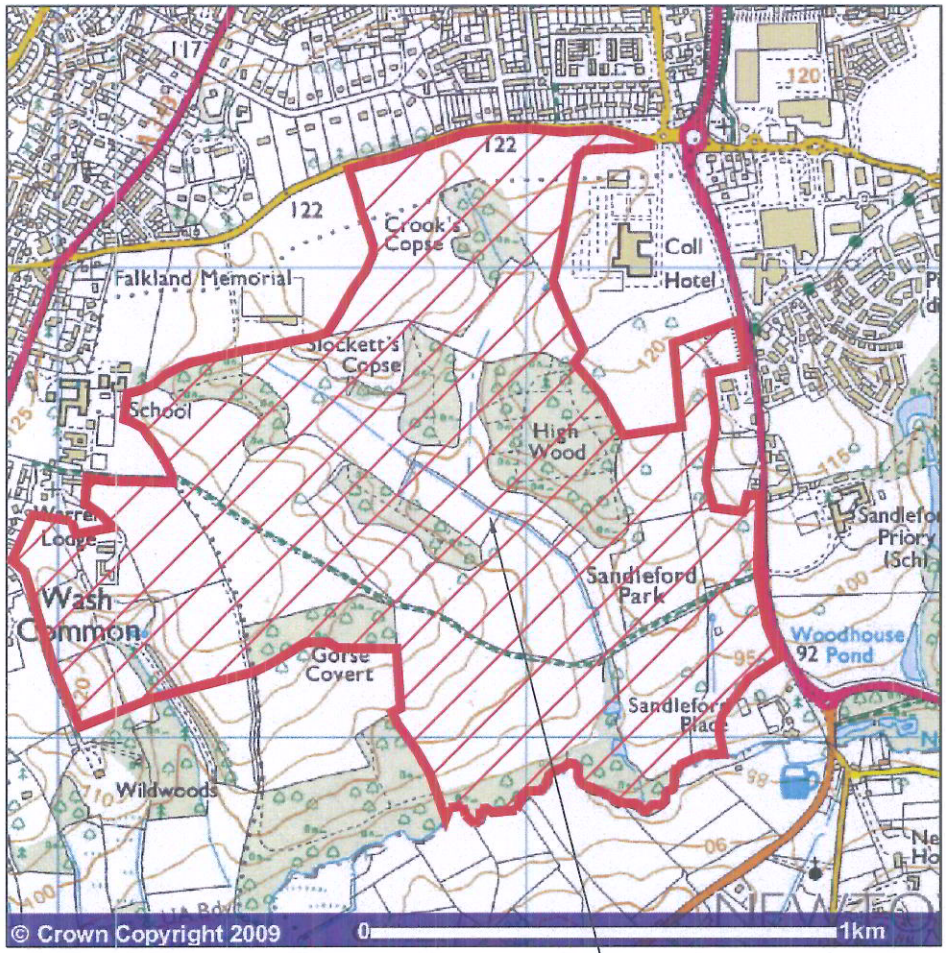
In accordance with the recommendations in PPS25, the design of the new development will adopt measures to reduce the surface water discharge through the use of sustainable drainage techniques. Should infiltration not prove feasible, then surface water runoff will be attenuated to existing rates, and will outfall to the River Enborne via the existing open watercourses which flow from the Northern areas of the site to the Southern boundary. It is recommended that source control techniques such as permeable paving for parking and vehicular access areas, and swales and detention basins are utilised to provide attenuation storage within the site.

This report concludes the site is at low risk of flooding and will not increase flood risk elsewhere in the catchment. Furthermore it is concluded that there is a practical means of surface water management for the site.

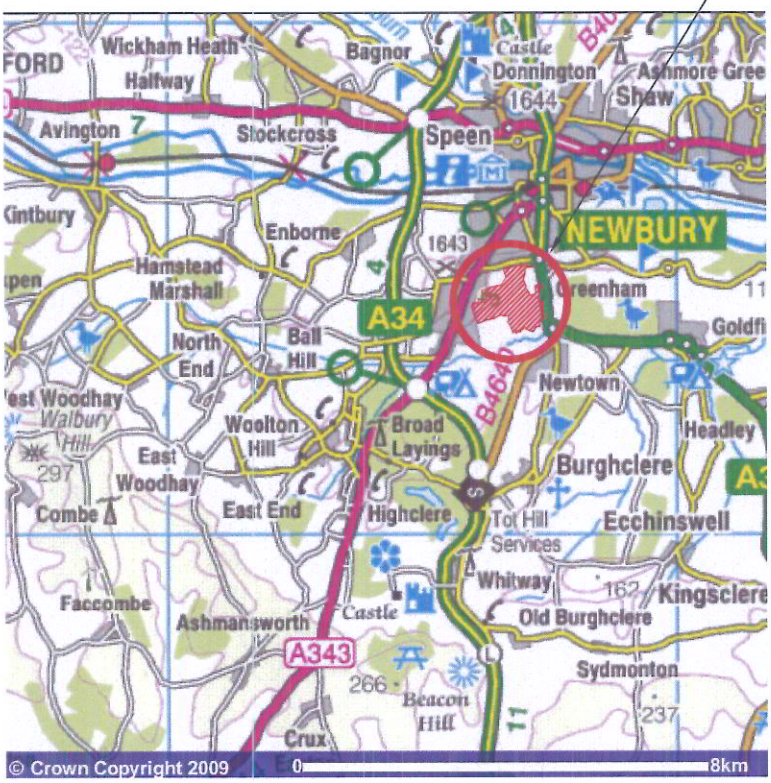
Appendix A

Site Location Plan – A059486-001
EA Flood Risk Map – A059486-002
Topographical Survey Plan
Proposed Land Use Plan

DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS



SITE LOCATION
LOCATION POST CODE : RG14 7TD
OS GRID REF: 446800mE, 164700mN



REV	DESCRIPTION	BY	CHK	APP	DATE
A	SITE BOUNDARY AMENDED.	CD	RW	SM	01.12.09

SANDLEFORD PARTNERSHIP

NEWSTEAD COURT, LITTLE OAK DRIVE
SHERWOOD BUSINESS PARK
ANNESLEY, NOTTINGHAMSHIRE
NG15 0DR

TEL: +44 (0)1623 684 550
FAX: +44 (0)1623 684 551
e-mail: nottingham@wyg.com

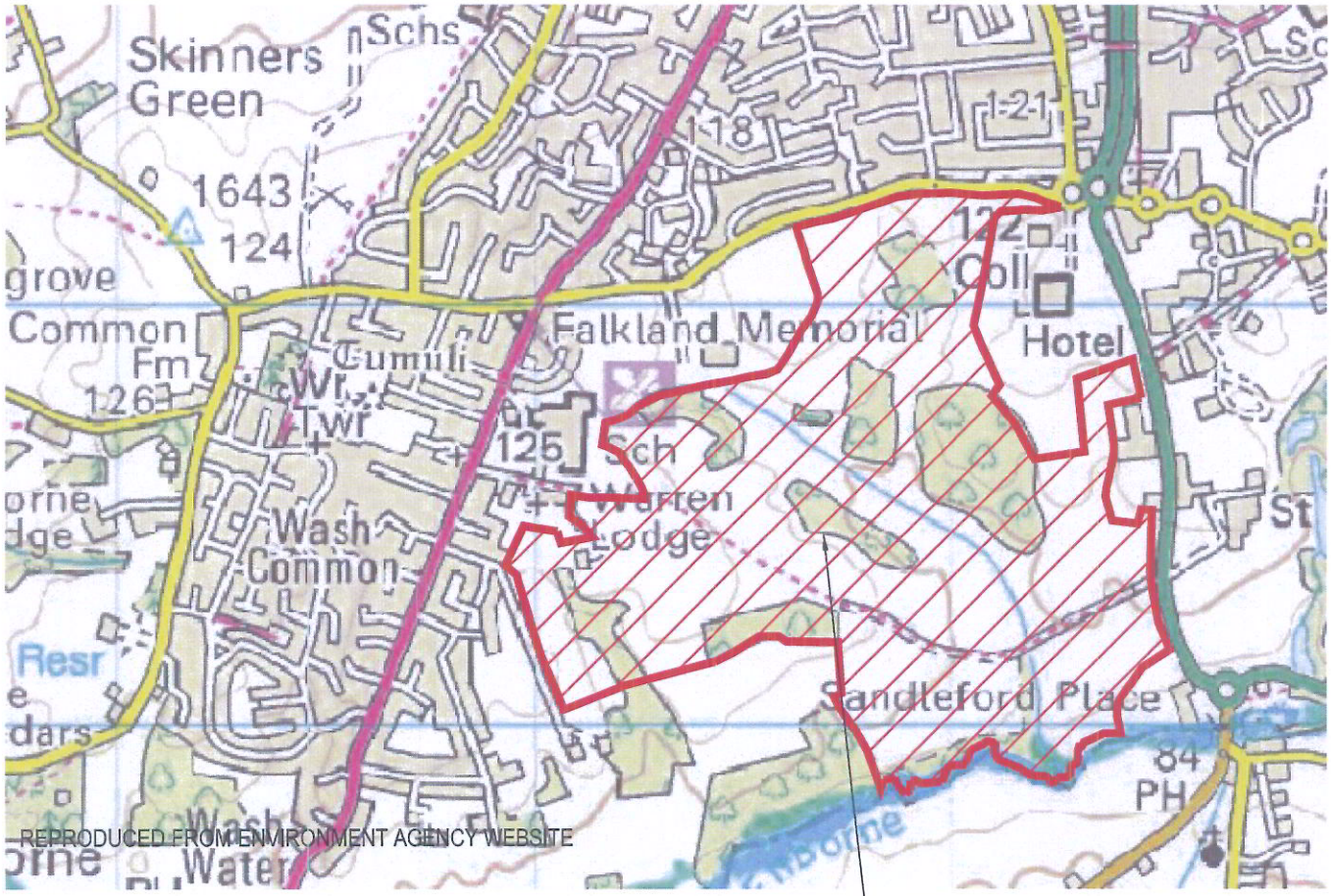
Project:
SANDLEFORD PARK
NEWBURY

Drawing Title:
SITE LOCATION PLAN

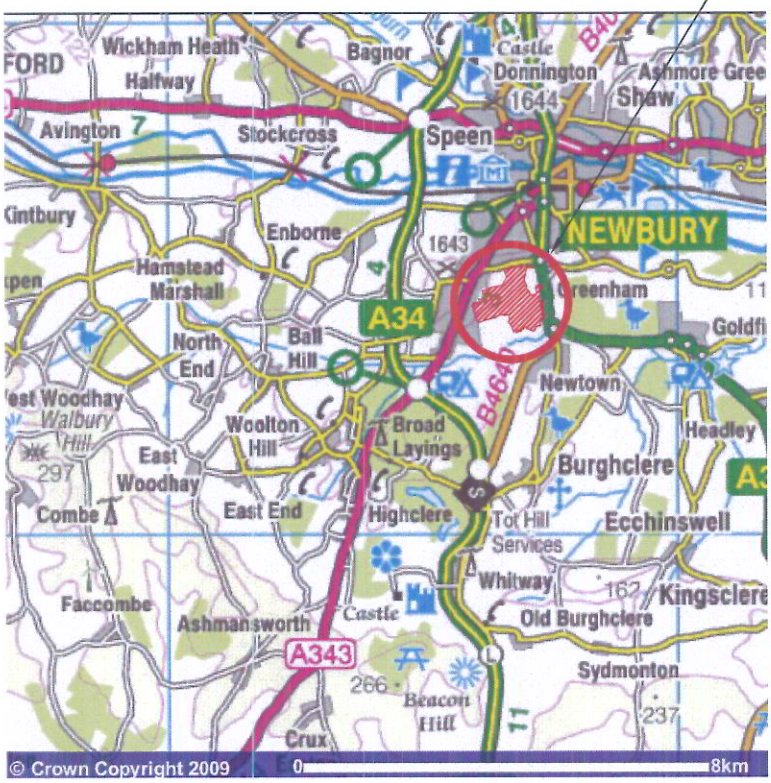
Scale @ A4	Drawn	Date	Checked	Date	Approved	Date
N.T.S.	RT	25.09.09	RW	25.09.09	SM	25.09.09

