

Uxbridge
Drainage Strategy
VSM Estates Limited

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ATKINS

Plan Design Enable

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1. Introduction

The 44 hectare site is located to the west of Central London and is to be redeveloped into a mixed use residential development with retail, business premises and leisure amenities in the form of an urban park. VSM Estates Limited (VSM) is the strategic developer of the site and is providing the strategic drainage and highway infrastructure across the site.

The London Borough of Hillingdon (LBH) as the Planning Authority and the Environment Agency are the regulating authorities for surface water drainage on the site.

Thames Water (TW) is the sewerage undertaker responsible for the public foul sewer network. They undertook a Sewer Impact Study (ref SMG 674 revised E4014 - 31st August, 2012) which informs this strategy

Individual plots, served by the strategic infrastructure, will be offered to the market and the site will be developed in accordance with the agreed masterplan by housing and commercial developers.

Atkins has been commissioned by VSM to undertake the design of the strategic surface water and foul water drainage sewer networks. As the strategic developer for the whole site, VSM, will advise individual plot developers of the drainage discharge rate for each plot, who will then be required to demonstrate compliance. Atkins will provide technical support to this process and assist in the monitoring of compliance with the overall drainage strategy. It is proposed that both VSM and their technical advisors will work closely with the London Borough of Hillingdon (LBH) in this regard. This process will be on-going until the development is fully 'built-out'.

Through the planning process LBH will be able to monitor and control both the foul and surface water sewer proposals for individual plots by requiring the full details of specific drainage arrangements. This strategic document will serve as the drainage masterplan to inform how LBH should assess these applications with regard to drainage discharges and support effective on-going management by ensuring that:

Surface Water - a combination of source control, site and regional SUDs components are implemented to satisfy the intent of this strategy and the overall agreed discharge rate from the strategic network to the River Pinn is not exceeded.

Foul Water - plots are connected to the correct part of the strategic network at the proposed population/discharge rates.

The strategic surface water sewer networks will incorporate SUDs components at source, site and regional levels. A Flood Risk Assessment (FRA) report (Issue F, dated September 2010), has been approved by the regulatory authorities as part of the planning process and information from that informs this surface water strategy.

1.1. Discharge of Planning Conditions 67 and 86

In addition to the objectives stated above, this report is intended to provide sufficient information to assist in the discharging of Planning Conditions 67 and 86. It will also inform and assist in the discharge of Condition 68 prior to the commencement of each phase or relevant component of the full planning element. The following Planning Condition and Section 106 wording has been taken from the Outline Planning Consent (Application Ref: 585/APP/2009/2752) dated January 2012 and the signed Section 106 (Town and Country Planning Act 1990) Agreement dated 18th January 2012.

Planning Condition 67

Unless otherwise agreed in writing by the Local Planning Authority, prior to commencement of each phase of the outline element of the development, or any of the elements of development for which full planning permission is hereby approved a drainage strategy detailing any on and/or off site drainage works for the relevant phase/relevant component of the full planning element (including the adoption of sustainable urban drainage initiatives into the development), shall be submitted to and approved in writing by the Local Planning Authority in consultation with the sewerage undertaker. No discharge of foul or surface water from the site shall be accepted into the public system until the drainage works referred to in the strategy have been completed.

Thereafter and prior to occupation of each phase/relevant component of the full planning element, the scheme shall be completed in accordance with the approved details and thereafter maintained for the life of the development, unless consent to any variation is first obtained in writing from the Local Planning Authority.

Planning Condition 86

No development shall take place on site until details of the incorporation of sustainable urban drainage have been submitted to, and approved in writing by the Local Planning Authority. The approved details shall thereafter be installed on site and thereafter permanently retained and maintained

Planning Condition 68

Prior to commencement of each phase of the outline element of the development, or any of the elements of development for which full planning permission is hereby approved, a scheme to dispose of foul and surface water for the relevant phase/relevant component of the full planning element, shall be submitted to and approved by the Local Planning Authority.

