CONTENTS

Introduction 9-1
Study Area 9-1
Policy Context 9-1
National Policies 9-1
Local Planning Policies 9-2
Consultation 9-3
Sources of Information 9-4
Methodology 9-4
Baseline Conditions 9-5
Groundwater 9-5
Surface Water 9-7
Flood Risk 9-8
Assessment of Potential Impacts 9-9
Proposed Development 9-9
Groundwater 9-10
Surface Water 9-12
Flood Risk 9-12
Summary of Unmitigated Potential Impacts 9-13
Proposed Mitigation Measures 9-14
Groundwater 9-14
Surface Water 9-15
Flood Risk 9-16
Assessment of Residual Impacts 9-17
Conclusions 9-18

INTRODUCTION

9.1 This Chapter details the hydrology of the application site and surrounding area and identifies potential impacts associated with the proposed development, details of which are provided in Chapter 3 above.

9.2 Appropriate mitigation measures have been considered and the residual impacts following mitigation have been assessed. The assessment is based on a baseline description of the local hydrological regimes.

9.3 A Flood Risk Assessment (FRA) and Sustainable Drainage (SuDS) Design Statement have been prepared in accordance with the requirements of the National Planning Policy Framework[1] (NPPF) and its associated Technical Guidance[2], and in line with methodologies set out within BS8533[3] (refer to Technical Appendix 9/1).

STUDY AREA

9.4 The application site is located off Overton Road approximately 750m north of Micheldever Station and 4km miles north of the village of Micheldever, Hampshire. Chapter 2 above provides a detailed account of the location of the application site. The application site comprises 3 hectares of a brownfield site previously used as rail sidings and a fuel storage depot. The study area considers the site itself and other relevant features. Generally these are within 250m of the boundary of the application site, but on occasions when considering the potential impact upon groundwater receptors, the study area may extend to a distance of 2km.

POLICY CONTEXT

National Policies

9.5 The development of the application site would be undertaken with due regard to technical guidance, relevant Pollution Prevention Guidelines and other codes of best practice in order to limit the potential for contamination of ground and surface waters, the potential for flooding to be caused by the proposed development, and other potential impacts. The development of the application site would be in accordance with the following:

- Control of Pollution Act 1974;
- Environment Act 1995;
- The Environment Agency's statutory obligations over the management and control of pollution into water;
- EC Water Framework Directive (2000/60/EC);
- Environment Agency – Pollution Prevention Guidelines;
- Code of Practice for Site Investigations, BS5930;

[1] National Planning Policy Framework : Communities and Local Government (March 2012)
[2] Technical Guidance to the National Planning Policy Framework : Communities and Local Government (March 2012)
[3] BS8533 : Assessing and Managing Flood Risk in Development – Code of Practice : British Standards Institute (October 2011)

- Environmental Good Practice on Site C650 (CIRIA 2005).
- Environment Agency, Groundwater Protection: Policy and Practice
- National SUDS Working Group, Interim Code of Practice for Sustainable Drainage Systems, 2004;
- CIRIA 697, The SUDS Manual, 2007;
- Control of Water Pollution from Linear Construction Projects – C648 (CIRIA, 2007);
- Flood and Water Management Act (2010); and
- National Planning Policy Framework (CLG, March 2012).

9.6 The Pollution Prevention Guidelines identified below are the principal documents used for guidance on preventing water pollution and the erosion from construction activities and are jointly produced by the Environment Agency for England and Wales, Scottish Environmental Protection Agency and the Environment and Heritage Services in Northern Ireland. All are available via the Environment Agency's (EA) website (www.environment-agency.gov.uk);

- PPG1: General Guide to the Prevention of Pollution;
- Introducing Pollution Prevention : PPG1 (Draft : Nov 2011)
- PPG2: Above Ground Oil Storage Tanks;
- PPG3: Use and Design of Oil Separators in Surface Water Drainage Systems;
- PPG4: Disposal of Sewage where no Mains Drainage is Available;
- PPG5: Works in, Near, or Liable to Affect Watercourses;
- PPG6: Working at Construction and Demolition Sites;
- PPG8; Storage and disposal of Used Oils;
- PPG18; Managing Firewater and Major Spillages;
- PPG21; Pollution Incident Response Planning;
- PPG22; Dealing with Spillages on highways; and
- PPG23: Maintenance of Structures over Water.

