8. WATER RESOURCES

8.1 Introduction

This chapter of the Defence Exempt Environmental Appraisal (DEEA) addresses the impact of the Proposed Development with respect to water resources. The Proposed Development comprises a replacement hydrodynamics research facility, known as the Hydrus Facility. This will include permanent structures such as the Operations Building and Support Building together with an Electrical Substation and external works including landscaping, a Sustainable Drainage System (SuDS), and access / circulation routes.

This chapter considers the following:

- The key features / characteristics of the water resources within the Hydrus Development Site, construction enclaves and associated facilities and landscaping and SuDS proposals;
- The sensitivity of identified receptors;
- The direct and indirect environmental impacts arising from the development;
- The mitigation to which AWE is committed in order to reduce the potential scale of any negative impacts and promote positive impacts; and
- The residual environmental impacts that result following the implementation of the proposed mitigation.

Environmental impacts predicted during the construction of the Hydrus Facility (short-term impacts) and those predicted to result from the presence of the new buildings (long-term impacts) have been assessed. The potential environmental impacts of the operational phase of the Proposed Development are also assessed. Further details of the Proposed Development and construction enclaves can be found in *Chapter 5: The Proposed Development* and *Chapter 6: Construction Phase* of this DEEA.

A Flood Risk Assessment (FRA) (Ref. 8-1) has been undertaken by RPS and a SuDS detail design submission (Ref. 8-2) has been compiled by Atkins for the Proposed Development and is included in *Technical Appendix B* of Volume II of this DEEA. Groundwater contamination is addressed in *Chapter 7: Ground Conditions* of this DEEA. This chapter has been prepared by RPS Group and URS Corporation.

8.1.1 Proposed Development

The Application Site and the Proposed Development is described in detail within *Chapter 5: The Proposed Development*. The Proposed Development consists of the following main elements:

1) The permanent features, which include:
   - Operations Building with a Lightning Protection System (LPS) comprising eight lightning conductor masts in the centre of the Hydrus Development Site;
   - Support Building in the north-east corner of the Hydrus Development Site; and
   - Electrical Substation in the west of the Hydrus Development Site.
2) The temporary construction area established in the western part of the Hydrus Development Site, which includes construction accommodation and welfare facilities, including canteen, WCs, changing facilities and site offices in temporary buildings. On completion of construction, the area will be reinstated to form part of the landscape scheme;
3) The use of two existing construction enclaves; the Central Area Construction Enclave (CACE) and the West End Construction Enclave (WECE). These will encompass material lay-down areas, prefabrication areas and a refuelling area, and construction office accommodation for construction management and welfare buildings. Further details of the construction enclaves, can be found in *Chapter 6: Construction Phase* of this DEEA; and
4) The permanent external works which includes SuDS, landscape strategy proposals, access / circulation routes and lighting. Further details can be found within *Chapter 13: Landscape and Visual* of this DEEA.

8.2 Planning and Policy Context

Chapter 3: Planning Policy Context provides an outline of the legislation and planning policy context for the Proposed Development. The key National and Local water environment and water resource related legislation and policy issues of relevance to this development are described in the following paragraphs.

8.2.1 National Legislation

The water environment within the UK is protected by the Water Resources Act 1991 (Ref. 8-3). The Environment Agency has responsibility and powers, as determined by the Environment Act 1995 (Ref. 8-4) to control abstractions, impoundment and discharges, as well as controlling water quality and biodiversity. The Water Resources Act 1991 is also supplemented by the Environmental Protection Act (EPA) 1990 (Ref. 8-5), which controls measures for integrated pollution prevention. A number of regulations have since been established to enact these laws, including:

- Water Resources (Environmental Impact Assessment) (England and Wales) Regulations, 2003 (Ref. 8-6);
- The Groundwater Regulations, 1998 (Ref. 8-7); and
- The Anti-Pollution Regulations, 1999 (Ref. 8-8).

The Water Framework Directive (WFD) (Ref. 8-9) is a vital piece of European legislation designed to integrate how the water bodies are managed. The WFD is implemented in England by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (Ref. 8-10). Other relevant legislation includes:

- Water Act 2003 (Ref. 8-11);
- Water Resources (Abstraction and Impounding) Regulations 2006 (Ref. 8-12);
- The Water Resources (Environmental Impact Assessment) (England and Wales) (Amendment) Regulations 2006 (Ref. 8-13);
- Water Supply (Water Quality) Regulations 2000 (Ref. 8-14);
- Water Supply (Water Quality) Regulations 2001 (Ref. 8-15);
- Water Supply (Water Quality) (Amendment) Regulations 2001 (Ref. 8-16);
- Control of Pollution (Applications, Appeals and Registers) Regulations 1996 (Ref. 8-17); and
- Control of Pollution (Oil Storage) (England) Regulations 2001 (Ref. 8-18).

8.2.2 National Planning Guidance

8.2.2.1 PPS 23: Planning and Pollution Control

Appendix A of Planning Policy Statement 23 (PPS23): Planning and Pollution Control (Ref. 8-19), with respect to water resources advises that in setting out local development frameworks and in taking decisions on individual planning applications, local planning authorities must take account of:

- The possible impact of potentially polluting development (both direct and indirect) on land use, including effects on health, the natural environment or general amenity;
- The potential sensitivity of the area to adverse effects from pollution, in particular reflected in ground and surface waters, water supply (Source Protection Zones (SPZs)) and the need to protect natural resources;
- The possible adverse impacts on water quality and the impact of any possible discharge of effluent or leachates which may pose a threat to surface or underground water resources directly or indirectly through surrounding soils;
- The need to make suitable provision for the drainage of surface water; and
- The provision of sewerage and sewage treatment and the availability of existing sewage infrastructure.

In addition to this Annex 1 of PPS23 (Ref. 8-20) advises that *'developers should be encouraged where appropriate to incorporate into their proposals Sustainable*

Urban Drainage Systems (SuDS). This will help to reduce the impact of diffuse pollution from run-off and flooding, as well as providing a contribution to local amenity and biodiversity'.

Groundwater quality is covered in more detail in *Chapter 7: Ground Conditions* of this DEEA.

8.2.2.2 PPS25: Development and Flood Risk

PPS 25: Development and Flood Risk (Ref. 8-21) sets out the Government's National policy on development and flood risk, which is intended for use by Regional Planning Bodies and Local Planning Authorities (LPAs). PPS25 sets out decision making principles that should be applied, so that for site specific applications LPAs should:

- Ensure that all planning applications are supported by a site-specific Flood Risk Assessment (FRA);
- Apply the sequential approach at the site level if a floodplain is present to minimise risk, by directing the most vulnerable development to areas of lowest flood risk;
- Give priority to the use of Sustainable Drainage Systems (SuDS); and
- Ensure all new development in flood risk areas is flood resilient and resistant, including safe access and escape routes, and that any residual risk can be safely managed.

8.2.3 Regional and Local Planning Policy

8.2.3.1 Regional Spatial Strategy for the South East of England: The South East Plan

The South East Plan (Ref. 8-22) sets out the vision for the future of the region to 2026, outlining the response to the challenges facing the region such as housing, the economy, transport and protecting the environment. The Plan brings together policies for development with other policies and programmes that influence the nature of places. The Plan sets out the direction and the scale of change to sustain a high quality of life across the region. The core objectives of the Plan are to balance continuing economic and housing growth with rising standards of environmental management and reduced levels of social exclusion and natural resource consumption.