Thereafter and prior to occupation of each phase/relevant component of the full planning element, the scheme shall be completed in strict accordance with the approved details and thereafter maintained for the life of the development, unless consent to any variation is first obtained in writing from the Local Planning Authority.

1.2. Historical Information

The following reports and technical notes have been referred to in preparing this report:

The surface water drainage proposals are supported by the following documents:

- Flood Risk Assessment Report (FRA), document number PDFMRU034, Revision F, dated September 2010 by Halcrow Yolles.

The following general documents are available to support the drainage proposals:

- Technical Note entitled “Geo-environmental Technical Note”, dated 30 August 2011 by Atkins.
- Halcrow RAF Uxbridge Phase 2 Geo-environmental Ground Conditions Report, Ref. PDFMRU-RPT-003

The FRA was issued to the Environment Agency, as part of the outline planning approval consultation process and was subsequently accepted and approved as part of the planning permission granted in January 2012.

1.3. Approving Authorities

The following organisations comprise the approving authorities and sources for the drainage strategy proposals:

- Thames Water (TW) – adoptable foul water sewers.
- Environment Agency – surface water discharges to the River Pinn
- London Borough of Hillingdon (LBH) – surface water drainage and SUDs
- Code for Sustainable Homes - surface water drainage and SUDs

2. Site Description

2.1. Location

The site is located to the west of Central London approximately 3.2km (2 miles) from the A40/M40. The site is situated within the administrative area of LBH. It is surrounded by residential development to the north and east, Hillingdon Road (A4020) to the west and Hillingdon golf course to the south.

A location plan is provided in Appendix A.

2.2. Topography

The site gradually slopes down from the north to the south from a level of 51m AOD to a level of 33m AOD. The site also slopes down from the west and east boundaries to the River Pinn (splitting the site on a north/south axis) from a level of 47m AOD at the boundaries to a river level of 31m AOD. All levels are approximate.

2.3. Ground Conditions

The Ground Conditions Report¹ shows the site to be underlain by Made Ground, Alluvium, River Terrace Deposits, Glacial Sand and Gravels, London Clay and the Lambeth Group.

The majority of the site is underlain by London Clay as stated in the Environmental Statement dated August 2009, pg 177. A borehole in the north-west of the site indicates the London Clay was present to a thickness of 11m. Upnor and Reading formations which are complex shallow marine deposits, typically comprising laminated clay, cross-bedded sand and basal conglomerate, underlie the London Clay formation. The same borehole indicates that these formations are present to a thickness of 28.5m. In general terms, the site has low permeability and is seasonally wet with acidic, loamy and clayey soils.

From the FRA the soil type on the site is classified as Type 4 with a soil index value of 0.45. This is described as Clayey or loamy over clayey soils with an impermeable layer at shallow depth. The FRA concludes that infiltration on the site is poor.

As the site has a large variation in existing level, the above report should be referred to for detailed comment on the prevailing groundwater conditions.

2.4. Site constraints

The table below highlights some of the site constraints:

¹ Halcrow RAF Uxbridge Phase 2 Geo-environmental Ground Conditions Report, Ref. PDFMRU-RPT-003 Version: P02, dated June 2011.

Table 1. Site Constraints

Green Belt	This lies within the central part of the site and is approximately 12.7 ha in area. SPD (2009) ² states that “land in the Green Belt should remain in its state of openness as a public recreation area and as a setting for the Listed Buildings.”
Green Chain	North of the site Local Authority Policy OL11 – provision and improvement of suitable recreational facilities; maintain their positive contribution in providing a visual and physical break in the built-up area; conserve and enhance the visual amenity and nature conservation value of the landscape; seek to improve public access to and through the area and promote an overall identity for green chains throughout the Borough.
Statutory Building	Listed 1. Grade I – 11 RAF Group operations rooms/underground bunkers (South East) 2. Grade II – Hillingdon House (East) 3. Grade II – Cinema (West)
Existing mature trees	Existing mature trees and hedge cover, including woodlands should be retained.
Ecology	There is a main badger sett in the north part of the Uxbridge site. It lies within 10 metres of a running track that is due to be removed. The sett is on a slope, at the top of which are a line of conifers that separate the sett entrances from the track. There are also other outlier setts that present constraints in other areas.

