15. HYDROLOGY AND DRAINAGE

15.1 Introduction

15.1.1 The study area for the purposes of the hydrological assessment is illustrated on Figure 15.1.

15.1.2 This assessment addresses the potential effects of the proposed development on the hydrology and drainage of the site and surrounding area. It has included:

- A walkover survey to obtain detail on all existing water features, catchments and drainage regime.
- An assessment of effects to be considered. The assessment considers the sources of potential flooding, sources of water contamination that could directly or indirectly affect the River Itchen, a description of the surface water drainage strategy for the site including details of a Sustainable Drainage System (SUDS) the objective being to maximise attenuation within the site and minimise surface water run-off, a description of the foul drainage strategy.
- A description of mitigation proposed for the scheme, in light of the assessment of effects.
- An assessment of all remaining residual risks after construction of any mitigation, to identify all cumulative and secondary effects.

15.1.3 A Scoping Report for the EIA was formally submitted to Winchester City Council and agreed in April 2009.

15.2 Site Description

15.2.1 Land within the applicant's control (the study area) extends to approximately 125 hectares, of which 93.1 hectares is within the application site. The site is located on the northern edge of the Winchester suburbs immediately to the east of the Andover Road and west of the London—Southampton railway line. The remaining third of the land controlled by the applicant is on the other side of the railway, falling towards the River Itchen and will be connected to the application site via a new pedestrian/cycle link utilising the existing rail underpass.

15.2.2 The application site is underlain by highly pervious soil overlying Upper Chalk, which extends over the whole region. There are no water courses or water features within the application site, all rainfall being quickly absorbed into the ground by virtue of the very high infiltration rate of the underlying strata. The site has two natural catchments, separated by a ridge line in the topography which runs west–east across the middle of the study area as shown on Figure 15.1. The southern catchment is traversed by a "dry valley" (referred to as "Dry Valley 2"). The dry valley passing is known to have ponded for a few weeks in the wet winter of 2000–01, this being the only recorded instance of flooding taking place at this location. The area of ponding reported was centred midway between Andover Road and the railway embankment and is believed to have been caused by a combination of inundation from the highway drainage outlet form Andover Road and obstruction of the flow path by the lateral hedge line and high ground water levels which occurred during the unusually wet winter. There are no records of ponding occurring in the base of the dry valley, adjacent the railway embankment.

15.2.3 The River Itchen lies about 1km to the east of the railway line and flows from north to south. The Itchen is the principal watercourse in the area and is a Site of Special Scientific Interest (SSSI) and a Special Area of Conservation (SAC). As such it has protection under The Wildlife and Countryside Act, as amended by the Countryside and Rights-of-Way Act 2000 and as a European site under the Habitat Regulations. This river reflects the geology of the area with high baseflows supported by exfiltration from the chalk and slow, long-term flood response to extended wet periods in winter. The winter of 2000–01 had flows in mid-December that flooded limited parts of Winchester and threatened to cause much more extensive flood damage. Development upstream must therefore take into account the impact of proposals on the river, both in terms of quality and flood flows.

15.2.4 Harestock Waste Water Treatment Works lies approximately 150m north of the north eastern corner of the site.

15.3 Assessment Methodology

15.3.1 The assessment involves expansion and detailed analysis of those variables identified in Winchester City Council's Scoping Opinion (April 2009) and includes the following:

- An examination of baseline conditions of the study area, including existing water features and drainage regime
- Flood risk assessment using the Flood Estimation Handbook (FEH), consideration of rainwater run-off, with a sequential approach in relation to the layout as described in PPS25 and Section 4 of the PPS25 Practice Guide
- A surface water drainage strategy that incorporates Sustainable Urban Drainage Systems (SUDS)
- Consideration of the River Itchen SSSI and SAC and the need for an Appropriate Assessment as defined by the Conservation (Natural Habitats & c.)Regulations 1994
- Details of water abstraction and water demand
- Consideration of water quality and foul water
- Consideration of the requirements of PPS23 in relation to groundwater and contamination
- A desk study of the risk of pollution to controlled waters from potential contamination on site
- The potential effects of the project, including construction effects, operational effects and cumulative or secondary effects,
- Proposed mitigation of the effects; and,
- Conclusions of the overall assessment.

15.3.2 In order to assess the significance of the impacts the following definitions of potential significance have been assumed:

Neutral – No significant effects

Minor – Not noteworthy or material; impacts are of a low magnitude and frequency

Moderate – Noteworthy, material; impacts are of moderate magnitude and frequency

Major – Impacts are likely to be of high magnitude and frequency with quality standards being exceeded at times

Beneficial – a positive impact compared to baseline conditions

Adverse – a negative impact compared to baseline conditions.

15.4 Planning Policy

15.4.1 Planning Policy Statement 25 (PPS25) sets out Government policy on development and flood risk. Its aims are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas of highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe, without increasing flood risk elsewhere, and, where possible, reducing flood risk overall.

15.4.2 The Water Resources Act 1991 defines the responsibilities and services provided by Sewerage Undertakers to ensure foul effluent is collected in a separate drainage system and treated before discharge in to the environment.