Project No.	Office	Type	Drawing No.	Revision
A059486	5101	C&S	001	A

DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS



SITE LOCATION
LOCATION POST CODE : RG14 7TD
OS GRID REF: 446800mE, 164700mN



REV	DESCRIPTION	BY	CHK	APP	DATE
A	SITE BOUNDARY AMENDED.	CD	RW	SM	01.12.09

NEWSTEAD COURT, LITTLE OAK DRIVE
SHERWOOD BUSINESS PARK
ANNESLEY, NOTTINGHAMSHIRE
NG15 0DR

TEL: +44 (0)1623 684 550
FAX: +44 (0)1623 684 551
e-mail: nottingham@wyg.com

Project:
SANDLEFORD PARK
NEWBURY

Drawing Title:
ENVIRONMENT AGENCY
FLOOD RISK MAP

Scale @ A4	Drawn	Date	Checked	Date	Approved	Date
N.T.S.	RT	07.10.09	RW	07.10.09	SM	07.10.09

Project No.	Office	Type	Drawing No.	Revision
A059486	5101	C&S	002	A

Note;-

Contour Interval: 1.0m

This survey is orientated North-South to a local grid with a scale factor of 1.00000.
All levels are above Ordance Datum derived by GPS methods and the OSTN02 / OSGM02 transformation.

Key

- General Fence
- Iron Railing / Palisades Fence
- Deer Proof Fence
- Gate
- Hedge
- Edge Of Vegetation
- Edge Of Bramble Scrub
- Top Of Slope
- Bottom Of Slope
- Line Of Drain / Stream
- Line Buried Pipe (Assumed)
- Kerb / Dropped Kerb. All levels shown are bottom of kerb
- Line Of Tree Canopy
- Sign Post
- Telegraph Pole
- Traffic Light
- Bus Stop
- Lamp Post
- Road Gulley
- Man Hole / Inspection Cover
- Marker Post
- Gate Post
- Fence Post
- Tree

Revision A 6 November 2009
Levels added on Newbury Rugby Club.
Detail and levels added to areas ommited due to the previous presence of livestock.

Revisions

N

MITCHAM

Mitcham Surveys – A Division of Mitcham Earthmoving Ltd
Southern Area Office – 28 Bourne Vale, Hungerford, Berkshire, RG17 0LL.
Tel/Fax 01488 681857 Mobile 07734 273712

Sandleford Partnership
Newbury
Berkshire

Sandleford Park

Site Survey
October 2009

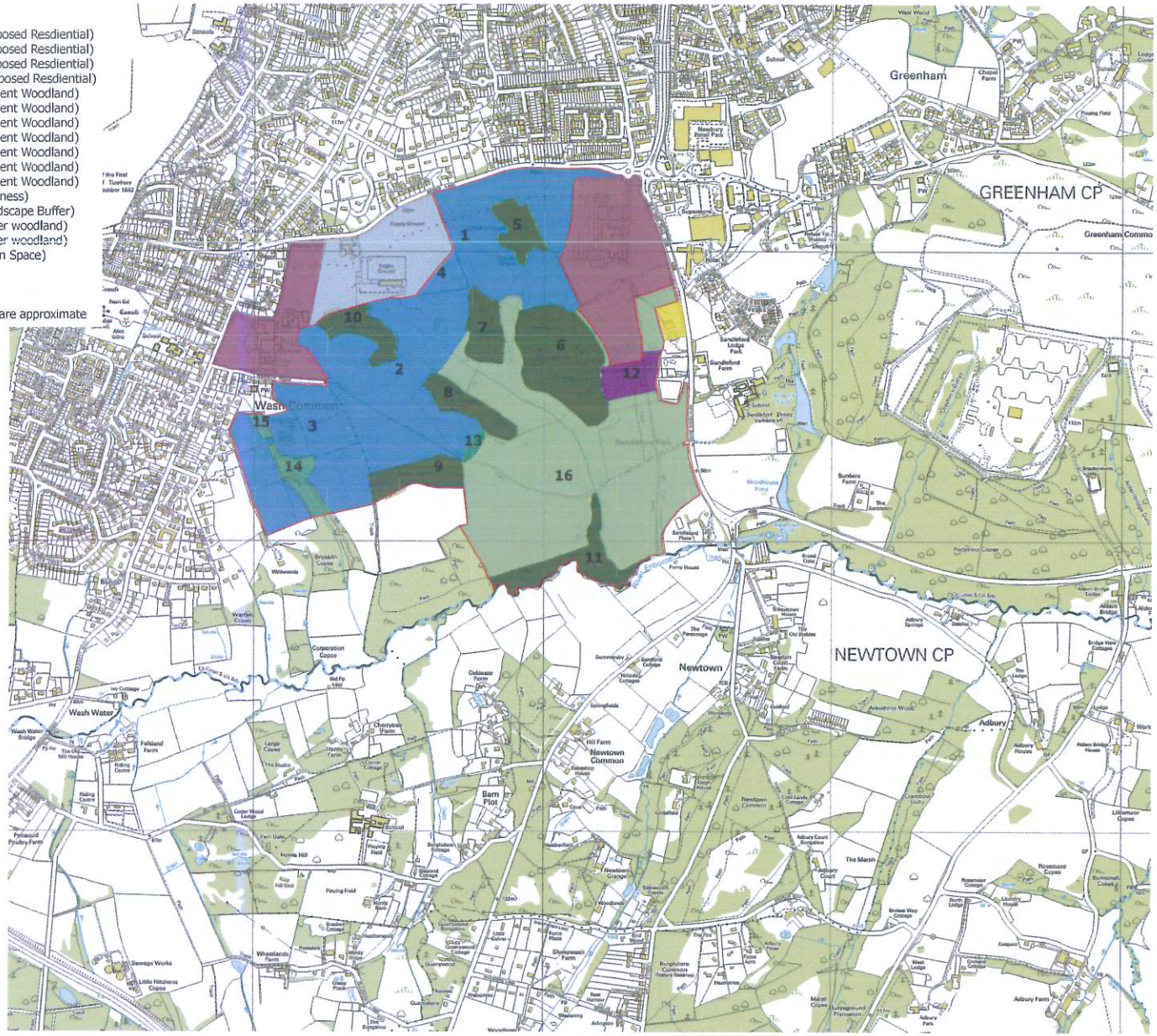
Drawn By. TJP	Job No. TP-730
Date. 11-NOV-09	Client Ref.
Scale. 1 : 2500	Drg No. 2a

SITE AREAS

1	16.21 ha (Proposed Resdiential)
2	21.69 ha (Proposed Resdiential)
3	14.92 ha (Proposed Resdiential)
4	01.22 ha (Proposed Resdiential)
5	02.30 ha (Ancient Woodland)
6	08.93 ha (Ancient Woodland)
7	02.68 ha (Ancient Woodland)
8	02.54 ha (Ancient Woodland)
9	02.84 ha (Ancient Woodland)
10	02.59 ha (Ancient Woodland)
11	03.96 ha (Ancient Woodland)
12	02.45 ha (Business)
13	00.35 ha (Landscape Buffer)
14	01.94 ha (Other woodland)
15	00.39 ha (Other woodland)
16	45.99 ha (Open Space)

Total 131 ha

Please note all areas are approximate



- Site Area
- Proposed Residential
- Proposed Business Use
- Ancient Woodland
- Other Woodland
- Open Space / Public Park
- Education
- Rugby Club
- Household Amenity Site

Notes:

Porposed Land Use Plan
for
Sandleford Park

DWG Nº: HP07098

Drawn: LA

Checked: SG

Scale: Not to Scale

Date: 24.06.2009

The Loft
St Clair's Farm
Wickham Road
Shedfield
Hampshire
SO32 2HW

tel: 01489 872 929
fax: 01489 872 939
www.wyg.com

Appendix B

Environment Agency Correspondence
Plans from the West Berkshire Strategic Flood Risk Assessment

Mr Robert Thompson
White Young Green Consulting Ltd
Newstead Court Little Oak Drive
Annesley
Nottingham
NG15 0DR

Our ref: WA/2009/107251/01-L01
Your ref: -

Date: 13 November 2009

Dear Mr Thompson

PROPOSED DEVELOPMENT COMPRISES RESIDENTIAL, COMMERCIAL AND NEW SCHOOLS.
SANDLEFORD PARK, NEWBURY, RG14 7TD

Thank you for your consultation, which we received on 27 October 2009.

Environment Agency Position
We are pleased to take part in pre-development discussions. We encourage this process to help to shape future applications.

We have reviewed the submitted information and have the following comments to make.

The application lies within Flood Zone 1 defined by Planning Policy Statement 25 as having a low probability of flooding. However the proposed scale of development may present risks of flooding on-site and/or off-site if surface water run-off is not effectively managed. Paragraph E9 of PPS25 requires applicants for planning permission to submit a FRA when development on this scale is proposed in such locations.

The site drains to the River Enborne that flows within a relatively incised valley at this location and there is a history of flooding affecting Sandleford Place, other roads and property in Newtown generally.

Development runoff should be strictly controlled to Greenfield runoff rates and sustainable drainage techniques (SUDS) employed to ensure that downstream flood risk is not increased and, wherever possible, reduced.

Any surface water strategy should utilise sustainable drainage techniques, in accordance with the SUDS management train (Ciria C609). Guidance on the preparation of surface water strategies can be found in the Defra/Environment Agency publication "Preliminary rainfall runoff management for developments".

Cont/d..

Guidance on climate change allowances can be found within Annex B of PPS25.

From the information you have supplied it would seem that the QMED equation in The Institute of Hydrology Report 124 may be appropriate for this site.

