CHAPTER 11

WATER RESOURCES, FLOOD RISK AND DRAINAGE

U and I (8AE) Limited and the London Fire Commissioner (LFC)

8 ALBERT EMBANKMENT

Volume I: Chapter 11 - Water Resources, Flood Risk and Drainage

MARCH 2019

PUBLIC

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TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70016347

DATE: MARCH 2019

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CONTENTS

11. WATER RESOURCES, FLOOD RISK AND DRAINAGE

11.1. INTRODUCTION

11.1.1. This Chapter reports the likely significant effects of the Proposed Development on the Site and surrounding area in terms of water resources, drainage, and flood risk. Where appropriate it also identifies proposed mitigation measures to prevent, minimise or control likely negative water resources, drainage, and flood risk effects arising from the Proposed Development and the subsequent anticipated residual effects.

11.1.2. This Chapter (and its associated figures and appendices) should be read together with the Introductory Chapters of this ES (**Chapters 1 – 5**), as well as **Chapter 15 Cumulative Effects**. **Chapter 12 Ground Conditions, Hydrogeology and Contamination** discusses the status and potential impacts to contamination and groundwater resources. A Flood Risk Assessment (FRA) and Outline Drainage Strategy have been produced by WSP to support the planning application and can be found in **Appendix 11.1**. Information from both the FRA and Drainage Strategy have informed this chapter.

11.2. LEGISLATION, POLICY AND GUIDANCE

LEGISLATIVE FRAMEWORK

11.2.1. The applicable legislative framework is summarised as follows:

- The Water Framework Directive (WFD) (2000/60/EC) (**Ref. 11.1**);
- The Water Environment (WFD) (England and Wales) Regulations, 2003 (**Ref. 11.2**);
- The Flood Risk Regulations, 2009 (**Ref. 11.3**);
- The Water Resources Act 1991 (**Ref. 11.4**);
- The Environment Act 1995 (**Ref. 11.5**);
- The Water Act 2003 (**Ref. 11.6**);
- The Water Act 2014 (**Ref. 11.7**);
- The Anti-Pollution Works Regulations 1999 (**Ref. 11.8**);
- The Water Industry Act 1991 (**Ref. 11.9**);
- Land Drainage Act 1991and 1994 (**Ref. 11.10**);
- Flood and Water Management Act 2010 (**Ref. 11.11**);
- The Environmental Damage (Prevention and Remediation) (England) Regulations 2015 (**Ref. 11.12**);
- The Environmental Permitting (England and Wales) Regulations 2010 (**Ref. 11.13**); and
- Environmental Permitting (England and Wales) (Amendment) (No. 2) Regulations 2016 (**Ref. 11.14**).

PLANNING POLICY

11.2.2. Planning policy at the national and local level and its relevance to environmental design and assessment is confirmed in **Chapter 1 Introduction** of the ES and the Planning Statement which accompanies the application and examines the merits of the Proposed Development against the relevant planning policy.

NATIONAL PLANNING POLICY FRAMEWORK

11.2.3. The National Planning Policy Framework (NPPF) (**Ref. 11.15**) was published on 27 March 2012, and was most recently updated on 19 February 2019. It is a key part of the reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth. There is an overarching presumption in favour of sustainable development that should be the basis of every plan and every decision.

11.2.4. The NPPF consolidates all the previous Planning Policy Statements (PPSs) and Planning.

11.2.5. Policy Guidance Notes (PPGs) into one document. The following paragraphs/policies, among others, are considered relevant to this assessment:

- *Paragraph 100: Requires that inappropriate development in areas at risk of flooding is avoided by directing development away from areas considered high risk, but where development is necessary.*
- *Paragraph 101: Explains that the aim of the Sequential Test aims to steer development in areas with the lowest probability of flooding; and*
- *Paragraph 103: Recommends that development […] gives priority to the use of sustainable drainage systems.*

Planning Practice Guidance (2015)

11.2.6. The NPPF should be read alongside other national planning polices and the planning practice guidance (PPG), the following are considered relevant to this assessment:

- Sustainable drainage systems: non-statutory technical standards (**Ref. 11.16)**;
- PPG for Flood Risk and Coastal Change (**Ref. 11.17**);
- PPG for Water Supply, Wastewater and Water Quality (**Ref. 11.18**).

LOCAL PLAN OR LOCAL DEVELOPMENT FRAMEWORK

11.2.7. The London Plan: Spatial Development Strategy for Greater London Consolidated with Alterations since 2011 (March 2016) (**Ref. 11.19**):

The London Plan 2016 sets out the new spatial development strategy for Greater London and consolidates all of the alterations to the London Plan since 2011. The London Plan sets out an integrated economic, environmental, transport and social framework for the development of London over a 20-25-year period (to 2036). The following policies are considered relevant to this assessment:

- *Policy 5.12 Flood Risk Management - "Development proposals must comply with the flood risk assessment and management requirements set out in the NPPF and the associated technical Guidance on flood risk";*

- *Policy 5.13 Sustainable Drainage - "Development should utilise sustainable urban drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the drainage hierarchy";*

- *Policy 5.14 Water Quality and Wastewater Infrastructure - "Development proposals must ensure that adequate wastewater infrastructure capacity is available in tandem with development. Proposals that would benefit water quality, the delivery of the policies in this Plan and of the Thames*

River Basin Management Plan should be supported while those with adverse impacts should be refused"; and

- *Policy 5.15 Water Use and Supplies has been set out to "Minimise the use of mains water by incorporating water saving measures and equipment […] designing residential development so that mains water consumption would meet a target of 105 litres or less per head per day".*

11.2.8. The current 2016 London Plan is still the adopted Development Plan; however, a new Draft London Plan has been published (December 2017) for comment, and will undertake an Examination in Public procedure, prior to adoption. Despite this, the Draft London Plan is still considered a material consideration in planning decisions. The following Draft Plan policies are considered appropriate to this assessment:

- *Policy SI12 Flood Risk Management; and*

- *Policy SI13 Sustainable Drainage.*

11.2.9. Lambeth Local Plan (adopted September 2015) (**Ref. 11.20**):

- *Policy EN5 of the Lambeth Local Plan (LP) 2015 'Flood Risk': EN5 relates to the integration of flood risk management and future development. Future developments should consider the impacts of climate change on flood risk and where possible utilise mitigation measures to reducing flood risk. For example, utilising SuDS, waterproofing techniques for basement developments, etc.*

- *Policy EN6 of the LP 2015 'Sustainable drainage systems and water management' relates to the use of Sustainable Drainage Systems (SuDS) in line with the London Plan drainage hierarchy and National SuDS standards. Developments should also consider minimising water consumption and the pressure of the development towards the public sewer network, through use of water recycling techniques as well as ensuring local water supply and public sewers have adequate capacity to serve the development.*

GUIDANCE

- LBL Preliminary Flood Risk Assessment (PFRA) (**Ref. 11.21**);
- LBL Strategic Flood Risk Assessment (SFRA) (**Ref. 11.22**);
- LBL Surface Water Management Plan (SWMP) (**Ref. 11.23**);
- LBL Sequential Test (ST) Document (**Ref. 11.24**);
- LBL Local Flood Risk Management Strategy (LFRMS) (**Ref. 11.25**);
- Future Water – The Government's Water Strategy for England (2008) (**Ref. 11.26**);
- CIRIA 753 2015: The SuDS Manual (**Ref. 11.27**);
- Thames Water: Final Water Resources Management Plan (WRMP) 2015-2040 (**Ref. 11.28**);
- Water Research Centre (WRc) Sewers for Adoption 7th Edition August 2012 (**Ref. 11.29**);
- TAG Unit A3 EIA – Impacts on the Water Environment Chapter (**Ref. 11.30**);
- Design Manual for Roads and Bridges – Road Drainage and the Water Environment HD15/09 (2009) (**Ref. 11.31**);

- Pollution Prevention Guidelines (PPG) (2014)[1]:
  - PPG1: Understanding your environmental responsibilities; (**Ref. 11.32**);
  - PPG2: Above ground oil storage tanks; (**Ref. 11.33**);
  - PPG3: Choosing and using oil separators: prevent pollution; (**Ref. 11.34**);
  - PPG4: Treatment and disposal of sewage where no foul sewer if available; (**Ref. 11.35**);
  - PPG5: Works in, near or over watercourses: prevent pollution; (**Ref. 11.36**); and
  - PPG6: Construction and demolition sites: prevent pollution. (**Ref. 11.37**).

11.3. RELEVANT ELEMENTS OF THE PROPOSED DEVELOPMENT

11.3.1. The assessment adopts the approach outlined in **Chapter 2 Approach to the Assessment** and is based on the Application Plans as described in **Chapter 4 The Proposed Development**. The following components of the Proposed Development are relevant to the assessment of the likely significant effects in relation to Water Resources, Flood Risk and Drainage associated with the proposed mixed use residential led development:

11.3.2. All aspects of the Proposed Development as described in **Chapter 4 The Proposed Development** are relevant to this Chapter as the proposals will entail an increase in the number of users of the Site including vulnerable users (residents) which may affect flood risk, water supply and foul water discharged. The introduction of new access points (e.g. lifts) from ground level to the basement also requires consideration in terms of potential flood risk issues. In general, all external spaces within the Site have to be considered in terms of their impact on surface water generated.

11.4. ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

SCOPE OF THE ASSESSMENT

11.4.1. **Chapter 2 Approach to the Assessment** confirms the position on the EIA Scoping exercise, the Scoping Report and subsequent Scoping Opinion which are available at **Appendix 2.1** and **2.2**.

11.4.2. The Scoping Opinion received on 31st August 2018 stated the following:

"The scope of the water resources and flood risk assessment is considered appropriate."

11.4.3. The Scoping Opinion further states the need to demonstrate no likely contamination pathways from the Site to the River Thames. **Chapter 12 Ground Conditions, Hydrogeology and Contamination** will provide mitigation measures for potential effects to the River Thames, if contaminant pathways are assessed to be plausible. From a drainage perspective, there is no proposed discharge from the Site to the River Thames or any other watercourse, and therefore the effect of the Proposed Development on the water quality of local watercourses is considered negligible.

11.4.4. As mentioned previously, the status and issues related to contamination and groundwater resources is discussed in the **Chapter 12 Ground Conditions, Hydrogeology and Contamination**.

[1] While the EA has withdrawn their 'good practice' guidance, the below Pollution Prevention Guidance are still relevant to this assessment.

INSIGNIFICANT EFFECTS

11.4.5. As mentioned above, the effect of the Proposed Development on the water quality of local watercourses (i.e. the River Thames) is considered negligible, from a drainage perspective, during both construction and operational stages; this is because no discharge is proposed from the Proposed Development into the local watercourses. This is discussed in the Proposed Development's Outline Drainage Strategy found within the FRA, which proposes to discharge both surface and foul water to the Thames Water (TW) combined sewer network. Further information on the drainage strategy is outlined in following sections.

11.4.6. It is assumed that both surface and foul water discharge into the TW combined sewer from the Proposed Development will have negligible effect on water quality during both Demolition and Construction (by incorporating a CEMP) and Operational Stages, as the Site already drains into the combined sewer. The proposed surface water drainage solutions, including the use of sustainable drainage systems (SuDS) are expected to positively affect the quality of water discharge.

11.4.7. In addition, the effect of the Proposed Development on the groundwater quality, during the Operational Stage, is considered negligible as it is proposed to discharge surface water into the public drainage network.

LIKELY SIGNIFICANT EFFECTS

DEMOLITION AND CONSTRUCTION STAGE

- Effects on/of flooding to the following receptors:
  - Construction Workers;
  - Residents/Users of the surrounding area.
- Effects on public drainage systems:
  - Water Quantity (capacity);
- Effects on potable water demand/water supply.

