M25 junction 10/A3 Wisley interchange TR010030

6.3 Environmental Statement Chapter 8: Road drainage and the water environment

Regulation 5(2)(a)
Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

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M25 junction 10/A3 Wisley interchange

The M25 junction 10/A3 Wisley interchange Development Consent Order 202[x]

6.3 ENVIRONMENTAL STATEMENT
CHAPTER 8: ROAD DRAINAGE AND THE WATER ENVIRONMENT

Regulation Number:	Regulation 5(2)(a)
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Rev 1	11 February 2020	Request for change
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Executive summary

The likely significant environmental effects with respect to the water environment resulting from the construction and operation of the Scheme have been assessed. The assessment has considered impacts on water quality (both surface and groundwater), flood risk and compliance with the Water Framework Directive (WFD).

A water quality assessment identified potential impacts to the surface water and groundwater during the construction and operation of the Scheme. However, subject to the implementation of all mitigation measures, the overall effect on surface water quality is neutral which is not considered significant. The overall effect to groundwater quality during the construction and operation of the Scheme was also assessed as neutral (subject to the implementation of all mitigation measures) which is not considered significant.

An assessment of the potential impact of the Scheme on groundwater quantity and resources concluded that, subject to implementation of appropriate mitigation measures, the overall effect to groundwater quantity is neutral which is not considered significant.

The groundwater quantity assessment has been conducted on the basis of a reasonable worst case where relevant data is not available. The groundwater quality assessment has been conducted using the available historic groundwater data. Once a site-specific Ground Investigation (GI) has been undertaken, a groundwater risk assessment will be prepared, and the assessment reviewed which may identify a requirement for additional or alternative mitigation measures for groundwater quantity or quality.

A Flood Risk Assessment (FRA) considered the impact of fluvial, surface and groundwater flooding. It concluded that during the construction and operation of the Scheme, subject to the correct implementation of all mitigation measures, the overall effect on flood risk is neutral which is not considered significant.

A WFD Compliance Assessment considered the impact of the construction and operation of the Scheme. It concluded none of the construction components of the Scheme are considered to cause deterioration at water body scale or should not prevent future attainment of good ecological status or ecological potential assuming mitigation already embedded in the preliminary design is implemented, any additional specific mitigation is implemented and generic guidance on the principles of WFD compliant design is adhered to.

8. Road Drainage and the Water Environment

8.1 Introduction

8.1.1 This chapter has been prepared to identify the likely significant effects with respect to the water environment resulting from the construction and operation of the Scheme. The assessment covers:

- Water quality, both surface and groundwater;
- Flood risk, both surface and groundwater; and
- Water Framework Directive (WFD) compliance.

8.1.2 This chapter is supported by the following technical appendices and associated documents:

- Proposed Scheme Layout Plans - application document TR010030/APP/2.8;
- Appendix 8.1 – Drainage Strategy Report;
- Appendix 8.2 – Summary of Groundwater Level Information;
- WFD Compliance Assessment - application document TR010030/APP/5.4; and
- Flood Risk Assessment (FRA) - application document TR010030/APP/5.5.

8.1.3 The spatial scope of the assessment has included features of the water environment within 1 km of the Scheme.

8.1.4 The assessment methodology followed is in accordance with the guidance provided in the DMRB Volume 11, Section 3, Part 10 HD 45/09 Road Drainage and the Water Environment.

8.1.5 This chapter does not cover hydrological impacts associated with the disturbance of contaminated land. Potential impacts to groundwater resources and groundwater quality associated with contaminated land have been considered in Chapter 10 Geology and Soils.

8.2 Competent expert evidence

8.2.1 This road drainage and the water environment chapter has been undertaken by the following individuals who have used their knowledge and professional judgement to undertake this assessment:

- a qualified Senior Environmental Scientist (BSc, CWEM) with over 10 years of knowledge and experience in road drainage and the water environment and holds professional membership with the Chartered Institution of Water and Environmental Management;
- a qualified Senior Hydrologist (BSc, MSc, CSci and CWEM) with 10 years of knowledge and experience in road drainage and the water environment and holds professional membership with the Chartered Institution of Water and Environmental Management. They are the author of the Flood Risk Assessment (FRA) which is referred to in this chapter;

- a qualified Senior Hydrogeologist (BSc, MSc, FGS) with over 10 years of knowledge and experience in water resources hydrogeology, a fellow of the Geological Society of London;
- a qualified Hydrologist and Geomorphologist (BA, MSc, MPhil) with over 10 years of knowledge and experience in road drainage and the water environment and holds professional membership with the Chartered Institution of Water and Environmental Management and the Royal Geographical Society (FRGS, CGeog (geomorph)). They are the author of the Water Framework Directive (WFD) Compliance Assessment which is referred to in this chapter; and
- a qualified Principal Consultant (BSc, MSc, CWEM, CSci, CEnv). With over 20 years of knowledge and experience in road drainage and the water environment and holds professional membership with CIWEM.

8.3 Legislative and policy framework

8.3.1 Legislation and policy related to protection and management of the water environment is listed in Table 8.1. The aim of water legislation and policy in England is to protect both public health and the environment by maintaining and improving the quality of water features. This includes all surface water bodies (e.g. rivers, streams, canals, lakes, ponds) and groundwater.

8.3.2 The Department of the Environment, Food and Rural Affairs (Defra) is responsible for all aspects of water policy in England. Management and enforcement of water policy is the responsibility of Regulators, principally the Environment Agency (EA), but also Lead Local Flood Authorities (LLFAs).

Table 8.1: Legislation, regulatory and policy framework

Legislation / Regulation	Summary of Requirements
European	
Water Framework Directive (2000/60/EC)	The Water Framework Directive (WFD) aims to protect and enhance the quality of the water environment. The WFD requires all natural surface water bodies to achieve both Good Chemical Status and Good Ecological Status. Artificial and Heavily Modified Water Bodies may be prevented from reaching Good Ecological Status due to the modifications necessary to maintain their function, e.g. navigation. They are, however, required to achieve Good Ecological Potential, through the implementation of a series of mitigation measures. The WFD also requires good status (both qualitative and quantitative) to be achieved for all ground water bodies and the prevention of the deterioration in groundwater status. In addition, it requires the achievement of objectives and standards for protected areas; and the reversal of significant and sustained upward trends in pollutant concentrations in groundwater. Status is reported at the water body scale, with individual water bodies forming part of larger river basin districts (RBD), for which river basin management plans (RBMPs) have been developed. The first RBMPs were published in 2009 followed by a Cycle 2 update published in 2016.

Legislation / Regulation	Summary of Requirements
Environmental Quality Standards Directive/Priority Substances (2013/39/EC)	Lists environmental quality standards (EQS) for priority substances and certain other pollutants as provided for in Article 16 of the WFD, with the aim of achieving good surface water chemical status. It includes certain substances that may be associated with runoff from highways.
Groundwater Directive (2006/118/EC)	Complements the WFD. It requires measures to prevent or limit inputs of pollutants into groundwater to be operational so that WFD environmental objectives can be achieved.
Habitats Directive (92/43/EEC)	To promote the maintenance of biodiversity by taking measures to maintain or restore natural habitats and wild species at a favourable conservation status, introducing robust protection for those habitats and species of European importance. Sites or species that come under this Directive will heighten the importance of water features that sustain them.
Floods Directive (2007/60/EC)	The aim is of this Directive is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. It sets the strategic level for flood risk that any development will need to comply with.
National	
National Policy Statement for National Networks (NPSNN)	Guidance and policy is set out in detail in paragraphs 5.219 to 5.231 of the NPSNN for water quality and resources and in paragraphs 5.90 to 5.115 for flood risk. The objectives include reference to the WFD and that new and existing development should be prevented from contributing to, or being put at unacceptable risk from, or being adversely affected by, water pollution. Existing status of water quality, water resources and physical characteristics in the water environment must be ascertained and that the impacts of the proposed project, including those associated with any cumulative effects, are assessed as part of the Environmental Statement. Careful design to facilitate adherence to good pollution control practice can reduce the risk of impacts on the water environment. For flood risk the NPPF is outlined with reference to the tests to be applied, decision making and potential mitigation required.
National Planning Policy Framework (NPPF) (Department for Communities and Local Government (DCLG), 2018)	The NPPF protects people and property from flooding. All local planning authorities are expected to follow the NPPF. It forms the basis of assessment of flood risk for schemes.
National Planning Practice Guidance (NPPG) 2018	Accompanying the NPPF, the NPPG (DCLG, 2018) was published in 2014 and updated in 2018. This advises on how Local Planning Authorities can ensure protection of water quality, the delivery of adequate water infrastructure and take account of the risks associated with flooding in the plan–making and the planning application process.
Antipollution Works Regulations 1999	Where pollution occurs, or is likely to occur the Environment Agency can serve a works notice under Section 161A of the Water Resources Act on any person who has caused or knowingly permitted the pollution (or risk of pollution) to a watercourse, requiring them to carry out anti-pollution/ preventative works and operations. The Environment Agency can also recover the costs of any investigation and anti-pollution works carried out. The Anti-Pollution Works

Legislation / Regulation	Summary of Requirements
	Regulations prescribe the content of anti-pollution works notices and the particulars that need to be placed on the pollution control registers maintained by the Environment Agency.
Environment Act 1995	The Act provides for the establishment of a body corporate to be known as the Environment Agency, the key regulator for the water environment.
Environmental Damage (Prevention and Remediation) Regulations 2015	The emphasis of these Regulations is proactively putting in place appropriate pollution prevention measures to reduce risks to the environment.
Environmental Protection Act 1990	This Act brings in a system of integrated pollution control for the disposal of wastes to land, water and air.
Flood Risk Regulations 2009 Amended 2009/3042	These Regulations transpose the Floods Directive (2007/60/EC). They aim to provide a consistent approach to managing flood risk. The Environment Agency are responsible for managing flood risk from main rivers, the sea and reservoirs. LLFAs are responsible for local sources of flood risk, in particular surface water, groundwater and ordinary watercourses.
Flood and Water Management Act 2010 and Commencement Orders	The key areas covered by this Act are: • Roles and responsibilities for flood and coastal erosion risk management; and • Improving reservoir safety.
Highways Act 1980 (HA 1980)	The Act deals with the management and operation of the road network in England and Wales including the drainage of highways into environmental waters and sewers.
The Environmental Permitting (England and Wales) Regulations 2016	These Regulations provide a consolidated system of environmental permitting in England and Wales and transpose provisions of fifteen EU Directives which impose obligations requiring delivery through permits or which are capable of being delivered through permits. Covers Environment Agency permits for flood risk (on Main River) and certain discharges to watercourses.
The Water Resources (Environmental Impact Assessment) (England and Wales) Regulations 2003, and amendment 2017	These Regulations impose procedural requirements in relation to the consideration of applications or proposals for an abstraction or impounding licence under Chapter II of Part II of the Water Resources Act 1991 and require consent in other cases.
Water Act 2003 and Water Act 2014	These Acts aim to improve water conservation, protect public health and the environment, and improve the service offered to consumers. The basis of the Act is three parts relating to water resources, regulation of the water industry and other provisions.
Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015	These Directions set out the environmental standards to be used for the second cycle of river basin plans. They transpose Directive 2013/39/EC on environmental quality standards for priority substances. They also cover Specific Pollutants which include certain metals that are associated with road are associated with road drainage.

Legislation / Regulation	Summary of Requirements
Water Industry Act 1991 (Amendment) (England and Wales) Regulations 2009	This Act sets out the responsibilities of the Environment Agency of England and Wales in relation to water pollution, resource management, flood defence, fisheries, and in some areas, navigation. The Act regulates discharges to controlled waters, namely rivers, estuaries, coastal waters, lakes and groundwaters.
Water Resources Act 1991	This Act sets out to regulate water resources, water quality and pollution, and flood defence. It sets out standards for Controlled Waters.
Water Environment (Water Framework Directive) (England and Wales) Regulations 2017	These Regulations outline the duties of regulators (Environment Agency in England) in relation to environmental permitting, abstraction and impoundment of water.
The Land Drainage Act 1991 and 1994	This Act requires that a watercourse be maintained by its owner in such a condition that the free flow of water is not impeded. The 1994 Act amends it in relation to the functions of internal drainage boards and local authorities.
The Control of Pollution (Oil Storage) (England) Regulations 2001	Applicable for storage of more than 200 litres of oil above ground at an industrial, commercial or institutional site, then these Regulations affect you. The sites they cover include; factories, shops, offices, hotels, schools, churches, public sector buildings and hospitals. The Regulations apply only in England.
Regional	
Thames River Basin Management Plan (RBMP)	This RBMP is designed to protect and improve the quality of the water environment. It includes consideration of the following topics: • Plans for the protection and improvement of the water environment; • Future plans that may affect the infrastructure sector and its obligations; • Development proposal considerations regarding the requirements of the plan; and Environmental permit applications.
Surrey Design A strategic guide for quality built environments, Surrey Local Government Association 2002	The purpose of the design guide is to promote high quality design of new development in Surrey. It aims to supplement the principles in National and regional planning guidance and guide the implantation of the Surrey Structure Plan. The guide has been produced on behalf of the Surrey Local Government Association (SLGA). Its preparation has been a collaborative effort between Principle 4.4 states that all developments should prevent water pollution and flooding, conserve groundwater and improve water habitats.
Local	
Elmbridge Borough Council - Local Plan 2018	One of the key policy documents in the Elmbridge Local Plan is the Elmbridge Core Strategy 2011. The Core Strategy sets out the core policies that are used for shaping future development in the Borough. Core Policies relevant to road drainage and the water environment are: • Policy CS26 – Flooding; and

Legislation / Regulation	Summary of Requirements
	• Policy CS15 - Biodiversity The other key policy document in the Elmbridge Local Plan is the Development Management Plan (DMP) 2015. The DMP contains more detailed "every-day" policies that all planning applications are assessed against. Policies within the DMP which are relevant to the road drainage and the water environment are: • DM2 - Design and amenity; • DM5 - Pollution; and • DM13 - Riverside development and uses.
Guildford Borough Council Submission Local Plan December 2017	The relevant policy in the document is Policy P4: Flooding, flood risk and groundwater protection zones.
Surrey Transport Plan: Environmental Considerations for Delivery of the Plan April 2011	In delivering the Surrey Transport Plan, the county council will, whenever feasible: • Require that any new transport related developments make use of land that is not located in areas that are subject to significant risk of flooding from all sources, and that does not increase flood risk elsewhere as a consequences of the development; and • Require that any new transport related developments and all maintenance works, be designed and delivered in ways that minimise any risks to water quality that could arise from the construction and operational phases of the activities (where relevant). This will support the vision and objectives of the plan.

8.4 Study area

8.4.1 The spatial scope of the assessment includes features of the water environment within 1 km of the Scheme. In accordance with HD 45/09 (HA, 2009), a 1 km study area is considered appropriate for the assessment of surface water quality soluble pollutants and therefore has been used throughout the water environment assessment.

8.5 Assessment methodology

8.5.1 The water environment assessment includes consideration of water quality (both surface and groundwater), the Water Framework Directive (WFD) and flood risk.