The Plan contains policies relating to Natural Resource Management, which contains relevant guidance on the management of water resources, water quality and flooding. Sustainable Water Resources and Groundwater (Policy NRM1) states that water supply and groundwater will be maintained and enhanced through avoiding adverse effects of development on the water environment. A twin-track approach of demand management and water resource development will be pursued. Water Quality (Policy NRM2) states that water quality will be maintained and enhanced through avoiding adverse effects of development on the water environment. Strategic Water Resources Development (Policy NRM3) states that there is a demonstrable need for new water resource schemes and increased demand management over the period of the Plan to cater for water supply needs of current and future development and the protection of the environment. Sustainable Flood Risk Management (Policy NRM4) states that the sequential approach to development in flood risk areas set out in PPS25 will be followed. Policy NRM4 goes on to state that local authorities, with advice from the Environment Agency, should undertake a Strategic Flood Risk Assessment (SFRA) to provide a comprehensive understanding of the flood risk and put in place a framework for applying the PPS25 sequential approach. This will facilitate allocating sites in areas with decreasing probability of flood risk. The SFRA would assess future climate change and identify appropriate types of development in accordance with the PPS25 sequential test and flood vulnerability of different land uses. Existing flood defences will be protected from development. Where development is permitted in appropriately defended floodplains, it must be designed to be resilient to flooding (to minimise potential damage) and to allow for the future maintenance, realignment or management of the defences to be undertaken. Conservation and Improvement of Biodiversity (Policy NRM5) states that in the development and implementation of plans and strategies, local authorities and other bodies shall avoid a net loss of biodiversity, and actively pursue opportunities to achieve a net gain.

In addition to these Natural Resource Management policies, the South East Plan contains a number of Cross Cutting Policies that are essentially policy levers that can be used to manage the changes proposed for the region between now and 2026. Sustainable Development (Policy CC1) indicates that the principal objective of the Plan is to achieve and to maintain sustainable development in the region with some of the priorities for this being identified as achieving sustainable levels of resource management and ensuring that the South East is prepared for the inevitable impacts of climate change. Climate Change (Policy CC2) asserts that measures to mitigate and adapt to current and forecast effects of climate change will be implemented through local planning policy and other mechanisms. It acknowledges that behavioural change will be essential in implementing this policy and the measures identified. With respect to water resources, it is anticipated that adaptation to risks and opportunities will be achieved through:

- Guiding strategic development to locations offering greater protection from impacts such as flooding, erosion, storms, water shortages and subsidence;
- Incorporating sustainable drainage measures and high standards of water efficiency in new and existing building stock;
- Increasing flood storage capacity and developing sustainable new water resources; and
- Ensuring that opportunities and options for sustainable flood management and migration of habitats and species are actively promoted.

Policy CC3, Resource Use, states that a sustained programme of action to help stabilise the South East's ecological footprint by 2016 and reduce it by 2026 should be incorporated into plans and programmes and that such actions will include:

- Increased efficiency of resource use in new development;
- Adaptation of existing development to reduce its use of energy, water and other resources; and
- Changes in behaviour by organisations and individuals.

Sustainable Design and Construction (Policy CC4) indicates that the design and construction of all new development, and redevelopment and refurbishment of existing building stock will be expected to adopt and incorporate sustainable construction standards and techniques. It is expected that with respect to water resources this will include consideration of how all aspects of development can contribute to securing high standards of sustainable development including aspects such as energy, water efficiency and biodiversity gain.

8.2.3.2 West Berkshire District Local Plan Saved Policies

In accordance with the Planning and Compulsory Purchase Act 2004 (Ref. 8-23) local councils have reviewed their existing planning policies and any that are agreed with the Secretary of State to still be applicable have been 'saved' and continue to be a consideration for planning applications until they are replaced by Local Development Framework documents (known as Local Development Developments (LDDs)). In the West Berkshire Local Plan Saved Policies (2007) there is only one saved policy on the Water Environment, namely River Corridors and Nature Conservation (ENV.14).

Policy ENV.14 advises that the Council, in consultation and co-operation with the Environment Agency and British Waterways, will seek to protect and enhance all waterway corridors within West Berkshire as important open land by:

- Seeking the conservation of existing amenity features and wherever possible the restoration of natural elements within the corridors and associated margins;
- Seeking the provision of appropriate public access;
- Seeking protection and improved access for operational and maintenance purposes, including maintenance strips where practical; and
- Resisting development which would have an adverse impact on nature conservation, fisheries, landscape, public access or water related recreation.

However, saved Policy OVS.3 on Planning and Community Benefits advises that the Council will require to be satisfied that the infrastructure, services and amenities made necessary by the development are provided or will be provided at the appropriate time so as to ensure the proper planning of the area. In addition, when considering proposals for development, opportunities will also be sought for securing environmental improvements and community benefits. Such provision will relate to those works necessary to the grant of planning permission, and which are relevant, reasonable and directly related and fairly and reasonably related in scale and kind to the Proposed Development. Of the listed examples in policy OVS.3, those that are of relevance to this chapter include:

- Landscaping, including major structural landscaping on sensitive or exposed sites; and
- The management of land and water areas for nature conservation purposes.

8.2.4 West Berkshire Level 1 Strategic Flood Risk Assessment

A Strategic Flood Risk Assessment (SFRA) (Ref. 8-24) was completed in June 2007 for the West Berkshire area, with the Level 1 findings published in a report dated May 2008. The SFRA found that the risk of flooding within West Berkshire is widespread, arising not only from rivers, but also from surface water and groundwater flooding.

The SFRA maps historical (from local knowledge) and recorded incidences of flooding and provides an overview of fluvial flooding in the area, these maps are included within the FRA in *Technical Appendix B* of this DEEA. These show no known historical or recorded flood incidences on the Application Site and also that the Application Site is outside of Flood Zones 2 (medium risk) and Flood Zones 3 (high risk). The FRA in *Technical Appendix B* of this DEEA considers this further.

8.2.5 British Standards and Other Guidance

Soil infiltration testing has been carried out in accordance with Building Research Establishment guidance on soakaway design (Digest 365) (Ref. 8-25). This is the recognised standard for completion of soil infiltration testing and soakaway design in the UK.

CIRIA Guidance C697, 'The SuDS Manual' (Ref. 8-26) provides best practice guidance on the planning, design, construction and maintenance of Sustainable Drainage Systems (SuDS) to facilitate their best effective implementation within developments.

In addition to this, CIRIA document C624 (Ref. 8-27) provides guidance to help implement good practice in assessing and managing flood risk as part of the development and planning process. It provides descriptions of the mechanisms and impacts and causes of flooding.

The Environment Agency provides advice and guidance to industry and the public on their legal responsibilities and good environmental practice in the form of Pollution Prevention Guidance Notes (PPGs) (Refs. 8-28, 8-29, 8-30, 8-31, 8-32, 8-33 and 8-34).

8.3 Assessment Methodology and Significance Criteria

The assessment of the importance of the water environment features and the significance of the predicted impacts has been undertaken using a methodology adapted from Volume 11, Section 3, Part 10 of the Design Manual for Roads and Bridges (Ref. 8-35). Although this methodology was originally produced for the assessment of the effect of highway development on the water environment, the principles are transferable to other development types.

Water Resources within CACE have been assessed as part of the High Explosives Fabrication Facility (HEFF) planning application which was granted planning permission from West Berkshire Council in February 2008 (Planning Reference: 07/02438/COMIND). Water Resources within WECE have been assessed as part of the New Office Accommodation (NOA) planning application which was granted planning permission from West Berkshire Council in February 2007 (Planning Reference: 06/02326/COMIND). The Proposed Development does not include any changes to the existing use of the CACE and WECE, and therefore no additional potential impacts will be introduced. Consequently, these areas are not considered in this assessment, which principally focuses on the proposed Hydrus Development Site.

8.3.1 Evaluation of Baseline Features

The baseline environmental conditions and the receptors likely to be affected by the Proposed Development are established through a desk study. The importance of identified water environment features is then defined, based on an assessment of their quality to both the human and natural environment. Table 8-1 outlines the criteria used to make this judgement and provides examples for each importance rating.

Table 8-1: Importance of Baseline Features.