Local Planning Policies

9.7 Section 3.4.1 of the Winchester Strategic Flood Risk Assessment (SFRA) summarises the salient policies relating to the water environment and flood risk.

Winchester District Local Plan Review

9.8 The Local Plan review adopted in July 2006 recognises the importance of achieving sustainable development and the role played by natural resources such as water. Chapter 3 of the Local Plan "Design and Development Principles" provides details of how the Council sees development proposals contributing towards the aim of achieving sustainable development within the District and the following highlights those parts of the plan that relate to the role of water resources and minimising flood risk.

9.9 Policy DP.6 of the Winchester District Local Plan Review stresses the need to make efficient use of resources when planning and designing developments including the need to include:

- measures to reduce water consumption and to safeguard the sources of water supply; and
- sustainable drainage systems.

9.10 Policy DP.6 also states that *"development should not be wasteful in its use of energy or in its depletion of natural resources (e.g. groundwater supplies). Development should not threaten groundwater supply or conflict with the Environment Agency's "Groundwater Protection Policy"*.

9.11 Specific advice is given in relation to flood risk through Policy DP.8, which was prepared in accordance with the advice in PPG25 and primarily seeks to avoid inappropriate development in areas at highest risk from flooding, and uses the Environment Agency's floodplain maps as the source of flooding data. Particular regard for flood risk should be had where development proposals:

- generate significant runoff from the site;
- impede (or impede the maintenance of) flood defences or existing structures which may serve as a flood defences;
- reduce water storage areas, either natural or manmade.

9.12 Policy DP.8 also sets out that a particular characteristic of Winchester District, given the high proportion of chalk downland and relatively high water tables, is groundwater flooding. What are normally dry valley bottoms can become functional waterways during periods of intense or prolonged rainfall. Development proposed in these 'dry' valley bottoms should also include an assessment of risk.

9.13 Policy DP.8 specifies that development in areas at risk of flooding should follow a sequential approach to site selection, locating development in the lowest available flood risk area, unless this would compromise other sustainability objectives, including the priority to be given to the use of land within defined built-up areas, or other policies of the adopted Plan. Subject to this, development or change of use will be permitted, provided that:

- appropriate measures are taken to ensure that the rate of runoff from the site will not be significantly increased;
- in all areas with potential risk of flooding, access is maintained for essential civil infrastructure in times of emergency;
- buildings are located away from 'dry' valley floors and other areas where there is a risk of groundwater flooding, and do not add to flood risk up or downstream.

CONSULTATION

9.14 At the time of writing the only regulatory consultation with respect to the water environment has been part of a Scoping Opinion Request to

Hampshire County Council. Details relating to the Scoping Opinion are set out in Chapter 1 above.

SOURCES OF INFORMATION

9.15 The baseline conditions set out below are drawn from widely available published materials, recent ground investigations, and from an information request issued to the EA.

9.16 A summary of the sources of information used in this assessment include:

- Centre of Ecology and Hydrology (CEH Wallingford), Flood Estimation Handbook CD ROM Ver. 3, 2009;
- Environment Agency Website (www.environment-agency.gov.uk) for details of river quality, source protection zones, aquifer classification and flooding;
- British Geological Survey, Solid and Drift Geology Map, Winchester, England and Wales Sheet 299, 1:50,000 scale;
- Hydrogeological Map for Hampshire and Isle of Wight;
- Emapsite Report for details on geology, hydrogeology, flood risk, licensed abstractions and pollution events (October 2011);
- Winchester City Council Strategic Flood Risk Assessment : Level 1 : September 2007;
- Partnership for Urban South Hampshire Strategic Flood Risk Assessment : December 2007;
- Environment Agency : The Test and Itchen Catchment Abstraction Management Strategy : Final Strategy : March 2006.

METHODOLOGY

9.17 The general approach to the EIA has been explained in Chapter 1 of this ES.

9.18 This sub-section introduces the methodology adopted for the assessment of flood risk and wider impacts upon the water environment. The assessments ensure that all potential significant impacts involved in the creation of the proposed development are considered.

9.19 Any potentially significant impacts raised in the assessments are considered and impacts or risks requiring mitigation measures are discussed.

9.20 A qualitative risk assessment methodology has been applied, in which the probability that an impact occurs and the magnitude of the impact, if it were to occur, are considered. These are combined to determine the 'Significance' of the impact. This approach provides a mechanism for identifying the areas where mitigation measures are required, and for identifying mitigation measures appropriate to the risk presented by the proposed development.