Water quality (surface water and groundwater)

8.5.2 The Highways Agency Design Manual for Roads and Bridges (DMRB) HD 45/09 (HA, 2009) provides guidance on the assessment of likely significance of effects on the water environment associated with highway schemes. This assessment methodology follows the guidance and criteria provided in HD 45/09. The significance of potential effects on the water environment has been determined by assessing the importance of the water receptors and magnitude of the impact of the Scheme (including mitigation measures).

Flood risk

8.5.3 In addition to the guidance and criteria provided in HD 45/09, a FRA has been carried out in accordance with the requirements of the National Planning Practice Guidance (NPPF) (DCLG, 2018) and its accompanying Technical Guidance (DCLG, 2014), and the Environment Agency's 'Climate change allowances for planners' NPPF supporting guidance (EA, 2013). The FRA is also in line with HD 45/09 (HA, 2009).

Water Framework Directive

8.5.4 A WFD Compliance Assessment has been undertaken by following the Planning Inspectorate's (PINS) guidance on the preparation of WFD assessments for a Nationally Significant Infrastructure Project[1]. It is based on a format that was originally developed in close consultation with the Environment Agency for a large transport infrastructure scheme[2]. This format was subsequently promoted by the Environment Agency as an example of best practice, particularly for large schemes that affect many water bodies. It captures the core requirements of a compliance assessment whilst being transparent and simple to interpret.

8.5.5 The WFD Compliance Assessment is a standalone report (application document TR010030/APP/5.4) which considers the impacts of the Scheme at a waterbody scale. For surface water bodies the WFD Compliance Assessment considers the potential impact of the Scheme on ecological components and chemical components. Ecological compounds include: biological quality elements; physico-chemical elements; hydromorphology supporting elements; and specific pollutants. Chemical components include: priority and priority hazardous substances. For groundwater water bodies the WFD Compliance Assessment considers the potential impact of the Scheme on quantitative components and qualitative components.

8.5.6 To determine whether water body components are affected by the Scheme, data will be drawn from Chapter 7, Biodiversity and Chapter 10, Geology and Soils. Chapter 7 provides data specifically relating to biological quality elements of a surface waterbody and Chapter 10 provides data specifically relating to quantitative and chemical quality of a groundwater waterbody. The HD 45/09 assessment methods have also been incorporated in the WFD Compliance Assessment specifically those used to determine risks of deterioration to water quality (i.e. from specific pollutants, priority and priority hazardous substances).

Data collection

8.5.7 The following activities were undertaken as part of the baseline assessment for the study area:

- Identification of surface water bodies: rivers, ditches, lakes;
- Identification of groundwater bodies;
- Identification of licensed water abstractions and discharges (both surface and groundwater);

[1] The Planning Inspectorate (2017) Advice Note 18, The Water Framework Directive
[2] HS2, 2016. Water Framework Directive Compliance Assessment Update (C453) Supplementary Information. London: HS2. C454-ATK-EV-REP-000-000001

- Identification of current and historic flood risk;
- Collation of waterbody characteristics and WFD classification;
- Identification of international / nationally designated conservation sites with citations related to the water environment; and
- Identification of Scheme design elements relevant to the water environment assessment such as (but not limited to) outfalls, soakaways, piling and gantries.

8.5.8 Baseline conditions have been determined through desk studies. The desk study included a review of the following information:

- British Geological Survey's Geology of Britain Viewer[3];
- Data published under the Open Government Licence[4];
- Envirocheck Report specifically purchased for this Scheme[5];
- The Environment Agency Flood Zones, surface water mapping and historical flood extents, taken from the Environment Agency data catalogue[6];
- The Elmbridge Strategic Flood Risk Assessment (SFRA) (Elmbridge Borough Council, 2014);
- The Guildford SFRA (Guildford Borough Council, 2015);
- The Surrey County Council (Lead Local Flood Authority, LLFA) Preliminary Flood Risk Assessment (PFRA) (2011);
- The Surrey Local Flood Risk Management Strategy 2017-2032 (2017);
- Elmbridge Section 19 Flood Investigation Report for the winter 2013/14 event (2015);
- Environmental datasets held of Defra's MAGIC website (Defra, 2018); and
- Environment Agency's What's in your backyard[7] and Data Catchment Explorer[8].

Prediction and evaluation of effects

Water quality

8.5.9 The prediction and evaluation of the effects of the Scheme follows the requirements and detailed assessment method set out in HD 45/09. The methods are outlined in Table 8.2. It should be noted that Method B was not undertaken as part of the assessment as no long-term risks were identified in Method A.

[3] http://mapapps.bgs.ac.uk/geologyofbritain/home.html
[4] http://environment.data.gov.uk/ds/catalogue/#/catalogue
[5] Landmark Information Group (2017) Site specific Envirocheck report. Purchased 5 Dec 2017
[6] http://environment.data.gov.uk/ds/catalogue/index.jsp#/catalogue
[7] http://apps.environment-agency.gov.uk/wiyby/default.aspx
[8] http://environment.data.gov.uk/catchment-planning/

Table 8.2: Methods used within the water environment assessment

Method	Description
Method A	This method focuses on the dilution of routine runoff and pollutants. The method is a simple assessment and includes the use of Highways Agency Water Risk Assessment Tool (HAWRAT) considering dilution of indicator metals (dissolved zinc and dissolved copper). The HAWRAT tool is designed to make an assessment of the short-term risks related to the intermittent nature of road run-off as well as the long-term risks. All discharges have been tested using HAWRAT. The methodology for routine runoff involves tests to predict future concentrations of zinc and copper in receiving watercourses with addition of discharge from the Scheme. This is based on Annual Average Daily Traffic (AADT) flows, catchment size for the road, dilution flows (Q95) and current water quality (hardness) for each receiving watercourse. This method also takes into account the likelihood of and extent of sediment deposition.
Method B	This method follows on from Method A. The method is a detailed assessment approach focusing on the long-term risks should a risk has been identified in Method A. If the predicted long-term annual averages exceed either of the EQS values for copper or zinc then the bioavailability of these metals needs to be assessed using a Biotic Ligand Model (BLM). If Method B also reports a failure of the EQSs, the designer should aim to achieve compliance with both EQSs and RSTs but at sites where this is difficult the design should at least provide sufficient treatment to comply with the EQSs.
Method C	This method focuses on groundwater effects. This is the standard method for assessing the impact of a scheme on groundwater quality. Typically, this considers the risk of pollution to groundwater of discharges from a scheme.
Method D	This method focuses on the probability of a serious spillage risk occurring that would affect the water environment. The method provides the return period of a serious accident based on road length, road characteristics (e.g. presence of junctions, roundabouts, and crossroads) AADT, percentage of Heavy Good Vehicles (HGVs), spillage risk factors and emergency services response time (based on site environment - e.g. urban/rural).
Method E	Hydrological Assessment of Design Floods. This gives generic guidance to estimation of flood events for catchments.
Method F	Hydraulic Assessment - This gives direction as to what is required in a flood consequences assessment and the process of hydraulic modelling to determine flood risk.

8.5.10 The specific requirements or thresholds to protect the surface water environment are shown in Table 8.3. For Method A, the thresholds are Environmental Quality Standards (EQS) for dissolved copper and zinc which are stated in HD 45/09 and must not be exceeded. It should be noted, the standards set out in HD 45/09 are legacy standards and have since been replaced by bio-availability standards. However, the standards stated in HD 45/09 are still appropriate and relevant as they provide an indication of the likelihood of potential impacts. Run-off Specific Thresholds (RST's) also provide an assessment of short-term impact of the Scheme for soluble copper and zinc.

Table 8.3: Water quality thresholds

Method	Test	Limit
Method A RST	Dissolved copper and zinc	Range of thresholds (pass/fail)
Method A EQS	Downstream dissolved zinc concentrations	7.8 µg/l
Method A EQS	Downstream dissolved copper concentrations *	1 µg/l for <50 mg/l CaCO3 6 µg/l for >50 - 100 mg/lCaCO3 10 µg/l for 100 - 250 mgCaCO3 28 µg/l for >250mg/l CaCO3 **
Method A sediment	Disposition index (extent of sediment coverage)	100 (pass/fail/protected area)
Method C	Low risk Medium risk High risk	Risk score <150 Risk score 150-250 Risk score >250
Method D	Risk of an accidental spillage reaching a watercourse or groundwater; risk of a serious pollution incident results from the accidental spillage; and the return period calculated for the risk of a pollution incident	Acceptable risk of a serious pollution incident occurring will be where the annual probability is predicted to be <1% Where road runoff discharges within 1 km of a natural wetland or designated wetlands or it could affect important drinking water supplies or other important abstractions the risk of a serious pollution incident has an annual probability of <0.5%

Key: EQS = Environmental Quality Standards; RST= Run-off Specific Threshold; * the maximum limit for dissolved copper is dependent on hardness of the receiving water, ** These standards have been superseded by the Environmental Damage (Prevention and Remediation) Regulations (2015) but are still used within the DMRB.

Table Source: HD45/09 Table A4.1

Flood risk

8.5.11 The assessment methodology for flood risk broadly follows HD 45/09 Method E – Hydrological Analysis of Design Floods and Method F – Hydraulic Assessment. The assessment methodology deviates from HD 45/09 where updates in policy and industry standard procedures for flood risk hydrological and hydraulic analysis have changed. The latest Environment Agency guidance on design flood estimation and flood modelling has been followed as appropriate for the analysis undertaken.

Water Framework Directive

8.5.12 A colour coding “Red, Amber, Green” (RAG) system was used for the assessment. Definitions for the colour coding were assigned to indicate the level of risk of objective non-compliance within each waterbody, accounted for mitigation assumed to be ‘embedded’ into later phases of the design. Further details of the WFD compliance assessment methodology are provided in application document TR010030/APP/5.4.

Assessment criteria

Water quality (surface water and groundwater) and flood risk

8.5.13 HD 45/09 methodology starts with identification of the importance of the environmental attributes within the Scheme study area. The magnitude of impact of the Scheme on the attribute is then determined using calculations and tests from the HD45/09, taking into consideration the influence of mitigation measures. The combination of the importance of an attribute and the magnitude of impact on that attribute gives a significance of potential effect.

8.5.14 The assessment criteria used follow those set out in HD 45/09 and is shown in Tables 8.4 to 8.7. Examples for evaluating the importance of water attributes are shown in Table 8.4. Examples for assessing the magnitude of impacts are shown in Table 8.5. A matrix for determining significance of effects is shown in Table 8.6.

Table 8.4: Estimating the importance of water environment attributes

Importance	Criteria	Typical Examples
Very High	Attribute has a high quality and rarity on regional or national scale	Surface Water: • EC Designated Salmonid/Cyprinid fishery • WFD Class 'High' • Site protected/designated under EC or UK habitat legislation (SAC, SPA, SSSI, WPZ, Ramsar site, salmonid water)/Species protected by EC legislation
		Groundwater: • Principal aquifer providing a regionally important resource or supporting site protected under EC and UK habitat legislation SPZ1
		Flood Risk: • Floodplain or defence protecting more than 100 residential properties from flooding
High	Attribute has a high quality and rarity on local scale	Surface Water: • WFD Class 'Good' • Major Cyprinid Fishery • Species protected under EC or UK habitat legislation
		Groundwater: • Principal aquifer providing locally important resource or supporting river ecosystem SPZ2
		Flood risk: • Floodplain or defence protecting between 1 and 100 residential properties or industrial premises from flooding
Medium	Attribute has a medium quality	Surface Water: • WFD Class 'Moderate'

Importance	Criteria	Typical Examples
	and rarity on local scale	Groundwater: • Aquifer providing water for agricultural or industrial use with limited connection to surface water SPZ3
		Flood risk: • Floodplain or defence protecting 10 or fewer industrial properties from flooding
Low	Attribute has a low quality and rarity on local scale	Surface Water: • WFD Class 'Poor'
		Groundwater: • Unproductive strata
		Flood risk: • Floodplain with limited constraints and a low probability of flooding of residential and industrial properties

Key: SAC = Special Area Conservation; SPA = Special Protection Area; SPZ = Source Protection Zone=SPZ; SSSI = Site of Special Scientific Interest; WPZ = Water Protection Zone.

Table Source: DMRB HD45/09 Table A4.3

Table 8.5: Estimating the magnitude of an impact on an attribute

Magnitude	Criteria	Typical Examples
Major Adverse	Results in loss of attribute and/or quality and integrity of the attribute	Surface Water: • Failure of both soluble and sediment-bound pollutants in HAWRAT (Method A, Annex I) and compliance failure with EQS values (Method B) Calculated risk of pollution from a spillage >2% annually (Spillage Risk Assessment, Method D, Annex I) • Loss or extensive change to a fishery • Loss or extensive change to a designated Nature Conservation Site
		Groundwater: • Loss of, or extensive change to, an aquifer • Potential high risk of pollution to groundwater from routine runoff - risk score >250 (Groundwater Assessment, Method C, Annex I) • Calculated risk of pollution from spillages >2% annually (Spillage Risk Assessment, Method D, Annex I) • Loss of, or extensive change to, groundwater supported designated wetlands
		Flood risk: • Increase in peak flood level (1% annual probability) >100 mm (Hydrological Assessment of Design Floods and Hydraulic Assessment • Methods E and F, Annex I)

Magnitude	Criteria	Typical Examples
Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute	Surface Water: • Failure of both soluble and sediment-bound pollutants in HAWRAT (Method A, Annex I) but compliance with EQS values (Method B) • Calculated risk of pollution from spillages >1% annually and <2% annually • Partial loss in productivity of a fishery
		Groundwater: • Partial loss or change to an aquifer • Potential medium risk of pollution to groundwater from routine runoff - risk score 150-250 • Calculated risk of pollution from spillages >1% annually and <2% annually • Partial loss of the integrity of groundwater supported designated wetlands
		Flood risk: • Increase in peak flood level (1% annual probability) >50 mm
Minor Adverse	Results in some measurable change in attributes quality or vulnerability	Surface Water: • Failure of either soluble or sediment-bound pollutants in HAWRAT • Calculated risk of pollution from spillages >0.5% annually and <1% annually
		Groundwater: • Potential low risk of pollution to groundwater from routine runoff - risk score <150 Calculated risk of pollution from spillages >0.5% annually and <1% annually Minor effects on groundwater supported wetlands
		Flood risk: • Increase in peak flood level (1% annual probability) >10mm
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity	The Scheme is unlikely to affect the integrity of the water environment
		Surface Water: • No risk identified by HAWRAT (Pass both soluble and sediment-bound pollutants) • Risk of pollution from spillages <0.5%
		Groundwater: No measurable impact upon an aquifer and risk of pollution from spillages <0.5%
		Flood risk: • Negligible change in peak flood level (1% annual probability) <+/- 10 mm

Magnitude	Criteria	Typical Examples
Minor Beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	Surface Water: • HAWRAT assessment of either soluble or sediment-bound pollutants becomes Pass from an existing site where the baseline was a Fail condition • Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is <1% annually)
		Groundwater: • Calculated reduction in existing spillage risk by 50% or more to an aquifer (when existing spillage risk <1% annually)
		Flood risk: • Reduction in peak flood level (1% annual probability) >10 mm
Moderate Beneficial	Results in moderate improvement of attribute quality	Surface Water: • HAWRAT assessment of both soluble and sediment-bound pollutants becomes Pass from an existing site where the baseline was a Fail condition • Calculated reduction in existing spillage by 50% or more (when existing spillage risk >1% annually)
		Groundwater: • Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is >1% annually)
		Flood risk: • Reduction in peak flood level (1% annual probability) >50 mm
Major Beneficial	Results in major improvement of attribute quality	Surface Water: • Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse
		Groundwater: • Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring • Recharge of an aquifer
		Flood risk: • Reduction in peak flood level (1% annual probability) >100 mm

Source: HD45/09 Table A4.4

Table 8.6: Estimating the significance of potential effects

Importance of Attribute	Magnitude of Impact			
	Major	Moderate	Minor	Negligible
Very High	Very Large	Large/Very Large	Moderate/Large	Neutral
High	Large/Very Large	Moderate/Large	Slight/Moderate	Neutral
Medium	Large	Moderate	Slight	Neutral

Importance of Attribute	Magnitude of Impact			
	Major	Moderate	Minor	Negligible
Very High	Very Large	Large/Very Large	Moderate/Large	Neutral
Low	Slight/Moderate	Slight	Neutral	Neutral

Source: HD45/09 Table A4.5

WFD Compliance Assessment

8.5.15 A WFD compliance assessment is required for new developments to demonstrate that proposals will not result in a deterioration in status (or potential) of any waterbody (defined in this assessment as Test A), or prevent the waterbody from meeting good status (or potential) in the future (2021 or 2027) (defined in this assessment as Test B).