15.5 Baseline Conditions

Foul Water Drainage

15.5.1 Winchester is served by separate sewerage systems. The foul water sewerage systems drain to wastewater treatment works to the north and south of the city. Harestock Wastewater Treatment Works, immediately north of the site serves the north of the city and the foul water sewerage in the vicinity of Barton Farm drains to this location.

15.5.2 Foul water sewers exist in the adjacent Andover Road. Discussions with Southern Water however have indicated that the local foul water sewerage network is currently operating beyond capacity and would therefore be unable to receive any further connections to the existing pipe network. A formal capacity check has been undertaken by Southern Water and has confirmed that there is no flow capacity in the local foul water sewerage network to accommodate the Barton Farm development and that the foul flow from the development would have to discharge directly to the nearby treatment works.

Sewage Treatment

15.5.3 Harestock Wastewater Treatment Works is a traditional sewage treatment works with trickling filter beds. It is located in "Dry Valley 3", adjacent to the Andover Road, immediately north of Barton Farm. The effluent from the works is discharged to the River Itchen immediately downstream of Headbourne Worthy.

15.5.4 At the time of the previous application in January 2004 it served a population of 19,000 with minimal non-domestic effluent. Discussions with Southern Water and the Environment Agency have established that the treatment works were upgraded in early 2006 as part of the AMP4 programme of works. The upgrade was undertaken primarily for water quality purposes (the Environment Agency had imposed a more stringent limit on phosphates in the discharge in addition to tightening the normal sanitary standards) but also served to increase treatment capacity. Southern Water has confirmed that the works now has treatment capacity for the first 1,000 of the 2,000 units proposed at Barton Farm. A formal capacity check has been undertaken by Southern Water and has confirmed that the upgraded works have sufficient capacity for the first 1,000 units of the development at Barton Farm.

15.5.5 Discharge consent was approved by the Environment Agency in January 2006 for the effluent from the upgraded treatment works. The consent is Habitat Regulations compliant and takes into account the improvements to treatment technology funded in AMP4. The discharge consent has a total phosphorus limit of 1mg/l which is set at BATNEEC (Best Available Technology Not Entailing Excessive Cost) due to existing phosphate issues associated with the River Itchen SAC.

15.5.6 The Environment Agency has confirmed that against current flow monitoring there is easily sufficient volumetric headroom in the existing discharge consent for the proposed 2,000 properties with 44% volumetric capacity remaining based on flow figures for 2005-2008 provided by Southern Water. This equates to an existing volumetric 'headroom' in the consent for approximately 5,000 new properties. The Agency has confirmed that this remains true even when assessing consented flow against projected flow figure for 2020 supplied by Southern Water.

15.5.7 Southern Water has confirmed that further upgrading of the treatment works would be required to provide the treatment capacity needed for the second 1.000 units of the Barton Farm development. The treatment capacity improvements are not included in the current Asset Management Programme (AMP 5) which extends to 2016 but Southern Water has confirmed that such improvements would be included in the next programme of works, in time for the development programme.

Surface Water Drainage

15.5.8 The application site at Barton Farm can be split into two catchment areas for the purpose of surface water drainage assessment, both to the west of the railway embankment. The areas are shown on Figure 15.1.

15.5.9 The southern area (Area 1) is bounded by the Southampton to Basingstoke railway line to the east, the properties off Park Road to the south and Andover Road to the west. The southern area has a dry valley (Dry Valley 2) passing through it from south west to north east. The northern area (Area 2) is bounded by Andover Road to the west, Well House Lane to the north and the Southampton to Basingstoke railway line to the east. The northern area falls towards another dry valley (Dry Valley 3) which also falls from west to east. The northern boundary of the site does not extend as far as the bottom of Dry Valley 3. Both dry valleys originate some distance to the west of Andover Road, an area that has been urbanised with low density development for many years.

15.5.10 In addition to the catchments within the application boundary, the hydrology at Barton Farm is influenced by two external factors. On the eastern side of the proposed development, a small area of the open space to the east of the railway embankment would drain towards Dry Valley 2 during times of extreme rainfall. Overland flow is restricted between the application site and the area east of the railway due to the railway embankment, which was constructed over 100 years ago. The only passage through the embankment within the application site is the underpass immediately south of Dry Valley 2. The area east of the embankment that would drain through this underpass is highlighted on Figure 15.1.

15.5.11 On the western side of Barton Farm an area of Andover Road, at its junction with Stoney Lane, outfalls into a drainage ditch on the boundary of the proposed development. It is not known at present the extent of Andover Road that drains into this ditch but its location near the low point of the highway, at the top end of Dry Valley 2, suggests that a large area could be contributing to the flow.

15.5.12 The natural undeveloped catchments, Area 1, Area 2 and the small area to the east of the railway embankment, are all farmland and used for agriculture. The topsoil and general weathered over-burden gives way to solid chalk within 1m of the surface. Rainfall percolates rapidly through the soil and into the groundwater in the chalk.

15.5.13 The groundwater within the application boundary generally remains several metres below the surface, as shown by borehole data and the Environment Agency's groundwater model. Despite the low level of resolution on the Environment Agency model, both show the level of groundwater to be several metres below the surface in Dry Valley 2, the critical area with respect to potential flooding by groundwater rise. Although groundwater levels do vary with rainfall there is no evidence of water levels having risen above ground level in the southern dry valley.