9.21 This approach allows effort to be focused on reducing risk where the greatest benefit may result. Mitigation is considered necessary where the significance of the impact is assessed as 'medium' or 'higher'. The assessment is outlined in Table 9-1 below.

Table 9-1
Matrix Used to identify the Significance of an Impact

Probability of Occurrence	Magnitude of Potential Impacts			
	Severe	Moderate	Mild	Negligible
High	High	High	Medium	Low
Medium	High	Medium	Low	Near Zero
Low	Medium	Low	Low	Near Zero
Negligible	Low	Near Zero	Near Zero	Near Zero

9.22 The definition of 'degrees of magnitude' for various examples of potential impacts, in terms of hydrology and hydrogeology is detailed in Table 9-2.

Table 9-2
Magnitude of Potential Impacts

Magnitude	Potential Impact
Negligible	No impact of alteration to existing important geological environs; No alterations or very minor changes with no impact to watercourses, hydrology, hydrodynamics, erosion and sedimentation patterns; No alteration to groundwater recharge or flow mechanisms; and No pollution or change in water chemistry to either groundwater or surface water.
Mild	Some loss of soils with no long term impact; Minor or slight changes to the watercourse, hydrology or hydrodynamics; Changes to site resulting in slight increase in runoff well within the drainage system capacity; Minor changes to erosion and sedimentation patterns; and Minor changes to the water chemistry.
Moderate	Slope failure or instability which may cause foundation problems, loss of extensive areas of peat or agricultural soil, damage to important geological structures/features; Some fundamental changes to watercourses, hydrology or hydrodynamics; Changes to site resulting in an increase in runoff within system capacity; Moderate changes to erosion and sedimentation patterns; and Moderate changes to the water chemistry of surface runoff and groundwater.
Severe	Slope failure or instability which causes loss of life, permanent degradation and loss of important geological feature; Wholesale changes to watercourse channel, route, hydrology or hydrodynamics; Changes to site resulting in an increase in runoff with flood potential and also significant changes to erosion and sedimentation patterns; and Major changes to the water chemistry or hydro-ecology.

BASELINE CONDITIONS

Groundwater

Aquifer Characteristics

9.23 EA Groundwater Prevention Policy designates the site as being located upon a Principal Aquifer with 'intermediate' vulnerability. The Principal Aquifer designation relates to the underlying chalk bedrock which has a high

permeability and is a geological layer capable of supporting water supplies and / or river base flow on a strategic scale

9.24 No superficial drift deposits are believed to underlie the locale. As such, there is no aquifer designation relating to superficial geology at this location.

Recharge Mechanisms

9.25 The Institute of Hydrology FEH CD ROM 2009 reports that the average annual rainfall at the application site to be in the region of 801mm per annum.

9.26 Despite the presence of made ground beneath areas of the site, the underlying chalk aquifer is recharged by infiltration of rainfall through the generally porous soils across the site and locale.

Groundwater Levels and Flows

9.27 Based upon ground investigation data summarised in Chapter 10, groundwater was confirmed at a rest level of over 37m below ground level in the immediate vicinity of the application site. Due to this significant vertical distance between site ground level and the groundwater table there would be adequate dispersion of pollutants through the unsaturated zone were runoff to be disposed to ground via infiltration techniques.

9.28 Hydrogeological gradients (indicated upon the Hydrogeological Map for Hampshire and Isle of Wight) would suggest that groundwater flow beneath the application site would be towards the southwest where several potential surface water receptors are fed by emergent groundwater.

9.29 Groundwater flow in the underlying chalk is likely to be significant and highly influenced by the extent of fractures. Groundwater storage potential within the underlying chalk is likely to be significant.

Source Protection Zones, Groundwater Abstractions, Use and Quality

9.30 Based upon the EA's Groundwater Source Protection Zone mapping, the application site is located within Source Protection Zone 3 (Outer Catchment) an outlying area providing groundwater recharge to an aquifer.

9.31 The application site is located within The Test and Itchen Catchment Abstraction Management Strategy (CAMS)[4] area. This strategy aims to manage and control groundwater abstractions.

9.32 There are large groundwater abstractions in the region for potable, industrial and agricultural purposes, including significant abstractions for watercress farms.

[4] Environment Agency (March 2006) *The Test and Itchen Catchment Abstraction and Management Strategy*

9.33 Data from Emapsite[5] has confirmed there are no licensed groundwater abstractions within 2km of the application site. This is confirmed upon Figure 5 of the CAMS.