8.5.16 The Scheme was assessed for its effect on achieving the two key environmental objectives. This was undertaken for each waterbody where the Scheme resulted in some modification to a waterbody or an indirect effect to the volume or quality of water within a waterbody.

8.5.17 A precautionary risk based approach was taken to the assessment. This considered tests A and B, accounting for uncertainty of potential impacts. The level of information available at the preliminary design stage as well as the lack of detailed baseline information for the water bodies assessed was taken into account.

8.6 Assumptions and limitations

8.6.1 This assessment has relied upon the accuracy and level of detail of the documented data sources. For example, the identification of water bodies and current characteristics has involved reference to Environment Agency websites for RBMPs and associated WFD water body information sheets. The datasets are updated annually and the latest available information has been included.

8.6.2 Site-specific ground investigation data were not available at the time of reporting. The DMRB Method C (effects of routine runoff on groundwater quality) and was completed using the limited available data at the time of reporting.

8.6.3 Due to the limited available groundwater data at the time of reporting, the impact on groundwater quantity have been assessed using two ‘realistic’ worst-case scenarios of groundwater flow direction.

8.6.4 The DMRB Method C (effects of routine runoff on groundwater) determined a medium risk to groundwater during the operation of the Scheme. DMRB guidance advises when a medium risk is identified an additional groundwater risk assessment should be undertaken to determine the need for and nature of mitigation required to protect groundwater. However, as no site-specific groundwater data were available at the time of reporting this could not be undertaken. However, in consultation with the Environment Agency, the risks to groundwater quality are not likely to be significant.

8.6.5 Once site-specific ground investigation data are available the DMRB Method C will be reviewed and if necessary an additional groundwater risk assessment

undertaken and the findings incorporated into the Scheme at the detailed design stage.

8.6.6 The Highways Agency Drainage Data Management System (HADDMS) and as built plans of the existing M25 and A3 were retrieved for the Scheme but were incomplete and the use was limited. Drainage and topographic surveys are therefore required to understand the existing drainage infrastructure. At the time of reporting the drainage and topographic surveys had not been undertaken. The assessment of the impact of the Scheme on water quality has been completed based on the available information.

8.6.7 Due to limited survey information available for the existing highway drainage system it has been assumed no existing mitigation measures to treat road runoff are present.

8.6.8 With regards to the water quality assessment a number of limitations are presented, which apply to the results once the assessment has been made:

- There is limited information regarding the existing drainage system and therefore pre-Scheme water quality impacts cannot be assessed;
- HAWRAT uses two-way Annual Average Daily Traffic (AADT) volumes in the estimation of pollutant build-up on the road, where AADT data is entered in broad bands of 10,000 to 50,000, 50,000 to 100,000, and >100,000. The estimation of pollutant build-up on the road could potentially be overestimated for outfalls. If a number of road catchments with different band two-way AADT volumes drain to the same outfall the highest band has been be used;
- Stream flow data for the receiving watercourse is required for the assessment. However, no gauged flows are available for the receiving watercourses. Where possible, flows have been estimated from a commercial software package called LowFlows^{TM} (in line with HD 45/09);
- In the absence of LowFlows data, the lowest flow accepted by HAWRAT (0.001 m^3/s) has been used which could underestimate the dilution available. This assumption is conservative and lends to a precautionary approach to the assessment of impacts; and
- The required treatment percentages returned by HAWRAT are very precise, however the guidance on the treatment efficiency of SuDS provided in HD 33/16 can only be used as broad indicator of performance. With the above in mind, a degree of pragmatism is required when designing and assessing the road drainage system; the treatment train should be sufficient to reasonably treat runoff.

8.6.9 With regards to the flood risk assessment a number of assumptions have been made relating to the development of the river model that has been used to test the impact of the Scheme on flood risk. The assumptions have been sensitivity tested and shown to not have a material impact on the conclusions of the flood risk assessment.

8.7 Baseline conditions (including importance of receptors)

8.7.1 Figure 8.1 and 8.2 shows the water environment features in the study area.

Surface water

8.7.2 WFD surface waterbodies within the study area fall within the Thames River Basin District (RBD) as set out within the Thames River Basin Management Plan (RBMP).

8.7.3 The study area overlies a watershed between the catchments of the Rivers Wey and Mole.

8.7.4 Five WFD (2000/60/EC) river waterbodies have been identified across the study area, these are shown on Figure 8.1.

8.7.5 Note, the WFD Compliance Assessment (application document TR010030/APP/5.4), focuses on the waterbodies directly impacted, whereas this chapter provides an overview of the water environment as a whole.

8.7.6 Table 8.7 provides details of the WFD river waterbodies and their importance. Although the current overall status for all river waterbodies is moderate, the requirement of the WFD is for all waterbodies to meet good status or good potential by 2027. Importance has therefore been based on this requirement.

Table 8.7: WFD river waterbodies and importance

Receptor	Approximate distance from Scheme (Red Line Boundary) at closest point	Overall waterbody status/ potential	Importance
River Wey - Shalford to River Thames Confluence at Weybridge (GB106039017630)	0 m	Moderate	High
Wey Navigation (Pyrford reach) (GB106039017910)	550 m	Moderate	High
Stratford Brook (GB106039017890)	0 m	Moderate	High
Guileshill Brook (GB106039017880)	50 m	Moderate	High
River Mole (Horley to Hersham) (GB106039017621)	50 m	Moderate	High

8.7.7 There are a number of drains in the study area that are not classified under the WFD. These are shown on Figure 8.2. Only drains which are in hydrological connectivity with the Scheme have been assessed and are listed in Table 8.8. These drains are in close proximity to the highway or a construction site compound which means they could potentially be impacted during construction or receive road runoff during operation.

8.7.8 The importance of these drains is presented in Table 8.9. As some of these drains are within Ockham and Wisley Commons SSSI and Thames Basin Heaths SPA they have been assigned a very high importance. These drains have been included in the assessment because of their proximity to the highway or a

construction site compound which means they could potentially be impacted during construction or receive road runoff during operation.

Table 8.8: Non-WFD river waterbodies in hydrological connectivity with the Scheme

Receptor name	Location description	Importance
Ditch in A3 central reservation (A)	Located between the northbound and southbound carriageways of the A3 between Ockham junction and Wisley Lane.	Low
Ditch in A3 central reservation (B)	Located between the northbound and southbound carriageway of the A3 between Wisley Lane and Bolder Mere.	Low
Adjacent A3 ditch (A)	Located adjacent to the southbound Carriageway of the A3 between Wisley Lane and Bolder Mere. The drain flows towards Bolder Mere, where it then passes through a culvert under the A3. It then flows in a northern direction into Wisley Common.	Very high
Adjacent A3 ditch (B)	Located approximately 340 m south of Bolder Mere. The drain flows in a north-west direction towards adjacent A3 ditch (A), which it eventually joins.	Very high
Natural outfall from Bolder Mere ditch	Natural outfall drain from Bolder Mere. Located on Bolder Mere's south-western shore.	Very high
Hut Hill ditch	Located approximately 100 m south of Hut Hill Cottage adjacent to the northbound carriageway of the A3.	Very high
Chatley Wood ditch and Ockham common ditch	Located approximately 150 m east of junction 10. The drain is intersected by the M25.	Very high
Pointers Road ditch	Located approximately 80 m north of junction 10 and east of the A3 at Redhill Bottom.	Very high
Seven Hills Hotel/Long Orchard Farm ditch	Located between Seven Hills Hotel and Long Orchard Farm approximately 110 m from the northbound carriageway of the A3.	Medium
A245 Byfleet Road ditch	Located to the south-west of Manor Pond. The drain flows from the A245 Byfleet Road towards a small pond which is connected to Manor Pond via a culvert.	Medium
Manor Pond ditch	Located approximately 50 m north of Painshill junction. The drain is connected to Manor Pond and flows towards the River Mole which it joins approximately 250 m north-east of Painshill junction.	High
Cockrow Hill ditches	Located approximately 400 m west of junction 10 and south of the M25.	Very high
Buxton Wood ditch	Located in Buxton Wood approximately 90 m north of the M25 and approximately 300 m from Buxton Wood bridge.	Medium
Wisley ditches north	Located approximately 50 m west of Buxton Wood bridge. The drain is intersected by the M25 and flow in a northwards direction eventually joining the River Wey approximately 130 m north of the M25.	Medium
Elm Lane ditch	Located approximately 60 m east of Hatch Lane. Drain is intersected by Elm Lane.	Very high

8.7.9 There is one WFD designated lake within the study area: Bolder Mere (GB30643218). This lake is also specifically referenced in the designation for the Ockham and Wisley Commons SSSI. It is located 840 m to the south west of junction 10 and adjacent to the southbound carriageway of the A3.

8.7.10 Bolder Mere receives road runoff from the southbound carriageway of the A3.

8.7.11 The current overall status of Bolder Mere is moderate. As previously mentioned the requirement of the WFD is to meet good status or good potential by 2027 so it has been assigned a high importance. However, as Bolder Mere is also referenced in the designation for the Ockham and Wisley Commons SSSI it has been assigned a very high importance.

8.7.12 There are a number of ponds within the study area, which are not WFD designated and could potentially be impacted by the Scheme, these are shown on Figure 8.2. Table 8.9 lists the non-WFD ponds which could potentially be impacted by the Scheme and their importance.

Table 8.9: Non-WFD lakes/ponds

Receptor ID	Location description	Reason for inclusion in assessment	Importance
1	Located immediately adjacent to Manor Lake approximately 70 m from the A245 Byfleet Road.	There is a drain which flows from the highway to the pond which could potentially be a pathway for pollutants to enter the pond during construction or a pathway for road runoff during operation to enter the pond.	Medium
2	Manor Pond is located approximately 40 m north-west of Painshill junction immediately adjacent to the A245 Byfleet Road.	Due to the proximity of the Manor pond to the highway it could potentially be impacted during construction or receive road runoff during operation.	Medium
3	Located approximately 80 m north of Painshill junction to the east of Manor Lake.	The pond is connected to Manor Lake and due to the proximity of the Manor pond to the highway it could potentially be impacted during construction or receive road runoff during operation which could then potentially pass into the pond.	Medium
4	Located approximately 130 m north-east of Painshill junction and to the west of the River Mole.	The pond is connected to Manor Lake and due to the proximity of the Manor pond to the highway it could potentially be impacted during construction or receive road runoff during operation which could then potentially pass into the pond.	Medium
5	Located approximately 20 m north of the A3 south of Seven Hills Hotel.	Due to the proximity of the pond to the highway it could potentially be impacted during construction or receive road runoff during operation.	Medium

Surface water abstractions

8.7.13 There are 10 surface water abstraction licences within the study area. Details of these abstraction licences have been obtained from a site-specific Envirocheck Report[9] and are documented in Table 8.10. The locations of the abstraction licences are shown in Figure 8.2.

Table 8.10: Abstractions

ID	Licence number	Purpose	Source	Approximate distance from Scheme (m)
3a, 3e, 3g and 3h	28/39/30/0344	Private water undertaking: large garden watering	Surface water (Ockham Mill Stream)	Multiple locations: 254, 264, 286, 300
3b, 3d, 3f and 3i		Private water undertaking: lake and pond throughflow		Multiple locations: 254, 264, 286, 300
3c		Private water supply: general use (medium loss)		254
4	28/39/30/0393	Aquaculture: make-up or top up water	Surface water (tributary of River Wey)	342
5a, 5c and 5f	28/39/30/0141	Golf courses: spray irrigation - direct	Surface water (Wey Navigation)	518
5b, 5d and 5e		Golf courses: spray irrigation - spray irrigation definition order		518
6a, 6b and 6c	28/39/30/0179	General agriculture: spray irrigation - direct	Surface water (River Wey)	Multiple locations: 45, 83
11a, 11c, 11f, 11j and 11k	28/39/30/0136	Horticulture and nurseries: spray irrigation - direct	Surface water (River Wey)	Multiple locations: 401, 421, 425, 501
11b, 11d, 11g, 11h and 11l		Horticulture and nurseries: spray irrigation - spray irrigation definition order		Multiple locations: 401, 421, 425, 501
11e, 11i,		Horticulture and nurseries: make-up or top up water		Multiple locations: 421, 425
12	28/39/30/0341	Golf courses: spray irrigation - storage	Surface water (River Wey)	651
20	28/39/32/0079	Private non-industrial amenity: lake and pond throughflow	Surface water (River Mole)	197
25a and 25b	28/39/32/0048	General agriculture: spray irrigation - direct	Surface water (River Mole)	321

[9] Landmark Information Group (2017) Site specific Envirocheck report. Purchased 5 Dec 2017

Surface water discharges

8.7.14 There are 36 surface water discharge consents within the study area according to Environment Agency data available under the Open Government Licence.

8.7.15 Table 8.11 lists the surface water discharge consents within the study area and Figure 8.2 presents the location of the discharge consents.