15.5.14 The groundwater model, although providing only a coarse analysis of the level and movement of the water towards the River Itchen, does provide a clear indication of the hydraulic gradient and direction. Infiltration taking place at any point within the application boundary passes to the south east. This is confirmed by the borehole data undertaken in 2003 (reported in Section 4.4 of HR Wallingford Report EX4734 included as Appendix 15.2), which although taken following a winter that was not particularly wet it clearly shows a south easterly movement.

15.5.15 Infiltration tests show that the underlying chalk is extremely pervious in nature. This confirms that the rain falling on the application site would percolate rapidly through the strata. Therefore the likelihood of overland flow from the small area east of the railway embankment draining to Dry Valley 2 is minimal.

15.5.16 There has been one known occurrence of flooding in Dry Valley 2. In 2000, there was observable ponding for several weeks along the bottom of the valley. The ponding occurred halfway down the valley, against the hedge line dividing Area 1 into two fields. It did not extend as far as the railway embankment and was not evident to the east of the embankment. The fact that the ponding did not occur at the lowest point of Dry Valley 2, suggests that the ponding was not caused by rising groundwater levels but by overland flow. The source of this flow is likely to be the highway drainage outfall overflow on the western edge of the proposed development and as such an overland flow path must be maintained along the bottom of Dry Valley 2. A formal Flood Risk Assessment has been undertaken and has determined the extent of the no development zones within the Barton Farm site. These zones are shown on Figure 15.2

15.5.17 There has been no occurrence of flooding within Area 2 of the proposed development. Instances of flooding have occurred within Dry Valley 3, including the development of a stream along the valley base between December 2000 and February 2001, but the proposed development will not impact, or be impacted by, the mechanisms that caused this flooding.

Flood Risk

15.5.18 A Flood Risk Assessment has been undertaken and is included as a supporting document. The majority of the site lies within Flood Zone 1 in which the proposed development is considered appropriate. The dry valley area (Dry Valley 2) is classified as Flood Zones 2 and 3. Whilst some "less vulnerable" development (employment, commercial) may be permitted in Flood Zone 2, no

development should be allowed in Flood Zone 3. Hence there is a development exclusion zone within the site, as defined by the flood zone classification. The extent of the classified flood zones are shown on Figure 15.1.

15.5.19 The ground investigation undertaken in 2003 indicated that the depth to groundwater was approximately 9m at a minimum along the dry valley. However, groundwater flooding is a particular characteristic of the Winchester District and ground water levels are known to vary. The Environment Agency's Groundwater model indicates depth to groundwater to be approximately 5m in the southern dry valley and 0m along the northern edge of the site, parallel with Well House Lane, reinforcing the need for development exclusion zones in these areas to guard against the risk of groundwater flooding.

15.5.20 As stated above, some flooding of the southern dry valley occurred during the wet winter of 2000. The location of the flooding midway between Andover Road and the railway embankment suggests that this was caused by overland flow on saturated ground exacerbated by the highway drainage outfall at the head of the valley and the impedance of flow by the lateral hedge line. Had the flooding been entirely due to groundwater rise that the extent of the flooding would have been greater than that observed and would have occurred in the base of the dry valley, being the lowest point on the site. The historical flooding, however caused, reinforces the need for a development exclusion zone along the southern dry valley.

Water Supply and Abstraction

15.5.21 The proposed development would need to be supplied with potable water by Southern Water from surface and groundwater sources in the south of Hampshire. The largest resource in the area is at Otterbourne on the River Itchen which includes both direct surface water abstraction and groundwater abstraction from several boreholes.

15.5.22 A formal capacity check has been undertaken by Southern Water to assess the impact of the additional demand on water supply caused by the development. Southern Water has confirmed that there is sufficient capacity within its water supply network to supply the development with little impact on the local area. The Environment Agency has also confirmed that the water supply requirements can be met by Southern Water within its existing abstraction licences and that no new licences would be required to meet development demand. The Agency has also indicated that it is working closely with Southern Water on a long term programme to reduce its reliance on water abstraction for water supply. This is an on-going programme which will gradually reduce licensed abstraction volumes as new, sustainable water resources are identified and brought "on line".

Water Quality

15.5.23 The principal receiving watercourse serving the site is the River Itchen, a designated SSSI and SAC. At the time of the previous application in January 2004 there were concerns regarding the level of phosphates being discharged to the River Itchen, primarily from the Harestock Wastewater Treatment Works. The treatment works were upgraded in early 2006 to meet a more stringent limit on phosphates in the discharge in addition to tightening the normal sanitary standards. The current consent from the Harestock Waste Water Treatment works complies with the Habitat Regulations and is set at BATNEEC for phosphates.

15.5.24 An assessment of the potential impact of the development on groundwater and the River Itchen has been undertaken, included at Appendix 15.1**,** which includes a baseline assessment of groundwater quality. The site is currently agricultural (arable) land and this has been the case for some time. It is situated within the catchment of the River Itchen, which has a total catchment area of 360km^2 upstream of Highbridge Gauging Station (located approximately 10km south of Winchester). The site is 1km from the nearest point of the river. Water mainly enters the site via incident (direct) rainfall but following very high rainfall also as run-off from the up-gradient catchment. All run-off is intermittent as there are no permanent surface watercourses across the site.