Surface water run-off should be controlled as near to its source as possible through a sustainable drainage approach to surface water management (SUDS). SUDS are an approach to managing surface water run-off which seeks to mimic natural drainage systems and retain water on or near the site as opposed to traditional drainage approaches which involve piping water off site as quickly as possible. SUDS involve a range of techniques including soakaways, infiltration trenches, permeable pavements, grassed swales, ponds and wetlands. SUDS offer significant advantages over conventional piped drainage systems in reducing flood risk by attenuating the rate and quantity of surface water run-off from a site, promoting groundwater recharge, and improving water quality and amenity.

The variety of SUDS techniques available means that virtually any development should be able to include a scheme based around these principles.

Further information on SUDS can be found in:

- PPS25 Annex F
- the PPS25 Practice Guide
- the CIRIA C522 document Sustainable Drainage Systems-design manual for England and Wales
- the CIRIA C697 document SUDS manual
- the Interim Code of Practice for Sustainable Drainage Systems. The Interim Code of Practice provides advice on design, adoption and maintenance issues and a full overview of other technical guidance on SUDS.

The Interim Code of Practice is available on both the Environment Agency's web site at: www.environment-agency.gov.uk and CIRIA's web site at www.ciria.org.uk

The development of the site offers a real opportunity for the sustainable enhancement of this site. We would recommend that the applicant investigates the use of a green roof. Green roofs offer a number of financial and environmental benefits over standard alternatives. In this particular location a green roof could enhance biodiversity and help attenuate surface water. Please look at the other benefits a green roof could offer on our green roof toolkit at http://www.environment-agency.gov.uk/business/sectors/91967.aspx.

The following representations outline some of the additional points we would wish to be considered.

Nature Conservation
We would expect all existing watercourses, ditches and ponds within the site to be retained and enhanced appropriately in terms of their ecological value. Additionally, we would expect that prior to the commencement of development a scheme for the provision and management of a buffer zone alongside all of the watercourses, ditches and ponds on site would be submitted to and agreed in writing by the local planning authority. Any such scheme should include:

- plans showing the extent and layout of the buffer zone,
- details of the planting scheme (for example, native species),

- details demonstrating how the buffer zone will be protected during development and managed/maintained over the longer term,
- details of any footpaths, fencing, lighting etc.

Development that encroaches on watercourses and ponds has a potentially severe impact on their ecological value. This is contrary to government policy in Planning Policy Statement 1 and Planning Policy Statement 9 and to the UK Biodiversity Action Plan. Land alongside watercourses and ponds is particularly valuable for wildlife and it is essential this is protected. Article 10 of the Habitats Directive also stresses the importance of natural networks of linked corridors to allow movement of species between suitable habitats, and promote the expansion of biodiversity. Such networks may also help wildlife adapt to climate change.

The buffer zone needs to be in excess of 10 metres wide measured from bank top for the whole extent of the site and this needs to be applied to both banks. Bank top is defined as the point at which the bank meets normal bank levels. This zone should be without structures, hard standing, footpaths, fences or overhanging development such as balconies and should not include domestic gardens or formal landscaping. The buffer zone needs to be designed and managed to develop this natural character and planted with locally native plant species of UK genetic provenance .

We would expect a scheme to be agreed to ensure that the landscape within the site is managed in such as way as to protect the ecological value of the site including the watercourses, ditches and ponds. To this end, we would expect that prior to the commencement of development a landscape management plan, including long- term design objectives, management responsibilities and maintenance schedules for all landscaped areas (except privately owned domestic gardens), would be submitted to and approved in writing by the local planning authority. The landscape management plan would then be carried out as approved and any subsequent variations agreed in writing by the local planning authority.

The scheme should include the following elements:
- detail extent and type of new planting (NB planting to be of native species),
- details of maintenance regimes,
- details of any new habitat created on site,
- details of treatment of site boundaries and/or buffers around water bodies.

This is necessary to ensure the protection of wildlife and supporting habitat and secure opportunities for the enhancement of the nature conservation value of the site in line with national planning policy.

Planning Policy Statement 9 (PPS9) requires that planning decisions should prevent harm to biodiversity interests (PPS9: Key Principles) and should also seek to enhance and expand biodiversity interests where possible. Article 10 of the Habitats Directive, and PPS9 (paragraph 12) stress the importance of natural networks of linked corridors to allow movement of species between suitable habitats, and promote the expansion of biodiversity. Such networks may also help wildlife adapt to climate change.

In line with the Environment Agency's culverting policy, we seek the removal of culverts wherever possible to re-establish river and bankside habitat and the continuity of the watercourse corridor. There are at least two lengths of culvert on the site that could be removed and an open channel with natural bed and banks re-established. In line with the remainder of the channel, we would then expect the

Cont/d..

buffer strip to continue through these areas and for them to be managed for nature conservation interests.

All the above issues are supported by Policy ENV.14 of the West Berkshire District Local Plan, which seeks to protect and enhance all waterway corridors as important open land.

The South East Plan Policy CC8 requires local authorities and partners to "work together to plan, provide and manage connected and substantial networks of accessible multi-functional green space" in the South East. The policy states that "Networks should be planned to include both existing and new green infrastructure. They need to be planned and managed to deliver the widest range of linked environmental and social benefits including conserving and enhancing biodiversity as well as landscape, recreation, water management, social and cultural benefits to underpin individual and community health and well-being".

Plans to enhance habitat for wildlife should clearly form part of this high quality, multifunctional green infrastructure. The South East Plan policy states that this should be planned into all major developments at the earliest possible stage. Along with the social and economic benefits, they we will seek to ensure that the green infrastructure plan achieves the main environmental benefits:

- Biodiversity conservation and enhancement.
- Climate change mitigation and adaptation.
- Protect and enhance the landscape, geodiversity and natural environment.
- Promote sustainable transport reducing the need to travel by car.

In terms of its function, the green space within the site should deliver a broad range of ecosystem benefits. This applies to the site as a whole: It is the green space within the site and links between the green spaces, when taken together, that a fully multifunctional green infrastructure network can be achieved.

In terms of the water environment within the wider Green Infrastructure, we would expect a development to demonstrate that the wetland features provide:

- Habitat provision and access to nature.
- Flood attenuation, water resource management and natural water 'cleansing'.
- Access, recreation, leisure benefits.
- Landscape setting.
- Links to existing networks of footpaths and to other development areas in this part of Newbury.

Green infrastructure should be developed into the heart of new and existing communities. Therefore the green infrastructure elements should be designed first, with the housing then fitted around them. This will include identifying the areas of habitat to be retained – like rivers, ditches, woodland and hedgerows, then identifying the best locations for other areas of open space and forming links between them and into the surrounding countryside. Maintaining and enhancing connectivity between the various ancient woodland blocks both within and adjacent to the site is of high importance, particularly for species such as dormouse. If possible some areas should be designated for wildlife benefit and should have limited access.

We would support the provision of wetland features that are incorporated into the links and corridors, such as ditches and swales as well as ponds in the areas of open green space.

Cont/d..

This would be in line with Policies ENV.8 and ENV.9 of the West Berkshire District Local Plan. Policy ENV.8 supports the management of land and water areas for nature conservation purposes and the creation of nature reserves with new development and land uses. Policy ENV.9 refers to the need within proposed development areas to sustain the ecological diversity of sites, the need for measures to safeguard and enhance existing nature conservation and habitat areas, including wildlife corridors and the opportunity to create new habitat areas to help improve the conservation status of locally vulnerable species.

Groundwater and Contaminated Land
Our records indicate the site is located on the Silchester Gravels over the former Bagshot Beds (now termed the London Clay Formation (Sand)). The London Clay Formation (Sand) is characterised by the presence of sand lenses and a higher sand content than the deeper London Clay Formation, and is classified as a Secondary Aquifer (formerly Minor Aquifer). The Silchester Gravels are also classed as a Secondary Aquifer.

Please consider the following points when you are going to submit the planning application for this development:

- Details of any surface water and foul drainage schemes to ensure the protection of groundwater quality.
- If demolition of buildings is planned (for example the building marked school) then potential sources of contamination should be identified and details of a scheme to mitigate the associated risks would need to be provided to ensure the protection of groundwater quality. Any potentially contaminated materials present (for example, oil storage tanks for heating, boilers and associated pipe work) could pose a risk to groundwater quality if they became mobilised during the demolition and development process.
- A consideration of new road development and the resulting impacts on groundwater quality from contaminated surface runoff. These impacts would require mitigation measures sufficient for the size and type of development (for example, oil interceptors) for the protection of groundwater quality.

Water Resources
The whole of southeast England has been designated an area of serious water stress due to limited water resources and high population. This designation is supported by the local water resource status assessed as part of the [catchment] CAMS, which is ‘no water available’/over-licensed or over-abstracted.

The southeast also has a high concentration of rivers and groundwater units which are over-abstracted or over-licensed. As such it is appropriate that water is used more wisely in the South East, and achieve more ambitious water efficiency targets than set out in the Building Regulations.

Any development at this site must consider water resources and water efficiency as a priority. We would like to see all dwellings built to a whole home water efficiency standard of 105 litres per person per day, or Code for Sustainable Homes (CSH) level 3/4. In order to achieve this we would recommend that you consider the following water efficiency measures:

- Rainwater harvesting
- Greywater recycling – including from showers and driveways to be used to flush toilets, water gardens.

Cont/d..

- Installation of water butts.
- Low flush or dual flush toilets
- Water efficient taps can half water consumption. For example, push top, spray or infrared taps.
- Careful landscape and maintenance planning ensuring grass is not cut too short, use of mulches to retain soil moisture and the provision of shade for plants requiring more water or using trees and shrubs which do not require as much watering.

Energy efficiency
We welcome new developments that incorporate energy efficiency. To tackle climate change it is essential that more efficient technologies are adopted and energy from sources that release far fewer – or no – carbon dioxide emissions is utilised.

- Solar thermal to harness energy for hot water
- Photovoltaic Cells that use daylight energy to produce electricity that can then power lighting and appliances (please note grants can be sourced from the Carbon Trust.
- Positioning buildings to make the best use of natural light.
- Using natural ventilation to create airflow through buildings removing the need for air conditioning.
- Wind Turbines – small scale turbines can be installed if wind speeds are appropriate.
- Combined heat and power units can lead to reduced CO2 emissions
- Ground source heat pumps

Please note due to the proximity of the site to a watercourse leading to River Enbourne all works carried out in connection with this development should comply with Environment Agency pollution prevention guidelines (PPG5): 'Works and maintenance in or near water'. Copies and further information are available from your local Agency office or from www.environment-agency.gov.uk/ppg.

You should confirm with the sewerage undertaker that; sufficent capacity remains to properly deal with the additional load and the sewerage conveying foul drainage to these works has sufficent hydraulic capacity.

For your information we also have our own guidance for developers, Building a Better Environment: A Guide for developers. This can be found on our website at http://www.environment-agency.gov.uk/business/sectors/32695.aspx.