Importance	Description	Example
Very High	Attribute with a high quality and rarity on a regional or national scale with limited potential for substitution.	Surface water: European Community (EC) designated salmonid fishery. River Quality Objective (RQO) river Ecosystem Class RE1. Site of National or International wildlife designation e.g. Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar. Groundwater: Major aquifer providing a regionally important resource or supporting site protected under wildlife legislation. Source Protection Zone (SPZ) 1. Flood risk: Flood plain or defence protecting more than 100 residential properties from flooding.
High	Attribute with a high quality and rarity on a local scale with limited potential for substitution, or attribute with a medium quality or rarity on a regional or national scale with limited potential for substitution.	Surface water: Major cyprinid fishery. RQO river Ecosystem Class RE2. Species protected under National or European Union (EU) wildlife legislation. Groundwater: Major aquifer providing locally important resource or supporting river ecosystem. SPZ2. Flood risk: Flood plain or defence protecting between 1 and 10 residential properties or industrial premises from flooding.
Medium	Attribute with a medium quality and rarity on a local scale with limited potential for substitution, or attribute with a low quality and rarity on a regional or national scale with limited potential for substitution.	Surface water: RQO river Ecosystem Class RE3 or RE4. Groundwater: Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ3. Flood risk: Flood plain or defence protecting 10 or fewer residential properties or industrial premises from flooding.
Low	Attribute with a low quality and rarity on a local scale with limited potential for substitution.	Surface water: RQO river Ecosystem Class RE5. Groundwater: Non-aquifer. Flood risk: Flood plain with limited constraints and a low probability of flooding of residential and industrial properties.

Baseline data has been collected by undertaking a desk study of publicly available data sources and a review of documents specific to AWE Aldermaston. Public sources include:

- The Environment Agency website (Ref. 8-36), including water quality monitoring data;
- Multi-Agency Geographic Information for the Countryside (MAGIC) website (Ref. 8-37);
- British Geological Survey website (Ref. 8-38); and
- Thames Water Utilities website (Ref. 8-39).

AWE maintains regular contact with the Environment Agency and discussions relating to the Proposed Development and the water environment have been reviewed as part of this assessment.

The collection of baseline environmental information follows standard procedures and therefore extends to a 2 kilometres (km) radius around the AWE Aldermaston Site. However, this extent varies according to the availability of data and the extent/connectivity of physical features.

8.3.2 Prediction and Evaluation of Impacts

The prediction of impacts is carried out with reference to the construction and operational phases of the Proposed Development. The assessment considers both adverse and beneficial effects and this is stated for each of the water environment components. The following terms are also determined for each effect where relevant.

The temporal scale of individual effects is described as either **short, medium or long-term**; short term relates to the construction phase, medium term extends from 1-5 years from the end of works, and long-term extends beyond 5 years from the end of works.

- **Direct or Indirect Effect**: if the receptor will be affected directly or indirectly;
- **Temporary or Permanent**: effects may occur over the life time of the scheme or may occur for a limited period of time e.g. whilst a specific construction activity is taking place;
- **Reversible/Irreversible Effect**: effects can be reversed by mitigation measures or by natural environmental recovery within reasonable timescales (5-10 years following cessation of operations);
- **Geographical Scale**: whether the effect will be felt at local, regional or national level; and
- **Cumulative Issues**: the combined effects of different development activities within the vicinity of the proposed works or different aspects of the proposed scheme on a particular receptor.

8.3.3 Significance Criteria

The assessment of significance is undertaken on the fully mitigated scheme and includes all design management proposals. The impacts, both beneficial and adverse, that remain following mitigation and design management are known as the residual impacts. These are presented in Section 8.6. In order to derive a significance level of each of these impacts the likely magnitude of the impact is established using the criteria shown in Table 8-2.

Table 8-2: Magnitude of Impacts.

Magnitude of Effect	Description
Major beneficial	Results in major improvement of attribute quality.
Moderate beneficial	Results in moderate improvement of attribute quality.
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring.
Negligible	Results effect attribute, but of insufficient magnitude to affect use or integrity.
Minor adverse	Results in some measurable change in attribute's quality or vulnerability.
Moderate adverse	Results in effect on integrity of attribute or loss of part of attribute.
Major adverse	Results in loss of attribute and/or quality and integrity of the attribute.

The significance of an effect is then determined by considering the magnitude of the effect against the importance of the water environment feature. A matrix is used to combine magnitude and importance to generate the overall significance of the effect, as illustrated in Table 8-3.

Table 8-3: Significance of Impacts.

Impact Magnitude	Importance of Feature			
	Very High	**High**	**Medium**	**Low**
Major	Major	Major	Major	Moderate/ Minor
Moderate	Major	Major/ Moderate	Moderate	Minor
Minor	Major/ Moderate	Moderate/ Minor	Minor	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

8.4 Baseline Conditions

The following sections summarise the baseline water resources for the Application Site and the surrounding area.

8.4.1 Application Site Setting

The Application Site comprises two parts and covers a total area of 14.03 hectares (ha). Both parts of the Application Site lie wholly within the established boundary of AWE Aldermaston as shown in the red line boundary drawing, Figure 1-1 contained within *Chapter 1: Introduction* of this DEEA.

The Hydrus Development Site together with the CACE and access road are located in the eastern part of the Application Site which is situated in the north-east of AWE Aldermaston. The western section of the Application Site lies approximately 1.2 kilometres (km) to the south-west of the Hydrus Development Site and is used as the WECE.

The permanent Hydrus Development Site covers an area of 6.47 ha and is centred at National Grid Reference SU 150 270. This area is mainly covered by grassland and sparse short vegetation with the topography being generally level at approximately 100 m Above Ordnance Datum (AOD), sloping slightly towards the eastern and southern boundary to approximately 97 m AOD. A small surface water ditch crosses the southern part of the Hydrus Development Site and a permanent water borehole with an associated head works chamber is located in the north-east of the Hydrus Development Site. There are several individual trees scattered across the Hydrus Development Site with a small wooded area situated in the south-east.

8.4.2 Geology and Hydrogeology

The general geological succession (Ref. 8-40) within the Hydrus Development Site comprises Silchester Gravels overlying the Bagshot Formation which in turn overlies the London Clay Formation. The boundary between the base of the Bagshot Formation and the top of the London Clay is known as the Bagshot Formation/Transitional Zone. The London Clay Formation is estimated as being typically 55 m to 100 m thick. The London Clay subsequently overlies the Upper Chalk, which does not outcrop in the local area. Intrusive investigation works that have been carried out within the Hydrus Development Site have shown that the natural geological deposits are overlain by Made Ground in some areas with thicknesses ranging from complete absence to 2.65 m.

The groundwater vulnerability map for this area (Ref. 8-41) indicates that the Hydrus Development Site is underlain by soils of high vulnerability and a Minor Aquifer (Silchester Gravels and Bagshot Formation). The soils have been classed as having high leaching potential, described as deep, permeable, coarse textured soils which readily transmit a wide range of pollutants because of their rapid drainage and low attenuation potential.

The London Clay formation which underlies the Silchester Gravels/Bagshot Formation comprises a non-aquifer of considerable thickness, forming an aquitard that separates the Minor Aquifer above from the underlying Major Aquifer (Upper Chalk). The Silchester Gravels/Bagshot Formation aquifer is therefore the key relevant hydrogeological unit for consideration of potential impacts from the Proposed Development.