15.5.25 Being agricultural land the site has in the past had organic fertilisers added to the soil, as well as other chemicals such as pesticides and herbicides. Inorganic fertiliser is annually added with nitrogen (ammonium nitrate) added every year and NPK (nitrogen-phosphorous-potassium) typically added every other year.

15.5.26 The application of any organic or inorganic fertiliser to the soil should be a controlled process balancing the needs of the crop. However, excess nutrients sometimes reach the groundwater and surface water, particularly following heavy rainfall. Excess nutrients in natural watercourses can result in high rates of weed and algal growth and, in the worst case, eutrophication (and algal blooms).

15.5.1 A preliminary desk based risk assessment of ground contamination has been undertaken and is included at Appendix 15.5. Contaminative land uses identified on site include the potential for animal carcass burial and general farming practices, including the use of pesticides and herbicides. In addition an above ground fuel storage tank has been identified within the operational building area associated with the farm. Contaminative off-site land uses include the Southampton to Basingstoke rail line embankment which forms the eastern site boundary.

15.5.2 A qualitative risk assessment has been undertaken in accordance with CIRIA C552. Low to moderate risks have been identified to the Upper Chalk from the vertical migration of aqueous and dissolved contaminants sourced from the historic use of pesticides, insecticides and herbicides on site, the above ground fuel tank within the Barton Farm buildings and the off-site railway land.

Hydrogeology

15.5.3 A search of the National Natural Cavities Database has been undertaken and found there are no natural cavities recorded at the Barton Farm site. There is one recorded natural cavity within 2km of the site, which comprises multiple solution pipes within the course of the River Itchen.

15.6 Drainage Strategy

Previous Studies

15.6.1 The strategies for both foul and surface water drainage were examined in detail for the previous application by HR Wallingford as detailed in its report “North Winchester Development, Stormwater and Foul Drainage Environmental Impact Analysis and Outline Design” (Report EX4734, June 2004) included as Appendix 15.2. The strategies have been maintained in principle but have been reviewed and updated following further consultation with the Environment Agency and Southern Water to accord with current guidelines and sustainability criteria.

Foul Drainage Strategy

15.6.2 The principal objectives of the foul drainage strategy are as follows:

- To minimise foul discharge by minimising water usage through sustainable building design.
- To provide a separate piped foul drainage network to collect all foul flow without risk of overflow to ground or surface water systems.
- To ensure treatment of the foul effluent to an acceptable quality before discharge into the wider environment.

15.6.3 The proposed residential units will be constructed to Level 4 of the Code for Sustainable Homes and will include water efficient appliances that will reduce significantly water usage and foul sewage compared to existing development standards. Adherence to the Code Level 4 will require in an average water usage of less than 105 litres per person compared with the existing standard of 150 litres per person, as defined by the Water Authoritities’ guidance Sewers for Adoption .This will result in an approximate reduction in foul water run-off of 30% compared to existing standards.

15.6.4 The outline foul drainage network is shown on Figure 15.3. and indicates that four principal foul drainage catchments will be required to drain the development due to the existing topography. Each catchment would be served by a piped drainage network an individual catchment foul pumping station, designed and constructed in accordance with Southern Water’s adoptable requirements. The pump stations will be designed with sufficient emergency storage volume to cater for power or pump

failures without the need for emergency overflows to any watercourse. All four pump stations would be linked via wireless telemetry to ensure balanced operation and integrated emergency response in the event of individual pump station failure.

15.6.5 The terminal pump station would be situated adjacent Well House Lane and would convey foul effluent to the Harestock Waste Water Treatment Works via a new rising main which would be laid within the existing treatment works drainage easement. A sewer requisition may be needed to lay the rising main from the boundary of the site to the treatment works. The terminal pump station would lift the foul flow from the developed site to a gravity sewer leading directly to the treatment works. As peak flows from the pump station are likely to exceed 2.5 DWF, a discharge tank may be required at the head of the gravity system to attenuate flows into the treatment works to the consented capacity allowance. This would be subject to detailed analysis and agreement with Southern Water as part of the detailed design of the system.

15.6.6 Appendix 15.3 contains correspondence with Southern Water which confirms that Harestock Treatment works has treatment capacity for the first 1,000 units but will require further upgrading works for the remainder of the development.

Surface Water Drainage Strategy

15.6.7 A number of options for managing surface water run-off have been examined in detail as set out in HR Wallingford's June 2004 Report (Appendix 15.2). The proposed strategy is to replicate the existing drainage regime as far as possible and, as there is no run-off from the site, to use infiltration methods to discharge all surface water to the ground within the boundary of the site. The drainage strategy is based on Sustainable Urban Drainage Systems (SUDS) principle and the SUDS Management Train. Wherever possible the run-off from the site will be controlled and discharged to ground at source with the remainder being controlled and discharged within the site boundary. Figure 15.4 shows the proposed drainage strategy for the site.

15.6.8 In outline the drainage of the application site will be as follows:

- Roofs and property paved areas will be drained to individual plot infiltration units.
- Public parking areas and shared, private paved areas to use pervious pavements of lager "community" infiltration units.
- Adopted roads and paved areas to be generally traditionally drained using pipes and gullies with interception, treatment ponds and infiltration basins situated in the southern dry valley and at low points on the northern boundary. The drainage system will be supplemented by a network of swales that will accommodate run-off from minor estate roads across the development.