Table 8.11: Discharge consents

ID	Type	Receiving water feature	Approximate distance from Scheme (m)
19	Sewage discharges - final/treated effluent - not water company	Tributary of Ockham Mill Stream	459
1015	Sewage discharges - final/treated effluent - not water company	Tributary of River Mole	374
1968	Sewage discharges - final/treated effluent - not water company	Tributary of River Mole	88
2214	Sewage discharges - final/treated effluent - not water company	Tributary of the River Mole	833
2543	Sewage discharges - final/treated effluent - not water company	Tributary of River Mole	241
2744	Sewage discharges - final/treated effluent - not water company	Tributary of Norton Wood ditch	271
2745	Sewage discharges - final/treated effluent - not water company	River Wey	545
3523	Sewage discharges - final/treated effluent - not water company	Tributary of the River Mole	152
4207	Sewage discharges - final/treated effluent - not water company	River Mole	120
4328	Sewage discharges - final/treated effluent - not water company	Tributary of the Bolder Mere Brook	88
4473	Sewage discharges - final/treated effluent - not water company	Tributary of Norton Wood ditch	148
4611	Sewage discharges - final/treated effluent - not water company	Tributary of Bolder Mere Brook	135
4875	Sewage discharges - final/treated effluent - not water company	Tributary of the River Mole	259

ID	Type	Receiving water feature	Approximate distance from Scheme (m)
5327	Sewage discharges - final/treated effluent - not water company	A tributary of the River Wey	175
5768	Sewage discharges - final/treated effluent - not water company	Bookham Brook	536
6027	Sewage discharges - final/treated effluent - not water company	River Wey	712
6082	Sewage discharges - final/treated effluent - not water company	River Mole	172
6499	Sewage discharges - final/treated effluent - not water company	Ockham Millstream	429
6645	Sewage discharges - final/treated effluent - not water company	Unnamed ditch, tributary of River Mole	84
6652	Sewage discharges - final/treated effluent - not water company	Tributary of Bolder Mere Brook	116
7010	Sewage discharges - final/treated effluent - not water company	River Mole	217
8377	Sewage discharges - final/treated effluent - not water company	Tributary of River Mole	492
8869	Sewage discharges - final/treated effluent - not water company	Tributary of the Norton Wood ditch	799
9738	Sewage discharges - final/treated effluent - not water company	Tributary of River Wey	340
10249	Sewage discharges - final/treated effluent - not water company	Guileshill Brook	334
10588	Sewage discharges - final/treated effluent - not water company	River Mole	780
10610	Sewage discharges - final/treated effluent - not water company	Bolder Mere Brook	464
10611	Sewage discharges - final/treated effluent - not water company	Bolder Mere Brook	464
10632	Sewage discharges - final/treated effluent - not water company	Bolder Mere Brook	464

ID	Type	Receiving water feature	Approximate distance from Scheme (m)
10958	Sewage discharges - final/treated effluent - not water company	Tributary of River Wey	623
12051	Sewage discharges - sewer storm overflow - water company	River Mole	47
12052	Sewage discharges - pumping station - water company	River Mole	47
12547	Sewage discharges - final/treated effluent - water company	River Wey	477
12662	Sewage discharges - final/treated effluent - water company	River Mole	87
12911	Sewage discharges - final/treated effluent - water company	River Wey	384
13341	Agriculture - arable farming	Land (surface)	112

Groundwater

8.7.16 Based on geological Open Data (1:625k scale), the bedrock geology at outcrop underlying the majority of the study area is the Bagshot Formation, which is comprised of sand. Underlying the southern portion of the study area (along the course of Stratford Brook) is the London Clay Formation, which is comprised of clay with silt and sand. Further south west, beyond Stratford Brook, there is an isolated area of the Bagshot Formation at outcrop.

8.7.17 The aquifer (Bagshot Formation) is designated as a WFD water body: the Chobham Bagshot Beds (WFD ID GB40602G601400). The current overall status of this groundwater body is good and therefore the water body has been assigned a high importance.

8.7.18 Based on geological Open Data (1:50k scale), the superficial geology, overlying the bedrock, follows the valleys of the main watercourses, that being the River Wey and the River Mole. The superficial geology present along the course of the River Wey is Alluvium, which comprises of clay, silt, sand and gravel, and Kempton Park Gravel Member, which is comprised of sand and gravel. The superficial geology present along the course of the River Mole is the Taplow Gravel Member, which is comprised of sand and gravel, and Alluvium. There are isolated areas of Lynch Hill Gravel Member, which is comprised of sand and gravel, close to the A3, to the south west and north east of M25, junction 10.

8.7.19 Detailed geological information and site specific geology, where it is available, is included in Chapter 10 Geology and Soils.

8.7.20 The study area is mainly underlain by superficial Secondary A Aquifers but there are also Principal Aquifers to the west and east of the study area, adjacent to the course of the River Wey and River Mole, indicating high groundwater sensitivity.

8.7.21 There are no groundwater Source Protection Zones (SPZ) within the study area.

8.7.22 Table 8.12 summarises the aquifer designations for the superficial deposits and bedrock formations found within the study area. Table 8.12 also presents the importance of the aquifers identified.

Table 8.12: Aquifer designations for superficial deposits and bedrock formations

Geology	Aquifer designation	Importance
Bedrock		
Bagshot Formation	Secondary A/WFD water body	High
London Clay Formation	Unproductive strata	Low
Superficial		
Alluvium	Secondary A	Medium
Kempton Park Gravel Member	Principal	High
Taplow Gravel Member	Principal	High
Lynch Hill Gravel Member	Secondary A	Medium

Groundwater levels

1.1.1 There is limited groundwater level data available within the study area and no long-term groundwater monitoring data is available. Information on groundwater strikes and rest levels have been collected from publicly available exploratory hole records[10] and other available sources, including HAGDMS24 and two previous ground investigations detailed in reports provided on the Guildford Borough Council planning applications website[11]. In summary, the available data suggests groundwater strikes between 0.2 and 16 mbgl and are recorded in the Bagshot Formation, the London Clay and the superficial deposits.

1.1.2 Groundwater which has been recorded within the London Clay is considered relatively immobile, due to the low permeability of the formation.

1.1.3 Localised artesian conditions have been identified in two boreholes (TQ05NE24 and TQ05NE25) located in the most southern extent of the Scheme.

1.1.4 Appendix 8.2 contains a summary of the rest groundwater levels and a summary of the water strikes from these previous investigations recorded in the Bagshot Formation and the superficial deposits. The recent rest groundwater levels are single manual dips recorded in either May 2014 or November 2012. These manual dips are mapped in Figure 8.4. Older manual dips, while included in Appendix 8.2, are not considered to be representative of present day conditions and have therefore been excluded from Figure 8.4.

1.1.5 Due to the limited availability of groundwater level data, it is not possible to determine the groundwater flow direction or the depth to groundwater in the vicinity of the Scheme. As the proposed GI work is still to be completed, for the

[10] British Geological Survey (2017) Onshore GeoIndex (Online) Accessed on 21/03/2018 from http://mapapps2.bgs.ac.uk/geoindex/home.html

[11] Guildford Borough Council (2018) Planning applications, Accessed on 21/03/2019 from http://www2.guildford.gov.uk/publicaccess/applicationDetails.do?activeTab=documents&keyVal=_GUILD_DCAPR_157858

purposes of the environmental statement, a parameter based 'reasonably likely worst case' approach has been taken in the assessment and sought to be mitigated. Intrusive site-specific ground investigation is schedules for the detailed design phase of the Scheme and will allow the groundwater flow direction and the depth to groundwater to be confirmed.

1.1.6 Further information is provided in Appendix 10.6 and Chapter 10 Geology and Soils.

Groundwater abstractions

8.7.23 There are three groundwater abstraction licences within the study area. Details of these abstractions have been obtained from a site specific Envirocheck Report[12] and are documented in Table 8.13. The location of the abstraction licences is shown in Figure 8.2.

Table 8.13: Groundwater abstractions

ID	Licence number	Purpose	Approximate distance from Scheme (m)
8a and 8 b	Th/039/0030/006	Horticulture and nurseries: spray irrigation	291
9a and 9b	28/39/30/0406	Horticulture and nurseries: spray irrigation	291
10	28/39/30/0359	Spray irrigation	316

Groundwater discharges

8.7.24 There are 26 discharge consents within the study area according to Environment Agency data available under the Open Government Licence.

8.7.25 Table 8.14 lists the discharge consents within the study area and Figure 8.2 shows the location of the discharge consents.

Table 8.14: Discharge consents

ID	Type	Receiving water feature*	Approximate distance from Scheme (m)
2367	Sewage discharges - final/treated effluent - not water company	Bracklesham Beds	509
2989	Sewage discharges - final/treated effluent - not water company	Bracklesham Beds	590
3049	Sewage discharges - final/treated effluent - not water company	Groundwater via a soakaway	663
3087	Sewage discharges - final/treated effluent - not water company	Bracklesham Beds	387
3968	Sewage discharges - final/treated effluent - not water company	Lower Bagshot Beds	580
3993	Sewage discharges - final/treated effluent - not water company	Lower Bagshot Beds	580

[12] Landmark Information Group (2017) Site specific Envirocheck report. Purchased 5 Dec 2017

ID	Type	Receiving water feature*	Approximate distance from Scheme (m)
3999	Sewage discharges - final/treated effluent - not water company	Lower Bagshot Beds	580
4021	Sewage discharges - final/treated effluent - not water company	Lower Bagshot Beds	580
7513	Sewage discharges - final/treated effluent - not water company	Alluvium overlying London Clay	742
8059	Sewage discharges - final/treated effluent - not water company	Bagshot Beds	61
8258	Sewage discharges - final/treated effluent - not water company	London Clay	815
8723	Sewage discharges - final/treated effluent - not water company	River gravel	328
8797	Sewage discharges - final/treated effluent - not water company	Gravel	160
9437	Sewage discharges - final/treated effluent - not water company	River gravels and Bagshot Beds	103
9754	Sewage discharges - final/treated effluent - not water company	Lower Bagshot Beds	580
9851	Sewage discharges - final/treated effluent - not water company	Lower Bagshot Beds	580
10099	Sewage discharges - final/treated effluent - not water company	River gravels	951
10147	Sewage discharges - final/treated effluent - not water company	Terrace gravel overlying Bagshot Beds	722
10319	Sewage discharges - final/treated effluent - not water company	Bagshot Beds	82
10717	Sewage discharges - final/treated effluent - not water company	Gravel	535
10718	Sewage discharges - final/treated effluent - not water company	Bracklesham Beds	14
10728	Sewage discharges - final/treated effluent - not water company	Gravel	544
11092	Sewage discharges - final/treated effluent - not water company	Groundwaters	768
11671	Sewage discharges - final/treated effluent - not water company	Groundwater via a soakaway	1
13039	Sewage discharges - final/treated effluent - not water company	Gravels overlying Bagshot Beds	58
13069	Sewage discharges - final/treated effluent - not water company	Bagshot Beds	911

*The receiving water feature has been reported as stated in the data obtained from the Environment Agency through the Open Government Licence. However, for some discharge consents the receiving water feature is unlikely e.g. London Clay.

Flood risk

8.7.26 Flood risk arises from difference sources and as required by the NPPF all sources of flood risk must be considered for a proposed scheme. The Flood Risk Assessment (FRA) provides a detailed account of baseline flood risk from all sources, a summary of which is provided in the following sub-sections.

Fluvial flood risk

8.7.27 Fluvial flood risk arises from watercourses where the capacity of the channel is exceeded by the water flowing within it. Watercourses are designated as Main River or Ordinary watercourses and fall under the responsibility of the Environment Agency and Surrey County Council (Lead Local Flood Authority (LLFA)) respectively.

8.7.28 The initial source of fluvial flood risk information is the Environment Agency Flood Zone mapping. This categorises fluvial flood risk from low probability (Flood Zone 1) to high probability (Flood Zone 3). In general, this mapping shows areas at risk from watercourses with catchments greater than 5 km^2. Fluvial flood risk can also arise from watercourses with smaller catchments, although the associated flood risk is likely to be less. The Environment Agency hold flood models of the Lower Wey and the River Mole. Outputs from the flood models have been used to define the baseline fluvial flood risk. The Lower Wey model does not include the Stratford Brook.

8.7.29 Table 8.15 identifies watercourses within the study area that are at risk from flooding, both those represented by Flood Zone mapping and those that are not. This table also shows the importance of the floodplain associated with each watercourse based on the classification criteria in Table 8.4.

Table 8.15: Fluvial flood risk importance classifications

Watercourse	Description	Importance
Fluvial flood risk identified by Environment Agency Flood Zone mapping		
River Wey (Main River)	Flood Zones 2 and 3 extend across wide areas at this location, and hence the River Wey has a major influence on fluvial flood risk.	Very High
River Mole (Main River)	Flood Zones 2 and 3 extend across wide areas at this location, and hence the River Mole has a major influence on fluvial flood risk in its catchment.	Very High
Stratford Brook (Main River)	The extent of Flood Zone 2 and 3 is relatively narrow along Stratford Brook, with a limited number of properties within the catchment.	High
Tributary of the River Mole (Main River)	The extent of Flood Zone 2 and 3 is relatively narrow along this watercourse, with a limited number of properties within the catchment.	High
Guileshill Brook (Main River)	There are very narrow areas of Flood Zone 2 and 3 indicating flow remains in channel during extreme flow events. Therefore, it is unlikely properties would benefit from the floodplain in this area.	Low
Fluvial flood risk associated with watercourses not represented with Environment Agency Flood Zone mapping		

Watercourse	Description	Importance
Fluvial flood risk identified by Environment Agency Flood Zone mapping		
East of Hatchford Wood ditch	Ordinary watercourse under the M25 immediately east of Hatchford Wood.	Medium
Chatley Wood pond and ditch and Ockham Common ditch	Ordinary watercourse under the M25 immediately east of junction 10. This watercourse provides hydraulic linkage with a pond.	Low
Brickfield Copse ditch	Ordinary watercourse under the M25 east of Hatchford.	Low
Bolder Mere downstream ditch and adjacent A3 ditch	Ordinary watercourse on the A3 south of junction 10 associated with Bolder Mere Lake.	Low

Surface water flood risk

8.7.30 Surface water flooding occurs when rainwater does not drain through the drainage system or soak into the ground, but lies on or flows over the ground.

8.7.31 The Environment Agency publish mapping that identifies areas at risk of surface water flooding, categorising areas as high risk to low risk. This is based on broad scale mapping, often identifying areas of low lying land which would be vulnerable to surface water accumulation.

8.7.32 The mapping identifies many locations within the study area as being at risk from surface water flooding, however most of these areas, specifically those showing high risk, are along river corridors and hence associated with watercourses. These areas are considered to be at risk of fluvial flooding rather than surface water.

8.7.33 The areas identified by the Environment Agency mapping as being at risk from surface water flooding, but not associated with identified watercourses have been listed in Table 8.16. Importance criteria are not defined for associated surface water flood risk, so the definition of importance has been made on a subjective basis of the risk category, potential vulnerable receptors and extent of risk area.