Yours sincerely

Miss Juliane Hedel
Planning Liaison Officer

Direct dial 01491 828 486
Direct fax 01491 834 703
Direct e-mail Juliane.Hedel@environment-agency.gov.uk

End

425000 430000 435000 440000 445000 450000 455000 460000 465000 470000

188000 183000 178000 173000 168000 163000 158000

Legend

- West Berkshire District Council Boundary
- Recorded Flood Events
- West Berkshire Flood Event Outlines

N

0 900 1,800 3,600

Metres

PLEASE NOTE - The inclusion of any site on this map does not imply that development is supported.

JACOBS

CLIENT: West Berkshire District Council

PROJECT: West Berkshire SFRA

TITLE: **Recorded Flood Events**

DRG No: FIGURE A2

SCALE	DATE
1:125,000 at A3	24/09/07

DRN	CHK'D	APRV'D
EN	PA	PA

P:\BWA\jobs\GIS\Projects\West Berkshire SFRA\300 Project\A2_Recorded_Flood_Events.mxd

425000 430000 435000 440000 445000 450000 455000 460000 465000 470000

425000 430000 435000 440000 445000 450000 455000 460000 465000 470000

188000 183000 178000 173000 168000 163000 158000

Legend

- West Berkshire Boundary
- Main River
- Flood Zone 2 Medium Probability
- Flood Zone 3a Climate Change
- Flood Zone 3a High Probability
- Flood Zone 3b Functional Floodplain

N

0 1,000 2,000 4,000

Metres

JACOBS

CLIENT: West Berkshire District Council

PROJECT: West Berkshire SFRA

TITLE: **Fluvial Flood Risk Overview**

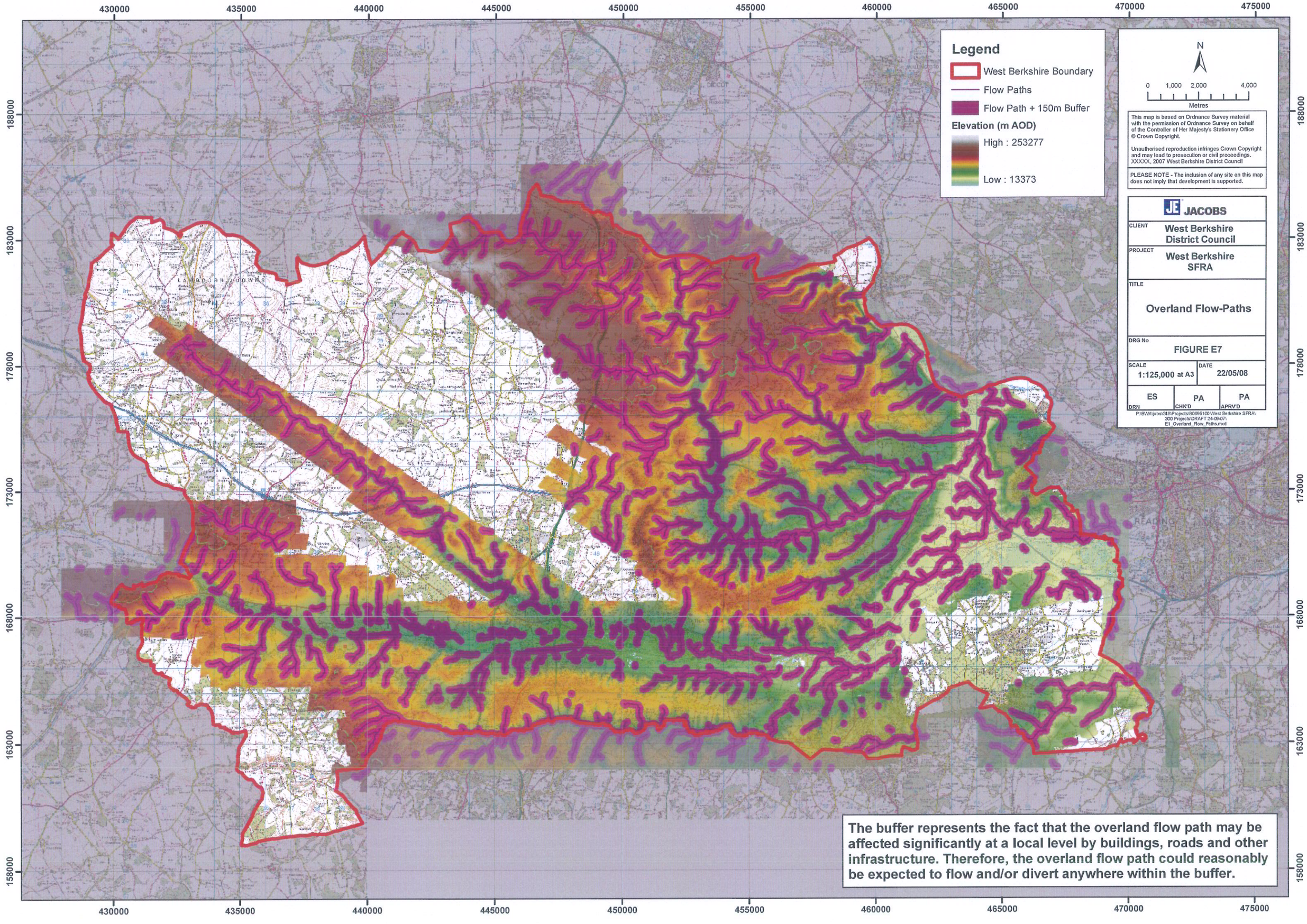
DRG No: FIGURE D1

SCALE	DATE
1:125,000 at A3	22/05/08

DRN	CHK'D	APRV'D
ES	PA	PA

P:\BWA\jobs\GIS\Projects\West Berkshire SFRA\300 Project\D1_Overall_Flood_Risk_Overview.mxd

425000 430000 435000 440000 445000 450000 455000 460000 465000 470000


Legend
West Berkshire Boundary
Flow Paths
Flow Path + 150m Buffer
Elevation (m AOD)
High : 253277
Low : 13373
N
0 1,000 2,000 4,000
Metres
This map is based on Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright.
Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. XXXXX, 2007 West Berkshire District Council
PLEASE NOTE - The inclusion of any site on this map does not imply that development is supported.
JACOBS
CLIENT West Berkshire District Council
PROJECT West Berkshire SFRA
TITLE Overland Flow-Paths
DRG No FIGURE E7
SCALE 1:125,000 at A3
DATE 22/05/08
DRN ES
CHK'D PA
APRV'D PA
P:\BWA\jobs\GIS\Projects\B0095100 West Berkshire SFRA\300 Projects\DRAFT 24-09-07\E1_Overland_Flow_Paths.mxd
The buffer represents the fact that the overland flow path may be affected significantly at a local level by buildings, roads and other infrastructure. Therefore, the overland flow path could reasonably be expected to flow and/or divert anywhere within the buffer.
430000
435000
440000
445000
450000
455000
460000
465000
470000
475000
188000
183000
178000
173000
168000
163000
158000

430000 435000 440000 445000 450000 455000 460000 465000 470000 475000

188000 183000 178000 173000 168000 163000 158000

Legend

West Berkshire Boundary

Main River

Bedrock Geology

- Barton, Bracklesham and Bagshot Beds
- Chalk including Red Chalk
- London Clay
- Oldhaven, Blackheath, Woolwich, and Reading and Thanet beds

N

0 1,000 2,000 4,000

Metres

JACOBS

CLIENT: West Berkshire District Council

PROJECT: West Berkshire SFRA

TITLE: District Geology

DRG No: FIGURE E8

SCALE: 1:125,000 at A3

DATE: 22/05/08

DRN	CHK'D	APRV'D
ES	PA	PA

P:\BWA\jobs\GIS\Projects\B0695100 West Berkshire SFRA\300 Projects\DRAFT 24-09-07\E1_Overland_Flow_Paths.mxd

F

Legend

Groundwater Contours (mAOD)

Scale 1:175,000

FIGURE 3
Groundwater Contours

Appendix C

Thames Water Sewer Record Plan

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2009_1659469

0 12.5 25 50 75 100 Meters

Scale:	1:1807
Width:	505m
Printed By:	jsoones
Print Date:	24/11/2009
Map Centre:	445750,164250
Grid Reference:	SU4564SE

Comments:

Sewer map.

ALS/ALS Standard/2009_1659469

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
6306	123	121.71
6304	123.94	123.08
6302	124.11	122.94
6355	124.18	123.17
7460	124.44	123.39
7410	124.53	123.21
7302	124.59	122.16
7461	124.52	123.42
7458	124.6	123.23
7301	124.72	120.27
7401	124.94	119.66
6105	124.17	122.34
6103	124.06	121.94
6104	122.67	119.72
6202	124.73	121.19
7104	120.73	119.1
7202	124.89	120.9
7151	119.86	118.67
7051	122.93	121.22
7155		
8201	124.06	
5305	117.76	116.59
5358	115.23	113.35
4352	115.58	114.23
6352	122.93	121.56
5306	118.4	117.35
5355	118.39	116.75
5357	119.46	117.9
5401	118.81	117.6
5454	122.5	121.05
6456		
6455	124.2	121.47
5253	116.69	114.8
5054	119.97	117.73
5053	121.42	117.93
6001	19.69	16.88
7003	123.44	120.97
5001	111.59	108.72
5002	115.07	112.05
5202	116.44	114.37
5251	114.76	113.01
5302	116	114.79
5303	117.18	115.61
5351	115.01	112.98
6453	124.58	121.8
6551	124.55	122.01
6503	124.57	122.2
6451	124.75	123.28
7451	124.82	122.47
7405	124.8	122.03
7454	124.73	122.94
7403	124.71	121.87
7456	124.77	123.18
5453	121.87	120.17
7404	124.75	122.05

REFERENCE	COVER LEVEL	INVERT LEVEL
6353	123.61	122.58
6303	124.42	123.33
6354	124.02	122.93
6301	124.3	122.45
7459	124.46	123.35
7409	124.46	123.12
7351	124.54	123.74
7408	124.63	122.98
7457	124.72	123.31
7407	124.72	123.23
7411	125.03	119.42
6201	124.49	121.99
6101	124.45	121.39
6151	122.5	120.45
7102	119.73	116.57
7152	120.56	118.49
7001	122.75	120.59
7103	119.79	118.27
7002	122.99	120.77
8101	124.17	122.63
5304	117.45	116.03
5307	115.2	113.42
5352		
5354	118.17	115.87
6351	121.37	119.71
6305	122.98	
5356	119.28	117.77
5403	119.24	118.3
5451	118.93	117.34
5402	119.64	117.69
5452	120.02	118.4
5151	115.54	113.22
5203	116.72	115
6002	19.54	16.78
5003	18.14	14.64
7004	123.68	121.16
7052	123.42	121.77
5051	113.55	110.15
5052	117.63	114.63
5252	116.43	113.93
5201	114.8	113.45
5301	114.77	113.57
5353		
6454	124.55	122.14
6403	124.62	122.53
6505	124.66	122.79
6552	124.56	122.18
6401	124.72	122.14
7453	124.76	123.12
7406	124.68	121.73
7455	124.66	122.88
7452	124.67	122.64
6404	124.29	122.67
7402	124.77	121.99
6405	124.27	122.87

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2009_1659469

0 12.5 25 50 75 100 Meters

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:1807
Width:	505m
Printed By:	jsoones
Print Date:	24/11/2009
Map Centre:	445750,164750
Grid Reference:	SU4564NE

Comments:

Sewer map.