15.6.9 All roofs and private property paved areas will be drained to soakaways or infiltration trenches. These would be provided for each individual property to avoid potential flood problems at a low point in a drainage system where a group of properties are served by a single unit. Building Regulations Part H will require that a 5m distance is maintained from the soakaway to the house although 3m is often accepted practice for the use of infiltration trenches. Houses in the lower part of the site would utilise trenches rather than soakaways to minimise the risk of high groundwater levels preventing effective infiltration. No housing would be placed in areas that are at risk of flooding along the bottom of Dry Valley 2.

15.6.10 From the infiltration tests undertaken in 2003 and the analysis carried out by HR Wallingford (Appendix 15.2), infiltration rates across the site are expected to vary with variability of the underlying chalk. Observed infiltration rates ranged between 0.27mm/s to 1.68mm/s with a conservative "design" infiltration rate of 0.5mm/s considered likely to be appropriate across the majority of the site. On this basis each property would require an infiltration trench 800mm deep (with 500mm cover), 800mm wide approximately 800mm long to cater for a typical 30 year rainfall event. The length of each trench would need to be extended to 1.2m should soakaways be required to cater for the 100 year rainfall event without surcharging (Ref HR Wallingford Report EX 4734, Appendix 15.2).

15.6.11 Groundwater levels vary across the site and are also dependant upon seasonal rainfall. The Environment Agency's groundwater model for the area indicated depth to groundwater as being in excess of 20m along the ridge line to less than 5m in the base of the southern dry valley and 0m at the boundary with Well House Lane. To mitigate against the risk of inundation of infiltration trenches by high groundwater, development exclusion zones have been established for the southern dry valley and the low area adjacent Well House Lane. New properties would be sited a minimum of 4m above the lowest ground levels. In addition, development levels would be arranged to ensure that in extreme circumstances should any soakaway surcharge as a result of either blockage or high ground water levels, overland would be routed away from habitable property to the highway infiltration basins.

15.6.12 It is proposed that pervious pavements would be used in areas of public parking and shared paving particularly in the commercial zone. It is likely that these parking areas will not be lined to allow direct infiltration using the fine aggregate bedding layers beneath the pavement to trap and filter any small amounts of hydrocarbon pollution that might occur. However, where there is significant risk of pollution from vehicles (such as goods deliver areas for example) the parking areas could also be lined and the sub-pavement drained to the adopted highway treatment and infiltration basins if required.

15.6.13 The adopted highways will be drained using the traditional gully and pipe system, to ensure that surface water is collected and controlled and that effective protection against the risk of ground water pollution can be maintained. The highway drains will pass to series of basins and trenches for infiltrating the run-off. These would have sedimentation/treatment ponds to limit high sediment loads entering the ponds and intercept any hydrocarbon pollution prior to discharge to the infiltration basins/trenches which will allow the run-off to percolate into the underlying ground. In addition, the drainage from the sections of new road which will become the "diverted" Andover Road and which will accommodate "through" traffic as well as residential traffic may have petrol/oil interceptors within the piped system to reflect the higher risk of pollution from spillages/accidents from the increased traffic levels. Each interceptor would have a penstock valve that could be closed in the event of an emergency to contain any spillages before discharge into the infiltration system. The installation of petrol interceptors would be considered in consultation with the Environment Agency following a full pollution risk assessment at the detailed design stage.

15.6.14 Treatment ponds and infiltration systems would be situated in the southern dry valley and at low points on the northern boundary to accommodate the surface water catchments as shown on Figure 15.4. The systems would be designed to store the highway run-off from together with any existing overland flow and groundwater flooding that might occur during the 100 year rainfall event (plus a 20% allowance for climate change) without flooding adjacent property. The detailed design will ensure that this can be achieved even if groundwater levels rise to existing ground levels.

15.6.15 The ponds will be designed for the 30 year event with flows passing from the ponds into infiltration trenches. Floor levels of properties will be designed not to flood at the 100 year plus climate change event. To prevent the ponds becoming totally dry during the summer, the pond will be lined to provide a permanently wet pool for ecological, aesthetic and water quality reasons.

15.6.16 A key feature of the use of infiltration in a chalk environment is that chalk is a fissured material and is relatively impermeable when worked on and compacted. Care will therefore be taken in carrying out general site construction and particularly the infiltration units to minimise compaction in these areas during construction. Where necessary the base of the infiltration areas will be "broken-up" to mitigate against the impact of reduced permeability die to compaction of the subgrade.

15.7 Identification and Evaluation of Key Impacts (Construction, Operational and Cumulative)

Impacts During Construction

15.7.1 The potential effect of the construction phase on groundwater and surface water flooding would be very low adverse. There are no direct watercourse catchments within the application site and the principal risk from construction activities therefore would be pollution of groundwater, particularly from spillages from stored fuel oil for construction plant. In addition, chalk powders or form slurry when worked in wet conditions that can become impermeable. Hence it will be important to control carefully construction activities to avoid increasing impermability, particularly in areas where

infiltration systems are to be constructed. There is therefore a requirement to incorporate appropriate mitigation measures and working practises to ensure the significance of potential effects is kept to minor adverse. Construction activities are unlikely to impact significantly on surface flooding.