Table 8-4 provides a summary table of the generalised geological succession and aquifer classification for the Application Site with further details being provided in *Chapter 7: Ground Conditions.*

Table 8-4. Geological sequence underlying AWE Aldermaston

Unit / Formation	Aquifer Classification	Classification Description
Silchester Gravels	Minor Aquifer (Variable Permeable)	Permeable drift deposits, fractured or potentially fractured rocks, which do not have a high primary permeability, or other formations of variable permeability including unconsolidated deposits. Seldom produce large quantities of water for abstraction; they are important for both local supplies and in supplying base flow to rivers.
Bagshot Formation / Transition Zone		
London Clay	Non Aquifer (Negligibly Permeable)	Generally regarded as containing insignificant quantities of water, flow although imperceptible does take place, can yield sufficient water for domestic use.
Upper Chalk	Major Aquifer (Highly Permeable)	Highly permeable formation with known or probably significant fracturing. May be highly productive and able to support large abstractions for public supply and other purposes.

8.4.3 Groundwater

8.4.3.1 Aquifer Properties and Groundwater Flow

Lateral groundwater flow across the AWE Aldermaston Site is largely controlled by topography and is dominantly horizontal through the Silchester Gravels and Bagshot Formation. Groundwater within the Silchester Gravels and the Bagshot Formation/Transitional Zone effectively acts as a single aquifer unit.

The general groundwater level beneath the Hydrus Development Site is described as being approximately 98 m AOD (generally 2 m below ground level).

The horizontal direction of groundwater flow and elevation in the water table is consistent with groundwater discharging from the Silchester Gravels and Bagshot Formation/Transitional Zone to streams running from the northern boundary and close to the south eastern boundary of the AWE Aldermaston Site. The natural surface water hydrology in the vicinity of the Proposed Development is described in section 8.4.4 of this chapter.

An assessment of aquifer properties is discussed in detail in the Hydrological Characterisation Report (Ref. 8-42). Horizontal groundwater flow dominates in the Minor Aquifer with average hydraulic conductivity in the Silchester Gravels of 6.2×10^{-6} metres per second (m/s) and 4.0×10^{-6} m/s in the Bagshot Formation/Transitional Zone. These units exhibit an average horizontal flow rate of 7.7 metres per year (m/yr) with a much lower vertical flow rate of 0.041 m/yr. The London Clay forms a relatively low permeability unit with an average vertical permeability in the order of 4.3×10^{-11} m/s.

8.4.3.2 Groundwater Source Protection Zones (SPZs)

The AWE Aldermaston Site lies within an SPZ III (Source Catchment). This designation is based on the catchment area of a groundwater source needed to support an abstraction from long term annual groundwater recharge.

8.4.3.3 Groundwater Abstractions and Discharges

A total of twelve private and licensed groundwater abstraction sources have historically been located on or near the AWE Aldermaston Site. The details of each abstraction are summarised in *Technical Appendix D* of the *Ground Conditions Technical Report (GCTR)* which is included as *Technical Appendix A* to this DEEA.

A new water supply borehole has been installed within the Hydrus Development Site boundary (north-west). This, together with a further two new water supply boreholes that have been installed: one to the east of the Hydrus Development Site and the other off Griffin Road to the south of the Hydrus Development Site will abstract water from the Chalk aquifer beneath the AWE Aldermaston Site. Although these boreholes have been installed, they are not currently in use. It is understood that they will not be used in the immediate future and have been installed as a precautionary measure for the supply of water in the event that the existing boreholes need to be temporarily closed for repair.

There are no reported discharges of water to land within 1 km of the Hydrus Development Site boundary.

8.4.4 Surface Water

8.4.4.1 Rainfall

AWE Aldermaston falls within hydrological area 31 of the former Ministry of Agriculture and Fisheries and Food (MAFF) Technical Bulletin 35 (Ref. 8-43). Annual rainfall of 677 mm/yr and potential evaporation of 516 mm/yr have been calculated from monthly average statistics over the period 1941 to 1970. The Meteorological Office recording station at Wisley (approximately 25 km south east of AWE Aldermaston) recorded an annual average rainfall of 647 mm/yr for the period 1971 to 2000. Recent data (2000 to 2003) collected at the AWE Aldermaston Site indicates an average rainfall of 89.8 mm/month which corresponds to an average of 1078 mm/yr. An estimated 145 – 180 mm/yr of rainfall is available for recharge to groundwater.

8.4.4.2 Hydrology and Surface Water Features

AWE Aldermaston is located approximately 2 km from the River Kennet, which is classified as a main river. Two tributaries of the River Kennet rise from an area close to the northern boundary of AWE Aldermaston Site and flow northwards.

There are a number of surface watercourses located outside of the Hydrus Development Site and AWE Aldermaston Site. Table 8-5 provides a summary of these together with their approximate distance and orientation from the Hydrus Development Site boundary.

Table 8.5: Watercourses in the vicinity of the Hydrus Development Site boundary

Watercourse	Approximate Distance from Hydrus Development Site Boundary (m)	Orientation
River Kennet	1600	North
River Enborne	1800	North West
Aldermaston Stream	200	West
Tributary of River Kennet	800	North West
Fishermans Brook	1100	South West
Tributary of Aldermaston Stream	Within 50 m	West
Silchester Brook	1800	South West
West End Brook	1600	South
Circus Farm Stream	1200	South

There are no main watercourses or significant water bodies present or within the immediate vicinity of the Hydrus Development Site. However, within the AWE Aldermaston Site boundary there is the Decoy Pond, Fish Pond and the North Ponds. These lies over 1 km south west, approximately 90 m east and 200 m west of the Hydrus Development Site respectively. The North Ponds receive surface water run-off from the whole AWE Aldermaston Site.

Although there are no main watercourses within the Hydrus Development Site, there is a small surface water ditch located in the south that flows eastwards toward Fish Pond. This surface water ditch is culverted along most of its route to, across and from the Hydrus Development Site, although it is open (unculverted) for a section of the route, towards the centre of the Hydrus Development Site.

8.4.4.3 Surface Water Abstractions and Discharge Consents

There is one surface water abstraction approximately 1 km west of the Hydrus Development Site boundary. This is a consent for the abstraction of water from a reservoir at Fosters Farm at a yearly rate of 22,730 m^3 per year.

In addition to this there are a number of discharge consents reported within 1 km of the Hydrus Development Site boundary, both within the AWE Aldermaston Site boundary and beyond. Table 8-6 below provides a summary of their location, discharge type and receiving water.

Table 8-6: Summary of Discharge Consents within 1 km of the Hydrus Development Site boundary

Operator	Distance (m) / Orientation	Discharge Type	Receiving Water
AWE	Adjacent to the northwest boundary	Trade Effluent Discharge and site drainage	Outfall 15 Contractors Road to Tributary of Aldermaston Stream
	200 m West		Outfall 13 North Ponds to Aldermaston Stream
	150 m East		Outfall 16 Fish Pond to Tributary of Fishermans Brook
	350 m East		Outfall 17 Stock Pond to Tributary of Fishermans Brook
R Young – Domestic Tip	550 m North East	Sewage Discharge / Final Effluent	Tributary of Wasing Stream

The consent to discharge from the North Ponds, as outlined in Table 8-6 above, applies to 'trade effluent comprising site drainage, remediated groundwater, steam condensate, compressor blowdown, cooling water, water tank drainage and other matter'. The volume of remediated groundwater and cooling water is not to exceed 510 m^3 per day. The consent stipulates concentrations for List I substances (under the Dangerous Substances Directive) that must not be exceeded in the discharge. This includes mercury (2.0 µg/l), trichloroethene (20 µg/l) and tetrachloroethylene (20 µg/l). It also states that concentrations of List II substances should not increase, and that they should not cause an exceedance of the environmental quality standard in the receiving water. Substances such as boron, heavy metals and a range of organics are included in the itemised list of List II substances. It specifically states that the Environment Agency must be notified if there are any changes in pH or in the concentration of boron or iron in the discharge.

8.4.4.4 Surface Water Quality

Watercourses in the vicinity of the Hydrus Development Site are classed as having 'fairly good' to 'very good' water quality, with GQAs between A and C. This indicates that these watercourses are capable of supporting a wide range of ecosystems including fisheries and wetland habitats. Table 8-7 below summarises the water quality of nearby watercourses according to the GQA scheme.