ALS/ALS Standard/2009_1659469

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
6902	125.52	123.89
7851	125.17	123.41
8902	123.71	120.82
8901	123.8	120.72
8903	124.62	122.85
9851	125.09	122.11
1203	123.06	121.57
5801	125.73	124.01
5852	125.84	124.61
6951	125.71	124.1
6801	125.74	124.89
6952	125.49	124.31
6701		
7751	125.43	123.94
8702	125.61	121.57
9853	125.11	124.31
9801	125.35	116.75
8503	125.3	122.15
8601	125.57	118.21
5651	124.97	122.82
8651	125.41	122.84
5502	124.91	123.55
5503	124.65	122.84
5551	123.42	121.62
9551	124.93	123.79
9501	124.75	122.81
9502	124.46	123.21
8801	125.46	121.66
8851	125.37	124.12
9803	125.09	121.49
5501	124.6	122.85
6551	124.55	122.01
6502	124.54	122.31
6503	124.57	122.2
6554	124.75	122.75
8502	125.29	118.9
9554	124.31	123.5

REFERENCE	COVER LEVEL	INVERT LEVEL
7802	125.12	123.11
7801	125.19	124.02
8904	125.32	123.36
8905	125.26	123.52
9902	124.02	120.6
9901	125.18	116.32
5851	125.81	125.04
5901	125.95	124.31
5802	125.81	124.2
6901	125.73	123.14
6851	125.69	124.27
6852	125.61	124.14
7701	125.42	123.13
7752	125.38	123.84
8853		
9852	125.27	122.38
9804		
5504	124.83	123.24
8652	125.44	123.06
6601	125.13	124.04
8653	125.14	123.9
7501	125.06	122.27
6501	125.03	123.11
8701	125.45	117.5
9553	124.57	123.46
9552	124.86	123.25
8852	125.39	123.72
8854		
9802		
5552	124.19	122.77
6504	124.61	122.69
6553	124.58	122.41
6505	124.66	122.79
6552	124.56	122.18
8551	125.15	123.41
8501	125.34	118.76
9503	124.37	123.44

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2009_1659469

0 12.5 25 50 75 100 Meters

Scale:	1:1807
Width:	505m
Printed By:	jsoones
Print Date:	24/11/2009
Map Centre:	446250,164250
Grid Reference:	SU4664SW

Comments:

Sewer map.

ALS/ALS Standard/2009_1659469

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL

REFERENCE	COVER LEVEL	INVERT LEVEL

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2009_1659469

0 12.5 25 50 75 100 Meters

Scale:	1:1807
Width:	505m
Printed By:	jsoones
Print Date:	24/11/2009
Map Centre:	446250,164750
Grid Reference:	SU4664NW

Comments:

Sewer map.

ALS/ALS Standard/2009_1659469

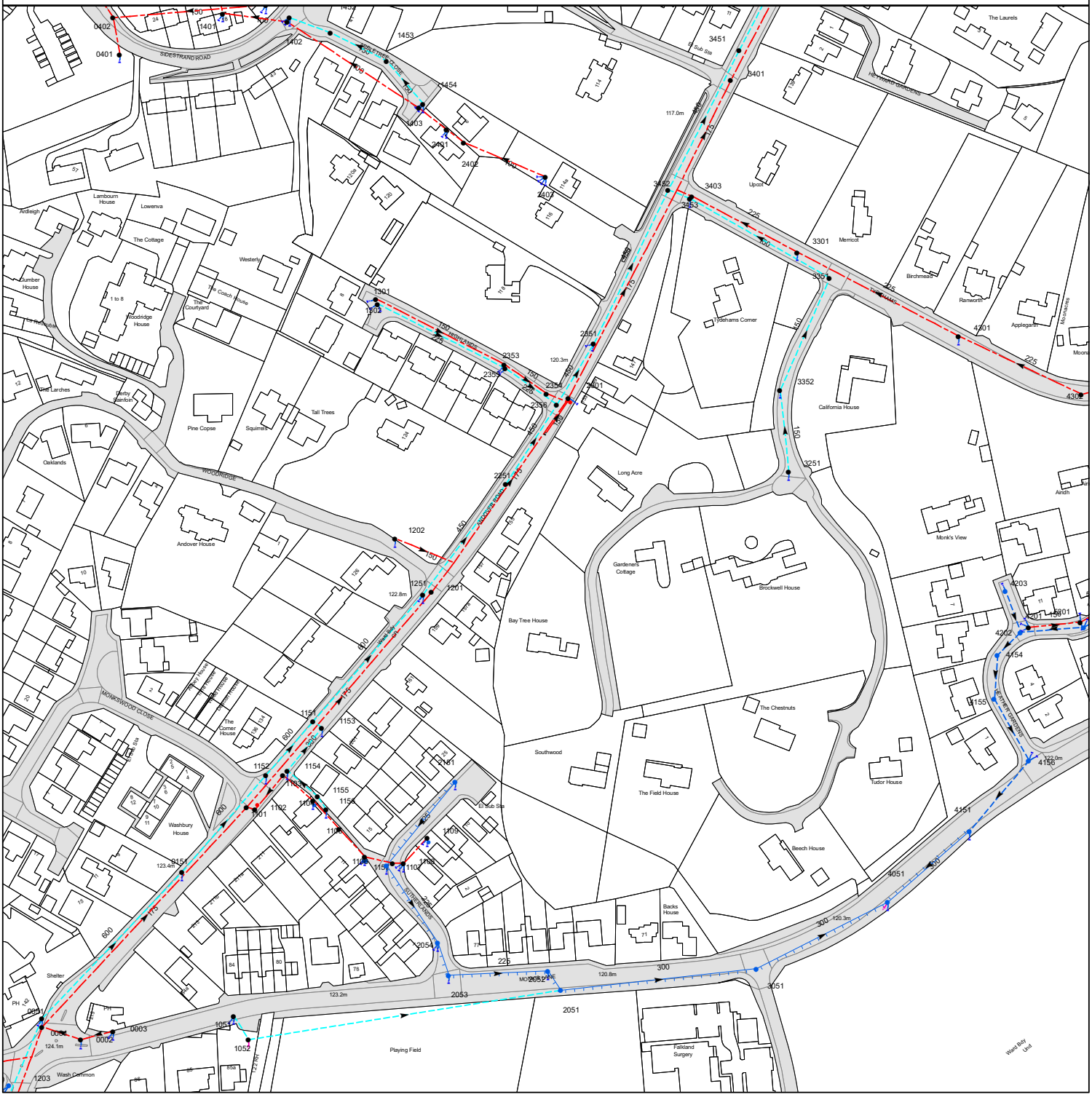
NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
1203	123.06	121.57

REFERENCE	COVER LEVEL	INVERT LEVEL

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2009_1659469



0 12.5 25 50 75 100 Meters

Scale:	1:1807
Width:	505m
Printed By:	jsoones
Print Date:	24/11/2009
Map Centre:	446250,165250
Grid Reference:	SU4665SW

Comments:

Sewer map.

ALS/ALS Standard/2009_1659469

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
2051	121.09	119.75
2052	121.05	120.05
1403	116.15	114.83
3401	116.06	111.54
4156	121.78	119.98
1151	123.12	121.06
4154	122.12	120.15
5222	122.48	120.34
1156	123.39	121.51
1104	123.47	119.53
2151	122.88	121.75
1103	123.17	119.41
2054	122.28	120.53
0151	123.43	121.09
1108	122.71	120.28
1106	122.97	119.93
4151	121.25	119.82
2403	120.85	120.08
3453	118	117.29
0402	103.4	102.34
1401	105.77	104.48
1451		106.52
1453	113.18	112.23
1251	122.91	120.71
4203	122.16	120.31
5201	122.42	120.35
0001	124.18	
0002	122.34	120.84
1051	123.82	122.37
1302		
3351	120.57	119.1
2301	120.87	112.67
2354		
2251	122.1	120.14
2355		
2351	120.07	117.77
3301	120.03	118.13
2401	118.14	116.95

REFERENCE	COVER LEVEL	INVERT LEVEL
2053	122.09	120.34
3051	120.76	119.29
1454	116.11	114.9
3451	115.38	113.24
1153	123.14	121.26
4155	121.86	119.83
4202	122.22	120.21
1102	123.34	114.99
1101	123.25	114.25
1155	123.45	121.32
1152	123.16	120.92
1154	123.16	121.26
4051	120.52	118.12
1157	122.63	120.97
1107	122.57	120.17
1109	122.88	121.04
1105	123.16	119.77
3452	118.05	115.67
3403	117.94	116.32
0401	104.54	103.51
1402	107.46	106.04
1452	109.46	108.32
1202	123.57	120.57
1201	122.92	113.42
4201	122.31	120.69
1203	123.06	121.57
0051	124.11	121.43
0003	122.25	121.27
1052		
1301		
2356		
4302	121.96	119.01
3352	121.7	120
3251	121.93	120.58
2353		
4301	121.59	118.59
2402	118.69	117.85

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2009_1659469

0 12.5 25 50 75 100 Meters

Scale:	1:1807
Width:	505m
Printed By:	jsoones
Print Date:	24/11/2009
Map Centre:	446750,163750
Grid Reference:	SU4663NE

Comments:

Sewer map.

ALS/ALS Standard/2009_1659469

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL

REFERENCE	COVER LEVEL	INVERT LEVEL

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2009_1659469

0 12.5 25 50 75 100 Meters

Scale:	1:1807
Width:	505m
Printed By:	jsoones
Print Date:	24/11/2009
Map Centre:	446750,164250
Grid Reference:	SU4664SE

Comments:

Sewer map.

ALS/ALS Standard/2009_1659469

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL

REFERENCE	COVER LEVEL	INVERT LEVEL

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2009_1659469

0 12.5 25 50 75 100 Meters

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:1807
Width:	505m
Printed By:	jsoones
Print Date:	24/11/2009
Map Centre:	446750,164750
Grid Reference:	SU4664NE

Comments:

Sewer map.

ALS/ALS Standard/2009_1659469

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL

REFERENCE	COVER LEVEL	INVERT LEVEL

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2009_1659469

0 12.5 25 50 75 100 Meters

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:1807
Width:	505m
Printed By:	jsoones
Print Date:	24/11/2009
Map Centre:	446750,165250
Grid Reference:	SU4665SE

Comments:

Sewer map.