OPERATIONAL STAGE

- Effects on/of flooding to the following receptors:
  - Residents/Users of the surrounding area;
  - Residents/Users of the proposed development,
- Effects on public drainage systems:
  - Water Quantity (capacity);
- Effects on potable water demand/water supply.

CONSULTATION

11.4.8. **Table 11-1** provides a summary of the consultation activities undertaken in support of the preparation of this Chapter.

Table 11-1 - Summary of Consultation

Body / organisation	Individual / stat body/organisation	Meeting dates and other forms of consultation	Summary of outcome or discussions
Thames Water (TW)	Developer Services	Consultation started on 24th November 2016	Sewer flooding history (December 2017): Confirmed no history of sewer flooding, based on TW records. TW Asset Records (December 2017): Provided baseline information of the existing sewers near the Site area. Pre-development Enquiry (Capacity Check): TW highlighted no issues in relation to proposed flow rates of the Proposed Development. Water Supply Availability: A Point of Connection Report confirmed that no off-site main and reinforcement works are necessary i.e. the existing water supply system has sufficient capacity to cater for the Proposed Development
Environment Agency (EA)	Statutory Consultee	Consultation started on 27th October 2016	EA confirmed that the Site is located in Flood Zone 3 and an area benefitting from Flood Defences. Provided latest flood risk information (September 2018).
Lambeth Borough Council	Jessica Bastock	Combined meeting with GLA and LBL on 7th Feb 2017	Confirmed approach to surface water drainage, in terms of surface water reduction. A 50% reduction of surface water runoff is acceptable for the drainage strategy; however, consideration of the TW sewer capacity will also be made. Confirmed approach for Flood Warning and Evacuation Plan i.e. to be provided for residents at ground floor level where there may be a residual risk of flooding, in an extreme breach event.
GLA	Samantha Wells	Combined meeting with GLA and LBL on 7th Feb 2017	Recommended approaches to consider for surface water discharges, in relation to the Nine Elms Integrated Water Management System (IWMS).

EXTENT OF THE STUDY AREA

11.4.9. A desktop study has been undertaken to establish hydrogeological conditions and to understand the water environment in proximity to the Site, the extent of the study area is not specifically defined as it depends on the specific influences (e.g. flood risk study area varies depending on area of influence from the specific source). The assessment also considers the effects on downstream sewers and the local water supply distribution network.

METHOD OF BASELINE DATA COLLATION

DESK STUDY

11.4.10. Baseline conditions considered within the Chapter include: the assessment of flood risk, water supply, and quantity of water discharged from the Site.

11.4.11. The following sources of information have been reviewed as part of the assessment to determine the baseline conditions:

- The EA online database;
- Gov.uk online 'Long term flood risk information' service;
- British Geological Survey (BGS) mapping;
- **Chapter 12 Ground Conditions, Hydrogeology and Contamination;**
- WSP Flood Risk Assessment and Outline Drainage Strategy (**Appendix 11.1**);
- WSP 8 Albert Embankment Generic Quantitative Risk Assessment (GQRA) (**Appendix 12.4**);
- WSP 8 Albert Embankment – Ground Investigation Report 2017) (**Appendix 12.5**);
- WSP Basement Impact Assessment (BIA); and
- All relevant legislation and guidance noted in Section 11.2.

SITE VISIT / OTHER ASSESSMENT

11.4.12. Several Site walkovers were carried out in Winter 2016 and Spring 2017 by representatives of the WSP team undertaking this Chapter.

11.4.13. Consultation with the statutory consultees and other relevant authorities have been undertaken as mentioned above and the advice and guidance provided have been used to inform this assessment. A summary of consultation is outlined in **Table 11-1**.

SIGNIFICANCE CRITERIA

11.4.14. The assessment of potential effects as a result of the Proposed Development has taken into account both the Demolition and Construction Stage, and Operational Stage. The significance level attributed to each effect has been assessed based on the magnitude of change/effect due to the Proposed Development and the sensitivity of the affected receptor/receiving environment to change, as well as a number of other factors that are outlined in more detail in **Chapter 2 Approach to the Assessment**. Magnitude of change/effect and the sensitivity of the affected receptor/receiving environment are both assessed on a scale of high, medium, low and negligible (as shown in **Chapter 2 Approach to the Assessment**. A summary of the significance matrix can be seen in **Table 11-2**.

Table 11-2 - Matrix for Determining the Significance of Effects

		Magnitude of change/effect			
		High	Medium	Low	Negligible
Sensitivity of Receptor	High	Major	Moderate to Major	Minor to Moderate	Negligible
	Medium	Moderate to Major	Moderate	Minor	Negligible
	Low	Minor to Moderate	Minor	Negligible to Minor	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

11.4.15. Magnitude of change/effect and the sensitivity of the affected receptor/receiving environment can be beneficial or adverse, and negligible where applicable. Magnitude of change/effect and sensitivity of the affected receptor/receiving environment have been assessed adapting the relevant tables within the following documents:

- Design Manual for Roads and Bridges (DMRB) HD 45/09: Road Drainage and the Water Environment (**Ref. 11.31)**; the DMRB provides guidance for appraising significance of potential impacts that road projects may have on the water environment; and
- TAG Unit A3 Environmental Impact Appraisal – Impacts on the Water Environment chapter (**Ref. 11.30**).

11.4.16. Although the above two documents were developed to provide guidance for assessing potential effects that road projects may have on the water environment, they provide a general framework which can be used to provide a consistent assessment of the impact of development proposals on the water environment.

11.4.17. **Table 11-3** below indicates the general criteria used to assess the sensitivity of water receptors as part of this assessment.