2.5. Drainage & Hydrology

2.5.1. Existing Sewers

Thames Water is the sewerage undertaker responsible for the foul sewerage network.

For details of the existing sewers, reference should be made to drawing number PDFMRU-P-DWG-124 in Appendix B. This shows the known and recorded existing statutory and private surface water and foul water networks. The development areas comprising the Uxbridge scheme are shown on drawing number 3300-10-101 also found in the Appendix B.

The Annington North and South drainage networks are currently managed and maintained by C2C; C2C has disconnected and diverted the surface and foul water networks from Annington North and South which are connected to the Uxbridge development. These no longer contribute to the flows within the Uxbridge site.

The existing on-site surface water sewers are privately owned and any foul water sewers serving more than one property have been transferred to Thames Water under the recent changes to the Water Industry Act 1991. The majority of the surface water sewers currently discharge into the River Pinn with the remainder forming cross connections into the foul water sewers. The foul water sewers currently discharge into Thames Water’s wider sewerage network through third party land.

² RAF Uxbridge Supplementary Planning Document (SPD) January 2009,
http://www.hillingdon.gov.uk/media/pdf/7/4/RAF_Uxbridge_SPD_whole_document.pdf

Also contributing to the on-site flows are a number of existing third parties' surface water sewers (upstream of the site) which connect to the on-site sewers within the northern and eastern development areas prior to being discharged into the River Pinn. Also within the eastern development area, foul water sewers (from upstream catchments) connect to the on-site foul water sewers prior to their outfalling into Thames Water's sewerage network. These surface and foul water sewers will need to be diverted and/or abandoned as necessary prior to commencing the development works. The foul sewers have transferred to Thames Water and become public sewers as of 1st October 2011 in accordance with Sections 102 and 105A of the Water Industry Act 1991 and therefore will be diverted under Section 185 of the Water Industry Act 1991.

2.5.2. Watercourses

The River Pinn runs through the site from north to south. The river is approximately 3-3.5m wide with banks generally low and shallow. The FRA has identified the flood area from the river in accordance with the EA flood information, a brief summary of which is given below.

There is a shallow pond (15-20cm deep) 8m wide by 15m long to the south east of the site adjacent to the River Pinn. The FRA has not identified a risk of flooding from this pond.

2.5.3. Flood Risk

The FRA designates the majority of the site as being in Flood Zone 1 with some proportion lying within Zones 2 and 3b. While development will not be allowed with the Zone 3b area (Functional Floodplain), the risk to the other areas is manageable and appropriate mitigation measures have been proposed. This generally follows the need to fix finished floor levels for buildings at an appropriate level above the flood level.

3. Surface Water

3.1. Introduction

This section describes the philosophy and principles of the surface water drainage strategy for the Uxbridge development.

Considering the Masterplan development proposals and prevailing site conditions, the aim of the strategy for the management of surface water runoff from the site will be to adopt the best available techniques that will maximise the benefits achievable for the site. This aim will comprise a mix of positive, sustainable and natural drainage provision. The exact combination of techniques will be determined as designs become more detailed but the overall intent of this strategy and discharge rates will be maintained.