Impacts During Operation

Water Quality

15.7.2 The key potential impacts on water quality from the development can be summarised as:

- Impacts on the ground water from change of land use and surface water strategy;
- Impacts on the River Itchen from the increased foul effluent flow from the Harestock Treatment Works.

15.7.3 HR Wallingford's Report EX5000, 'Water Cycle Analysis' included, as Appendix 15.4 examined in detail the impacts of the proposed development on the local water regime. Although the Report was written in 2004 and before the 2006 upgrade of the Harestock Treatment Works, its conclusions remain valid.

15.7.4 Section 5 of The Water Cycle Analysis Report examines the impacts of changing land use on pollution loads. The existing site is under agricultural use and fertilisers are used as part of the farming operations. The amount of nitrogen and phosphorous that leaches to groundwater each year depends very much on land cover and management practices. For the developed sites the main source of nitrogen and phosphorous pollution would occur from sewage effluent outfall (see below) although small quantities might be present at times from the landscaped areas of Public Open Space. There is also a risk of diffuse nitrogen and phosphorous pollution from roads if ammonia based de-icing salts are used in winter although concentrations tend to be much lower than from arable land. Pollution from hydrocarbons from highway run-off is also an issue although the sustainable drainage system proposed with effective pollution control and treatment measures will minimise the risks from these pollutants.

15.7.5 The developed site will result in an increase in foul effluent discharge from the Harestock treatment works to cater for the new population. The effluent will however be treated to BATNEEC standard and discharge volumes will be well within the consented outflow from the works. In granting the current consent, the impacts on the River Itchen have been assessed and, by merit of the consent being granted, found to be acceptable.

15.7.6 Following the analysis set out in Report EX5000 it can be concluded that diffuse nutrient pollution to ground water from the developed site would be significantly lower than for arable agriculture. This would however be offset to some extent by the increase in effluent discharge from Harestock Treatment Works. However as nitrogen and phosphorous in sewage would be treated at Harestock to a high standard using BATNEEC, the overall impact of the site is likely to be neutral or low beneficial in terms of reducing nutrient loads to the Itchen.

15.7.7 From the groundwater risk assessment it can be concluded that the application of fertilisers, to playing fields and gardens, will be over a very much reduced area compared to that which is currently normal practiced. Hence, the total quantity of excess nutrients that could potentially reach the groundwater and ultimately the River Itchen is likely to be reduced after development. The same is very likely to be true for pesticides and herbicides.

15.7.8 The proposed development includes the realignment of the Andover Road from its current location along the site boundary to a new alignment through the site. As a consequence of this the road drainage will be directed through the lined treatment ponds prior to discharge to the infiltration ponds. This is an improvement on the current situation where road run off entering the site infiltrates the chalk without treatment.

15.7.9 The construction of modern sewerage systems (sewers and wet-wells) must be compliant with a high construction standard, set out in British Standard BS EN752:2008. Leakage from sewers is therefore not anticipated. Discharge of treated sewage effluent will be undertaken according to a

discharge consent held by Southern Water and therefore the impact of that discharge is not assessed here.

15.7.10 The use of household chemicals is not anticipated to have an impact on the groundwater and thereby the River Itchen. Most chemicals used in the home do not have a mobile residue. Those that do, bleach for example, are normally discharged to foul sewer and end up at the sewage treatment works. Random disposal of small volumes of other waste such as fuel and oils to the ground cannot be easily predicted or controlled. However the volume that may be disposed in this way is unlikely to give rise to groundwater contamination. The design of household soakaways for roof run-off should exclude surface grates or other means that potentially provide an easy disposal pathway for liquid household waste.

15.7.11 The proposed method of drainage provision will ensure the river impact is virtually nil with no direct run-off. There will therefore be no measurable hydraulic or water quality impact. With effective mitigation and pollution control the potential impact from hydrocarbon pollution on groundwater is likely to be neutral.

Groundwater Recharge and Water Abstraction

15.7.12 Section 4 of HR Wallingford's Report EX5000 (Appendix 15.4) includes an analysis of the estimated change in seasonal groundwater recharge following development. The results show that under the present land use there is likely to be no recharge to the underlying Chalk during the summer months due to evaporation and transpiration form crops. Recharge is likely to start in September and end in March, with the greatest recharge occurring during December, depending on the seasonal variability of rainfall from year to year. For the developed paved areas would account for approximately 60% of the developed area from which surface water run-off would be discharged into the underlying Chalk using SUDS techniques. In general this is likely to enhance groundwater recharge as for these areas water would be no longer stored in the upper soils which would result in lower losses through evaporation and transpiration. There is therefore likely to be an increase in groundwater recharge on the site due to the change in use. This increase of course has to be balanced against the increase in water abstraction needed to supply the site.

15.7.13 As set out in previous sections, Southern Water and the Environment Agency have confirmed that the development can be supplied with potable water from Southern Water's supply network and within its existing licences for water abstraction. In considering the existing water abstraction licences, the impacts of abstraction have been considered by the Agency and by merit of granting the licence, are deemed to be acceptable. This was based on water usage criteria (150 l/person/day) whereas the development will accord with Level 4 of the Code for Sustainable Homes which will result in a 30% reduction in water usage (105 l/person/day). There will therefore be a consequent reduction in water abstraction impacts over those previously assessed. The Wallingford analysis in Report EX5000 compares the likely demand for water from the developed site (assuming water efficiency measures are adopted) with the potential increase in groundwater recharge post development, and, ignoring the return flow from the sewage works, concludes that the development of the site could have a net benefit to the water balance during the summer and autumn when flows on the River Itchen are at their most critical.