Table 8.16: Surface water flood risk importance classifications

General location	Description	Importance
Surrounding Wisley Common	There are several interconnecting areas at risk (ranging from low to high) of surface water flooding at and around Wisley Common. This includes over 800m length of the M25 at high risk. Owing to the hydraulic connectivity between the areas at risk, and wide spread high risk areas, there is potential impact on property and the M25.	High
South of Downside	Various areas at low risk from surface water flooding, and the location of this suggest a potential overland flow route which is blocked by the existing M25 that may cause backing up. However, there are not properties at risk.	Medium

General location	Description	Importance
	Also at this location a 1km length of the M25 is identified to be at high risk from surface water flooding, although it is assumed that the existing drainage of the road network adequately addressed this risk.	
A3 adjacent to Bolder Mere Lake	There is a 500m length of the A3 at this location identified to be at high risk from surface water flooding, although it is assumed that the existing drainage of the road network adequately addressed this risk. This appears to also be connected with surface water flow paths in the area, although there are no properties at risk of flooding in this area.	Medium
Northern extent of the Scheme	In the northern area of the Scheme there are various isolated areas shown to be at risk and these areas are likely to be associated with localised depressions in topography. There also appears to be a flow route to a series of lakes associated with the River Mole. Baseline surface water flood risk is low risk to vulnerable receptors.	Low
Ockham Common	There are several interconnecting areas at risk (ranging from low to high) of surface water flooding at and around Ockham Common. These appear to be flow routes to Bolder Mere Lake. There are no properties within this area.	Low

Groundwater flood risk

8.7.34 Groundwater flooding normally occurs where the water table meets the ground surface in low lying areas which are underlain by permeable rock known as aquifers. Groundwater flooding tends to follow long periods of sustained rainfall, but can also be caused by local obstructions to groundwater flow (e.g. following the placement of engineering structures or buildings with foundations) or by the rebound of groundwater levels after a decrease in abstraction or dewatering.

8.7.35 The Strategic Flood Risk Assessments (SFRAs) for Elmbridge[13] and Guildford[14] identify areas that are susceptible and at risk from groundwater flooding. This mapping identifies that throughout the study area the risk from this source of flooding ranges from very low to low.

8.7.36 This very low to low risk of groundwater flooding is applicable to areas above the existing/surrounding ground level. Any areas which are significantly below surrounding ground levels, for example localised depressions in topography, would be at a higher risk of groundwater flooding, and this risk would increase the deeper the feature.

8.7.37 Based on the current understanding of groundwater flood risk in the study area, the overall importance of this source of risk is considered low for any areas above the existing surrounding ground level. Although the flood risk may be

[13] Elmbridge Borough Council (2014) *Elmbridge Strategic Flood Risk Assessment completed by URS on behalf of Elmbridge Borough Council*.
[14] Guildford Borough Council (2015) *Guildford Strategic Flood Risk Assessment completed by Capita on behalf of Guildford Borough Council.*

higher for areas of low topography, there are no properties within these areas (based on localised depressions shown in the surface water mapping), and therefore the importance will remain low.

8.7.38 As the Scheme progresses, ground investigation/surveys would provide a more detailed understanding of groundwater flood risk. This detailed and localised ground condition information may alter the current flood risk classification which has been identified in the SFRA based on broadscale geological mapping for the area.

8.7.39 To summarise, baseline risk associated with groundwater flooding is identified as low.

Other sources of flood risk

Reservoir inundation

8.7.40 The Environment Agency identify areas at risk of flooding from reservoir inundation, i.e. flooding occurring as a result of reservoir overtopping or failure. In general, this is considered a low probability source of flooding owing to the strict inspection and maintenance regimes imposed on reservoir owners by law, i.e. the Reservoirs Act 1975. However, in line with the NPPF all sources of flood risk must be considered for proposed development.

8.7.41 The reservoir inundation mapping identifies that the floodplain along the River Mole would be at risk of inundation following reservoir failure. However, the inundation mapping broadly follows the fluvial Flood Zone mapping and poses a risk with a much lower probability than fluvial flooding. Therefore, the reservoir flood risk within the study area is considered as low.

8.7.42 This reservoir inundation mapping also identifies that a section of the A3 to the south of Bolder Mere Lake would be at risk of flooding following reservoir failure. The mapping indicates that this source of flood risk is Bolder Mere Lake. Bolder Mere is classified as a category D reservoir. A category D reservoir is one where no loss of life can be foreseen as a result of a breach and very limited additional flood damage would be caused. Although there are no properties identified within this area at risk, the A3 would be at risk, and therefore this source of flooding is considered as low risk.

Canal flooding

8.7.43 There are no canals within the study area therefore it is considered that there is no risk within the study area. This source of flood risk is not considered further in this ES.

Water transmission infrastructure

8.7.44 There is an inherent risk of flooding from water transmission infrastructure, both potable and sewerage, owing to burst or leaking pipes. The risk will be dependent on the location and age of the network in this area, however the SFRAs indicate that there has not been any flooding from this source within the study area.

8.7.45 The mapping of the water transmission network has not been provided at this stage, and the potential implications will be captured in the detailed design and construction methodology stages. Therefore, the flood risk associated with water

transmission infrastructure has been categorised as low in respect of this chapter.

Designated sites

8.7.46 There are four statutory designated sites (only statutory designated sites require consideration as part of the assessment) located in the study area:

- Thames Basin Heaths Special Protection Area (SPA);
- Ockham and Wisley Commons Site of Special Scientific Interest (SSSI);
- Ockham and Wisley Local Nature Reserve (LNR); and
- Old Common LNR.

8.7.47 The location of the designated sites is shown on Figure 8.3. The presence and importance of these designated sites to the water environment has been captured in the assignment of importance to water features in sections 8.7.7, 8.7.10, 8.7.15 and 8.7.25.

8.7.48 The effects on these sites have been addressed fully in Chapter 7 Biodiversity with the water environment aspects outlined below.

8.7.49 The Thames Basin Heaths SPA is intersected by the A3. Ockham and Wisley Commons SSSI and Ockham and Wisley LNR are intersected by the A3 and M25. There are drains and a WFD lake water body located in these three designated sites.

8.7.50 Old Common LNR is not in hydrological connectivity with the Scheme so will not be considered further in this assessment.

8.8 Potential impacts

8.8.1 The potential impacts of the Scheme are discussed in this section.

Construction

8.8.2 Temporary impacts during construction have the potential to affect the water environment through (but not limited to) the following:

8.8.3 Examples of where and how the impacts might occur have been provided. It should be noted that generally only one example has been provided but other examples of the impact are likely to be present.

<u>Surface water</u>

- The excavation of materials, and the subsequent deposition of soils, sediment, or other construction materials, for example through the creation of balancing ponds which are proposed at various locations within the Scheme boundary;
- The spillage of fuels or other contaminating liquids from plant used in the construction process;
- The mobilisation of contamination following the disturbance of contaminated ground or groundwater, for example through earth movement during the construction of the new roads such as the new Wisley Lane;

- Runoff from construction sites to surface water bodies, for example where construction works are immediately adjacent to a watercourse or lake such as the widening of the A3 immediately adjacent to Bolder Mere; and
- Disturbance of non-native invasive species - construction activities can result in the spread along surface water bodies and their riparian zone, for example through the construction of bridges and construction/modification of culverts such as the construction of the Stratford underbridge.

8.8.4 These impacts could result in sediment and/or other contaminants entering watercourses or lakes and affecting the quality of the water which could have implications for the designated sites, abstractions and WFD compliance.

Groundwater

8.8.5 Groundwater effects would include the same potential effects as for surface water. In addition, if localised dewatering is required, disposal of pumped water to surface water must be undertaken in accordance with the discharge consent, preventing excess sediment or contaminants entering surface water. This may be necessary where the ground is excavated to create a cutting.

8.8.6 Also deep foundations may create rapid vertical flow pathways into the underlaying aquifers or affect flow paths. The Scheme includes the construction of a number of new bridges, including: Stratford Brook underbridge, the M25 junction 10 west bridge and the new Wisley Lane overbridge, which will require deep foundations.

8.8.7 The excavation of the ground to form cuttings may also create rapid vertical flow pathways into the underlaying aquifers or affect flow paths for example the private access track which will be construction immediately to the east of the A3 southbound on-slip at Painshill interchange.

Flood risk

8.8.8 The storage of materials and temporary impermeable areas at site compounds may result in an increase in flood risk to the Scheme itself and surrounding land. For example, there is a main site compounds located just south of Stratford Brook to the west of the A3.

8.8.9 Discharge of abstracted water during construction may also give rise to increased flood risk, especially if discharged to smaller watercourses.

8.8.10 Temporary works to watercourses to facilitate construction, such as temporary crossings or modifications to watercourses, have the potential to affect flows in the channels and on floodplains.

WFD

8.8.11 Potential construction impacts include those listed above under surface water and groundwater, but also includes the following potential impacts.

8.8.12 Construction of a full span bridge across Stratford Brook may cause temporary damage to riparian and channel features.

8.8.13 Construction of new culverts to accommodate road crossings over minor watercourses (for example the minor watercourse located in Wisley Common to the north of the A3 (Bolder Mere downstream ditch) will require a culvert to allow

the new Wisley NMU path to pass over it) as well as culvert replacements and extensions (for example the existing culvert under the A3 adjacent to Bolder Mere will be extended to the north and south of the A3 to allow for the minor watercourse (Bolder Mere downstream ditch) to continue under the widened A3) may all result in a) localised damage to channel and riparian features and b) disruption of the natural hydraulic and sediment transport processes.

8.8.14 Realignment of minor watercourses to connect to new culverts or extended old culverts presents a risk of damage to channel features, substrate and riparian zones.

8.8.15 Loss of ephemeral ditches due to construction of Scheme components may result in habitat loss. For example the widening of the M25 footprint to accommodate the new position of the slip road will cause a loss of Chatley Wood ditch and Ockham Common ditch.

8.8.16 Encroachment into Bolder Mere ~~and Manor Pond~~ of retaining walls supporting a wider carriageway~~s~~ may result in damage to shallow, gradually graded lake margins.

Operation

Surface water

8.8.17 During operation roads are designed to drain freely to prevent build-up of standing water on the carriageway whilst avoiding exposure to or causing flooding. Contaminants deposited on the road surface are washed off during rainfall. Where traffic levels are high the level of contamination increases and therefore, the potential for unacceptable harm being caused to the receiving water also increases (HD 45/09).

8.8.18 There are potential impacts to surface water quality and flow volumes owing to the increase in impermeable area as a result of the widening of the A3 and A245 and construction of new roads (new Wisley lane) and access tracks and additional risks associated with road runoff and pollution.

8.8.19 On all roads, there is also a risk that a spillage may lead to an acute pollution incident. Where spillages do reach a surface watercourse the pollution impact can be severe, but is usually of short duration, typical of an acute pollution impact (HD 45/09).

8.8.20 In addition, surface water abstractions or designated sites downstream could be affected by the contaminated road runoff.

8.8.21 A broad range of potential pollutants are also associated with routine cleaning activities such as cleaning gully pots and similar entrapment structures to carriageway maintenance work. The flushing-out of gully pots has been identified as a potential source of pollutants, which may be as damaging as some spillage impacts. The use of herbicides for the control of plant growth along road verges and central reservations may also lead to contamination of road runoff (HD 45/09).

8.8.22 Other than heavy metals and nutrients, the significant dissolved constituent of highway runoff in the UK is sodium chloride (NaCl), applied as de-icing salt during the winter. Sodium chloride can cause damage to vegetation and can

potentially trigger the release of accumulated nutrients and heavy metals adsorbed to the suspended solids into solution (HD 103/06).

Groundwater

8.8.23 Below ground structures, including deep foundations and retaining walls can form a barrier to groundwater flow, depending on the groundwater flow direction. This can potentially reduce groundwater contributions to groundwater dependant water features (e.g. water courses and any groundwater abstractions in the water body).

8.8.24 The new retaining wall along the north western boundary of Bolder Mere could impede groundwater flow to the lake and through the Bagshot Formation, if the groundwater flow direction is perpendicular to the retaining wall (NW to SE). Alternatively, if the groundwater flow direction is from east to west in this area, the existing retaining wall may be retaining water in the lake, and removal of this wall would impact Bolder Mere. Further details on the retaining wall along the north western boundary of Bolder Mere can be found in the WFD Compliance Assessment (application document TR010030/APP/5.4).

8.8.25 Deep foundations created for the construction of bridges and gantries may create rapid vertical flow pathways into groundwater. Gantries are proposed on the M25 and A3.

8.8.26 On the roads, there is also a risk that a spillage may lead to an acute pollution incident. Where spillages do reach groundwater the pollution impact can be long lasting and difficult, if not impossible, to remediate (HD 45/09).

Flood risk

8.8.27 Any new development has the potential to impact on ground permeability and therefore flood risk. This is of primary importance where development will increase the impermeable ground coverage within a site. The proposed development involves additional roads (for example the new Wisley Lane), access tracks (for example the new restricted byway located east of the A3 between Painshill interchange and Court Close Farm), road widening (for example widening of the A3 and the widening of the A245) and enlarging existing roundabouts (for example junction 10 of the M25), which will involve an increase in impermeable surfacing.

8.8.28 There are potential impacts on fluvial flooding as a result of loss of Stratford Brook floodplain due to construction and modification of a river crossings. Any construction on land that is within a flood zone has the potential to alter flow paths and/or flood levels. By taking up some of the existing floodplain storage, there is less opportunity for water to spread out and this can result in increased flood levels. Flows can be restricted at watercourse crossings that can raise the likelihood of flooding upstream or to the constructed carriageway itself. There is a potential for an increase in surface water flooding due to increased impermeable area associated with the construction of new roads for example the new Wisley Lane, widening of existing roads for example the widening of the A3 and A245, construction of access tracks for example the new restricted byway near Painshill junction and enlarging of existing roundabouts for example the enlarging of junction 10. With an increase in impermeable catchment, more water is collected for a given rainfall event, which induces higher rates and volumes of runoff. This has the potential to overload the capacity of the drainage

system. The increased flow rates can also contribute to larger flood peaks in receiving watercourses.

8.8.29 Where Scheme elements coincide with areas of existing groundwater flood risk, these may lead to an increased risk of groundwater flooding. Where subsurface activities are in an area of significant groundwater presence, risk of groundwater flooding is increased.

8.8.30 Where deep foundations for new bridges and gantries or sheet piling is located within areas of existing groundwater flood risk, these have potential to form a barrier to groundwater flow, thereby locally increasing the groundwater flood risk up gradient.

8.8.31 Drainage of cuttings may also add to surface water stream flows with the potential to open up flow paths from groundwater, depending on the depth of the water table in the area.

WFD

8.8.32 Potential operational impacts include those listed above under surface water and groundwater, but also includes the following potential impacts.

8.8.33 The single span bridge over Stratford Brook may result in simplification of the riparian zone associated with shading and the footprint of the structure.

8.8.34 The culvert replacements (for example the culvert under Elm Lane) and extensions (for example for the minor watercourse which flows under the A3 by Bolder Mere) may result in a) localised loss of channel and riparian features and b) disruption of the natural hydraulic and sediment transport processes.

8.8.35 The realignment of the minor watercourse, which flows parallel to the A3 between Wisley Lane and Bolder Mere, to allow for highway widening may result in loss of channel features, substrate and riparian zones.

8.8.36 Encroachment into Bolder Mere ~~and Manor Pond~~ as a result of the construction of ~~-~~a retaining wall~~s~~ supporting a wider carriageway~~s~~ will result in loss of ~~-~~a shallow, gradually graded lake margin~~s~~ which could potentially disrupt the lake nutrient balance.

8.8.37 As described in 8.8.24, replacing the retaining wall alongside Bolder Mere may effect groundwater flow in the Chobham Bagshot Beds groundwater body, potentially impacting Bolder Mere itself which is a groundwater dependent terrestrial ecosystem (GWDTE).