Table 8-7: The GQA assessments for watercourses in the area (from the Environment Agency website)

Watercourse	Reach	GQA	
		2001-2003	2002-2004
Fishermans Brook	Source to Padworth Stream	B	B
Padworth Stream	Old Warren to Kennet	B	A
River Kennet	Aldershot Stream to River Enborne	B	B
River Kennet	River Enborne to Sulhamstead Stream	A	B
River Enbourne	Baghurst Brook to River Kennet	B	A
Silchester Brook	Tadley to Silchester STW	C	C

8.4.5 Water Supply and Site Drainage

The AWE Aldermaston Site is supplied by mains water (as well as maintaining groundwater abstractions for on-site water supply) and served by a foul water (sanitary and trade effluent) and a surface water drainage system.

8.4.5.1 Effluent Disposal

There is a foul water sewer and trade waste sewer that head north-eastward across the Hydrus Development Site. The Hydrus Facility will be connected to the existing AWE Aldermaston foul water collection system which flows to the Silchester sewage treatment works located 3 km to the south-east of AWE Aldermaston. Additional trade waste connections will not be made as part of the development.

8.4.5.2 Surface Water Drainage

With the gradient of the surface, overland flow across the Application Site will occur in an eastward and south-eastward direction, as indicated in the *Flood Risk Assessment* contained within *Technical Appendix B* of this DEEA. The majority of surface water runoff from the Hydrus Development Site drains to the Fish Pond, located approximately 90 m to the north-east of the Hydrus Development Site. This is through a 300 mm diameter culverted drainage channel and by overland flow. Overland flow can drain to the culverted drainage channel via an open and enlarged section where it is then discharged to the Fish Pond. The culverted drainage channel increases in diameter to 375 mm, and then to 600mm before the outfall to the Fish Pond. The Fish Pond discharges via a feeder stream to Fisherman's Brook, which subsequently flows northwards to the River Kennet.

There will be some surface water runoff by overland flow from the Hydrus Development Site to the culverted drainage channel to the west, although with the gradient of the surface, volumes will be minimal. This drainage channel is discharged to the North Pond and Ornamental Lake.

There are gravel filled linear infiltration trenches fitted with 150 mm diameter slotted piping (French drains) in areas of the Hydrus Development Site, with these allowing the conveyance and infiltration of surface waters. There is one of the linear infiltration trenches along the length of Cwm Road to the north of the Hydrus Development Site, and another along the length of North Way and Viaduct Way to the south of the Hydrus Development Site. There are also lengths of linear infiltration trench to the east of the Hydrus Development Site, with these draining eastwards.

8.4.5.3 Surface Water Infiltration

Soil infiltration testing, summarised in the *Ground Conditions Technical Report* and included as *Technical Appendix A* to this DEEA gave a rate for design of $2.0E^{-5}$ m/sec. This infiltration rate is towards the lower end of the range for good drainage. For infiltration to ground to be acceptable, the highest groundwater level must be a minimum of 1.0 m below the bottom of the permeable sub-base. Current data shows groundwater levels to be generally in the region of 0.5 to 2.0 m below existing ground levels. As a result of the infiltration rate and these groundwater levels, the release of surface water to ground has not been taken into account in determining the design of the SuDS scheme.

8.4.6 Flood Risk

A Flood Risk Assessment (FRA) in accordance with PPS25 has been undertaken for the Proposed Development and is contained within *Technical Appendix B* of this DEEA.

8.4.6.1 Fluvial and Tidal Flooding

Land areas are delineated based on the risk of flooding by fluvial and tidal sources, with Flood Zone 1 an area of low risk (annual flood probability is less than 0.1%); Flood Zone 2 an area of medium risk (annual flood probability is between 0.1% and 1%); and Flood Zone 3a an area of high risk (annual flood probability is more than 1%). Flood Zone 3b is the Functional Floodplain, and comprises the area where water preferentially flows or is stored in times of flood (annual flood probability is approximately 5% or greater).

The vulnerability of different types of development and land-uses are considered when assessing the risk in flood zones The site is located in Flood Zone 1, with this an area of low risk from fluvial and tidal sources, and considered to be appropriate for all vulnerability classifications.

8.4.6.2 Non-Main Rivers and Drainage Ditches

There has been no history of flooding from the drainage channels that cross the Hydrus Development Site, and they are culverted for the most part and discharge to local ponds. A large part of the Hydrus Development Site is part of a larger drainage catchment that drains towards an existing ditch towards the south of the Hydrus Development Site. The remainder of the Hydrus Development Site is relatively flat, falling slightly to the north-west, and the north, and with slightly more gradient falling towards the east. The catchment of this drainage channel upstream of the Hydrus Development Site is approximately 5.8 ha. This upstream catchment is made up of narrow access roads, buildings and soft landscape. Drainage of this upstream catchment is via a piped system discharging to the culverted drainage channel. The FRA demonstrated that there was no flood risk to the Hydrus Development Site from the upstream catchment, however, there were areas in the upstream catchment that were shown to currently flood.

8.4.6.3 Pluvial Flooding from Overland Flow

Pluvial flooding is a result of overland flow following a rainfall event, before the runoff enters a watercourse or sewer. The flood risk relates to the conveyance of waters both from areas outside the Hydrus Development Site and areas within the Hydrus Development Site, and the ponding of these waters in depressions in the topography. AWE Aldermaston is located on a plateau and as such, pluvial flooding associated with overland flow from off-site areas is not considered to be an issue. The topography of the Hydrus Development Site indicates that surface water overland flow will principally be in an easterly and south-easterly direction. The existing drainage infrastructure, including the location of the Fish Pond to the north-east of the Hydrus Development Site, would limit any sizeable ponding of water on site and hence negate any potential risk, as the FRA in *Technical Appendix B* further considers.

8.4.6.4 Infrastructural Flooding

Infrastructural flooding is where sewerage systems are completely overwhelmed to cause flooding, and may occur alone or be combined with other flood sources.

There are no historical records of infrastructural flooding at the Hydrus Development Site associated with the two culverted drainage channels previously discussed, and the short sections of infrastructure connecting to these channels. There is a foul waste and trade waste sewer that crosses the Hydrus Development Site, and a surface water sewer to the west. There are also linear infiltration drains around parts of the northern, southern and eastern areas of the Hydrus Development Site. The infrastructure within the site is privately owned and maintained. Although there is no existing risk of infrastructural flooding, the Proposed Development could increase the discharge flow rates and the requirement for additional infrastructure to be installed. However, the receiving infrastructure has adequate capacity to accommodate surface and foul water discharges from the Proposed Development.

8.4.6.5 Groundwater Flooding

A brief description of geology and hydrogeology is given above, with further information summarised in *Chapter 7: Ground Conditions* and also in the *Ground Conditions Technical Report* included as *Technical Appendix A* to this DEEA. The predominant direction of groundwater flow in the shallow aquifer is to the east, with levels that decline from approximately 98.0 m AOD in the west to 96.6 m AOD in the east. The water table is generally situated at a shallow depth below the ground surface, as described in *Chapter 7: Ground Conditions*. There are no historical records of groundwater flooding on the Hydrus Development Site; hence groundwater flooding is not considered to be an existing issue.

8.4.7 Potential Receptors

Based upon the baseline conditions described above, the following water resource receptors can be found within the Hydrus Development Site and the wider Study Area:

- Controlled waters comprising groundwater resources beneath the AWE Aldermaston Site;
- Controlled waters comprising groundwater resources and abstractions outside the AWE Aldermaston Site boundary;
- Controlled waters comprising down gradient surface water features both within and outside the AWE Aldermaston Site boundary; and
- Site water supply and drainage infrastructure.

Only off-site groundwater abstractions and fishing rights that lie down gradient of the main groundwater flow direction from the Proposed Development have been taken forward into the impact assessment.