Table 11-3 - Classification of Sensitivity of Water Receptors

Sensitivity	Criteria	Examples
High	An attribute with High quality and rarity, regional or national scale and limited potential for substitution.	§ Principal Aquifer providing potable water to a large population (groundwater). § Important and notable fish population (surface water). § Water Framework Directive (WFD) 'High' status water body acting as a potable water supply. § Residents (on and off Site). § Public sewer with available capacity subject to major improvement works. § Major river providing a potable water resource to a large population.
Medium	An attribute with Medium quality and rarity, regional or national scale and limited potential for substitution.	§ WFD 'Good' status water body. § Aquifer providing abstraction water for agricultural or industrial use (ground water). § Commercial users (on and off Site). § Construction workers.

Sensitivity	Criteria	Examples
		§ Public sewer with available capacity subject to some upgrades works. § Minor river providing a water resource to a small population or industry.
Low	An attribute with Low quality and rarity, regional or national scale and limited potential for substitution.	§ WFD less than good status water body. § Unproductive strata (ground water). § Public sewer with available capacity. § Heavily managed river and floodplain providing a local flood storage volume. § Minor river or drain of low quality.

11.4.18. The TAG Unit A3 and DMRB guidance includes a 'very high' classification for the value/importance of receptors. For the purposes of this assessment, receptors assessed with a 'very high' value/importance in accordance to TAG Unit A3 and DMRB guidance will be assessed as having a 'high' sensitivity.

11.4.19. In adapting the table, sensitivity of people to flooding has been assessed taking into account their intrinsic vulnerability based on several factors such as awareness, in-place practices, operation times, age, etc., for example residents are generally considered more vulnerable than commercial users, as the former sleep in the development, although in some cases their vulnerability might be reduced by specific factors (e.g. duplex with living areas at the ground floor level and sleeping accommodation on the first floor; such arrangement would allow residents to be able to access a safe refuge on the first floor in the unlikely event of a breach in the flood defences). Construction workers normally have a lower vulnerability than residents due to their increased awareness of health and safety and training.

11.4.20. The criterion for determining magnitude of change/effect is detailed in **Table 11-4**.

Table 11-4 - Classification of Magnitude of Effect

Magnitude	Criteria	Examples
High	Results in a loss or major improvement of feature.	Significant fluvial flooding affecting offsite receptors caused or severely exacerbated by the proposals has a high probability of occurring (i.e. exceeding 1% annual probability) with potential high depth/velocity of water and risk to life and/or major financial effect; vice-versa the Proposed Development might significantly reduce or eliminate flooding for events with a high probability of occurring. Significant flooding which could potentially cause major effect at the Site including loss of life is has a high probability of occurring (i.e. exceeding 1% annual probability). Pollution of potable source of abstraction/removal of major existing polluting discharge to a watercourse. Significant increase/reduction in the flow entering controlled systems causing a major change in the probability/magnitude of flooding. Loss or extensive change to a fishery. Change in WFD classification of river reach. Loss or gain of important fishery).

Magnitude	Criteria	Examples
Medium	Results in a medium effect on integrity or improvement of feature or loss or gain of part of a feature.	Flooding which could potentially cause financial effect and disruption offsite, caused or exacerbated by the proposals, has a high probability of occurring (i.e. exceeding 1% annual probability). Flooding of the Site which could cause financial effect and disruption (but no loss of life) has a high probability of occurring (i.e. exceeding 1% annual probability). Contribution of significant effluent towards receiving river, but insufficient to change WFD classification. Loss of productivity of a fishery. Increase/reduction of amount of flow entering controlled systems (sufficient enough to cause a noticeable change in the probability/magnitude of flooding)).
Low	Results in a low effect of integrity of feature or loss of part of a feature.	Small increase/decrease in the likelihood or magnitude of flooding as a consequence of the development. Limited Increase/reduction of amount of flow entering controlled systems which would cause a small/barely noticeable change in the probability/magnitude of flooding) Measurable changes in feature, but of limited size and/or proportion.
Negligible	Results in an effect on measure but insufficient magnitude to affect attribute.	The Proposed Development is unlikely to affect the integrity of the water environment and the effect on flooding is not significant. For example, discharge to watercourses but no significant loss/gain in water quality, probability of flooding, fishery, productivity or biodiversity No significant effect on the economic value of the feature.

11.4.21. The TAG Unit A3 guidance provides classifications of magnitude of impact in' Large', 'Moderate', and 'Slight' quantities and the DMRB guidance provides classification of magnitude of effect in 'Major', 'Moderate', 'Minor' and 'Negligible'. For the purposes of this assessment, we will consider them as 'High', 'Medium', 'Low' and 'Negligible', respectively.

EFFECT SIGNIFICANCE

11.4.22. The following terms have been used to define the significance of the effects identified:

- **Major effect**: where the Proposed Development could be expected to have a very significant effect (either positive or negative) on flood risk, on drainage and water resources availability and quality in the area;
- **Moderate effect**: where the Proposed Development could be expected to have a noticeable effect (either positive or negative) on flood risk, on drainage and water resources availability and quality in the area;
- **Minor effect**: where the Proposed Development could be expected to result in a small, barely noticeable effect (either positive or negative) flood risk, on drainage and water resources availability and quality in the area; and
- **Negligible**: where no discernible effect is expected as a result of the Proposed Development on flood risk, on drainage and water resources availability and quality in the area.

11.5. BASELINE CONDITIONS

EXISTING BASELINE

Site and Topography

11.5.1. The existing topography of the Site (Appendix B of the FRA found at **Appendix 11.1**) varies across the Site. Along the frontage of the River Thames, ground levels directly adjacent of the West Site are between 4.4-4.6m Above Ordnance Datum (AOD), from south to north. Ground levels generally rise to approximately 4.7mAOD, at the Albert Embankment carriageway west of the Site, when approaching the River Thames embankment.

11.5.2. The Central Site, bound by Lambeth High Street, Whitgift Street and the railway viaduct generally comprises ground levels between 4.2-4.3mAOD, with carriageway levels at approximately 4.0-4.1mAOD.