9.34 The CAMS surface water resource assessment identifies the application site as being located within the Upper Test catchment designated as having 'No Water Available'. This indicates that no water is available for further licensing at low flows, although water may be available at high flows with appropriate restrictions.

9.35 No specific groundwater quality data is available for the application site.

9.36 The CAMS (Section 3.8) indicates that most of the land use in the Test and Itchen catchment is agricultural with the main source of groundwater pollution being from agricultural activities. The principal cause of concern within the catchment is diffuse nitrate pollution of groundwater.

Surface Water

9.37 The application site lies within the Upper Test river catchment, although no Main Rivers, Ordinary Watercourses, or other significant surface water features exist on-site or within close proximity of the application site.

9.38 The nearest significant surface water feature is a tributary of the River Test, the River Dever (designated Main River), which flows in a westerly direction through the hamlet of Micheldever approximately 3.5km south of the application site.

9.39 The source of a further spring-fed tributary of the River Dever rises at Cranbourne Grange, near Upper Bullington, approximately 5km to the southwest of the application site.

9.40 Surface water quality objectives within the Upper Test, including the River Dever and its local tributaries, are largely achieving their "very good" and "good" targets. Very good surface water quality is borne out by the presence of watercress farms and beds shown on OS mapping along the River Dever and Upper Test.

9.41 Records of Licensed Discharge Consents within 500m of the application site were obtained from the Emapsite GroundSure EnviroInsight Report. Locations are presented on Drawing MS/9/1A. Three discharge consents were identified upgradient of the application site; all relate to discharge of treated effluent from private sewage treatment facilities.

9.42 Southern Water records indicate that there are no public surface water or foul sewers and no public water mains within the immediate vicinity of the application site.

[5] Emapsite, Groundsure EnviroInsight Report for details of geology, hydrogeology, groundwater vulnerability, discharge consents and abstraction licences, November 2011

9.43 As there are no surface water receptors on-site, or within close proximity of the application site, the proposed development would pose no direct detrimental impact to any Main Rivers or surface water features. Indirect impacts upon surface water could potentially arise, however, from contaminant pathways via the groundwater.

Flood Risk

9.44 Based upon the Flood Zone Maps published by the EA, the proposed development is shown to lie entirely within 'low probability of occurrence' Flood Zone 1 (which represents an annual probability of less than 0.1% of a flood occurring in any one year).

9.45 All potential sources of flooding to the application site have been considered and assessed in detail within the FRA provided in Appendix 9/1.

9.46 The primary flood risk associated with the the proposed development is posed by the additional surface water runoff generated as a result of the proposed increase in impermeable area onsite, which could potentially result in an increase in flood risk to offsite areas.

9.47 There is a potential risk to the site itself associated with overland flow, conveyed from the adjacent higher ground to the east and north of the application site.

9.48 A summary of the potential sources of flooding and a review of the potential risk posed by each source at the application site is presented in Table 9-3 below.

Table 9-3
Potential Sources of Flood Risk

Potential Source	Potential Flood Risk at Application Site?	Reason
Fluvial flooding	No	Site located within Flood Zone 1 and no watercourses within vicinity of site.
Tidal flooding	No	Inland location.
Surface water flooding	No	Land within the cutting to the west of the site is considered to be susceptible to surface water flooding. Due to its elevated terrain, the site itself is not deemed to be affected.
Flooding from rising / high groundwater	No	Elevated terrain and lack of historic evidence suggest that groundwater emergence poses no flood risk to the site.
Overland flow flooding	Yes	Overland runoff from adjacent land and highways could potentially encroach onto the site.
Flooding from artificial drainage systems	No	No public surface water sewers, foul sewers or public water mains which pose a significant flood risk from surcharge or blockage.
Flooding due to infrastructure failure	No	The site is not reliant upon any flood defence infrastructure, therefore, no flood risk is posed by failure of infrastructure.

ASSESSMENT OF POTENTIAL IMPACTS

9.49 This sub-section identifies the potential impacts of the proposed development on the hydrogeological and hydrological environments prior to mitigation. It also assesses the likelihood of occurrence of each identified impact. The results of this assessment are summarised in Table 9-4. It should be noted that the magnitude of the impact has been assessed as described in Table 9-2.

Proposed Development

9.50 The proposed development comprises a energy recovery centre, and associated access and parking. A detailed description of the proposed development is presented in Chapter 3.