8.4.8 Value / Importance of Receptors Carried Forward for Impact Assessment

In order to execute a transparent assessment of potentially significant environmental impacts, it is necessary to provide a classification of the overall sensitivity / importance of each of the receptor groups detailed in Section 8.4.

The overall sensitivity / importance of the receptor groups groundwater (Silchester Gravels/Bagshot Formation Minor Aquifer) and surface water is considered Local. The importance of the site water supply and drainage infrastructure is considered to be Local.

8.5 Potential Impacts and Mitigation Measures

This section describes the magnitude of potential impacts of the construction and operation phases of the Proposed Development. For both phases, the potential mechanisms of impact are first identified, before an assignment of the magnitude is presented and mitigation measures outlined. Both construction and operational phases are assessed separately.

8.5.1 Construction Phase

8.5.1.1 Surface Water Quality

There are a number of materials and wastes or by-products which could arise during the construction phase which could impact upon surface water quality. Although there are no main rivers on the site or immediate surrounds, culverted channels and overland flow drain the majority of runoff water to the Fish Pond, east of the Hydrus Development Site, with this discharging to Fisherman's Brook, and subsequently to the River Kennet. As a consequence, there is the potential for both direct and indirect contamination to local watercourses of high quality from a pollution incident associated with the use and storage of machinery, equipment and materials on-site during the construction phase. Construction of the Operations Building will require dewatering of the Silchester Gravels and to a certain extent the underlying Bagshot Formation, as described in *Chapter 6: Construction Phase* and considered in *Chapter 7: Ground Conditions* of this DEEA.

Key potential sources of pollution from the construction phase that could impact upon surface water quality include:

- Mobilisation and deposition of fine materials (e.g. silts and clays) from the use of plant and equipment (e.g. access routes, construction compounds);
- Pollution risk in relation to the use of certain materials (e.g. cement, lubricants);
- Accidental leaks or spills during transportation, storage and maintenance of plant or equipment;
- Creation of new access tracks and temporary increases in vehicle traffic volumes – both around the site and with journeys to and from the area;
- Soil erosion and increased sediment loading from localised changes to catchment hydrology (e.g. compaction of soil and excavation of material);
- Provision of temporary on-site sanitary facilities for construction site staff; and
- Dewatering and excavation works, including the transfer of waters removed from the ground that are then to be discharged elsewhere.

In the absence of mitigation the potential scale of impact on the AWE Aldermaston Site surface water drainage system and water resources with respect to pollution from construction activities is considered to be moderate adverse.

The Proposed Development will include certain measures that will mitigate the potential impact on surface water quality during the construction phase. The construction phase includes the use of the WECE and CACE, as described in *Chapter 6: Construction Phase*. A temporary contractor compound will also be established in the western part of the Hydrus Development Site. The construction phase will include a surface water drainage scheme, as outlined in more detail in the FRA included in *Technical Appendix B* of this DEEA. Detailed plans of the SuDS scheme are included within the planning application.

All construction works shall be undertaken in accordance with a Construction Environmental Management Plan (CEMP). The CEMP will ensure that all the relevant national guidance and current UK best practice identified in this assessment is adhered to during construction. In addition to this AWE's Code of Construction Practice (CoCP) (Ref. 8-44) and Safe Systems of Work (SSoW) will be adhered to during construction works.

Throughout all phases of construction, all work areas and access tracks will be kept tidy with surfaces kept clean and in a good condition. Relevant measures and controls will be employed to suppress dust and fine materials on site, primarily to prevent an impact to air quality, but to an extent also for water quality. In order to reduce an impact to surface water quality, plant and equipment will be continuously maintained in accordance with the manufacturer's specifications. This includes the cleaning of plant and equipment in designated areas within the CACE to reduce the mobilisation and deposition of fine materials. In addition, plant and equipment will be located away from sensitive receptors within the Application Site, which for the most part means within the CACE.

Concrete for the Proposed Development will be brought to site ready-mixed, with this significantly reducing the pollution risk from cement and lubricants on the Hydrus Development Site. Concrete is required for a number of areas, including the reinforced concrete hardened structure of the Operations Building; and the mass concrete pad and piled foundations for the LPS masts. Concrete will normally be poured into excavated trenches or shuttered mounds, with this containing any potential water quality risk. Where concrete is to be poured on the surface, appropriate measures will be taken to prevent any release to surrounding areas (e.g. through the use of kerbing, raised threshold etc).

Other potentially contaminating materials, such as lubricants and petrochemicals, will be stored within the CACE and kept within appropriate containers that can be securely sealed, with the use of suitable bunded areas to store the containers where necessary.

A schedule of the mechanical plant to be used during the construction phase is given in *Chapter 6: Construction Phase*. This schedule will allow a focus to be given to the plant that may be more prone to accidental leaks or spills during transportation, storage and maintenance. Any maintenance works to mechanical plant will be completed within either the CACE where possible; or otherwise appropriate measures will be taken to prevent any potential release of contaminants to the surrounds. This may include temporary bunding and/or the inclusion of spill kits for trapping contaminants.

Vehicles will move around the Application Site using access roads as far as possible to reduce the mobilisation and deposition of fine materials. The existing and any proposed roads are served by a surface water drainage scheme, as described in the section below on Surface Water and Flood Risk. Any erosion to soil, increased sediment loading and change to the surface water hydrology will be limited as far as possible.

A temporary contractor's compound in the western part of the Hydrus Development Site will house construction accommodation and welfare facilities, including canteen, WCs, changing facilities and site offices in temporary buildings up to two storeys in height. On completion of the construction phase, the area will be reinstated to form part of the landscape scheme. Although the Proposed Development introduces temporary on-site sanitary facilities, the likelihood of these having a water quality impact is limited based on them being provided within a dedicated area where the facilities will be properly serviced and maintained.

The dewatering activities and subsequent excavation works that are required for the construction of the Operations Building will incorporate a number of water quality mitigation measures. Solid waste would be stored in 1 tonne bulk bags and disposed of in accordance with AWE standards and the relevant legislation. Slurry waste will be placed in containers to settle and any bleed water will be removed, to allow disposal of the residues as solid waste.

The bleed water and water extracted from the perimeter well points will be suitably screened to minimise suspended solids and then discharged via a V-notch tank to allow visual assessment of the water quality, flow monitoring and access for sampling if required. Once the first sections of the SuDS attenuation culverts (adjacent to the SuDS detention pond on the southern side of the Hydrus Development Site) are installed, then these sections will be used to store and

regulate the flow of any groundwater extracted from the perimeter well-point system.

8.5.1.2 Surface Water and Flood Risk

The Hydrus Development Site is not at risk from fluvial or tidal flooding, flooding from non-main rivers and drainage ditches, pluvial flooding from overland flow, infrastructural flooding or from groundwater flooding, as outlined in the FRA included in *Technical Appendix B*.

However, construction works on undeveloped areas have the potential to increase the local and catchment-wide risk of flooding from surface water sources. The laying of impermeable infrastructure, access roads, construction laydown and the concrete and piled foundations can all have an effect. In addition, the dewatering that is required for the construction of the Operations Building will remove water from the ground, requiring it to be discharged elsewhere.

Key potential causes for the increase in surface water runoff from the site, and consequently to the risk of flooding, during the construction phase include:

- Alteration to the rate, route and volume of surface water runoff while the construction surface water drainage is being established;
- Stripping of soil or the import of fill that may affect surface water runoff potential and drainage patterns through the compaction and smearing of soils; and / or
- Alteration to the surface water runoff regime with the crossing of drainage routes and with temporary drainage channels leading to the ponding of waters on site; and
- Dewatering and excavation works, including the transfer of waters removed from the ground that are then to be discharged elsewhere.

In the absence of any mitigation the potential scale of impact on the AWE Aldermaston Site surface water drainage system and water resources from increased surface water run-off during the construction phase is considered to be moderate adverse.