Flooding

15.7.14 The masterplan ensures that development will not take place in the areas that will be susceptible to flooding. A swale will be constructed in the base of the southern dry valley leading to the water treatment ponds and infiltration basin at the lowest part of the site. This swale will ensure that any residual overland flow from within and outside the development site together with any groundwater issues will be channelled to the treatment/infiltration systems and will be retained within the extents of the published floodplain.

Appropriate Assessment

15.7.15 Given the River Itchen's status as a SSSI and SAC, consideration has been given to the need to undertake an Appropriate Assessment of the impact of the development on the river environment. Of particular concern was the impact of the increase in effluent discharge from the Haresfield

Treatment Works and increased in water abstraction required to serve the development. In considering the need for an Assessment the Environment Agency, Natural England, Winchester City Council and Southern Water have been consulted. Following these consultations it has been concluded that a separate Appropriate Assessment would not be required for this development because the development can be served within the Southern Water's existing discharge consent and abstraction licences. In obtaining the consent and licences an assessment of the impacts on the River Itchen has already been made and the impacts deemed acceptable.

Summary of Impacts

15.7.16 Table 15.1 contains a summary of anticipated drainage and hydrological impacts. The impacts assume the enhancement and mitigation proposals set out below will be implemented.

15.8 Enhancement and Mitigation Proposals

Mitigation During Construction

15.8.1 Due to the difficulties encountered in attempting to remove pollutants from a water body, the best form of mitigation is to prevent pollution at source as far as possible.

15.8.2 An Environmental Management Plan (EMP), which will be agreed with the Planning Authority and Environment Agency, will incorporate measures to reduce the potential for water quality to be effected. These measures can include:

- Minimising the potential for silt run-off by covering/sealing exposed spoil/soil.
- Preventing essentially "clean" drainage mixing with run-off from construction areas.
- Provision of measures to control potentially contaminated surface water run-off from construction activities.
- Carefully controlling the use of cement and concrete.
- Provision for the proper storage and handling of all on site chemicals, fuel and oil, with adequate hard standing, impermeable barriers and bunding to contain accidental spillages/leakages entering the ground, drainage channels or watercourses.
- Provision of emergency response plans to ensure adequate preparation for the control and mitigation of pollution incidents should they occur.

15.8.3 An active monitoring programme for the construction phase will also be included in the EMP to ensure that the potential effects on water quality are minimised.

Mitigation During Operation

Foul Drainage

15.8.4 The foul drainage and pump stations would be designed to adoptable standards and would be maintained by Southern Water upon completion. As such no specific mitigation measures are envisaged although it will be important to ensure that the risk of foul effluent leaching to groundwater is fully addressed. Specific consideration would be given to ensure:

- Foul pipe work, manholes and pumping chambers are stringently tested and surveyed to ensure water and air tightness, as required by Southern Water.
- Pump Stations are designed to incorporate sufficient emergency storage to cater for power or pump failure without risk of overflowing.
- Pump stations are linked via wireless telemetry to ensure balanced operation and coordinated emergency response without risk of overflow.

Surface Water Drainage

15.8.5 Mitigation measures for surface water drainage however may be summarised as follows:

- The surface water drainage strategy is based on the SUDS Management Train with no direct outfall to the nearby River Itchen.
- Uncontaminated surface water from roofs and private paved areas will be separated from highway run-off and discharged to ground at source
- Run-off from adopted highways collected by a hierarchy of pollution control elements before discharging to ground. Measures include trapped gullies, petrol interceptors and penstocks for the main road drainage runs, lined treatment basins and finally infiltration systems.

Flooding

15.8.6 Development exclusion zones have been established to ensure that no habitable properties are positioned within the published Flood Zones or in areas at risk from ground water flooding. The lowest properties will remain some 4m above ground levels in the base of Dry Valley 2.

Water Abstraction

15.8.7 The development will be constructed to Level 4 of the Code for Sustainable Homes which will reduce water usage by 30% compared to existing standards (105 litres per day compared with 150 litres per day). This will be achieved predominately by the installation of water efficient appliances, both fixed (baths, toilets, taps, showers etc) and non-fixed (washing machines, dishwashers etc). Rainwater harvesting for garden use will also be encouraged through the provision of water butts to supplement efficient water usage.