9.51 In summary, key aspects which would potentially impact upon the hydrogeological / hydrological regimes include:

- hardstanding would be provided to the entrance, weighbridge, car parking and all vehicle movement areas;

- surface water from external hardstanding areas and roadways would be collected in a positive drainage system which discharges into the proposed infiltration basin, infiltration swales, soakaways and porous surfacing via appropriate pollution control measures;
- the whole plant and waste handling would be housed within the buildings / tanks on site;
- rainwater falling directly onto the building roof areas would be harvested, treated, and reused within the process for steam generation;
- the floor of the waste reception building would be positively drained in a sealed system to collection tanks on site for treatment and reuse;
- all process water used by the plant would be recycled and recovered within the central water treatment and recovery plant. The plant has been designed to recover all grey water as well as utilise all water from the building operations, internal drains and rainwater;
- living 'green' roof technology may be provided to intercept roof runoff and provide a degree of treatment prior to reuse;
- on-site storage and handling of limited quantities of fuels and potential pollutants.

Groundwater

Groundwater Quality

9.52 Without the incorporation of mitigation measures the construction and operation of the proposed facility has the potential to impact on groundwater quality. This would be from the risk of contaminated runoff being generated from the following potential sources:

- accidental spillage of raw materials, fuels and lubricants, required over the short term by construction plant and over the longer term from operation of the facility and from the vehicles moving around the site, including the accidental spillage of potentially polluting liquids;
- potential release of fire fighting water in the unlikely event of a fire at site;
- increase in suspended solids; and
- the change in land use may result in contaminated runoff from the weighbridges and vehicle movement areas.

9.53 During the construction phase, the potential for pollution of any groundwater by raw materials, fuels, other liquids and runoff from the operational site would be limited by best practice techniques and inherent compliance with 'COSHH' regulations. The likelihood of groundwater contamination due to a leak or spill of pollutants during construction or contaminated runoff during operation of the site is therefore considered to be **'low'** due to the short period during which there is a risk, the limited quantities of pollutants being handled or stored at any one time, and the significant vertical distance between site ground levels and the underlying groundwater table. The magnitude of the impact is assessed as being **'moderate'**. The overall significance of impact is therefore considered to be **'low'**.

9.54 The potential for pollution of any groundwater by raw materials, fuels, other liquids and runoff from the operational site would be limited by robust site

practices. The likelihood of groundwater contamination due to a leak or spill of pollutants during construction or contaminated runoff during operation of the site is therefore considered to be **'medium'** due to the significant vertical distance between site ground levels and the underlying groundwater table. The magnitude of the impact is assessed as being **'moderate'**. The overall significance of impact is therefore considered to be **'medium'** based upon the potential migration of contaminants to other receptors including the underlying aquifer and surface water.

9.55 During the operational phase, it is considered that the potential for occurrence of pollution of potable groundwater in the chalk aquifer is **'medium'**. Owing to the significant vertical distance between site ground levels and the underlying groundwater table, contaminants would tend to be hydraulically separated from the aquifer and the travel time through the intermediate geology would provide a degree of mitigation. The magnitude of impact would therefore be '**moderate'** with a corresponding **'medium'** level of overall significance.

9.56 In the event of a fire at the operational site there is potential, without mitigation, for uncontrolled discharge of contaminated water from site which could infiltrate to groundwater. The likelihood of this occurring is **'low'** due to the fire suppression measures inherent provided as part of the proposed scheme. The magnitude of impact is assessed as being **'moderate'** to **'severe'** with a **'low'** to **'medium'** level of overall significance to groundwater quality in the absence of mitigation.

9.57 Chapter 10 (Geology and Land Quality) of this ES deals with the risks to groundwater from potential contaminants within the historic made ground.

Groundwater Levels and Flow

9.58 Given the setting of the application site it is considered that the proposed development would have a limited impact on the groundwater flow regime for the following reasons:

- the significant depth below ground level to the underlying Aquifer;
- the lack of groundwater abstractions within 2km of the site;
- the presence of made ground and structures beneath western areas of the baseline site;
- the shallow foundations of the proposed building.

9.59 During the construction phase, the likelihood of groundwater inundation into excavations is considered **'negligible'** owing to the significant depth to the groundwater table. The magnitude of impact would be **'moderate'** with a corresponding **'near zero'** level of overall significance.