An appropriate surface water drainage scheme is therefore included in the construction stage of the Proposed Development. This is to ensure that surface water runoff from the site does not exceed existing runoff rates and volumes, thus ensuring no detrimental impacts to flooding or degradation to receiving drainage systems both in the local area and also elsewhere in the catchment. The FRA included in *Technical Appendix B* defines the methodology used for the surface water drainage scheme in the construction stage, with this summarised below. It should be noted that the construction of the SuDS scheme will be implemented during the enabling works and therefore available as a mitigation measure prior to the start of main construction.

The Hydrus Development Site at construction stage will comprise all the land uses normal for a major construction project such as office accommodation, welfare facilities, open storage, laydown, fabrication, construction vehicle and plant refuelling. Surface finishes are largely dictated by the use to which the various sub-areas within the construction site will be put. In general, external hardstanding surfaces will be permeable except where there is greater risk of pollution, for example; construction vehicle parking, vehicle and plant refuelling and washout and wheel wash areas. It is possible that permeable laydown areas could become impermeable with the passage of time and via trafficking by construction plant, so a network of herringbone filter drains are also provided to ensure these areas do not pond.

The proposed SuDS scheme for the construction phase will contain the following SuDS features:

- Detention basin;
- Swales;
- Cut-off ditches; and
- Granular infiltration blanket under Hydrus Development Site Construction Area.

The proposed SuDS scheme for the construction phase will contain the following controls:

- Vortex flow control devices;
- Full retention oil separators;
- Silt Separators (hydrodynamic separators); and
- Penstocks (pollution control valves).

The proposed SuDS scheme for the construction phase will contain the following elements of traditional drainage:

- Piped drainage; and
- Filter drains with catch pits / manholes.

There is a need to complete dewatering works during the construction phase, prior to the construction of the Operations Building. The dewatering works will encircle the Operations Building with sheet piling driven into the London Clay, thus hydraulically isolating the internal areas from the outer area. Dewatering will take three forms: well-points will be situated within the sheet pile perimeter to lower groundwater levels; ejector wells will be situated within the excavation to lower porewater pressure; and sump pumps within the perimeter to remove any surface waters and minor groundwater seepages, as described in *Chapter 6: Construction Phase* and considered in *Chapter 7: Ground Conditions* of this DEEA.

The FRA in *Technical Appendix B* gives details on the proposed dewatering methodology. This provides information on the regulation and storage of groundwater removed during the dewatering works through the use of the proposed SuDS scheme. The FRA confirms that the discharge limit from the outfall will not exceed the limits of 10.9 l/sec, as set by the Environment Agency.

8.5.1.3 Water Infrastructure

AWE Aldermaston Site is served by a privately built and maintained infrastructure for the supply of water along with surface water, foul water and trade waste sewers.

Currently there are two groundwater abstraction boreholes in close proximity to the Hydrus Development Site, with one of these in use at present for the supply of potable water. In addition, there are three new groundwater abstraction boreholes that have been installed, one within the Hydrus Development Site boundary, one to the east of the Hydrus Development Site and the other off Griffin Road to the south. Although there is likely to be a high requirement for potable water during the construction phase, it will be possible to meet this demand without building any storage reservoirs with a direct supply from the existing groundwater abstraction boreholes. A large part of the water demand will be reduced with the concrete being brought to site ready-mixed.

Disposal of wastewater generated as a result of construction phase activities could impact the AWE Aldermaston Site drainage system. There may also be potential impacts on water resources from storage, handling and disposal of water generated from construction dewatering. Any welfare facilities installed for the use of personnel during the construction phase will be connected to the AWE Aldermaston foul drainage system. There is a potential that the foul drains or trade effluent systems could be used as a disposal route from limited dewatering activities. Potential impact to water supply and drainage infrastructure could also result from accidental damage as a result of excavation. Potable water supply for toilet facilities, firewater supply and water supply for wheel washing will be connected to the AWE Aldermaston Site water supply. It is likely that water for other activities such as dust suppression will also be provided from the existing AWE Aldermaston Site supply.

The scale of potential impacts on the AWE Aldermaston Site water supply and foul drainage system in the absence of mitigation is considered to be moderate adverse.

Waters from the Hydrus Development Site, will not be discharged directly to the surface water drainage system as it may breach the conditions of any discharge consents currently in place. Instead provisions will be made to either treat the water at AWE Aldermaston, or discharge it to foul sewer, with the permission of the sewerage undertaker. Before discharge to sewer, pre-treatment (for example, in the form of settlement) to reduce the solid load of the discharge will be carried out. Discharge will be monitored to ensure any consent conditions are not breached.

An incident response plan will be prepared in the event of a spillage or release of collected waters to any drains. This plan will be retained on the Hydrus Development Site.

8.5.2 Operational Phase

The Proposed Development will include an Operations Building, a Support Building, an Electrical Substation, SuDS and the external works and landscape strategy proposals. This will provide a replacement hydrodynamics facility.

Further details of the Proposed Development are given in *Chapter 5: The Proposed Development*.

The Operations Building comprises an eight-sided structure beneath a circular shallow-domed roof of metal standing seam. The Support Building houses additional services to the Operations Building. The Support Building and the Electrical Substation incorporate Sedum green roofs that will improve the biodiversity of the Hydrus Development Site and help to reduce surface water runoff rates and volumes.

8.5.2.1 Surface Water Quality

The Proposed Development includes hardstanding areas that are to be used for the movement of vehicles, with this possibly resulting in an impact on surface water quality through an accident or a build up of materials, such as silts and oils. Aside from an accident, the pollution associated with the flushing of any build up of materials into the surface water system is likely to have the most significant impact on surface water quality. The flushing of any build up of materials is likely to be more prolific after a prolonged dry period and with a low intensity rainfall event, as this offers less dilution of pollutants. This could result in a moderate adverse impact on the AWE Aldermaston Site surface water drainage system and water resources in the absence of any mitigation measures.

This risk will be greatly reduced as there will only be a limited amount of vehicles accessing the Hydrus Development Site, principally as parking will be at an off site location during the operational phase with staff and visitors transported by buses. The build-up of materials will be further reduced as the buses will be regularly cleaned and maintained.

A surface water drainage scheme will be incorporated into the operational phase of the Proposed Development, with this including sustainable features. These sustainable features have a direct bearing on surface water quality, with filtration systems such as swales allowing pollutants to be filtered out or broken down by bacteria whilst also slowing the flow of water to encourage pollutants to settle out or be broken down naturally; and retention system such as ponds and detention basins allowing settlement and natural breakdown of pollutants. The inclusion of sustainable features in the surface water drainage scheme is therefore beneficial to surface water quality. This is outlined in more detail in section 8.5.2.2 below.

As with the construction phase, petrochemical interceptors will be provided within certain parts of the surface water drainage strategy to minimise contaminants that are discharged from the Hydrus Development Site. These interceptors will be included in the drainage runs leading from the oil tanks and loading bays of the Proposed Development, with the surface of these areas covered with an impermeable material and graded so that surface waters drain to the interceptors.

A management plan for the safe operation of the completed development will be prepared. The plan will include the practice and protocol for resolving an accidental spillage or pollution event so as to further avoid an impact on surface water quality.

8.5.2.2 Surface Water and Flood Risk

The Proposed Development is in Flood Zone 1, with this an area of low risk (annual flood probability is less than 0.1%). In accordance with Annex D of PPS25, Flood Zone 1 is considered appropriate for all vulnerability classifications. The risk to the Proposed Development from fluvial or tidal flood sources is therefore considered to be insignificant and therefore negligible impact is expected.