11.5.3. The East Site, along Newport Street, comprises ground levels between 4.4-4.8mAOD. The carriageway levels in this area are approximately 4.4mAOD. As such, the eastern area of the Site has a high spot in relation to the adjacent areas.

Geology and Hydrogeology

11.5.4. Based on BGS mapping (Sheet 270, 1:50 000 series) referred in the BIA (**Appendix 12.1**), the geology of the Site comprises Kempton Park Gravel (superficial deposits) over the London Clay Formation. The London Clay Formation (bedrock geology) is underlain by the Harwich Formation, Lambeth Group, Thanet Sands and Upper Chalk Formation.

11.5.5. WSP have undertaken a Ground Investigations Report (GIR) (**Appendix 12.3**) within the Central and Western Sites, which has been referred to in the BIA. The GIR refers to a Site Investigation (SI) undertaken in November 2008 and is available from the Lambeth Council Planning Portal (ref: "Phase 2 Factual Report on Ground Investigation – 8 Albert Embankment, London, SE1", first issue). As part of the GIR, intrusive ground investigations were undertaken between 12th October 2016 to 24th November 2016. A summary of the SI findings is outlined in **Table 11-5** below:

Table 11-5 - Summary of Geological Profile of the Site (WSP GIR 2017)

Stratum	Average Elevation of upper surface (mAOD) - Central	Average Elevation of upper surface (mAOD) - Western	Typical strata information
Hard Standing	+4.30	+4.40	Concrete, macadam, pavement
Made Ground	+4.02	+3.86	Gravel of flint and brickwork, Clay sand/sandy clay, compact orange brown silty sand with occasional brickwork fragments.
River Terrace Deposits	+1.94	+2.04	Medium dense orange brown sand with variable gravel content.
London Clay	-3.44	-4.12	Firm to stiff blue grey slightly silty closely fissured clay.

11.5.6. The GIR details the borehole sampling undertaken on-site which were undertaken to depths of up to 48.10m with permeability testing, laboratory testing and gas and groundwater monitoring. Based on the investigations, the BIA concluded that the geology and water level encountered was generally consistent with the SI information summarised in **Table 11-5** above.

11.5.7. The GIR also concluded that the below the River Terrace deposits, groundwater strikes at elevations of circa -7.0mOD and -22.0mOD, -25.0mOD and -30.0mOD.

Existing Watercourses

11.5.8. The River Thames, a Main River watercourse, is located approximately 30m west of the Site and is managed by the EA.

Existing Artificial Watercourses/Water Bodies

11.5.9. The White Hart Dock is located 10m south of the Site, at the junction of Black Prince Road and Albert Embankment. Based on anecdotal evidence, it is believed that the White Hart Dock was built c.1968 as a parish dock. It has been suggested that the dock was historically used to hold emergency water supply during World War II. The dock largely remained derelict until the Transport, Planning and Strategy (TPS) division of Lambeth led on the development of a package of environmental improvements, part of which involved the commissioning of public art for White Hart Dock.

11.5.10. As discussed in the following sub-section, the TW Asset Records suggest that the White Hart Dock discharges to a 381mm TW Combined sewer further south of the Albert Embankment carriageway.

Existing Flood Defences

11.5.11. The information provided by the EA as part of their 'Product 4' (contained within the FRA) indicates that the River Thames is defended along this section by the Thames Barrier and the Thames Tidal Flood Defences against a tidal flood event that has a 0.1% annual probability of occurring.

11.5.12. The EA Product 4 information states that the defences along the River Thames in this area are all raised, man-made and are privately owned.

11.5.13. The EA Product 4 notes that the overall condition grade of the defences in the area is 2 (Good), on a scale of 1 (very good) to 5 (very poor) and that the EA inspect the defences twice a year to ensure that they remain fit for purpose. It also states that defences along this section of the River Thames must be maintained by their owners to a crest level of 5.41mAOD (the Statutory Flood Defence Level in this reach of the Thames). The EA Product 4 also requires future defence walls raised to a level of 6.35m AOD by 2100 to allow for climate change and maintain the same standard of protection.

Existing Surface and Foul Water Drainage

11.5.14. Based on the TW asset records, December 2017, (Appendix B of the FRA found at **Appendix 11.1**) there is a public combined sewer within the area, whereby combined sewers run along the carriageways within proximity of the Site: to the north on Whitgift Street, to the east on Newport Street, to the south on Black Prince Road, to the west on Albert Embankment and central to the Site on Lambeth High Street.

11.5.15. A summary of the sewer details are as follows:

Table 11-6 - Thames Water Sewer Records for the Site and Surrounds

Location	Type	Size (Mm)
Whitgift Street	Combined	300
Newport Street	Combined	150
Black Prince Road	Combined	910x610
Albert Embankment	Combined	300
Lambeth High Street	Combined	300

11.5.16. A review of the TW Asset Records indicates that the sewers above are approximately 4-6mbgl.

11.5.17. Following a Site visit, there is anecdotal evidence that there is an existing highway drainage system within the carriageway. It is expected that such drainage discharges into the TW sewers indicated in **Table 11-6** above.

11.5.18. In addition to the above, the TW Asset Records also suggest that the White Hart Dock, south of the Site, discharges to a 381mm TW Combined sewer further south of the Albert Embankment carriageway.

11.5.19. A TW pre-development enquiry was submitted as part of the FRA to check the capacity of the existing combined public drainage network where the Proposed Developments intends to discharge both surface and foul water. In their response, they have not highlighted any capacity issues related to the Proposed Development's discharge flows.