9.60 It is also considered that the likelihood of occurrence of altering groundwater flow as a result of foundation construction would be **'low'** to **'negligible'** and the magnitude of impact would be **'negligible'** with a corresponding **'near zero'** level of overall significance.

9.61 Without mitigation, the likelihood of occurrence of altering / reducing the groundwater recharge would be **'high'** albeit the magnitude of impact would be '**mild'** with a corresponding **'medium'** level of overall significance.

9.62 Proposed processes require around 40m^3 per day of water. Without mitigation, and presupposing that all water would be abstracted locally, the likelihood of occurrence of altering the groundwater regime would be **'high'** and the magnitude of impact would be '**moderate'** with a corresponding **'high'** level of overall significance.

Surface Water

9.63 The potential for pollution of surface water is inherently linked to groundwater pollution as local surface water receptors are groundwater fed.

9.64 During the construction phase, in the short term, hydrocarbon pollution from untreated runoff associated with roads and car parking areas could cause issues for surface water quality without suitable mitigation. The likelihood of this occurring is **'medium'** due to ground disturbance associated with construction or hydrocarbon pollution from vehicles over a relatively short timeframe. Due to the significant lateral distance (in excess of 3.5km) between the application site and the nearest surface water receptor the magnitude is assessed as **'mild'** with a **'low'** level of overall significance to surface water quality without the incorporation of suitable mitigation methods.

9.65 During the operational phase, in the short, medium and long term, hydrocarbon pollution from untreated runoff associated with roads and car parking areas could cause issues for surface water quality without suitable mitigation. The likelihood of this occurring is **'medium'** over the lifetime of the development. Due to the significant lateral distance (in excess of 3.5km) between the application site and the nearest surface water receptor the magnitude is assessed as **'moderate'** with a **'medium'** level of overall significance to surface water quality without the incorporation of suitable mitigation methods.

9.66 The development of the application site through the inclusion of impermeable roof and external hardstanding etc has the potential to alter the local hydrological regime by increasing the rate of runoff from the site, which may cause localised flooding.

9.67 It is considered that there is a **'high'** probability of increased surface water runoff during the short, medium and long term which could cause a **'mild'** impact. The significance of this impact has the potential to be **'medium'** in the absence of mitigation.

Flood Risk

9.68 The development of the application site would not potentially lead to an increase in population within a flood risk area during the construction and operation phases as the application site lies in 'low probability of occurrence' Flood Zone 1.

9.69 A detailed assessment of the flood risk to the site is presented in Appendix 9/1. Based upon the potential flood risk impact from overland flows, it is considered that there is a **'medium'** probability of increased flood risk during the short, medium and long term which could cause a **'moderate'** impact upon the site functionality. The significance of this impact has the potential to be **'medium'** in the absence of mitigation.

Summary of Unmitigated Potential Impacts

9.70 Unmitigated potential impacts are summarised in Table 9-4.

Table 9-4
Summary of Unmitigated Potential Impacts

Potential Impact	Spatial and Temporal Impact	Probability of Occurrence	Magnitude of Impact	Significance of Impact	Mitigation Required?
Groundwater					
Contaminated runoff including leakage of fuels entering groundwater during construction phase	Local, Short Term (Adverse)	Low	Moderate	Low	Yes
Contaminated runoff entering groundwater during operational phase	Regional, Short and Long Term (Adverse)	Medium	Moderate	Medium	Yes
Contaminated runoff entering potable aquifer	Regional, Long Term (Adverse)	Medium	Moderate	Medium	Yes
Uncontrolled discharge of fire fighting water into groundwater	Regional, Short and Long Term (Adverse)	Low	Moderate to Severe	Low to Medium	Yes
Groundwater inundation during construction	Local, Short Term (Adverse)	Negligible	Moderate	Near Zero	No
Reduction in Groundwater Flow	Local, Short and Long Term (Adverse)	Negligible	Negligible	Near Zero	No
Reduction in groundwater recharge	Regional, Long Term (Adverse)	High	Mild	Medium	Yes
Abstraction of groundwater for process use	Regional, Long Term (Adverse)	High	Moderate	High	Yes
Surface Water					
Contaminated runoff entering surface waters during construction phase	Regional, Short and Long Term (Adverse)	Medium	Mild	Low	No
Contaminated runoff entering surface waters during	Regional, Short and Long Term (Adverse)	Medium	Moderate	Medium	Yes

Potential Impact	Spatial and Temporal Impact	Probability of Occurrence	Magnitude of Impact	Significance of Impact	Mitigation Required?
operational phase					
Increased rate of runoff from site leading to flooding	Local, Long Term (Adverse)	High	Mild	Medium	Yes
Flood Risk					
Potential flood risk to the site	Local, Short and Long Term (Adverse)	Medium	Moderate	Medium	Yes

PROPOSED MITIGATION MEASURES

9.71 Mitigation measures to address the potential impacts detailed in Table 9-4 are described below. These measures either reduce the likelihood of an event occurring, or reduce the magnitude of the consequences if the event does occur. It should be noted that several of the mitigation measures proposed below would have a positive effect on more than one potential impact.