3.2. Design Criteria and Permissions

The design and management of the proposed surface water drainage network for the site will be carried out in accordance with recognised current industry guidelines and associated reports as listed below; it should be noted that Code for Sustainable Homes Level 4 will be achieved and this requirement attracts a number of design conditions that need to be satisfied

- Sewers for Adoption, 6th Edition
- BS EN 752: 2008 - Drain and sewer systems outside buildings
- National Planning Policy Framework (NPPF)
- CIRIA Report C522 - Sustainable Urban Drainage Systems- Design Manual for England and Wales,
- CIRIA Report C697 – the SuDS Manual
- CIRIA Report C624 - Development and Flood Risk – Guidance for the construction industry
- Code For Sustainable Homes (CoSH)
- The Local Planning Authority's Development Plan
- London Plan policy 4A.14
- Flood Risk Assessment Report dated September 2010 by Halcrow Yolles, Ref PDFMRU034

For positive drainage networks hydraulic simulations have been carried out for the required return periods as follows:

- Design storm frequency – 1 in 1, 1 in 2 and 1 in 5 year (no surcharging)
- Design storm frequency – 1 in 30 year (surcharging but no flooding)
- Design storm frequency - 1 in 100 year + 30% for climate change in peak rainfall intensity (managed flooding)

The proposed drainage network invert levels at outlets to the River Pinn will be designed to be 225mm above the river's summer flow level.

Refer to Appendix B for MicroDrainage modelling results

For this site, and to comply with The Code for Sustainable Homes, Section 2B of the Category 4 Sur1 requirements will apply. The basis for the control and management of surface water runoff to achieve compliance is having to reduce the post development peak rate of runoff to the limiting discharge. The limiting value has been agreed with the EA as 12.27 l/s/ha as detailed in the FRA. This is the greenfield runoff for the 1:100 year storm event shown in Table 5.1 of the FRA.

For achieving additional credits for Category 4 compliance, the design of the surface water management for the site will address the water quality criteria factors as outlined in the Code. These are 1) to comply with appropriate water quality criteria, there is to be no discharge from the developed site for rain fall depths up to 5mm and 2) the runoff from all hard surfaces shall receive an appropriate level of treatment in accordance with the SUDS manual (CIRIA C697) to minimise the risk of pollution.

It should be noted that consent under Section 109 of the Water Resources Act 1991 will be required to permit the construction of any outfalls and structures in line with EA policies and procedures. Consent from the EA will be obtained prior to undertaking any works on the river. The appropriate Development Control Officer (Flood Defence) at the EA will be contacted to discuss the consent requirements and all necessary details will be provided at detailed design stage.

3.3. Surface Water Runoff

The proposed Masterplan for the site development will increase the impermeable area for the development by 15% compared to the existing impermeable site area (FRA Table 2.1, Section 2.1.3). As a result the existing site surface water runoff rate will increase correspondingly. This increase will have to be managed to minimise the increased flood risk.

3.4. Site Considerations for Sustainable Drainage Systems and Techniques (SUDS)

Planning Condition 76 states that *'no infiltration of surface water drainage into the ground is permitted other than with the express written consent of the Local Planning Authority, which may be given for those parts of the site where it has been demonstrated that there is no resultant unacceptable risk to controlled waters. The development shall be carried out in accordance with the approved details'*.

With the site lying predominantly on a London Clay subgrade, the use of infiltration techniques into the ground is not a feasible option and the drainage strategy will address other techniques for the control and treatment of surface water runoff.

The use of sustainable drainage techniques for the surface water drainage of the site will be assessed in accordance with the principles outlined in CIRIA documents C522 and C697 and the NPPF. The following are the range of techniques likely to be applicable for the development site:

- **Source control; various measures including rainwater recycling.** This system could be considered by plot developers through the use of water butts which are the most common means of harvesting rainwater for garden use. They are small, off-line storage devices that are designed to capture and store roof runoff. Pervious paving is also recognised as a source control technique.
- **Swales; these are vegetated features that store or convey water.** They can be designed for and should adopt low flow velocities to allow particulate matter to settle out, thus providing effective pollutant removal. For this development, swales will be broad and shallow channels covered by grass and/or other suitable vegetation. They will be located along the spine road through the site to primarily receive surface water run-off from roads and pavements. These swales will be designed to maximise the water quality treatment benefits to surface water run-off by ensuring the conveyance of flows is over vegetated surfaces as long as can be achieved.