The Hydrus Development Site comprises predominantly level and cleared land generally covered by crushed stone / concrete with areas of grassland and some existing trees. Despite the former use of the site, the assessment in the FRA, as included in *Technical Appendix B*, assumes that the site is greenfield – this will therefore offer considerable betterment when assessing the surface water runoff regime. The Proposed Development will alter the response to rain events, with increased runoff rates and volumes and altered drainage routes. The size of the Hydrus Development Site and the increase in hardstanding area further exacerbates the risk from this form of flooding. Appropriate mitigation is therefore required to prevent an adverse effect on surface water runoff, and consequently to flood risk. The FRA in *Technical Appendix B* provides details of the technical assessment that was completed, with details of the proposed surface water drainage scheme summarised below. SuDS are incorporated into the surface water drainage scheme for the operational phase of the Proposed Development.

The main features of the drainage scheme largely remain the same from construction through to the operational stage. However, the volume of buried attenuation measures with restricted outflow will be constructed in stages as the hard surfaces of the floor slabs for the building are constructed. Also, the infiltration area under the site cabins will be abandoned after construction.

The surface water drainage scheme for the operational phase contains the following SuDS features:

- Detention Basin;
- Swales;
- Cut-off Ditches; and
- Soakaways and Attenuation Storage tank beneath the access road.

The surface water drainage scheme for the operational phase contains the following SuDS controls:

- Vortex flow control devices;
- Orifices;
- Bypass and full retention oil separators;
- Downstream defenders (hydrodynamic separators); and
- Penstocks (pollution control valves).

The surface water drainage scheme for the external works (operational stage) contains the following elements of traditional drainage:

- Piped drainage with catch pits / manholes;
- Road gullies; and
- Kerb and slot drain systems.

In addition, the Support Building and Electrical Substation will each incorporate a Sedum green roof, adding to the biodiversity interests of the site and helping to reduce surface water runoff rates. It was not considered appropriate to incorporate a similar green roof on the Operations Building, as this would compromise roof inspection in the event of a lightning strike. The completed development will include a comprehensive landscape scheme with trees and shrubs, hedge planting, shrub planting, close mown grassland, low maintenance conservation grassland, and areas with marginal planting. These vegetated features will further reduce the surface water runoff rates and volumes across the Hydrus Development Site and are of benefit to the biodiversity of the area, as outlined in *Chapter 13: Landscape and Visual* and *Chapter 15: Ecology* of this DEEA.

8.5.2.3 Water Infrastructure

The main potential impacts to water resources relate to an increase in the loading to the surface water and foul water sewer infrastructure and increased demand on water supplies. There is an existing infrastructure in place for the discharge of surface water and foul water and for the supply of potable water. This infrastructure will be adequate for the Proposed Development as described in the construction phase and the baseline section, without need for any modification. However, additional measures to provide some betterment to water resources are also included, as described below.

The Proposed Development includes measures that will help reduce the amount of surface water runoff leaving the Hydrus Development Site, such as the sedum green roof on the Support Building and Electrical Substation and the landscaping scheme. The sustainable features in the surface water drainage scheme are designed to attenuate the rate and volume of surface water runoff. Foul water volumes from the completed development will be reduced, with waters used in cleaning operations recycled within the facility, so eliminating effluent discharges and reducing active effluent arisings. Water that has become contaminated will be collected in sumps and processed through a separation system to remove particulates and other components. Small amounts of liquid waste will be collected by bowser from the Support Building for disposal off-site. There will be no connection made to the trade waste sewer.

As no new operations will be undertaken following completion of the Proposed Development there will be no significant increase in water usage – in fact, the water re-usage measures included in the Proposed Development are likely to result in a slight decrease.

Table 8-8: Summary of Residual Impacts.

Description of Potential Impacts	+ve/-ve	Time Span	Scale	Mitigation	Residual Impact Significance	Monitoring Measures and Management Techniques
Potential Construction Phase Impacts						
Surface Water Quality	-ve	Short-term	Moderate	Construction work completed in accordance with relevant AWE Construction Site Rules. Production of Construction Environmental Management Plan. Exposed ground to be kept to a minimum, stockpiles to be covered or seeded with use of silt fences and/or cut off trenches. Discharge from wheel wash / plant washing facilities to be contained and recycled according to AWE Waste Water Risk Assessment Procedures. Appropriate labelling, storage and handling of all potentially contaminative materials including use of sheeting, bunds and drip trays. Implementation of operational safeguards to prevent accidental spills during construction. Protection of existing boreholes within the Application Site to avoid damage or direct discharge of potentially contaminative substances to groundwater. Groundwater or surface water generated during excavation or dewatering to be contained and passed via a silt trap prior to discharge to surface water drainage system. Implementation of construction phase SuDS scheme for surface water runoff and water from dewatering works.	**Negligible**	Specified in Construction and Environmental Management Plans and SuDS documents
Surface Water and Flood Risk	-ve	Short-term	Moderate	Construction work completed in accordance with relevant AWE Construction Site Rules. Production of Construction Environmental Management Plan. Implementation of construction phase SuDS drainage strategy for surface water runoff and water from dewatering works.	**Negligible**	Specified in Construction and Environmental Management Plans and SuDS documents
Water Infrastructure	-ve	Short-term to Long-term	Moderate	Construction work completed in accordance with relevant AWE Construction Site Rules. Production of Construction Environmental Management Plan. No discharge of groundwater, rainfall run-off or wastewater to site drainage network without provision for silt removal, containment, chemical testing and approval in accordance with AWE Waste Water Risk Assessment procedures. Implementation of construction phase SuDS drainage strategy for surface water runoff and water from dewatering works.	**Negligible**	Specified in Construction and Environmental Management Plans
Potential Operational Phase Impacts						
Surface Water Quality	-ve	Long-term	Low	Implementation of Operational Environmental Management System in line with AWE current policies. Implementation of operational phase surface water drainage scheme (SuDS) Use of SuDS incorporating ponds as storage to attenuate increases in surface water run-off. Use of SuDS in the form of positive drainage systems which drain via a bypass separator to attenuation ponds and use filter traps adjacent to impermeable pavement.	**Negligible to Minor Beneficial**	AWE Operational Management Procedures
Surface Water and Flood Risk	-ve	Long-term	Low	Maintenance of SuDS features such as vegetation on the swales and detention basin, the maintenance of surface water drainage channels and the shallow cut-off ditch around the site perimeter. Cleaning and repair of the petrochemical interceptors and the maintenance of the impermeable roads and cellular storage.	**Negligible**	AWE Operational Management Procedures
Water Infrastructure	-ve	Long-term	Low	Maintenance of SuDS features such as the green roofs and vegetation on the swales and detention basin. Maintenance of water efficiency measures in the completed development.	**Negligible**	

8.6 Residual Impact Assessment and Conclusions

Residual impacts are those impacts during the construction and operational phase that exist after the application of mitigation measures.

The potential impacts and mitigation measures that have been described for the construction and operational phases include surface water quality, surface water and flood risk and water resources. The residual impact assessment and conclusions for these areas are given below using the criteria for assessing the significance of impacts as given in Section 8.3.

Table 8-8 summarises the residual impact to water resources following the implementation of mitigation measures outlined in the previous section.

8.6.1 Construction Phase

With mitigation, the significance of the residual impacts during construction is predicted to be **negligible** for receptors as a result of 'normal and foreseeable' construction activities.

8.6.2 Operational Phase

Once the outlined mitigation measures are implemented, the significance of residual impacts arising from the operational phase of the Proposed Development and infrastructure are predicted to be **negligible** for all sensitive receptors identified.

8.7 Cumulative Impact Assessment

An assessment of cumulative impacts has been undertaken for the Proposed Development with other new build projects scheduled for the AWE Aldermaston Site between 2005 and 2015, as set out in the Site Development Context Plan 2008 (SDCP08) (Ref. 8-45). It is considered that the cumulative impact of the identified developments on water resources will be negligible provided that standard practices are adopted in design and that appropriate mitigation measures are applied.

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