9.72 A number of operational mitigation measures and best available techniques have been incorporated into the scheme design, which would reduce the potential risk to ground and surface water.

Groundwater

9.73 Various best practice techniques would be incorporated within the management procedures for construction and operation activities onsite in order to protect the water environment from pollution incidents. The mitigation measures can be summarised as follows:

- during construction there would be heavy plant and machinery required on site and as a result it is appropriate to adopt best working practices and measures to protect the water environment, including those set out in the Environment Agency's Pollution Prevention Guidance (PPG1);
- in accordance with PPG2 all above ground on-site fuel and chemical storage would be bunded;
- an emergency spill response kit would be maintained on site;
- a vehicle management system / road markings would be put in place wherever possible during construction and operation to reduce the potential conflicts between vehicles and thereby reduce the risk of collision; and
- a speed limit would be imposed on site to reduce the likelihood and significance of any collisions.

9.74 Measures would be put in place to mitigate the risk of potentially contaminated fire suppression water from being discharged to surface waters or groundwater in accordance with PPG18, '*Managing Fire Water and Major Spillages'*. Fire fighting run-off would either be treated prior to discharge or tankered off site for treatment and disposal.

9.75 The implementation of mandatory pollution control measures and best working practice techniques during construction would limit potential impacts during the construction phase.

9.76 All discharges from highway and hardstanding areas would be appropriately treated prior to release to ensure that any discharge meets the required environmental quality standards as to be set out within the discharge consent.

9.77 Appropriate proprietary pollution control measures (*e.g.* silt traps, trapped gullies, petrol interceptors) would be incorporated within the surface water drainage network prior to discharge to the infiltration basin and infiltration swale facilities.

9.78 Abstraction of significant volumes of groundwater would be obviated by the proposed harvesting, treatment and reuse of rainwater, supplemented by the treatment and reuse of on-site greywater.

9.79 Should limited abstraction of groundwater to be required, the CAMS states that for Water Resource Management Unit 4 (Upper Test), non-consumption licences will generally be considered, subject to environmental assessment.

Surface Water

9.80 Sustainable drainage (SuDS) techniques would be implemented across the application site in line with the requirements of the NPPF and best practice to satisfy surface water management and water quality criterion and objectives. SuDS infiltration techniques would be provided onsite for control, management, and disposal of the additional surface water runoff generated by the proposed development utilising the underlying chalk bedrock as an appropriate soakage medium.

9.81 Rainwater falling directly onto the building roof areas will be harvested, treated, and reused within the process for steam generation.

9.82 Living ‘green’ roof technology may be provided to intercept roof runoff and provide a degree of treatment prior to reuse.

9.83 All process water used by the plant will be recycled and recovered within the central water treatment and recovery plant. The plant has been designed to recover all grey water as well as utilise all water from the building operations, internal drains and rainwater.

9.84 For the remainder of the application site it is proposed to provide SuDS in the form of an infiltration basin, porous paving across selected parking bays, infiltration swales and filter drains / soakaways, sited to complement the proposed development layout and the existing topography.

9.85 Where appropriate, SuDS features would include marginal planting around the basal perimeter of the basins and within carefully profiled pools in order

to enhance water quality and biodiversity offering. Similarly, planting would be specified along selected, carefully profiled sections of the swales.

9.86 Infiltration basins, by definition, are not formal ponds comprising large extents of permanent open water. Localised pools may be sustained through careful design, but for the purposes of this ES these features are only likely to become temporarily inundated with runoff during and immediately following rainfall, before draining fairly efficiently through the subsoil.

9.87 SuDS features would be maintained and managed over the lifetime of the development, but would be managed sympathetically in line with ecological and habitat constraints.

9.88 The FRA (Appendix 9/1) provides details of the SuDS Design Statement, with full details of the surface water drainage calculations and SuDS mitigation strategy.