- **Filter drains, strips and pervious pavements** allow rainwater run-off to infiltrate below finished development surfaces and provide storage if needed. The water is temporarily stored before infiltration into the ground, or discharged to a watercourse or other drainage system. Pervious paving can be combined with positive storage facilities (eg storm cell crates) to create additional surface water storage volume where required. These 'storm cells' sit below the pervious pavement construction. Pervious paving will be assessed for use on the secondary roads and it is proposed to utilise a combination of surface infiltration and sub-surface storage.

Pervious pavements frequently incorporate perforated carrier pipes within filter trenches running beneath the pavement. With this arrangement, when all design components are used together, the surface water would undergo at least three levels of filtration treatment: through the surfacing, the granular sub-base and through the granular material within the pipe trenches below the sub-base;

- **Retention Basins** these hold excess water and allow controlled discharge to minimise flood risk; they are surface storage basins that provide flow control through attenuation of stormwater runoff. Those proposed for this development will normally be dry and only hold 'open' water for short periods during and following rainfall events but they will incorporate ephemeral wetland features to enhance appearance, encourage bio-diversity and provide a level of final treatment before water is discharged to the River Pinn.

3.5. The Proposed Strategy

The proposed development comprises the redevelopment of the site to provide approximately 1,417 residential units, retail, commercial and primary school facilities. All surface water runoff from developed areas will be discharged to the River Pinn apart from a short length of highway in the south west of the site which will drain to a Thames Water sewer in Hillingdon Road, as is currently the case.

After reviewing the existing topography of the site and its features and for the purposes of drainage modelling, the site has been divided into three catchments – Northern, Eastern and Western sections. The majority of the development is concentrated to the west of the River Pinn. The western catchment has been further divided into two sub-catchments each with a separate outfalls and are labelled as sub-catchments W1 and W2. The Eastern catchment will have two outfalls (for development drainage and existing highways) and the Northern catchment will have a single outfall.

The proposed surface water strategy is shown on drawings 5105977/UXB/GE/0064 and 0065 in Appendix B. It should be noted that the final configuration of catchment boundaries and combination of sustainable drainage features may require amendment as the design and/or the masterplan evolves. Should such amendments be necessary they will be made in accordance with this strategy in terms of discharge rates and drainage features and will require the full approval of LBH.

It has been agreed with the EA that the design discharge rate and storage for the site is to be based on the 1:100 year storm event (including an appropriate allowance for climate change). The agreed discharge rate is 12.27 l/s/ha (Table 5.1 of FRA).

3.5.1. Western Catchment

The sub-divisions of the western catchment are shown on the drawings in the Appendix B. Each catchment comprises a mix of residential development, external areas and access roads.

The overall surface water runoff from the catchment will be limited by a hydraulic control and a mixture of pervious paving, underground storage (such as crates, granular sub-base, chambers and pipes) and an on-line retention basin which discharges into the River Pinn.

During periods of raised river levels, outfalls from the proposed surface water systems will be surcharged. To test the impact of surcharged outfalls we have established which combination of river and drainage catchment storm events are likely to occur during the 100 year design life using a joint probability analysis.

3.5.2. Joint Probability Analysis

The EA worksheet (UK Sustainable Drainage website) was completed for the 30 minute critical event for the network. The river modelling study identified that a 16.5hr storm was the critical river event. The worksheet matrix identified 3 events which would combine to produce a submerged outfall during the 100 year design life. Each event was modelled for each outfall and it was shown that no additional flooding would occur over and above normal discharge conditions.