ALS/ALS Standard/2009_1659469

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
8452	121.99	120.95
8451	121.88	120.68
9451	121.54	120.38
9401	121.36	119.83
6402	120.26	118.58
8151	115.05	115.04
9301	122.49	120.84
5202	122.4	120.2
5203	122.39	120.04
5204	122.42	119.87
5205	122.44	120.14
9252	122.43	120.33
9353	122.39	121.65
5303	121.89	119.26
8251	120.82	119.11
6204	122.44	120.94
5207	122.09	119.53
5302	122.07	119.42
9352	122.5	121.59
7301	122.09	120.54
9454	122.45	121.44

REFERENCE	COVER LEVEL	INVERT LEVEL
8401	121.89	120.57
9452	121.72	120.42
9453	121.58	120.52
9402	121.71	120.07
6401	120.35	118.14
5222	122.48	120.34
5201	122.42	120.35
5208	122.33	120.38
5221	122.48	120.48
5210	122.36	120.51
5220	122.49	120.71
6301	122.08	120.03
4302	121.96	119.01
5206	122.47	119.74
6201	122.48	120.64
8252	121.51	119.91
9251	122.18	120.01
931A	122.31	121.41
5301	122.11	119.6
9351	122.46	121.32

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2009_1659469

0 12.5 25 50 75 100 Meters

Scale:	1:1807
Width:	505m
Printed By:	jsoones
Print Date:	24/11/2009
Map Centre:	447250,163750
Grid Reference:	SU4763NW

Comments:

Sewer map.

ALS/ALS Standard/2009_1659469

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL

REFERENCE	COVER LEVEL	INVERT LEVEL

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2009_1659469

0 12.5 25 50 75 100 Meters

Scale:	1:1807
Width:	505m
Printed By:	jsoones
Print Date:	24/11/2009
Map Centre:	447250,164250
Grid Reference:	SU4764SW

Comments:

Sewer map.

ALS/ALS Standard/2009_1659469

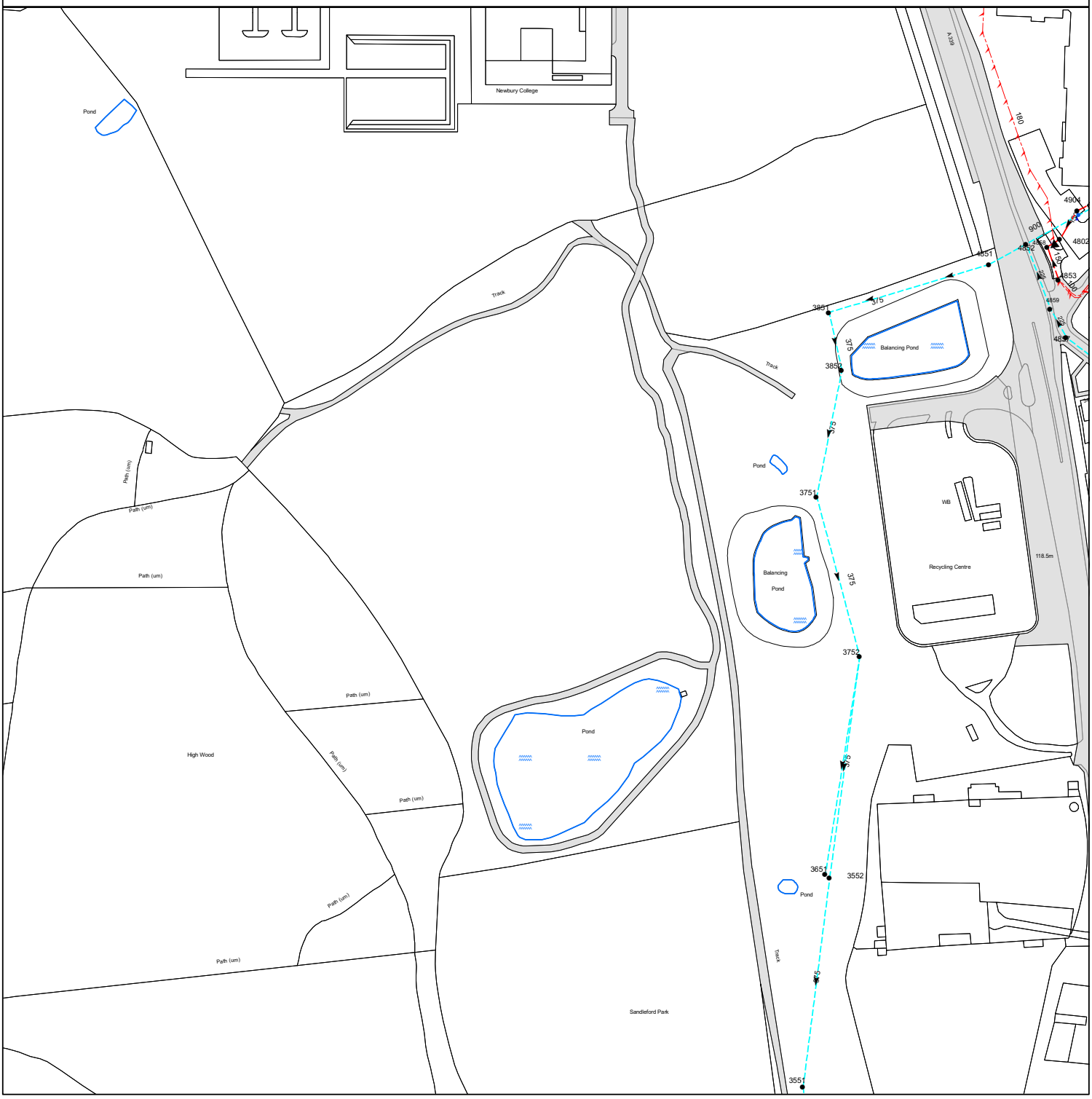
NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
3451	101.22	99.39
4251	94.85	93.14
3051	87.51	84.72

REFERENCE	COVER LEVEL	INVERT LEVEL
3351	98.73	97.15
4151	91.7	90.11
3551	105.15	103.43

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2009_1659469



0 12.5 25 50 75 100 Meters

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:1807
Width:	505m
Printed By:	jsoones
Print Date:	24/11/2009
Map Centre:	447250,164750
Grid Reference:	SU4764NW

Comments:

Sewer map.

ALS/ALS Standard/2009_1659469

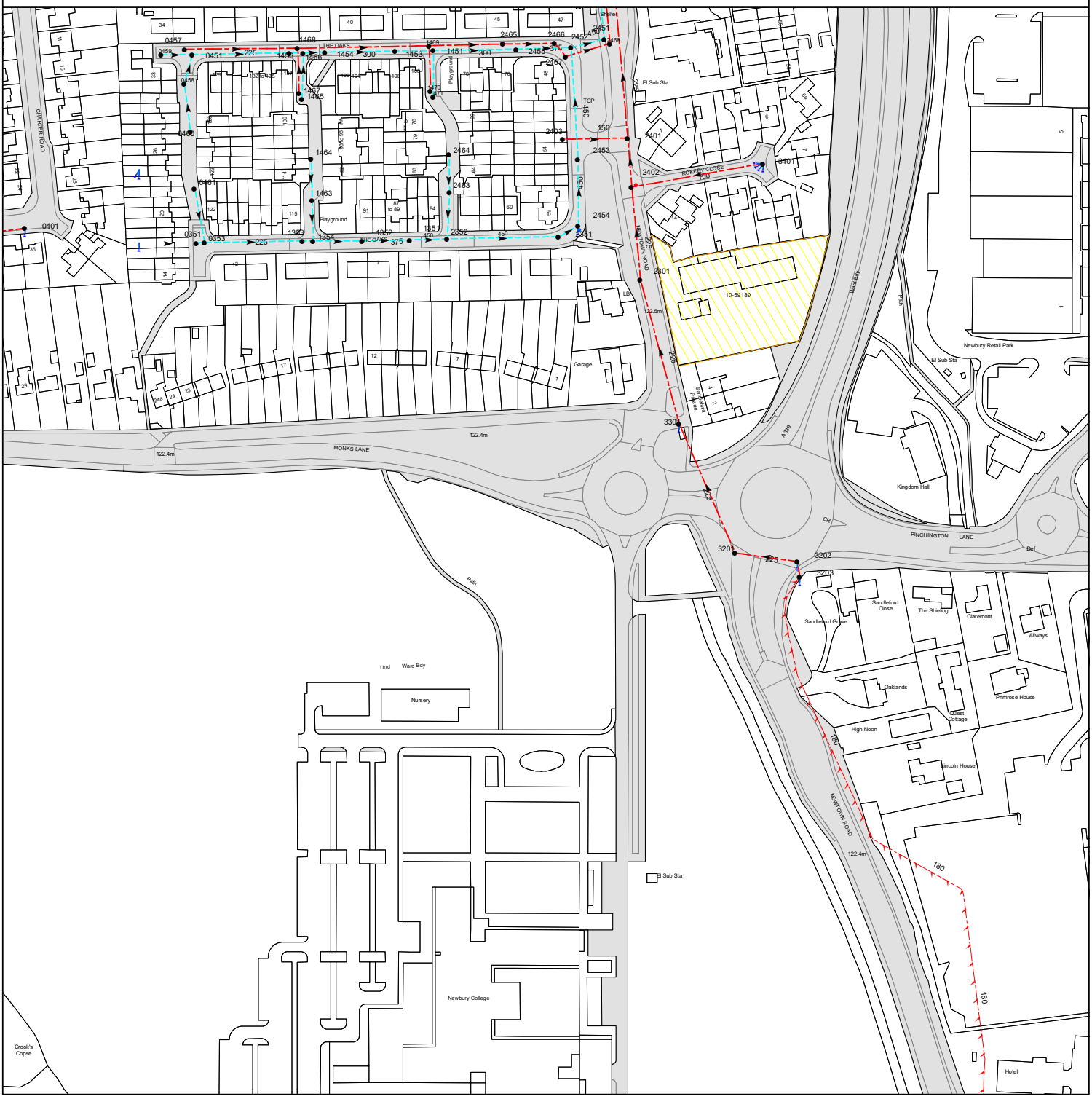
NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
4851	120.06	116.41
4852	120.92	119.13
4802	120.61	116.38
3751	115.65	113.93
3552	109.15	107.43
3851	119.24	116.79
4859	120.29	117.04
3551	105.15	103.43

REFERENCE	COVER LEVEL	INVERT LEVEL
4858		116.53
4853	120.06	119.16
4904	120.32	116.63
3651		
3752	113.15	111.43
3852	120.15	115.86
4857	120.13	116.18

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2009_1659469



0 12.5 25 50 75 100 Meters

Scale:	1:1807
Width:	505m
Printed By:	jsoones
Print Date:	24/11/2009
Map Centre:	447250,165250
Grid Reference:	SU4765SW

Comments:

Sewer map.