8.9 Design, mitigation and enhancement measures

Construction mitigation

Surface water

8.9.1 Construction methods are developed in outline at this stage but mitigation will include, but not be limited to the following:

- All works to be undertaken with regard to Pollution Prevention Guidelines (PPGs)[15]. These detail good practice advice for undertaking works which may have the potential to cause water pollution;
- Temporary works sites, haul roads and other associated works should be designed and maintained to minimise impact;
- Where temporary watercourse diversions are required or in–channel working, specific mitigation may be needed to ensure the temporary design is in line with the WFD and that temporary impacts are minimised;
- Areas which may generate contaminated water, such as oil storage areas, would need to be bunded and have water discharged to self–contained units with treatment facilities. There would be no discharge to groundwater;
- Tests would be undertaken to ensure contaminated material is identified, isolated and reworked or removed to special landfill to avoid any leachate problems; and
- Temporary land–take required for construction will include adequate areas of land set aside for robust control measures, for example sustainable drainage control.

Groundwater

- Where deep foundations extending below the groundwater table are intended to be part of the Scheme, these should be designed in accordance with industry standards - taking into account the site-specific water level and flow monitoring data obtained from intrusive ground investigation for the Scheme;
- The new retaining wall along the north western boundary of Bolder Mere will be designed based on the site-specific groundwater level data collected during the planned ground investigation. As the groundwater flow direction in this area is not currently known, two realistic worst-case scenarios have been mitigated for:
    - Groundwater flow direction NW to SE across the retaining wall – in this scenario, the retaining wall will be designed so as not to impede groundwater flow. King Sheet Piling®[16] with its discontinuous below ground piling design means sheet piling would not impede groundwater flow.
    - Groundwater flow direction E to W across the retaining wall – in this scenario, the new retaining wall will be designed to replicate the existing wall, ensuring that the water in Bolder Mere is retained by the new wall. A continuous sheet piling design would be used in this scenario.

[15] Pollution Prevention Guidelines (PPGs) with particular reference to PPG1 (general guide to the prevention of water pollution), PPG3 (use and design of oil separators in surface water drainage systems), PPG5 (works near or liable to affect watercourses) and PPG6 (working at construction and demolition sites). The PPGs contain a mix of regulatory requirements and good practice advice. They have been withdrawn by the Environment Agency but are still considered good practice advice to avoid pollution of watercourses. All of the PPGs are available from http://webarchive.nationalarchives.gov.uk/20140328084622/http://www.environment-agency.gov.uk/business/topics/pollution/39083.aspx

[16] The King Sheet Piling (KSP®) system is covered by one or more patents or patent applications, including GB2463079. Copyright Balfour Beatty plc 2008. Contractors building a KSP wall must first ensure a license agreement is completed. More information is available at www.ksppiling.co.uk.

- In consultation with the Environment Agency, it has been agreed that following completion of the GI, a hydrogeological risk assessment will be undertaken, which will be followed by a review of the design and mitigation measures to confirm the mitigation measures proposed are adequate.
- A piling risk assessment would be carried out to ensure the selected piling method does not introduce contamination pathways into the aquifer. Piling design should include mitigation in the form of substantial clear spacing between piles and appropriate piling installation methods; and
- Areas which may generate contaminated water, such as oil storage areas, would need to be bunded and have water discharged to self–contained units with treatment facilities. There would be no discharge to groundwater.

Flood Risk

- For construction work which has drainage implications, the proposed drainage system should comply with the National Standards, such as Schedule 3 under the Flood and Water Management Act 2010. In addition, any planning obligations will need to make provision for the adoption and maintenance of any SuDS, including any necessary access rights to property;
- Construction activities within the floodplain will be minimised as far as possible (consultation with the LLFAs will take place as appropriate and sustainable drainage mitigation will be incorporated into the design to not increase flood risk);
- The Environment Agency flood warning system will be adopted during construction. A suitable plan would be put in place to ensure effective and safe evacuation of personnel (and plant if safe to do so) from the areas at risk on receipt of a flood warning; and
- Where subsurface works are required, depending on the groundwater levels at the time of construction, localised dewatering may be required. No works are planned which would increase the groundwater flood risk.

WFD

8.9.2 The evolution of the Scheme design through options assessment and preliminary design has recognised its sensitive environmental setting. The current configuration of the Scheme was selected in preference to other more expansive options to minimise encroachment of road works into designated and sensitive areas. This geographically constrained form of the Scheme is itself an embedded mitigation that limits the number and extent of water features affected.

8.9.3 The mitigation measures listed under the surface water and groundwater sections above will also apply to WFD quality elements. To further minimise the impact of the Scheme components on WFD quality elements the following guidance has also been adopted:

- Single span structures are the preferred type of crossing because they minimise impact on the water environment if designed appropriately;
- Where culverts are the only feasible technical solution, the culvert should be designed in an environmentally sensitive way;

- Where widening, deepening, straightening or realigning of naturally functioning channels cannot be avoided, modification will need to be carried out in a manner that minimises long term impact; and
- Where hard bed and bank reinforcement are required the design should aim to work with natural processes. Softer, bioengineered solutions will in many cases afford appropriate protection and be a cheaper/more sustainable design.

8.9.4 Application document TR010030/APP/5.4 contains further details on the mitigation associated with the WFD.

Operation mitigation

8.9.5 Mitigation measures during operation are required for several reasons:

- To treat contaminants in normal road run-off;
- To deal with any accidental spillages occurring on the carriageway;
- To prevent increase to flood risk in the area; and
- To protect and enhance wildlife corridors near watercourses.

8.9.6 The design of the drainage system for the Scheme complies with all current standards and SuDS best practice techniques to ensure that sustainability is a key drainage design criterion.

Surface water

8.9.7 The preferred approach is to provide mitigation in the form of SuDS. The DMRB considers how SuDS may be used to treat run-off and provide mitigation for both the quality and attenuation of water. The choice of the system is dependent on the physical environment of the Scheme and needs to consider the availability of land, climate and rainfall characteristics, soil permeability, topography and spillage risk.

8.9.8 With the limited survey information available to inform the drainage design at the time of reporting, the strategy is based on the following principles:

- In general, the Scheme will use the existing outfalls where identifiable from HADDMS and As Built plans and close to the proposed low points on the highways (according to the highway design); and
- Where the low points of the highway do not correlate with known outfalls; soakaways are proposed.

8.9.9 Ponds are proposed as attenuation measures. As well as acting as an attenuation measure the ponds will also provide water quality treatment.

8.9.10 The Scheme has some significant constraints, the most important of which is to minimise land take particularly within the Special Protection Area (SPA). To achieve this, the provision of some attenuation ponds as narrow linear assets or expanded swales have been incorporated into the design (referred to as attenuation ditches).

8.9.11 The location of the attenuation ponds and attenuation ditches are shown on the Scheme Layout Plans. Table 8.17 lists the proposed drainage catchments and proposed mitigation.

Groundwater

8.9.12 As previously mentioned where the low points of the highway do not correlate with known outfalls a soakaway or infiltration trench will be proposed.

8.9.13 Soakaways have the following advantage (Susdrain, 2018):

- They provide storm water attenuation, storm water treatment and groundwater recharge; and

8.9.14 Good water quality treatment performances through the physical filtration to remove solids, adsorption onto the material in the soakaway, and biochemical reactions involving micro-organisms growing on the fill or in the soil.Infiltration trenches have the same advantages as soakaways but provide high water quality treatment performances through the same processes as soakaways.

8.9.15 Pollution control measures, such as oil interceptors will be included on soakaways and infiltration trenches.

8.9.16 Once a site-specific GI has been undertaken the data will be used to confirm the proposed mitigation measures are appropriate.

8.9.17 Deep foundations extending below the groundwater table should be designed in accordance with industry standards, considering the site-specific water level and flow monitoring data obtained from intrusive ground investigation for the Scheme.

8.9.18 Retaining walls extending below the groundwater table should be designed for reasonable worst-case scenarios of groundwater flow direction, ensuring no impact on water levels and flows into Bolder Mere.

8.9.19 Piling design should include substantial clear spacing between piles and appropriate piling installation methods as mitigation.

Flood risk

8.9.20 To contribute to the flood management objectives of neutral or better effect on the overall flood risk, discharge to watercourses must be controlled.

8.9.21 Fluvial flood risk. The proposed drainage design will ensure that the runoff from the Scheme is attenuated before reaching the watercourse for the 1 in 100 annual probability event (1%) taking into account a 20% allowance for climate change and hence there will be no increase in the runoff rate from the site and no increase in fluvial flood risk.

8.9.22 Surface water flood risk. The drainage system of the Scheme will consist of a combination of the existing highway (brownfield) and adjacent undeveloped land (greenfield). The drainage system will be designed in line with the current standards of the HD 45/09 (HA, 2009) to ensure that runoff from the new impermeable area does not exceed the greenfield rate. Longitudinal drains will be designed to take into account a 1 in 5 year annual probability event, plus 20% climate change.

Groundwater flood risk

8.9.23 Where deep foundations extending below the groundwater table are designed to be part of the Scheme, these should be designed in accordance with industry standards, considering the site-specific water level and flow monitoring data

obtained from intrusive ground investigation. Piling design should include mitigation in the form of substantial clear spacing between piles and appropriate piling installation methods.

WFD

8.9.24 The mitigation measures listed under the surface water and groundwater sections above will also apply to WFD quality elements.

Table 8.17: Proposed drainage catchments

Catchment area reference	Outfall/soakaway reference	Receptor	Proposed mitigation	Impermeable area (ha)	Permeable area (ha)
1	PO-J10-003	Stratford Brook	Attenuation pond	1.75	0.18
2	PO-J10-014	Stratford Brook	Attenuation ditch	1.60	1.15
3	PO-J10-001	Adjacent A3 ditch (A)	Attenuation pond	0.61	0.56
4	S-J10-001	Groundwater	Soakaway	0.21	0.20
5	PO-J10-002	Bolder Mere downstream ditch	Attenuation pond	2.25	0.75
6	PO-J10-007	Elm Lane ditch	None	0.35	0.00
7	S-J10-021	Groundwater	Attenuation pond and soakaway	1.26	0.21
8	S-J10-002	Groundwater	Soakaway	0.24	0.00
9	EO-J10-012	Assume Groundwater as no surface water feature shown on OS map	Attenuation pond	1.57	0.71
10	S-J10-008	Groundwater	Infiltration trench	0.34	0.54
11	S-J10-020	Groundwater	Attenuation pond and infiltration trench	3.14	0.90
12	S-J10-006	Excluded from assessment as catchment does not receive runoff from the road			
13	PO-J10-011	Adjacent A3 ditch (B)	Attenuation pond & attenuation ditch	1.75	0.05
14	S-J10-004	Groundwater	Soakaway	0.15	0.19
15	S-J10-007	Excluded from assessment as catchment does not receive runoff from the road			
16	S-J10-009	Groundwater	Attenuation pond and infiltration trench	3.03	1.14
17	S-J10-003	Excluded from assessment as catchment does not receive runoff from the road			
18	S-J10-015	Groundwater	Attenuation pond and soakaway	4.26	0.73
19	PO-J10-005	A245 Byfleet Road ditch	Attenuation pond	~~2.09~~1.81	~~0.00~~3.02
20	S-J10-014	Groundwater	Attenuation pond and infiltration trench	4.56	0.77

Catchment area reference	Outfall/soakaway reference	Receptor	Proposed mitigation	Impermeable area (ha)	Permeable area (ha)
21	S-J10-016	Groundwater	Attenuation pond and infiltration trench	1.74	1.07
22	PO-J10-009	Stratford Brook	Attenuation ditch	0.14	0.10
23	PO-J10-010	Stratford Brook	Attenuation ditch	0.13	0.11
24	PO-J10-008	Excluded from assessment as catchment does not receive runoff from the road			
25	PO-J10-004	Excluded from assessment as catchment does not receive runoff from the road			
26	PO-J10-015	Excluded from assessment as catchment discharges to existing drainage system with no changes to existing carriageway area and no new carriageway proposed			
27	PO-J10-019	Assume groundwater as the drain located close to outfall has been reported as dry	Attenuation pond and soakaway	1.46	0.63
28	PO-J10-012	Excluded from assessment as catchment does not receive runoff from the road			
29	PO-J10-013	Excluded from assessment as catchment does not receive runoff from the road			
30	S-J10-022	Excluded from assessment as catchment does not receive runoff from the road			
31	S-J10-023	Excluded from assessment as catchment does not receive runoff from the road			
32	PO-J10-017	Excluded from assessment as catchment discharges to existing drainage system with no changes to existing carriageway area and no new carriageway proposed			
33	PO-J10-018	Excluded from assessment as catchment discharges to existing drainage system with no changes to existing carriageway area and no new carriageway proposed			
34	PO-J10-016	Excluded from assessment as catchment discharges to existing drainage system with no changes to existing carriageway area and no new carriageway proposed			
35	PO-J10-006	Bolder Mere downstream ditch	None	0.56	0.00
36	EO-J10-009	Bolder Mere downstream ditch	None	0.96	0.11
37	S-J10-010	Groundwater	Soakaway	0.58	0.54

8.10 Assessment of effects

Significant effects

8.10.1 This section describes the significant effects following the implementation of avoidance and mitigation measures. An effect is classed as significant if it is moderate, large or very large.

Construction

Surface water

8.10.2 Likely impacts from road construction activities are typically temporary and can be mitigated through good engineering practices.

8.10.3 For surface water receptors, subject to the implementation of all mitigation measures, the overall effect on surface water has been assessed as neutral which is not considered significant.

8.10.4 As no significant effects on surface water features have been identified, no significant effects on licensed abstractions or consented discharges are predicted.

Groundwater

8.10.5 As for surface water, likely impacts from road construction activities are typically temporary and can be mitigated through good engineering practices.

8.10.6 For groundwater receptors, subject to the implementation of all mitigation measures the overall effect on groundwater has been assessed as neutral which is not considered significant. The design and implementation of Scheme components to which groundwater is particularly sensitive are further protected by requirements of the Development Control Order for the Scheme.

Flood risk

8.10.7 For flood receptors, subject to the implementation of all mitigation measures, the overall effect on flood risk has been assessed as neutral which is not considered significant.

WFD

8.10.8 None of the construction components of the Scheme are considered to cause deterioration at water body scale or should not prevent future attainment of good ecological status or good ecological potential, assuming mitigation already 'embedded' in the preliminary design is implemented, any additional specific mitigation is implemented and generic guidance on the principles of WFD compliant design is adhered to. The design and implementation of Scheme components to which WFD compliance is particularly sensitive are further protected by requirements of the Development Control Order for the Scheme.

8.10.9 The Scheme will not only be compliant with the WFD but will also implement enhancements within affected water bodies that will make a positive contribution towards the future attainment of good ecological status and good ecological potential.

8.10.10 The WFD Compliance Assessment can be seen in full in application document TR010030/APP/5.4.

Operation

Surface water

8.10.11 The preliminary drainage design for the Scheme can be seen on the Proposed Scheme Layout Plans. The Scheme has been split into thirty-seven catchments. Table 8.17 provides a summary of the proposed drainage catchments. Eleven of the catchments discharge to surface water features.