3.5.3. Catchment W1

The catchment drainage techniques comprise a combination of swales, pervious paving with foundation stone and sub-base carrier drains (some with underground storage facilities) and positive drainage within the highways. These all combine to collect runoff in a single retention basin system prior to discharge to the River Pinn. The retention basin has been sized to maximise the usage of the available space and it is proposed that this feature will be formed and landscaped to be sympathetic to its setting in the Park. Embankment slopes will be constructed to gradients which will allow safe maintenance of grassed areas using standard mechanical methods.

The treatment process for the runoff comprises a mix of filtration through the pervious paving and the carrier drains and settlement and final treatment through the retention basin.

Details for Catchment W1 proposed by this strategy are as follows:

Table 2. Western Sub-Catchment W1 details for Surface Water Drainage

Total area (including roofs, roads and other paved surfaces, landscaped areas and gardens)	13.051ha
Total impermeable area (including roofs, roads and other paved surfaces excluding landscaped areas and gardens)	7.37 ha
Proposed SUDs techniques	Swales, Pervious Paving, Filter drains/strips, Sub-surface storage (e.g. Storm Crates, granular sub-base, pipes) Retention basin
Maximum discharge at Outfall W1 (network W1 pipe ref. 1.016)	90.2 l/s
Estimated Storage within network	2913m ³ within network & 1871m ³ within basin

3.5.4. Catchment W2

The catchment drainage techniques comprise a combination of pervious paving with foundation stone and sub-base carrier drains incorporating underground storage facilities. There is no available land in this catchment to incorporate a retention basin system prior to discharge to the River Pinn.

Details for Catchment W2 proposed by this strategy are as follows:

Table 3. Western Sub-Catchment W2 details for Surface Water Drainage

Total area (including roofs, roads and other paved surfaces, landscaped areas and gardens)	8.152 ha
Total impermeable area (including roofs, roads and other paved surfaces excluding landscaped areas and gardens)	4.58 ha
Proposed SUDs techniques	Swales, Pervious Paving, Filter drains/strips, Sub-surface storage (e.g. Storm Crates, granular sub-base, pipes)
Maximum discharge at Outfall W2 (network W2 pipe ref. 1.013)	55.0 l/s
Estimated Storage within network	3,178m ³ within network

3.5.5. Northern Catchment (N1)

The catchment drainage techniques comprise a combination of pervious paving and foundation stone with sub-base carrier drains combined with a minority of underground storage and positive drainage within the highways. There is no attenuation or designed treatment for the existing highways. Treatment of the surface water runoff from the development areas will be achieved via a mix of filtration through the stone and particulate settlement.

The route for the outfall follows St Andrew's Road and the proposed outfall location is direct to the River Pinn just to the north of St Andrew's Road. There are no suitable locations to incorporate a detention basin in this area.

As the proposed school, to the east of the catchment, will incorporate surface water run-off treatment and balancing at source and within the curtilage of the school grounds, it is not considered in detail here. VSM will advise regarding the required discharge rates.

Details for the Northern catchment proposed by this strategy are as follows:

Table 4. Northern Catchment details for Surface Water Drainage

Total area (including roofs, roads and other paved surfaces, landscaped areas and gardens)	1.542 ha
Total impermeable area (including roofs, roads and other paved surfaces excluding landscaped areas and gardens)	0.958 ha
Proposed SUDs techniques	Pervious Paving, Filter drains/strips, Sub-surface storage (e.g. Storm Crates, granular sub-base, pipes)
Maximum discharge at Outfall N1 (network N1 pipe ref. 1.007)	11.2 l/s
Estimated Storage within network	566m ³ within network

3.5.6. Eastern Catchment

The catchment drainage techniques comprise a combination of pervious paving with foundation stone and sub-base carrier drains, positive drainage within the highways and an retention basin situated between Hillingdon House and the eastern 1:100 year flood zone extents of the River Pinn. Surface water treatment will be via a combination of filtration and particulate settlement.