ALS/ALS Standard/2009_1659469

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
2452	122	119.16
2451	121.52	118.93
0458	122.11	120.76
0451	121.89	120.5
1468	122.03	119.62
1465	121.96	120.54
1454	121.94	120.04
1469	122.09	119.31
1451	121.13	119.82
2465	122.03	119.075
2466	122.05	118.79
0461	122.54	120.77
1463	122.55	120.59
2453	122.33	119.48
3401	122.87	121.65
3202	122.19	121.07
2301	122.44	119.86
0401	122.48	121.52
0353	122.45	120.49
1354	122.59	120.02
1351	122.45	119.75
2351	122.42	119.6
2464	122.15	120.82
2401	122.11	119.63

REFERENCE	COVER LEVEL	INVERT LEVEL
2468	121.68	118.355
0459		
0457	121.87	119.97
1456	121.89	120.22
1467	121.95	119.85
1466	122.08	119.62
1453	122.01	119.85
1470	122.36	120.19
1471	122.4	120.85
2455	122.03	119.46
2467	122.1	118.68
1464	122.26	120.93
2463	122.33	120.51
2402	122.27	119.7
3201		
3203	122.6	121.55
3301	122.52	120.02
0351	122.42	120.51
1353	122.41	120.07
1352	122.4	119.9
2352	122.58	119.66
2454	122.45	119.55
2403	122.11	120.15
0460	122.33	121.14

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2009_1659469

0 12.5 25 50 75 100 Meters

Scale:	1:1807
Width:	505m
Printed By:	jsoones
Print Date:	24/11/2009
Map Centre:	447750,164250
Grid Reference:	SU4764SE

Comments:

Sewer map.

ALS/ALS Standard/2009_1659469

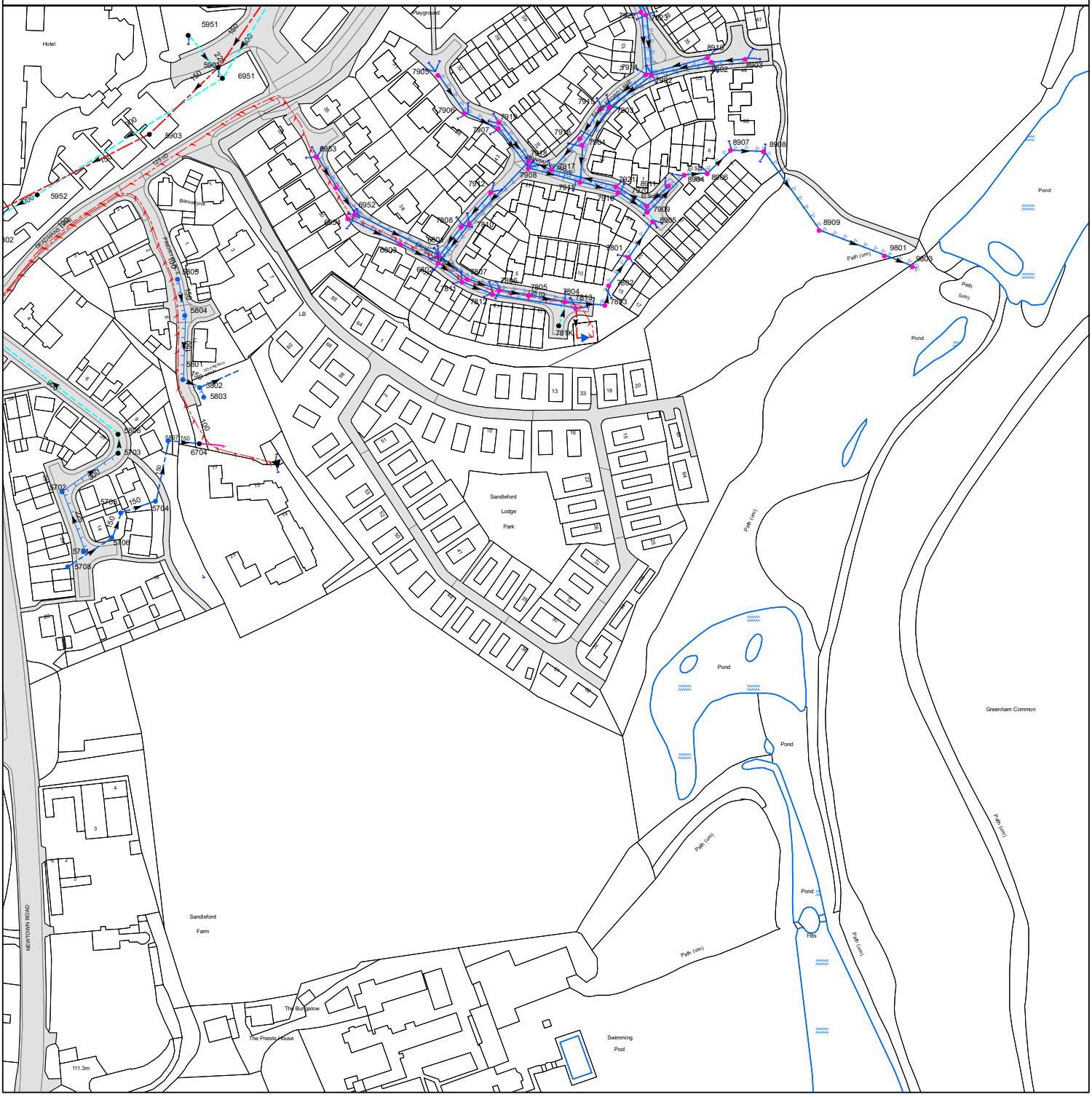
NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL

REFERENCE	COVER LEVEL	INVERT LEVEL

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2009_1659469



0 12.5 25 50 75 100 Meters

Scale:	1:1807
Width:	505m
Printed By:	jsoones
Print Date:	24/11/2009
Map Centre:	447750,164750
Grid Reference:	SU4764NE

Comments:

Sewer map.

ALS/ALS Standard/2009_1659469

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
5952	120.17	116.81
7910		
7911		
7908		
6953		
7916		
7907		
6954		
6803		
6801		
7811		
7810		
7806		
781K	116.69	114.2
7801		
5708	118.7	117.81
5706	119.22	117.64
5703	119.48	117.19
5704	118.88	116.56
6704	116.19	115.2
5803		
7906		
7903		
7905		
5951	120.62	118.19
7914		
7920		
7902		
8911		
8906		
8902		
8903		
8909		
9803		
5804	115.5	114.1
7813		

REFERENCE	COVER LEVEL	INVERT LEVEL
7912		
7921		
7917		
7918		
7904		
5903	119.93	117.19
5805	115.8	114.45
6952		
6802		
7808		
7807		
7812		
7805		
7802		
5702	119.24	117.79
5701	118.83	117.97
5806	119.47	117.18
5705	119	117.56
5807	119.25	116.37
5802		
7919		
7915		
6951	119.83	117.17
5901	120.23	117.47
7922		
7923		
7909		
8905		
8904		
8910		
8907		
8908		
9801		
5801	116.95	113.81
7804		
7803		

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0118 925 1504.

Appendix D

Preliminary Surface Water Runoff Calculations
Indicative Drainage Layout Plan – A059486-005

White Young Green

Project No	A059486
Number of calculation sheets	1
Office	Nottingham
Division	C&S
Prepared by	CD
Date	15-Oct-09

Project Title	**Sandleford Park FRA**
Work Section	**Assessment of Greenfield Runoff**

Greenfield estimation of peak flow rate of runoff

The aim of this first section is to determine the peak discharge rate of the greenfield site runoff for 1, 30 and 100 year return period events.

Site characteristics

Hydrological Region (1 – 10)(R) = 6

Taken from R&D Technical Report W5-074/A/TR/1 Figure 1.1

(SOIL) type (1 – 5) (S) = 3

Taken from Wallingford Proceedure WRAP Map.

Development size (A) = 56.5 ha

Annual Rainfall (SAAR) = 750 mm

Taken from R&D Technical Report W5-074/A/TR/1 Figure 4

Soil Runoff Coefficient (SPR) = 0.37

SPR value for SOIL – this is not the FSR index class value for SOIL (1 to 5) but its corresponding runoff coefficient (SPR) as follows:

SOIL	1	2	3	4	5
SPR	0.10	0.30	0.37	0.47	0.53

Development mean annual peak flow (Q_{BAR}) = $(0.00108(A/100)^{0.89} \times SAAR^{1.17} \times SPR^{2.17}) \times 1000$

= 174 l/s

For development sites of 50 ha or less, use 50 ha when applying the formula. Subsequently factor the resulting value by the ratio of the site area to 50 ha. (i.e. if the site is 10 ha divide the answer by 5)

Adjusted Q_{BAR} (rate if required) =

Mean annual peak flow per unit area (Q_{BAR}/A) = 3.07 l/s/ha

Q_{1yr} = Q_{BAR}/A x 0.85 = 2.61 l/s/ha

Q_{30yr} = Q_{BAR}/A x GC_{30} = 6.76 l/s/ha

Q_{100yr} = Q_{BAR}/A x GC_{100} = 9.93 l/s/ha

GC_{30} and GC_{100} Taken from R&D Technical Report W5-074/A/TR/1 Figure 1.2

WYG Engineering

Project No	A059486
Number of calculation sheets	3
Office	Nottingham
Division	C&S
Prepared by	CD
Date	08-Oct-09

Project Title	**Land at Sandleford Park, Newbury**
Work Section	**Comparison of existing and proposed runoff rates**

The existing site comprises arable farmland with several small pockets of woodland.

The proposed redevelopment is for approximately 2000 residential dwellings. A further area of approximately 2.45 ha to the North East of the site has been identified for possible business use. In total it is proposed to develop 56.5ha of the 131ha site with the remaining areas to remain unaltered as open parkland or woodland.

It is estimated that approximately 50% of the developed site (residential) and 75% of the site (employment) will comprise impermeable surfaces.

The following calculation provides a comparison of the runoff rate for the existing and developed site. The existing site runoff rate has been calculated separately using IOH method 124. The Rational Method is used for calculation for the proposed development runoff.