8.10.12 DMRB Method A surface water quality tests were undertaken using the drainage design for the Scheme. If mitigation is proposed the Method A surface water quality tests included this. The tests used forecasted 2037 traffic densities. The operational impacts and overall effects for the proposed Scheme are presented in Table 8.20.

8.10.13 Catchments 1, 2, 22 and 23 discharge to Stratford Brook. All the catchments which discharge to Stratford Brook pass the Method A test (when assessed individually) and would have a negligible impact with neutral significance of effect.

8.10.14 Catchments 3, 5, 6, 13, 35 and 36 discharge to minor drains within the River Wey catchment. However, because the drains are ephemeral (i.e. there is typically no flow in summer months), the catchments have been individually assessed as discharging to the ground. The results for these catchments are documented under the groundwater section below. A Method A aggregated assessment for all these catchments, apart from catchment 6, has also been undertaken where the drainage joins a non-ephemeral watercourse. The results of this assessment is documented under the aggregated assessment section below. The drain which catchment 6 discharges into appears to soak into the ground and not join a non-ephemeral watercourse so the catchment has only been assessed as discharging to the ground.

8.10.15 When the road runoff from catchment 19 outfalls from the attenuation pond it discharges into the A245 Byfleet Road ditch which feeds into a pond which is then connected to Manor Pond. Manor Pond is connected to a tributary of the River Mole. Catchment 19 passes the Method A test and would have a negligible impact with neutral significance of effect on the drain it discharges into.

8.10.16 As previously stated catchment 19 discharges into the A245 Byfleet ditch which then enters a series of ponds. This type of discharge pathway is not permitted under HD 45/09. HD 45/09 includes a mandatory requirement that discharges must not be made into lakes, ponds or canals, However, the general approach outlined in the drainage strategy is to use the existing outfalls where identifiable from HADDMS as-built plans and close to the proposed low points on the highways (according to the highway design). It is thought this discharge point is part of the existing drainage network and close to a low point on the highway, but this will not be confirmed until the drainage survey is completed. Once a drainage survey has been completed if no viable alternative discharge point can be established for this catchment then a departure from the DMRB will be required.

8.10.17 In terms of spillage risk, all catchments which discharge to surface water pass. The results of the spillage assessment are presented in Table 8.21.

Groundwater

8.10.18 DMRB Method C tests were undertaken for each of the 13 catchments which discharge to groundwater. Method C tests were also undertaken for the six catchments which discharge to ephemeral ditches within the River Wey catchment. The tests show there would be a medium risk to groundwater for each catchment. The result of the assessment is presented in Table 8.18.

8.10.19 As a medium risk has been identified mitigation measures have been identified to protect groundwater quality. Once site-specific ground investigation data are available the DMRB Method C tests will be reviewed to confirm the proposed mitigation measures are appropriate.

8.10.20 Based on the results of the Method C tests, subject to the implementation of all mitigation measures, the impact on groundwater quality has been assessed as negligible with a neutral significance of effects.

Table 8.18: Method C effects on routine runoff to groundwater

Catchment area reference	Outfall reference	Risk score	Risk of impact
3	PO-J10-001	185	Medium
4	S-J10-001	228	Medium
5	PO-J10-002	200	Medium
6	PO-J10-007	185	Medium
7	S-J10-021	235	Medium
8	S-J10-002	220	Medium
9	EO-J10-012	250	Medium
10	S-J10-008	250	Medium
11	S-J10-020	250	Medium
13	PO-J10-011	200	Medium
14	S-J10-004	235	Medium
16	S-J10-009	220	Medium
18	S-J10-015	250	Medium
20	S-J10-014	250	Medium
21	S-J10-016	250	Medium
27	PO-J10-019	243	Medium
35	PO-J10-006	200	Medium
36	EO-J10-009	200	Medium
37	S-J10-010	215	Medium

8.10.21 In terms of spillage risk, all catchments pass the spillage risk threshold. The impact is assessed as negligible with neutral significance of effect. The results of the spillage assessment are presented in Table 8.21.

Abstractions and discharges

8.10.22 As there is no impact on surface water quality and groundwater quality and quantity there will therefore be no anticipated significant effect on licensed surface water abstractions and consented discharges to surface water or groundwater during the operation of the Scheme.

Table 8.19: Method A effects of routine runoff on surface waters and groundwater

Catchment area reference	Outfall reference	Receiving water feature	Without mitigation							With proposed mitigation							
			Pass or fail Runoff Specific Threshold (RST) copper	Pass or fail RST for zinc	Pass or fail Environmental Quality Standard (EQS) for copper	EQS for zinc	Sediment bound pollutants	Magnitude of impact for water quality	Significance for water quality	Proposed mitigation	Pass or fail RST for copper	Pass or fail RST for zinc	Pass or fail EQS for copper	Pass or fail EQS for zinc	Sediment bound pollutants	Magnitude of impact for water quality	Significance for water quality
1	PO-J10-003	Stratford Brook	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral Insignificant	Attenuation pond	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral Insignificant
2	PO-J10-014	Stratford Brook	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral Insignificant	Attenuation ditch	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral Insignificant
19	PO-J10-005	A245 Byfleet Road ditch	Fail	Pass	Pass	Pass	Pass	Minor adverse	Slight significance	Attenuation pond	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral Insignificant
22	PO-J10-009	Stratford Brook	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral Insignificant	Attenuation ditch	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral Insignificant
23	PO-J10-010	Stratford Brook	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral Insignificant	Attenuation ditch	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral Insignificant

Table 8.20: Method A effects of routine runoff on surface waters – aggregated assessment

Catchment area included in assessment	Assessment point	Receiving water feature	Without mitigation							With proposed mitigation*							
			Pass or fail Runoff Specific Threshold (RST) copper	Pass or fail RST for zinc	Pass or fail Environmental Quality Standard (EQS) for copper	EQS for zinc	Sediment bound pollutants	Magnitude of impact for water quality	Significance for water quality	Proposed mitigation	Pass or fail RST for copper	Pass or fail RST for zinc	Pass or fail EQS for copper	Pass or fail EQS for zinc	Sediment bound pollutants	Magnitude of impact for water quality	Significance for water quality
1, 2, 22, 23	PO-J10-003	Stratford Brook	Pass	Pass	Pass	Pass	N/A	Negligible	Neutral Insignificant	Attenuation pond and attenuation ditch							
2, 22, 23	PO-J10-014	Stratford Brook	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral Insignificant	Attenuation ditch							
22, 23	PO-J10-009	Stratford Brook	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral Insignificant	Attenuation ditch							
3, 5, 13, 35, 36	River Wey (approximately 200 m north west of Buxton Bridge)	River Wey	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral Insignificant	Attenuation pond and attenuation ditch							

*Only completed if assessment fails without mitigation

Table 8.21: Method D pollution impacts from accidental spillages

Catchment area reference	Outfall reference	Receiving water feature	Return period with existing pollution reduction measures	Return period (in decimals as per spillage test)	Proposed measures*	Residual risk with proposed pollution reduction measures	Return period (in decimals as per spillage test)	Magnitude of impact for spillage	Significance for spillage
1	PO-J10-003	Stratford Brook	1,992	0.0005	Attenuation pond	3,985	0.0003	Negligible	Neutral Insignificant
2	PO-J10-014	Stratford Brook	1,431	0.0007	Attenuation ditch	2,385	0.0004	Negligible	Neutral Insignificant
3	PO-J10-001	Adjacent A3 ditch	833,400	0.0000	Attenuation pond	1,666,880	0.0000	Negligible	Neutral Insignificant
4	S-J10-001	Groundwater	1,293,269	0.0000	Oil interceptor and soakaway	1,255,448	0.0000	Negligible	Neutral Insignificant
5	PO-J10-002	Bolder Mere downstream ditch	7,229	0.0001	Attenuation pond	14,458	0.0001	Negligible	Neutral Insignificant
6	PO-J10-007	Elm Lane ditch	19,791	0.0001	None	19,791	0.0001	Negligible	Neutral Insignificant
7	S-J10-021	Groundwater	6,508	0.0002	Attenuation pond and soakaway	10,847	0.0001	Negligible	Neutral Insignificant
8	S-J10-002	Groundwater	32,733	0.0000	Soakaway	54,554	0.0000	Negligible	Neutral Insignificant
9	EO-J10-012	Groundwater	3,076	0.0003	Attenuation pond	6,152	0.0002	Negligible	Neutral Insignificant
10	S-J10-008	Groundwater	2,797	0.0004	Infiltration trench	4,662	0.0002	Negligible	Neutral Insignificant
11	S-J10-020	Groundwater	345	0.0029	Attenuation pond and infiltration trench	576	0.0017	Negligible	Neutral Insignificant
13	PO-J10-011	Adjacent to A3 ditch (B)	7,052	0.0001	Attenuation pond and attenuation ditch	11,754	0.0001	Negligible	Neutral Insignificant
14	S-J10-004	Groundwater	74,856	0.0000	Soakaway	124,760	0.0000	Negligible	Neutral Insignificant
16	S-J10-009	Groundwater	1,533	0.0070	Attenuation pond and infiltration trench	2,555	0.0004	Negligible	Neutral Insignificant
18	S-J10-015	Groundwater	4,472	0.0002	Attenuation pond and soakaway	7,453	0.0001	Negligible	Neutral Insignificant
19	PO-J10-005	A245 Byfleet Road ditch	~~3,169~~ 4,362	0.0002~~3~~	Attenuation pond	~~6,337~~ 8,724	~~0.0002~~ 0.0001	Negligible	Neutral Insignificant
20	S-J10-014	Groundwater	1,981	0.0005	Attenuation pond and infiltration trench	3,302	0.0003	Negligible	Neutral Insignificant
21	S-J10-016	Groundwater	4,569	0.0002	Attenuation pond and infiltration trench	7,615	0.0001	Negligible	Neutral Insignificant
22	PO-J10-009	Stratford Brook	48,962	0.0000	Attenuation ditch	81,604	0.0000	Negligible	Neutral Insignificant
23	PO-J10-010	Stratford Brook	194,901	0.0000	Attenuation ditch	324,835	0.0000	Negligible	Neutral Insignificant

Catchment area reference	Outfall reference	Receiving water feature	Return period with existing pollution reduction measures	Return period (in decimals as per spillage test)	Proposed measures*	Residual risk with proposed pollution reduction measures	Return period (in decimals as per spillage test)	Magnitude of impact for spillage	Significance for spillage
27	PO-J10-019	Groundwater	3,233	0.0003	Attenuation pond and soakaway	5,389	0.0002	Negligible	Neutral Insignificant
35	PO-J10-006	Bolder Mere downstream ditch	36,530	0.0000	None	36,530	0.0000	Negligible	Neutral Insignificant
36	EO-J10-009	Bolder Mere downstream ditch	7,452	0.0001	None	7,452	0.0001	Negligible	Neutral Insignificant
37	S-J10-010	Groundwater	1,103,082	0.0000	Soakaway	1,838,471	0.0000	Negligible	Neutral Insignificant

– *If there is more than one proposed measure the measure with the least pollution reduction factor has been used e.g. if a pond and soakaway/infiltration basin are proposed then the reduction factor for a soakaway/infiltration basin has been used.

Flood risk

8.10.23 The operation of the Scheme is not considered to adversely affect flood risk. The design of the Scheme avoids impacts to floodplains and mitigates any potential impacts on surface water due to changes in the drainage runoff. There are no impacts on other sources of flood risk. The flood risk assessment is contained in application document TR010030/APP/5.5.

WFD

8.10.24 The operation of the Scheme is not considered to cause deterioration at water body scale and should not prevent future attainment of good ecological status or good ecological potential, assuming mitigation already 'embedded' in the preliminary design is implemented, any additional specific mitigation is implemented and generic guidance on the principles of WFD compliant design is adhered to.

8.10.25 The design and implementation of Scheme components to which WFD compliance is particularly sensitive are further protected by requirements of the Development Control Order for the Scheme.

8.10.26 The Scheme will not only be compliant with the WFD but will also implement enhancements within affected water bodies that will make a positive contribution towards the future attainment of good ecological status and good ecological potential. This includes redirecting the existing road runoff which discharges directly into Bolder Mere to a nearby watercourse. The reduced pollutant load into the lake is expected to improve water quality which in turn improves biological quality elements and hydro-morphological quality elements.

8.10.27 The WFD Compliance Assessment can be seen in full in application document TR010030/APP/5.4.

Residual effects

Construction

Surface water

8.10.28 For surface water receptors, subject to the correct implementation of all mitigation measures, the overall residual effect on surface water has been assessed as neutral which is not considered significant.

8.10.29 As no significant effects on surface water features have been identified, no significant residual effects on licensed abstractions or consented discharges are predicted.

Groundwater

8.10.30 As for surface water, likely impacts from road construction activities are typically temporary and can be mitigated through good engineering practices.

8.10.31 For groundwater receptors, subject to the correct implementation of all mitigation measures, the overall residual effect on groundwater has been assessed as neutral which is not considered significant.

Flood risk

8.10.32 No residual impacts to flood risk are anticipated.

WFD

8.10.33 Subject to the mitigation measure being implemented and guidance on the principles of WFD compliant design being adhered to, the Scheme will be compliant with the WFD and there will be no overall residual effect.

Operation

Surface water

8.10.34 For surface water receptors, subject to the implementation of all mitigation measures, the overall residual effect on surface water has been assessed as neutral which is not considered significant as shown in Table 8.20.

Groundwater

The assessment shows all catchments discharging to ground present a medium risk to groundwater quality. In consultation with the Environment Agency, the risks to groundwater quality are not likely to be significant. With the proposed mitigation measures the impact on groundwater quality has been assessed as negligible with a neutral significance of effects. However, once site specific groundwater data is available the DMRB Method C assessment will be reviewed to confirm the proposed mitigation measures are appropriate.

Potential groundwater quantity effects have been assessed as negligible assuming mitigation measures are implemented. In consultation with the Environment Agency, it has been agreed that following completion of the GI, a hydrogeological risk assessment will be undertaken followed by a review of the design and appropriate mitigation measures.

Flood risk

8.10.35 No residual impacts to flood risk are anticipated.

WFD

8.10.36 Subject to the mitigation measure being implemented and guidance on the principles of WFD compliant design being adhered to, the Scheme will be compliant with the WFD and there will be no overall residual effect.

8.11 Cumulative effects

8.11.1 Cumulative effects can arise from within one scheme, for example the combined impacts of multiple drainage outfalls on a single receiving watercourse. These sorts of impacts have been assessed as part of the method for the ES and the results are summarised below and presented in Table 8.22.

8.11.2 An aggregated assessment for the catchments discharging to Stratford Book was undertaken. Another aggregated assessment for the catchments discharging to minor drains within the River Wey catchment was also undertaken. The discharge points within 100 m of each other were aggregated for the assessment of potential impacts associated with sediment-bound

pollutants and the catchment discharge points within 1 km of each other were aggregated for the assessment of potential impacts associated with soluble pollutants.