Existing Water Supply/Demand

11.5.20. Based on the TW asset records, the appears to be several water supply assets in proximity to the Site, with assets located on Albert Embankment, Black Prince Road, Whitgift Street, and Newport Street. The details of the water supply assets are summarised in **Table 11-7** below:

Table 11-7 - Thames Water Supply Assets near the Site

Location	Type	Size (Inches)
Whitgift Street	Distribution Mains	3"
Newport Street	Distribution Mains	3"
Black Prince Road	Trunk Mains	12"
	2No. Distribution Mains	7"
Albert Embankment	Distribution Main	7"
Lambeth High Street	2No. Distribution Main	4"

11.5.21. Based on the online TW network capacity checker for water supply infrastructure, the Site is within a very sensitive area. However, a Site-specific water supply/point of connection report was requested from TW for the Proposed Development, submitted March 2017, (**Appendix 11.2**). TW confirmed that the existing water supply network has capacity to meet the proposed loading demands, subject to upgrade works/connections (further discussed in Section 11.9).

11.5.22. From a more strategic perspective based on the Water Resources Management Plan (WRMP), a baseline London supply demand study indicates that the London Water Resource Zone (WRZ) is sufficiently supplied with water as the current supply exceeds the current demand.

11.5.23. For future scenarios, the demand forecast has been derived using population and property projections; water use data and trends, and a range of other information such as household and business use, and/or leakage to forecast how the demand for water are likely to vary over the next 25 years. The supply forecast has been derived taking into consideration available surface water abstraction, storage reservoirs, groundwater abstraction. In addition, components that would reduce the supply have been forecasted such as outages, bulk supplies, sustainability reductions, and climate change.

11.5.24. An additional 'target headroom' buffer has been taken into account for uncertainty for the supply and demand forecasts.

11.5.25. Based on the WRMP, the London WRZ is predicted to have a supply-demand deficit of -133Ml/d by 2020, increasing to -414 Ml/d within the year 2040.

11.5.26. To limit and reduce the deficit, the WRMP outlines a 'final plan' which details solutions to balance the deficit, which are outlined as follows:

- Leakage Reduction;
- Metering Savings;
- Water Efficiency Savings;
- Tariffs and Behavioural Changes;
- Groundwater Schemes;
- Increase in Regional Transfer;
- Wastewater Reuse; and
- Bulk Water Supply.

11.5.27. If the 'final plan' is incorporated by TW, the London Supply-Demand Balance would be balanced, based on Figure 9-2 of the WRMP.

EXISTING SOURCES OF FLOOD RISK

Fluvial Flooding

11.5.28. Based on the EA Product 4 information, our knowledge and experience, this stretch of the River Thames is tidal. No other watercourses which might represent a potential source of fluvial flooding are located in proximity to the Site.

11.5.29. Based on the above, fluvial flooding is considered not relevant to this Site.

Tidal Flooding

11.5.30. The Detailed Flood Map provided by the EA as part of their Product 4 (refer to the FRA **Appendix 11.1**) shows that the Site is located in the defended Flood Zone 3, within the defended tidal floodplain

of the River Thames. Flood Zone 3 is an area where the annual probability of flooding would exceed 0.5% (which corresponds to a 1 in 200 year return period tidal flood event) in the absence of flood defences.

11.5.31. However, the EA Product 4 confirms that the area in which the Site is located is defended against tidal flooding from the River Thames to a very high standard of protection i.e. 0.1% annual probability of occurring, 1 in 1,000 year return period. The level of the defences will need to be raised over time to maintain the same standard of protection accounting for the impact of climate change.

11.5.32. In consistency with the EA data, Figure 11 of the SFRA shows the Site is located within Flood Zone 3 and within an area benefitting from flood defences (see **Appendix 11.1**).

11.5.33. Therefore, based on the available information and assessment, tidal flooding could happen only in the extreme case of an extreme breach/overtopping scenario. The potential effects of such event are explained further below.

11.5.34. Based on Thames Tidal Upriver Breach Inundation Modelling Study (TTBMS) 2017[2], also contained within the EA Product 4, the Site is at residual risk of flooding assuming a breach event at the location relevant to the Site.

11.5.35. The potential levels of flooding at the Site in case of a breach in the Thames tidal flood defences, as explained by the EA in the Product 4, are not related to specific return periods as the river levels are controlled through the Thames Barrier closures. The levels used are referred to as the Maximum Likely Water Levels: current and future (2100 climate change scenario) flood water levels relevant to the Site have been provided within the Product 4.

11.5.36. The breach flood levels, relevant to the Site, vary between 4.61mAOD to 5.16mAOD, for the 2014 and 2100 year scenario respectively, with the highest potential levels located at Albert Embankment.

11.5.37. When assessed against the existing levels of the Site, in the current scenario, there may be potential depths of up to 0.6m in the extreme breach event. For future scenarios, the Site has predicted flood depths of up to 0.9m in the 2100 epoch (the worst case scenario) and depending on location within the Site.

11.5.38. The Vauxhall area, including the Site, was affected by tidal flooding in 1928 based on the EA data. The Thames Barrier and associated defences have been built since, which significantly increases the standard of protection of the capital and of the area.

11.5.39. Based on the above, the probability of tidal flooding at the Site is assessed as low given the high standard of protection.

Surface Water Flooding

11.5.40. Based on the online gov.uk EA Detailed Risk of flooding from Surface Water Map, the majority of the Site has been identified to have a 'Very Low' likelihood of flooding from Surface Water i.e. the Site is

[2] The TTBMS (2017) model simulates 5769 continuous tidal breaches along the entire extent of the Thames from Teddington to the Thames Barrier. The modelling study provides modelled levels of the Maximum Likely Water Levels (MLWLs) for the 2014 and 2100 year epochs, in the case of a breach event.

predicted to have a less than 0.1% chance of flooding in any given year. However, the Central Site, has a low to medium risk of surface water flooding where:

- 'Low' risk means that the area has an annual probability of flooding of between 1% and 0.1%; and
- 'Medium' risk means that the area has an annual probability of flooding of between 1% and 3.3%.

11.5.41. The predicted surface water flooding, in the Central Site, is consistent with the topography of the Site (further detailed in Appendix B of the FRA (**Appendix 11.1**) as the ground levels of this area (~4.1-4.2mAOD) acts as a 'low spot' in comparison to the areas immediately west and east (~4.5mAOD), and surface water would naturally convey towards low areas unless intercepted by a drainage network.