Flood Risk

9.89 Robust flood mitigation measures are proposed in order to adequately manage and reduce risks to an acceptable level for the lifetime of the proposed development. Details of the proposed mitigation measures are summarised below.

9.90 Finished floor levels would be elevated a minimum of 150mm in relation to immediately adjacent external ground levels in order to prevent the ingress of overland flow into the proposed buildings by providing a level differential above any shallow overland flood flow route.

9.91 Proposed highways / drainage would be designed in accordance with latest Sewers for Adoption criteria, incorporating appropriate overland flood flow routes for the conveyance of excess floodwater towards areas of low vulnerability land use.

9.92 Where vulnerable development may be affected by overland flows, or where overland flows emanate from off-site areas, it is proposed that carefully sited / orientated landscape buffers, cut-off drains, filter strips, and swales be provided to stem the overland progress of excess floodwater.

9.93 SuDS facilities, in the form of an infiltration basin, infiltration swales, porous paving, and filter drain / soakaways in conjunction with carefully profiled landscape areas are proposed in order to retain floodwater onsite for up to and including the critical 1% annual probability storm event incorporating an allowance for climate change (applied as a 20% uplift in peak rainfall intensity) over the lifetime of the proposed development. This provides a benefit to downstream off-site areas and property as there is little or no control of overland runoff from the site for the baseline situation.

9.94 The outline SuDS mitigation strategy and overland flow mitigation measures are presented on Drawing MS/9/2 within the FRA (Appendix 9/1).

9.95 Due to the low residual risk of flooding from an event exceeding the proposed design criteria no specific flood resilience measures are necessary.

9.96 The application site is duly presented as being highly sustainable in terms of flood risk, subject to proposed (readily deliverable) mitigation measures being implemented.

ASSESSMENT OF RESIDUAL IMPACTS

9.97 The residual impacts following the implementation of the mitigation measures referred to above are summarised in Table 9-5 below.

Table 9-5
Summary of Mitigated Residual Impacts

Potential Impact	Proposed Mitigation Measures	Mitigated Probability of Occurrence	Mitigated Magnitude of Impact	Residual Significance of Impact
Groundwater				
Contaminated runoff including leakage of fuels entering groundwater during construction phase	*Site best practice (maintenance, traffic management, bunding, spill kits etc).*	Low	Mild	Low
Contaminated runoff entering groundwater during operational phase	*SuDS and appropriate pollution control measures. Robust site working practices.*	Low	Moderate	Low
Contaminated runoff entering potable aquifer	*SuDS and appropriate pollution control measures. Robust site working practices.*	Low	Moderate	Low
Uncontrolled discharge of fire fighting water into groundwater	*Appropriate PPG18 controls.*	Low	Moderate	Low
Reduction in groundwater recharge	*SuDS infiltration techniques for the disposal of surface water to ground.*	Negligible	Mild	Near Zero
Abstraction of groundwater for process use	*Mains supply and recovered rainwater (50% provided through greywater recycling)*	Negligible	Moderate	Near Zero
Surface Water				
Contaminated runoff entering surface waters during operational phase	*SuDS and appropriate pollution control measures. Robust site working practices.*	Low	Mild	Low
Increased rate of runoff from site leading to flooding	*SuDS infiltration techniques for the disposal of surface water to ground.*	Negligible	Mild	Near Zero
Flood Risk				

Potential Impact	Proposed Mitigation Measures	Mitigated Probability of Occurrence	Mitigated Magnitude of Impact	Residual Significance of Impact
Potential flood risk to the site	*Cut-Off swales to intercept overland runoff and minor elevation of development in relation to external ground levels.*	Negligible	Moderate	Near Zero

CONCLUSIONS

9.98 The potential impacts of the proposed development upon the baseline hydrological environment have been identified and assessed, and where appropriate, mitigation measures have been accommodated into the design of the proposed facility.

9.99 All aspects of the construction and operation of the facility would be in accordance with best practice guidance.

9.100 A Flood Risk Assessment (FRA) has been undertaken for the proposed development. The FRA concluded that the application site is presented as being deliverable and highly sustainable in flood risk terms with readily deliverable proposed mitigation measures in place, and that key requirements set out within the NPPF and local planning policies may be adequately satisfied.

9.101 Overall, it is concluded that, with respect to the groundwater and surface water environments, there would be no significant residual impacts of the proposed development with the proposed mitigation measures in place.