8.11.3 All the catchments which were aggregated for Stratford Brook pass the Method A surface water quality tests and would have a negligible impact with neutral significance of effect.

8.11.4 The River Wey was used as the assessment point for the aggregated assessment which included the catchments discharging into the ephemeral drains. The River Wey was used as the assessment point because it is where the ephemeral drains join a non-ephemeral watercourse.

8.11.5 All the catchments which were aggregated for the ephemeral drain assessment pass the Method A surface water quality tests and would have a negligible impact with neutral significance of effect on the River Wey.

8.11.6 Additionally, cumulative impacts can arise where more than one scheme is under construction that have potential to impact on the same receptor. Typically, new developments increase impermeable area and run-off. They can potentially cause drainage pathways to be altered and can provide an increased source of pollution to shared water receptors.

8.11.7 Only developments within the study area have been assessed. For developments, identified in Table 8.22 and shown on Figure 17.2, drainage strategies should be in place or proposed for these developments. These separate drainage systems should accommodate their own temporary drainage requirements during the construction phases and appropriate mitigation that should ensure minimal impacts to water through construction and operational phases.

8.11.8 With this in mind, it is assessed that there should be no significant adverse cumulative effects during construction or once operational.

Table 8.22: Cumulative effects

Other Scheme	Cumulative impact on assets affected by Scheme	Additional significant construction effects	Additional significant operation effects
M25 Junction 10 - 16 Smart Motorway Programme (SMP)	Construction is assumed to take place at the same time as the Scheme construction so there could be potential cumulative effects to the water environment, particularly to the River Wey and River Mole, which are adjacent to the development and groundwater aquifers which are located beneath the development. These receptors have also been identified as receptors for the Scheme. Potential impacts during construction and operation to the surface water and groundwater environment are documented in section 8.8. During construction adherence to best practice guidance and the adoption of good working practices and strict	None	None

Other Scheme	Cumulative impact on assets affected by Scheme	Additional significant construction effects	Additional significant operation effects
	adherence to the Environment Agency Pollution Prevention Guidance (PPGs) during construction means there should be no significant adverse cumulative effects during construction. With the adoption of mitigation measures there should be no significant adverse cumulative effects during operation.		
The former Wisley Airfield	Planning permission has not yet been granted for this application but if construction were to take place at the same time as construction of the Scheme, there could be potential cumulative effects to the water environment, particularly to Stratford Brook which is adjacent to the development. The development is also within the River Wey catchment and beneath the development are groundwater aquifers. These receptors have also been identified as receptors for the Scheme. Potential impacts during construction to the surface water and groundwater environment are documented in section 8.8. A new access road off the Ockham junction roundabout is planned for the Wisley Airfield development. The access road crossing the Stratford Brook is included within the Scheme along the same route and there will not be additional crossing over the Brook. During construction adherence to best practice guidance and the adoption of good working practices and strict adherence to the Environment Agency Pollution Prevention Guidance (PPGs) during construction means there should be no significant adverse cumulative effects during construction. Residential developments will typically have a low pollution risk once constructed and will be required to follow well established best practice guidance to mitigate pollutant loading and flood risk. It is considered likely that the development would have appropriate mitigation in place in order to obtain planning permission and therefore there should be no significant adverse cumulative effects during operation.	None	None

Other Scheme	Cumulative impact on assets affected by Scheme	Additional significant construction effects	Additional significant operation effects
Land to the East of South Cottage, White Horse Lane, Ripley, GU23 6BB	It is assumed that construction will be completed before the Scheme construction begins so no construction cumulative effects are anticipated. The development is within the Stratford Brook catchment and beneath the development are groundwater aquifers. These receptors have also been identified as receptors for the Scheme. However, residential/retail developments will typically have a low pollution risk once constructed and will be required to follow well established best practice guidance to mitigate pollutant loading and flood risk. It is considered likely that the development would have appropriate mitigation in place in order to obtain planning permission and therefore there should be no significant adverse cumulative effects during operation.	None	None
Royal Horticultural Society Gardens, Wisley Lane, Wisley, Woking, GU23 6QS	It is assumed construction will overlap with the construction of the Scheme and there could be potential cumulative effects to the water environment, particularly to the River Wey, which is located adjacent to the development and groundwater aquifers located beneath the development. These receptors have also been identified as receptors for the Scheme. Potential impacts during construction and operation to the surface water and groundwater environment are documented in section 8.8. During construction adherence to best practice guidance and the adoption of good working practices and strict adherence to the Environment Agency Pollution Prevention Guidance (PPGs) during construction means there should be no significant adverse cumulative effects during construction. The nature of this development would suggest a low pollution potential once constructed. The development would be required to follow well established best practice guidance to mitigate pollutant loading and flood risk. It is considered likely that the development would have appropriate mitigation in place in order to obtains planning permission and therefore there should be no significant	None	None

Other Scheme	Cumulative impact on assets affected by Scheme	Additional significant construction effects	Additional significant operation effects
	adverse cumulative effects during operation.		
Royal Horticultural Society Gardens, Wisley Lane, Wisley, Woking, GU23 6QS	It is assumed construction will overlap with the construction of the Scheme and there could be potential cumulative effects to the water environment, particularly to the River Wey, which is located adjacent to the development and groundwater aquifers located beneath the development. These receptors have also been identified as receptors for the Scheme. Potential impacts during construction and operation to the surface water and groundwater environment are documented in section 8.8. During construction adherence to best practice guidance and the adoption of good working practices and strict adherence to the Environment Agency Pollution Prevention Guidance (PPGs) during construction means there should be no significant adverse cumulative effects during construction. The nature of this development would suggest a low pollution potential once constructed. The development would be required to follow well established best practice guidance to mitigate pollutant loading and flood risk. It is considered likely that the development would have appropriate mitigation in place in order to obtains planning permission and therefore there should be no significant adverse cumulative effects during operation.	None	None
Nutberry Farm, Portsmouth Road, Ripley, Woking, GU23 9XX	It is assumed construction will overlap with the construction of the Scheme and there could be potential cumulative effects to the water environment, including Stratford Brook and a groundwater aquifer located beneath the development. These receptors have also been identified as receptors for the Scheme. Potential impacts during construction and operation to the surface water and groundwater environment are documented in section 8.8. During construction adherence to best practice guidance and the adoption of good working practices and strict adherence to the Environment Agency Pollution Prevention Guidance (PPGs)		

Other Scheme	Cumulative impact on assets affected by Scheme	Additional significant construction effects	Additional significant operation effects
	during construction means there should be no significant adverse cumulative effects during construction. The nature of this development would suggest a low pollution potential once constructed. The development would be required to follow well established best practice guidance to mitigate pollutant loading and flood risk. It is considered likely that the development would have appropriate mitigation in place in order to obtains planning permission and therefore there should be no significant adverse cumulative effects during operation.		
Former San Domenico Restaurant (App, No/Ref: 2017/0524)	Planning permission has not yet been granted for this application but if construction were to take place at the same time as construction of the Scheme there could be potential cumulative effects to the water environment. The development is in the River Mole catchment and beneath the development is a groundwater aquifer. These receptors have also been identified as receptors for the Scheme. Potential impacts during construction and operation to the surface water and groundwater environment are documented in section 8.8. During construction adherence to best practice guidance and the adoption of good working practices and strict adherence to the Environment Agency Pollution Prevention Guidance (PPGs) during construction means there should be no significant adverse cumulative effects during construction. The nature of this development would suggest a low pollution potential once constructed and will be required to follow well established best practice guidance to mitigate pollutant loading and flood risk. It is considered likely that the development would have appropriate mitigation in place in order to obtain planning permission and therefore will be unlikely to significantly impact on the water environment. No operational cumulative effects are anticipated.	None	None
Former San Domenico Restaurant	Planning permission has not yet been granted for this application but if construction were to take place at the	None	None

Other Scheme	Cumulative impact on assets affected by Scheme	Additional significant construction effects	Additional significant operation effects
(App, No/Ref: 2014/4612)	same time as construction of the Scheme there could be potential cumulative effects to the water environment. The development is in the River Mole catchment and beneath the development is a groundwater aquifer. These receptors have also been identified as receptors for the Scheme. Potential impacts during construction and operation to the surface water and groundwater environment are documented in section 8.8. During construction adherence to best practice guidance and the adoption of good working practices and strict adherence to the Environment Agency Pollution Prevention Guidance (PPGs) during construction means there should be no significant adverse cumulative effects during construction. The nature of this development would suggest a low pollution potential once constructed and will be required to follow well established best practice guidance to mitigate pollutant loading and flood risk. It is considered likely that the development would have appropriate mitigation in place in order to obtain planning permission and therefore will be unlikely to significantly impact on the water environment. No operational cumulative effects are anticipated.		
Site of 46 Portsmouth Road, Cobham, Surrey, KT11 1HY	It is assumed construction of this development will be completed before the Scheme construction begins. Therefore, no construction cumulative effects are anticipated. The development is located in an already developed area of Cobham. It is in the River Mole catchment and beneath the development are groundwater aquifers. These receptors have also been identified as receptors for the Scheme. The nature of the development would suggest a low pollution potential once constructed and will be required to follow well established best practice guidance to mitigate pollutant loading and flood risk. It is considered likely that the development would have appropriate mitigation in place in order to obtain planning permission and	None	None

Other Scheme	Cumulative impact on assets affected by Scheme	Additional significant construction effects	Additional significant operation effects
	therefore there should be no significant adverse cumulative effects during operation.		
Felton Fleet School Byfleet Road Cobham Surrey KT11 1DR	Planning permission has not yet been granted for this application but if construction were to take place at the same time as construction of the Scheme there could be potential cumulative effects to the water environment. The development is located in the River Mole catchment and beneath the development are groundwater aquifers. These receptors have also been identified as receptors for the Scheme. Potential impacts during construction and operation to the surface water and groundwater environment are documented in section 8.8. During construction adherence to best practice guidance and the adoption of good working practices and strict adherence to the Environment Agency Pollution Prevention Guidance (PPGs) during construction means there should be no significant adverse cumulative effects during construction. The nature of the development would suggest a low pollution potential once constructed and will be required to follow well established best practice guidance to mitigate pollutant loading and flood risk. It is considered likely that the development would have appropriate mitigation in place in order to obtain planning permission and therefore there should be no significant adverse cumulative effects during operation.	None	None

8.12 NPSNN compliance

8.12.1 Paragraph 5.221 of the NPSNN sets out that where a development is likely to have significant adverse effects on the water environment, assessment of the impacts is required. In line with the NPSNN requirements this chapter of the ES ascertains the existing status of and carries out an assessment of the impacts of the proposed project on, water quality, water resources and physical characteristics.

8.12.2 The NPSNN also states that development proposals should have regard to the relevant RBMP and the requirements of the WFD (including Article 4.7) and its daughter directives, including those on priority substances and groundwater. A

WFD Compliance Assessment has been prepared and appropriate design and mitigation measures have been incorporated into the Scheme to facilitate WFD compliance.

8.12.3 The principles of how developments are to be assessed by the Examining Authority and the Secretary of State with respect to pollution control and other environmental protection regimes are detailed in paragraphs 4.48 to 4.56 of the NPSNN. Key requirements are that any discharges or emissions from a proposed scheme may be subject to separate regulation under the pollution control framework or other consenting and licensing regimes and relevant permissions will need to be obtained for such activities with permit applications submitted at least six months prior to submission of a DCO.

8.12.4 With regard to flood risk and surface water drainage, the NPSNN supports the NPPF (DCLG, 2018). In line with the Flood Risk section (paragraphs 5.90 to 5.115) of the NPSNN, the Scheme would be subject to a FRA that considers all sources of flood risk. The FRA would be informed by consultation with the EA and relevant LLFA. The FRA would also be informed by the results of any hydrological and hydraulic modelling undertaken to define baseline flood risk, quantify any Project impacts on this baseline, and to inform the design of any necessary flood risk management measures. A FRA has been completed for the Scheme. The Scheme design has incorporated a drainage strategy that centres on the application of SuDS, appropriate to local conditions, to manage surface water runoff.

8.12.5 NPSNN encourages pre-application discussions with all relevant regulators to begin as early as possible. Discussions with stakeholders, including the EA has taken place regarding the WFD Compliance Assessment and FRA.

8.13 Monitoring

8.13.1 To ensure mitigation measures are properly implemented it is essential there is effective environmental management throughout the construction, operation and aftercare of the Scheme.

8.13.2 The CEMP will form the basis for environmental management of the Scheme. It will ensure that environmental issues are properly addressed initially through the construction phase and establishes the basis for ensuring environmental issues and commitments are dealt with during the operation and aftercare of the Scheme.

8.14 Summary

8.14.1 The spatial scope of the assessment has included features of the water environment within 1 km of the Scheme.

8.14.2 The assessment has considered the impacts (both construction and operation) on water quality (both surface and groundwater), flood risk through the means of an FRA (application document TR010030/APP/5.5) and the compliance with the WFD (application document TR010030/APP/5.4).

8.14.3 Key water environment receptors/characters within the study area include:

- Stratford Brook (a WFD water body GB106039017890);
- Flood zones 2 and 3 associated with Stratford Brook;

- Bolder Mere lake (a WFD water body GB30643218);
- Tributary drains of the River Wey catchment (part of the WFD water body GB106039017630);
- Tributary drains of the River Mole catchment (part of the WFD water body GB106039017621);
- Secondary A Aquifers (part of the WFD water body GB40602G601400); and
- A Principal Aquifer.

8.14.4 The assessment shows that, subject to the correct implementation of all mitigation measures, there will be no significant temporary adverse effects on surface water quality, groundwater quality, WFD compliance, groundwater or fluvial and surface water flood risk during the construction period.

8.14.5 The surface water risk assessment concluded the following:

- Negligible impact with neutral significance of effect to Stratford Brook from the discharge from the Scheme;
- Negligible impact with neutral significance of effect to the River Wey;
- Negligible impact with neutral significance of effect to the drain adjacent to the A245 Byfleet Road which feeds into a pond which is then connected to Manor Pond; and
- Spillage risk for all surface water catchments is assessed as negligible with neutral significance.

8.14.6 The groundwater quality risk assessment concluded a negligible impact with neutral significance of effect to water quality of the aquifers underlying the Scheme. Once site-specific groundwater data are available the assessment will be reviewed which may identify a requirement for additional or alternative mitigation measures.

8.14.7 An assessment of the potential impact of the Scheme on groundwater quantity and resources concluded that, subject to implementation of mitigation measures, the overall effect to groundwater quantity is neutral which is not considered significant.

8.14.8 Spillage risk for all groundwater catchments is assessed as negligible with neutral significance.

8.14.9 The FRA concludes that, based on current flood risk understanding and the incorporation of flood risk mitigation, the proposed Scheme would be at an acceptable level of flood risk and would not increase flood risk elsewhere. This conclusion remains true, both now and over the lifetime of the Scheme taking climate change into consideration.

8.14.10 The WFD compliance assessment concluded the Scheme can be made compliant with the requirements of the WFD. None of the components that make up the Scheme are considered to cause deterioration at the water body scale and all should not prevent future attainment of good ecological status and good ecological potential.

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