11.5.42. The mapping also shows that surface water flooding might affect the roads surrounding the Site; this is consistent with the roads elevations assuming insufficient capacity in the public highways drainage network. A large area on Lambeth High Street is classified as having: a 'high' risk of surface water flooding where: 'High' risk means that the area has an annual probability of flooding of over 3.3%.

11.5.43. The areas of surface water flooding in the area based on the EA modelling correlate with the topography of the Site and are intended for strategic purposes only and are unlikely to take full consideration of the existing highway drainage system, which would provide some alleviation to the predicted flooding.

11.5.44. Based on the above, the probability of surface water flooding at the Site has been assessed as medium.

Sewer Flooding

11.5.45. As part of our consultation TW were asked for information with respect to flooding from sewers; within their formal response they noted that 'The flooding records held by TW indicate that there have been no incidents of flooding in the requested area as a result of surcharging public sewers.' (December 2017) (Appendix F of the FRA).

11.5.46. Figure D5 of the SWMP details recorded sewer flooding incidents based on TW records for the Southwark area. Based on this, the Site is within a post code area whereby there are have been no reported sewer flooding incidents, at the time of publication, which is consistent with the Site-specific information provided by TW.

11.5.47. Based on the above, the probability of sewer flooding at the Site is assessed as low.

Groundwater Flooding

11.5.48. Figure 3.5.1 of the SWMP shows that there was a reported groundwater flooding incident located approximately 350m south-east of the Site; the same figure indicates the increased risk for elevated groundwater in the area (including the Site) as a result of underlying permeable superficial deposits, where groundwater has the potential to rise sufficiently to interact with the ground surface or lie within 2m of the ground surface. No other reported incidents were in proximity of the Site (i.e. within 1km).

11.5.49. The SFRA includes a groundwater assessment of the borough (the Lambeth Intermediate Assessment of Groundwater Flooding Susceptibility) in its appendix. The assessment states the following:

- *"Due to the significant thickness of underlying London Clay Formation in the majority of the borough, the susceptibility from groundwater flooding from rising groundwater levels in the Chalk*

and 'Basal Sands' is considered to be negligible. Where the Lambeth Group outcrops in the east of the Lambeth BC (Brockwell Park area), groundwater levels are suppressed due to regional groundwater abstractions. Therefore, the key groundwater flooding mechanisms are associated with permeable superficial deposits.

- *The majority of the groundwater flooding incidents are thought to be related to perched water tables within superficial deposits, particularly the River Terrace Deposits. Many of the groundwater flooding incidents are located near to / along lost rivers such as the River Effra. These will be topographic lows and perched groundwater tables are likely to be close to ground surface in these areas, so that there is an increased susceptibility to groundwater flooding."*

11.5.50. However, given that the Site is currently within an existing brownfield area, the presence of permeable superficial layers is likely to be limited as a result of subterranean development within the area. The existing Site comprises a basement level floor which suggests that the gravels will have been removed where basements are currently present, and therefore any groundwater present is limited.

11.5.51. The WSP Ground Investigations Report correlates with the SFRA as a series of boreholes undertaken within the Central Site reveal groundwater strikes below the River Terrace Deposits at elevations circa -7.0mOD, -22.0mOD and -30.0mOD i.e. associated with the present superficial deposits.

11.5.52. Based on the above, the probability of groundwater flooding at the Site has been assessed as low.

Artificial Sources of Flooding

11.5.53. Based on the online gov.uk "Long Term Flood Risk Information", no flooding from artificial sources (reservoirs and dams) was identified for the Site area.

11.5.54. In addition, there is no evidence of any potential flooding of the White Hart Dock as the dock is small relative to the Site and also due to its apparent connection into the TW sewerage network i.e. it does not appear to be source of flooding as there is no clear pathway leading to the Site.

11.5.55. Based on the information available and the assessment undertaken, the probability of flooding from artificial sources at the Site has been assessed as negligible.

11.6. SENSITIVE RECEPTORS

11.6.1. Based on the baseline conditions presented above, **Table 11-8** presents the sensitive receptors which will be assessed in the following assessment, along with their sensitivity to change which is based on the general criteria outlined below:

Table 11-8 - Classification of Magnitude of Impact

Receptors	Medium	Sensitivity	Description
Flood Risk (All sources including: river, surface water, groundwater, etc.)	Construction Workers	Medium	Flooding may impact upon Construction Workers, but their sensitivity is lowered as a result of their competency in their role as well as operating in teams and/or prescribed systems.
	Residents/Users of the surrounding area	High	Residents/Users of the surrounding areas generally have no awareness of flood risk and residents' vulnerability is high given their presence overnight (via sleeping accommodation)

Receptors	Medium	Sensitivity	Description
	Site Occupants (Staff, residents, and public)	Medium	The residents' vulnerability is reduced as the majority of the apartments are located at the first floor or above. Ground floor apartments are raised and could be flooded to a limited extent only in case of a breach in a future climate change scenario.
TW Water Supply Network	Water Quantity	Low	The sensitivity of TW's Water Supply network is considered low due to TW's pre-development enquiry response confirming the capability to cater to the Proposed Development (March 2017).
TW Combined (Surface and Foul water) Drainage Network	Water Quantity	Low	The sensitivity of TW's combined network, from a capacity perspective, is considered low due to TW's pre-development enquiry response not highlighting any issues with capacity, in consideration of the Proposed Development proposed flow rates (March 2017).

11.7. EMBEDDED MITIGATION

11.7.1. The following mitigation measures have been incorporated within the design to reduce impacts on sensitive receptors:

11.7.2. The Proposed Development locates 'more vulnerable' users such as residents away from the ground floor and below. All residential users, with the exception of Whitgift Street affordable housing units, are located on the first floor and above. The Whitgift Street affordable housing unit block has a limited amount of residential users on the ground floor, and as a result a flood water evacuation route (i.e. a stairwell access) to upper levels has been provided as part of the design, to provide a safe means of escape for ground floor users in the case of extreme flood risk event.