The retention basin has been sized to maximise the usage of the available space and it is proposed that this feature will be formed and landscaped to be sympathetic to its setting in the Park. Embankment slopes will be constructed to gradients which will allow safe maintenance of grassed areas using standard mechanical methods.

There are separate direct outfalls to the River Pinn for the existing highway and development areas. The outfall for the highway drain is to the north of Hillingdon House just to the south of St Andrew's Road and approximately 50m south of the northern catchment outfall. The outfall for the attenuation pond is located directly west of the pond.

Details for the Eastern catchment proposed by this strategy are as follows:

Table 5. Eastern Catchment E1 details for Surface Water Drainage

Total area (including roofs, roads and other paved surfaces, landscaped areas and gardens)	0.809 ha
Total impermeable area (including roofs, roads and other paved surfaces excluding landscaped areas and gardens)	0.240ha
Proposed SUDs techniques	Pervious Paving, Filter drains/strips, Sub-surface storage (e.g. Storm Crates, granular sub-base, pipes)
Maximum discharge at Outfall E1 (network E1 pipe ref. 3.001)	2.5 l/s (5l/s proposed to reduce risk of blockage)
Estimated Storage within network	140m ³ within network

Table 6. Eastern Catchment E2 details for Surface Water Drainage

Total area (including roofs, roads and other paved surfaces, landscaped areas and gardens)	0.985 ha
Total impermeable area (including roofs, roads and other paved surfaces excluding landscaped areas and gardens)	0.680 ha
Proposed SUDs techniques	Pervious Paving, Filter drains/strips, Sub-surface storage (e.g. Storm Crates, granular sub-base, pipes) Detention basin
Maximum discharge at Outfall E2 (network E2 pipe ref. 1.016)	8.1l/s
Estimated Storage within network	62m ³ within network, 318 m ³ within basin

3.6. Compensatory Flood Plain Storage

A small area of the residential development within the Western Catchment will encroach into the 1:100 year floodplain of the River Pinn. This is shown on the drawing number PDFMRU 301 in the Appendix B. EA requirements state that no floodplain storage can be removed. The flood water storage volume lost by the construction of this small area of development will be replaced and compensated for elsewhere on a level for level basis.

Two areas have been identified on the eastern bank of the River Pinn as compensation storage areas. The total volume of compensatory storage required is 56m³. Refer to drawing numbers PDFMRU 300, 302 and 303. Proposed contours of the compensation areas are shown on drawing numbers PDFMRU 304 and 305. All drawings are shown in Appendix B. These are indicative proposals at this stage which will be subject to further landscaping design to ensure they are blended into the surrounding area.

3.7. Adoption

It is proposed that all plot development surface water drainage systems will be managed and maintained by a management company to be appointed by VSM Estates Limited. However, VSM will work closely with the relevant SuDS Approval Body to ensure that the most appropriate arrangement for the on-going maintenance of SuDS is secured for the life-time of the development.

The strategic approach to the adoption and maintenance of the SUDS network is detailed in the SUDS Management Plan.

Atkins has confirmed with the London Borough of Hillingdon that the provision of a 'private' drainage network under proposed adoptable highways is acceptable.

4. Foul Water

4.1. Introduction

This section describes the philosophy and principles of the foul water drainage strategy for the Uxbridge development.

4.2. Transfer of Private to Public Sewers

There are two existing main sewers (one combined and one foul) running north to south through the site which eventually connect to the existing Thames Water sewerage network. The combined sewer runs to the east of the River Pinn and the foul water sewer runs to the west of the River Pinn.

The sewers are shown on Drawing Nos 5105977/UXB/GE/0021, 0022 and 0023 in Appendix B.

The combined and foul sewers serve the VSM Estate Ltd and Annington Property Ltd and have been transferred and become public sewers as of 1st October 2011 in accordance with Sections 102 and 105A of the Water Industry Act 1991.

4.3. Design Criteria

The design of the foul water drainage system will be in accordance with the Sewers for Adoption, 6th Edition. Account will be taken of the design requirements for the proposed residential plots.