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Table 15.1 Summary of Impacts

Feature	Potential Effect	Baseline Quality	Baseline Sensitivity	Magnitude of Effect High, Medium, Low, Neutral Beneficial/Adverse (+/-)		Significance of Effect Major, Moderate, Minor, Neutral Beneficial/Adverse (+/-)	
				Construction Phase	Operational Phase	Construction Phase	Operational Phase
River Itchen	Water Quality (Increased Foul Discharge)	Site of Special Scientific Interest, Special Area of Conservation	High	**Neutral**, no increased discharge	**Neutral**, development can be served within the existing consent	**Neutral,** no increased discharge	**Neutral**, development can be served within the existing consent
	Fluvial Flooding	Areas of Flood Zones 2 and 3 within the site	Low	**Neutral,** no impact on the flood plain during construction	**Neutral**, development situated outside the floodplain	**Neutral,** no impact on the flood plain during construction	**Neutral**, development situated outside the floodplain
	Groundwater Flooding	High and variable groundwater levels	Moderate	**Neutral,** no impact on groundwater during construction	**Neutral**, any groundwater flooding which does occur will be contained in the fluvial floodplain on which development is excluded	**Neutral,** no impact on groundwater during construction	**Neutral**, any groundwater flooding which does occur will be contained in the fluvial floodplain on which development is excluded
	Water Abstraction	Sensitive to water abstraction, particularly during the dry season	High	**Neutral,** no impact on groundwater during construction	**Low Adverse**, but outside the environs of the site	**Neutral,** no impact on groundwater during construction	**Minor Adverse**, but outside the environs of the site
	Groundwater Quality	Impacted by current farming practices	High	**Neutral**, providing CEMP followed.	**Low Beneficial**, from stopping of farming fertiliser/herbicide/pesticide application	**Neutral**, providing CEMP followed.	**Minor Beneficial**, from stopping of farming fertiliser/herbicide/pesticide application
	Groundwater Recharge	Groundwater contributes to fluvial flow	High	**Neutral,** no impact on groundwater recharge during construction	**Low Beneficial**, due to direct drainage systems and reduced evaporation and transpiration	**Neutral,** no impact on groundwater recharge during construction	**Minor Beneficial**, due to direct drainage systems and reduced evaporation and transpiration

15.9 Summary

15.9.1 An assessment of the potential effects on the development has been undertaken in accordance with the Scoping report agreed by Winchester City Council in April 2009.

15.9.2 The application site is underlain by highly pervious soil and has two natural catchments each with dry valleys .Rainfall on the area percolates to the groundwater which flows to the River Itchen approximately 1km to the east of the site. The River Itchen is a Site of Special Scientific Interest and Special Area of Conservation and is protected under the Wildlife and Countryside Act and the Habitats Regulations. The Environment Agency has confirmed that areas of Flood Zone 2 and Flood Zone 3 exist along the southern dry valley. Consultation with Natural England, the Environment Agency. Winchester City Council and Southern Water has concluded that an Appropriate Assessment is not required fro this development.

15.9.3 The proposed development comprises 2000 new homes and associated facilities. Foul sewage from the development will be conveyed to the nearby Harestock Waste Water Treatment works which currently has treatment capacity for 1000 of the proposed new homes. Capacity upgrading will be required for the full development, which will be undertaken by Southern Water as part of its Asset Maintenance Programme. The whole of the development can however be accommodated by within the treatment works' existing discharge consent. Southern Water has also confirmed that the development can be supplied with potable water from its existing network within its existing water abstraction licences. The development will be constructed to Level 4 of the Code for Sustainable Homes which will result in 30% less water usage than a 'standard' equivalent development.

15.9.4 Surface water from the development will be accommodated by a drainage system based on the SUDS Management Train which will replicate the existing natural catchment and infiltrate all run-off to the ground. There will be no direct outfall to the River Itchen or other tributary watercourses. Interception through a series of swales and vegetated treatment ponds will ensure that groundwater quality is not adversely affected. The cessation of the application of farming chemicals following development will also result in some improvement in the quality of the groundwater. The surface water drainage strategy will ensure that the underlying aquifer continues to be recharged following the development with a slight improvement over existing conditions during the summer months.

15.9.5 A Flood Risk Assessment has been undertaken and has concluded that provided no development takes place within the published flood zones, the risk of flooding is not significant. Surface water ponding is known to have occurred in the southern dry valley during the very wet winter of 2000. This is thought to have been caused by overland flow from the Andover Road highway drainage system being dammed by a transverse hedgebank and high groundwater levels. The proposed masterplan includes the construction of a swale along the base of the valley which will convey all overland flow from the catchment to the lowest point in the valley and ensure that any future ponding will be contained within the published floodplain.

15.9.6 From the assessment undertaken it has been concluded that no major effects on groundwater and surfaces have been identified as a result of the development in terms of water flow and water quality. The magnitude of any potential effects would be reduced or removed by the mitigation measures proposed for incorporation into the development scheme. For ground water quality and groundwater recharge there will be some positive benefits as a result of the development.

Figures

Figure 15.1 Existing SW Drainage Features

Figure 15.2 Development Exclusion Zones

Figure 15.3 Foul Drainage Strategy

Figure 15.4 Surface Water Drainage Strategy

Appendices

Appendix 15.1 The Potential Impact of the Development on Groundwater and the River Itchen – Parsons Brinckerhoff, October 2009

Appendix 15.2 Stormwater and Foul Drainage HR Wallingford Report EX4734, June 2004.

Appendix 15.3 Correspondence with Southern Water and updated Position Statement

Appendix 15.4 Water Cycle Analysis – HR Wallingford Report EX 5000, June 2004

Appendix 15.5 Preliminary Risk Assessment (Desk Study) for Barton Farm, Andover Road, Winchester – Parsons Brinckerhoff, October 2009

Supporting Documents

Flood Risk Assessment – Parsons Brinckerhoff May 2009