Apply Rational Method to establish the site runoff

Q=CIA/360 C- runoff coefficient, I - Rainfall intensity mm/hr, A catchment Area (ha)

Existing site

From IOH method 124 calculation:

1 in 1 year event -	147.5 l/s	(2.61 l/s/ha)
1 in 30 year event -	381.9 l/s	(6.76 l/s/ha)
1 in 100 year event -	561.0 l/s	(9.93 l/s/ha)

Establishing runoff coefficient

Post development

Description	A Area (ha)	C- Runoff coefficient	C*A
Impermeable (buildings & paved areas)	28.86	1.00	28.86
Permeable (gardens and open space)	27.64	0.00	0.00
Total	56.50		28.9

Post development effective runoff coefficient = 28.86 / 56.5 = 0.51

Estimate of Rainfall Intensity

From Figure 6.1 Rainfall depths of five year return period and 60 minutes duration (M_{5-60} min)

M_{5-60} = 19.3

From Figure 6.2 Ratio of sixty minutes to two day rainfalls of five year return period (r)

r = 0.35

WYG Engineering

Project No	A059486
Number of calculation sheets	3
Office	Nottingham
Division	C&S
Prepared by	CD
Date	08-Oct-09

Project Title	**Land at Sandleford Park, Newbury**
Work Section	**Comparison of existing and proposed runoff rates**

Storm Duration (D) hrs	Z1	M5-D	Annual return period event			5 years return period event			30 years return period event			100 years return period event		
			Z2	$M_{1\text{-}D} = M_{5\text{-}D}$ x Z2	Rainfall intensity mm/hr	Z2	$M_{1\text{-}D} = M_{5\text{-}D}$ x Z2	Rainfall intensity mm/hr	Z2	$M_{1\text{-}D} = M_{5\text{-}D}$ x Z2	Rainfall intensity mm/hr	Z2	$M_{1\text{-}D} = M_{5\text{-}D}$ x Z2	Rainfall intensity mm/hr
0.25	0.61	11.773	0.61	7.22	28.89	1.03	12.13	48.5	1.50	17.695	70.78	1.94	22.82	91.282
0.5	0.79	15.247	0.62	9.47	18.94	1.03	15.7	31.41	1.58	24.111	48.22	1.99	30.37	60.743
1	1	19.3	0.64	12.3	12.3	1.03	19.88	19.88	1.54	29.741	29.74	2.02	39.07	39.071
2	1.2	23.16	0.65	15.1	7.558	1.03	23.85	11.93	1.54	35.597	17.8	2.02	46.72	23.361
4.00	1.48	28.564	0.67	19.3	4.815	1.03	29.42	7.355	1.52	43.391	10.85	1.98	56.6	14.15
10	1.88	36.284	0.69	25.1	2.513	1.02	37.14	3.714	1.48	53.846	5.385	1.92	69.66	6.9655
24	2.4	46.32	0.71	33	1.375	1.02	47.25	1.969	1.44	66.57	2.774	1.84	85.2	3.5501
48	3	57.9	0.73	42.4	0.884	1.02	59.06	1.23	1.40	80.815	1.684	1.76	101.7	2.1185

Estimate and comparison of site runoff rate

Storm Duration (D) hrs	Annual return period event				5 years return period event				30 years return period event				100 years return period event			
	Rainfall intensity mm/hr	Existing runoff (l/s)	Post development unattenuated runoff (l/s)		Rainfall intensity mm/hr	Existing runoff (l/s)	Post development unattenuated runoff (l/s)		Rainfall intensity mm/hr	Existing runoff (l/s)	Post development unattenuated runoff (l/s)		Rainfall intensity mm/hr	Existing runoff (l/s)	Post development unattenuated runoff (l/s)	Post dev unattenuated runoff + CC (30%) (l/s)
0.25	28.9	147.5	2316.3		48.5	180.0	3888		70.8	381.9	5674		91.3	561.0	7318	9513
0.5	18.9	147.5	1518.1		31.4	180.0	2517.9		48.2	381.9	3866		60.7	561.0	4870	6330
1	12.3	147.5	985.9		19.9	180.0	1593.6		29.7	381.9	2384.3		39.1	561.0	3132	4072
2	7.6	147.5	605.9		11.9	180.0	956.2		17.8	381.9	1426.9		23.4	561.0	1872.8	2434.6
4	4.8	147.5	386.0		7.4	180.0	589.6		10.8	381.9	869.6		14.1	561.0	1134.3	1474.6
10	2.5	147.5	201.5		3.7	180.0	297.8		5.4	381.9	431.7		7.0	561.0	558.4	725.9
24	1.4	147.5	110.3		2.0	180.0	157.8		2.8	381.9	222.4		3.6	561.0	284.6	370.0
48	0.9	147.5	70.8		1.2	180.0	98.6		1.7	381.9	135.0		2.1	561.0	169.8	220.8

WYG Engineering

Project No	A059486
Number of calculation sheets	3
Office	Nottingham
Division	C&S
Project Title	**Land at Sandleford Park, Newbury**
Prepared by	CD
Work Section	**Comparison of existing and proposed runoff rates**
Date	08-Oct-09

Estimate and comparison of site runoff volume

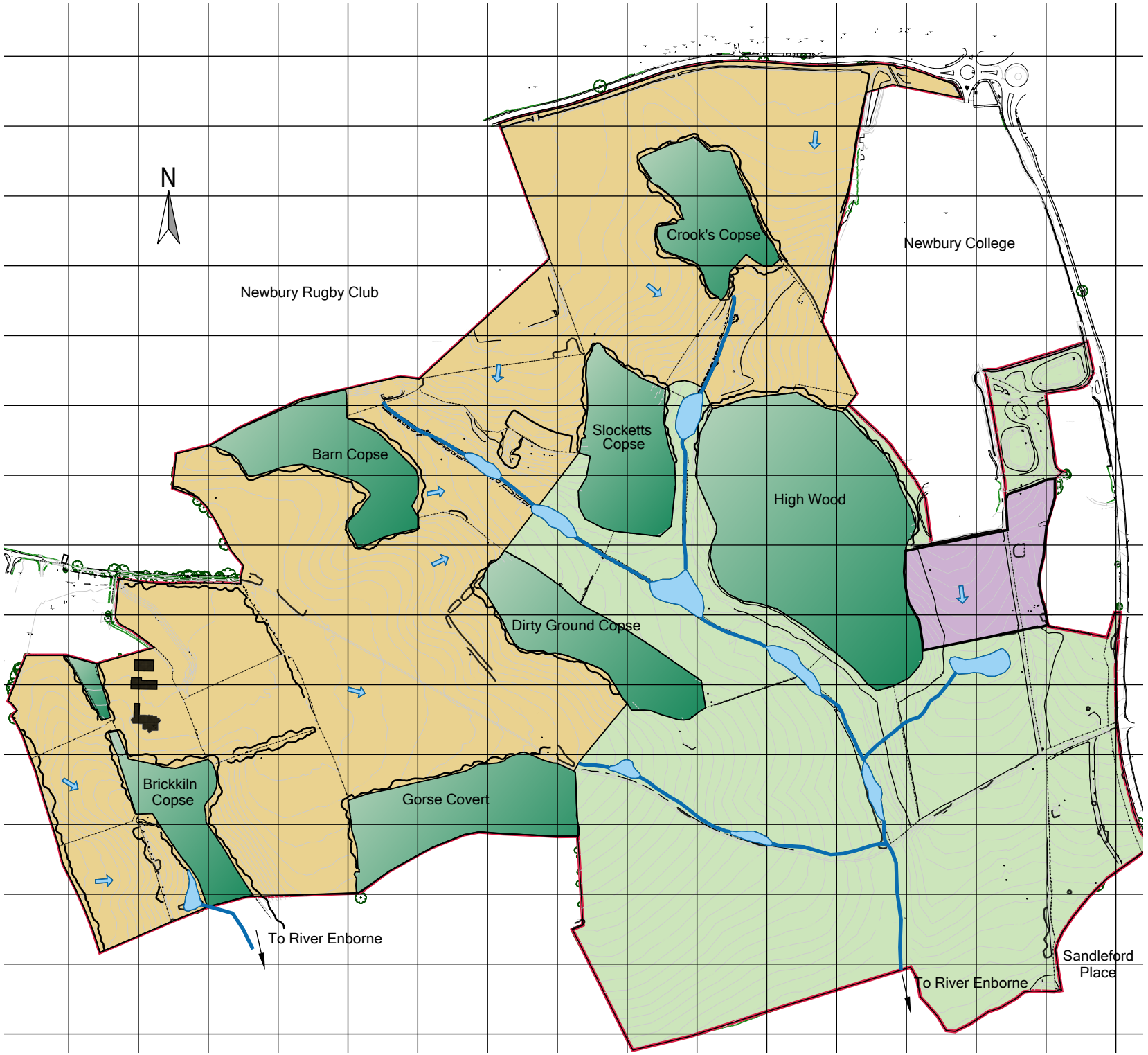
Storm Duration (D) hrs	Annual return period event				5 years return period event				30 years return period event				100 years return period event			
	Existing runoff volume (m^3)	Post development runoff volume (m^3)	Attenuation volume (m^3) to achieve existing runoff		Existing runoff volume (m^3)	Post development runoff volume (m^3)	Attenuation volume (m^3) to achieve existing runoff		Existing runoff volume (m^3)	Post development runoff volume (m^3)	Attenuation volume (m^3) to achieve existing runoff		Existing runoff volume (m^3)	Post development runoff volume (m^3)	Attenuation volume (m^3) to achieve existing runoff	Attenuation volume inc 30%CC (m^3) to achieve existing runoff
0.25	133	2085	1952		162	3500	3338		344	5107	4763		505	6586	6081	8057
0.5	266	2733	2467		324	4532	4208		687	6958	6271		1010	8765	7755	10385
1	531	3549	3018		648	5737	5089		1375	8583	7208		2020	11276	9256	12639
2	1062	4362	3300		1296	6884	5588		2750	10273	7524		4039	13484	9445	13490
4	2124	5558	3434		2592	8491	5899		5499	12523	7023		8078	16335	8256	13156
10	5310	7252	1942		6480	10720	4240		13748	15540	1791		20196	20103	-93	5937
24	12744	9527	-3217		15552	13635	-1917		32996	19212	-13784		48470	24590	-23881	-16504
48	25488	12242	-13246		31104	17044	-14060		65992	23323	-42669		96941	29347	-67593	-58789

Summary

The EA will require that the surface water runoff rate from the developed site is restricted to the existing runoff rate.

The critical storm event for attenuation volume is the 2 hour duration and 100 year + climate change return period event. The estimated attenuation volume is 13490m3.

Rainfall intensities have been increased by 30% to allow for climate change (see table B2 in PPS25)



DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS

KEY

- WOODLAND
- PROPOSED RESIDENTIAL DEVELOPMENT
- PROPOSED BUSINESS USE DEVELOPMENT
- PROPOSED STORAGE BASINS AND OPEN WATERCOURSES. FLOW CONTROL WITHIN STORAGE BASINS PROVIDED BY THROTTLE PIPES AND WEIRS.
- GENERAL DIRECTION OF FLOW FOR PROPOSED DRAINAGE NETWORK
- CONTOURS

REV	DESCRIPTION	BY	CHK	APP	DATE

THE SANDLEFORD PARTNERSHIP

NEWSTEAD COURT, LITTLE OAK DRIVE
SHERWOOD BUSINESS PARK
ANNESLEY, NOTTINGHAMSHIRE
NG15 0DR

TEL: +44 (0)1623 684 550
FAX: +44 (0)1623 684 551
e-mail: nottingham@wyg.com

Project:

SANDLEFORD PARK
FLOOD RISK AND DRAINAGE ASSESSMENT

Drawing Title:

INDICATIVE DRAINAGE LAYOUT

Scale @ A4	Drawn	Date	Checked	Date	Approved	Date
NTS	CD	07.12.09				

Project No.	Office	Type	Drawing No.	Revision
A059486	5201	C	005	