4.4. Correspondence with Thames Water

Thames Water has confirmed that 120 residential units within the development could connect to the existing foul sewer system prior to undertaking any reinforcement/upgrade works on the Thames Water network.

Following a revision to the proposed points of connection to the Thames Water network and the potential for decreasing the amount of off-site upgrading and reinforcement works as a result of the lower number of residential units, a revised SIS to assess the current works requirements was commissioned from Thames Water. This has been completed and the conclusion is to adopt the provisions of Option 1 within the study and provide approximately 150m of off-site tank sewer. The SIS is provided in the Appendix B.

4.5. Foul Water Drainage Strategy

The foul water drainage strategy follows the same catchment layout developed for the surface water proposals.

Discharge flows for the proposed development were calculated in accordance with the document 'Sewers for Adoption' 6th Edition published by WRc plc on behalf of Water UK.

4.5.1. Northern Catchment

The northern catchment will be split into residential 66 units and school of 0.335 ha (GEA). Three options are available for the location of the outfall points for the proposed discharges.

- Option 1 – through the Western Catchment into Stratford Bridge (Ref: TQ682190). Refer to drawing number 5105977/UXB/GE/0021 for details.
- Option 2 – into the existing Hyacinth Drive Sewer Pumping Station (Ref: TQ6844214). Refer to drawing number 5105977/UXB/GE/0022 for details.
- Option 3 – this is a hybrid of Options 1 and 2. The 66 residential units discharge to Stratford Bridge (Ref: TQ682190) through the western catchment. The school discharges into the Hyacinth Drive Sewer Pumping Station (Ref: TQ6844214). Refer to drawing number 5105977/UXB/GE/0023 for details.

The connection to the existing Hyacinth Drive Sewer Pumping Station is severely constrained by the presence of a badger sett to the north of the Uxbridge site. Therefore Option 2 is not practicably achievable and Thames Water has confirmed that they do not favour Option 3.

4.5.2. Eastern Catchment

Foul flows will be discharged into the existing Thames Water networks manhole at Hillingdon Road through the combined sewer to the east side of the River Pinn. This is part of the Option 1 off-site reinforcement study completed by Thames Water and referred to earlier.

The existing foul water sewers and discharges for existing bunkers is to remain unchanged.

4.5.3. Western Area

The discharge flows will be connected to the foul sewer to the west of the River Pinn and therefore ultimately to the network on Stratford Bridge.

4.6. Adoption

All foul water sewers including pumping stations will be offered for adoption.

5. Conclusion/Recommendations

The report has presented the surface water and foul water drainage strategy for the Uxbridge development.

The surface water drainage system will discharge into the River Pinn through the use of a combination of drainage techniques including positive and SUDs systems. It is intended to minimise the impacts from the development on the quantity and quality of the runoff, and maximise amenity and biodiversity opportunities.

The systems adopted, within the individual catchments areas, comprise a mix of pervious paving and stone filtration with carrier drains, underground storage facilities, swales and treatment/attenuation ponds. It is anticipated that the combination of these features may change to respond to particular situations or conditions that are not evident at the time of writing this report but overall compliance with the strategy will still be achieved.

The softening of the SUDS features proposed may change slightly as the detailed design evolves and more detailed landscaping is undertaken.

Compensatory flood storage is required for a small part of the western catchment. Two areas on the eastern bank of the River Pinn have been identified as potential locations for this provision.

The foul water drainage systems will discharge to adopted foul sewers which are under the control of the sewerage undertaker, Thames Water.

As the site is progressively developed, VSM will impose drainage discharge rates on individual plot developers who will then be required to demonstrate compliance with this drainage strategy. VSM and their technical advisors will work closely with the London Borough of Hillingdon to support to this process and assist in the monitoring of overall compliance.

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Appendices

Appendix A. Location Plan

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Appendix B. Drawings and associated documents

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