11.7.3. The Surface Water Drainage Strategy has been designed to a standard of up to the 1in100 year storm period event. The Environment Agency Climate Change guidance requires assessments to consider both the central (20%) and upper end (40%) allowances to understand the range of impact of peak rainfall intensity. The Surface Water Drainage Strategy for the Site has been designed to cater to the upper end allowance of 40% for further resilience.

11.8. ASSESSMENT OF EFFECTS, MITIGATION AND RESIDUAL EFFECTS

DEMOLITION AND CONSTRUCTION STAGE

EFFECT UPON FLOOD RISK

Construction Workers

11.8.1. The Site is protected against tidal flooding to a high standard of protection therefore it could flood only in an extreme overtopping/breach scenario.

11.8.2. The Site is currently entirely impermeable; therefore, the volumetric surface water runoff is not expected to increase as a consequence of the Proposed Development as there would not be an increase in impermeable area. The only potential effect on the surface water drainage regime would be a minor change in the rate and direction of runoff as a result of, for example, an alteration of the

ground levels. Altering ground levels may cause surface water to naturally convey towards low spots of the Site area, which may cause surface water flooding.

11.8.3. Deep excavation and piling work activities may in theory alter the existing ground conditions of the Site and groundwater environment. However, the Site already comprises existing basements and therefore any change is unlikely to cause a significant impact on groundwater.

11.8.4. In addition, the existing geology of the Site comprises predominantly Made Ground and London Clay, therefore there is unlikely to be any significant groundwater regardless. Should there be any groundwater encountered within the basement excavations, it is likely to be shallow and in limited quantity as there may only limited thickness of superficial deposits (River Terrace Deposits) in the area and also due to the majority of gravels removed where basements are present. Therefore, ground works and excavations are unlikely to affect groundwater and associated potential flooding.

11.8.5. Other potential sources of flooding (e.g. sewer) have also been investigated and no significant issues have been identified.

11.8.6. As discussed in **Chapter 5 Demolition and Construction**, a Construction Environmental Management Plan (CEMP) will be adopted during this stage of development. This would include local flood prevention measures that comply with policy and guidance. Temporary drainage facilities will be provided during this stage to ensure the management of surface water runoff until the permanent surface water drainage solutions are incorporated. Further ground investigations (including a piling risk assessment) would be undertaken to ascertain the status of the hydrogeology and it is envisaged that a suitable planning condition will be applied, to ensure ground investigations are completed and are satisfactory prior to further works.

11.8.7. Therefore, in light of the nature of the potential flooding (mainly surface water flooding) the magnitude of effect, prior to mitigation, is considered to be low. The sensitivity of Construction Workers to the risk of flooding is considered medium. This is due to their presence on Site only during working hours, their awareness and training.

11.8.8. The sensitivity of Construction Workers is medium and the magnitude of effect, prior to mitigation, is low. Therefore, there is likely to be a direct, temporary, medium-term effect on Construction Workers of **Minor negative**, prior to the implementation of mitigation measures, and therefore **not significant.**

Mitigation

11.8.9. No additional mitigation required.

Residual Effect

11.8.10. As no mitigation is required, residual effects will remain as reported above.

RESIDENTS AND USERS OF THE SURROUNDING AREAS

11.8.11. The sensitivity of residents and occupants of the surrounding area is variable but can be assumed as high to be precautionary. This is because the residents of the surrounding area live and sleep in buildings nearby, are not formally trained and lack the awareness of the activities undertaken at the Site during the construction works.

11.8.12. The Site is not located within an active floodplain therefore the Proposed Development would not impact on floodplain storage capacity. As such from a tidal flood risk perspective the Proposed Development would not have any negative impact elsewhere.

11.8.13. As discussed in the previous section, the drainage regime of the Site may be subject to minor alterations in the absence of a correct management system of surface water runoff, and therefore there may be some surface water flooding conveying from the Site to the surrounding areas.

11.8.14. However, as discussed in the previous section, a CEMP would be incorporated during construction. This would ensure the risk of surface water flooding as well as other potential sources of flooding such as groundwater (if present) are mitigated.

11.8.15. Furthermore, any potential effects offsite would be mitigated by the distance and the reasonably flat nature of the area; the magnitude of potential effect is therefore considered negligible.

11.8.16. The sensitivity of Residents and occupants of the surrounding area is high (worst case scenario) and the magnitude of change, prior to mitigation, is negligible. Therefore, there is likely to be a direct, temporary, medium-term **negligible** effect on Residents and occupants, prior to the implementation of mitigation measures, and therefore **not significant.**

Mitigation

11.8.17. No additional mitigation required.

Residual Effect

11.8.18. As no mitigation is required, residual effects will remain as reported above.

EFFECTS UPON WATER SUPPLY

11.8.19. The Site is currently served by TW's water supply network. During the demolition and construction stage, it is expected that the activities on-site will utilise existing water supply infrastructure. The demand will vary throughout the programme of works dependant on the specific activity. However, the demand on water supply is not expected to significantly change from the demand from the existing Site uses as a result of the activities during this stage due to the limited Site area and the fact that the Site is currently in use (and will continue to be at various points during the demolition and construction stage). At various points in the demolition and construction stage, the water demand could be either higher or lower than the demand from the current site uses. Therefore, the magnitude of change is considered to be low.

11.8.20. The sensitivity of TW's water supply network is considered low. TW's pre-development enquiry response confirmed the capability to cater to the Proposed Development (March 2017) and it is expected that the operational Proposed Development will demand more water than all demolition and construction activities.

11.8.21. The sensitivity of TW's Water Supply Network is low and the magnitude of change, prior to mitigation, is low. This would result in a direct, temporary, medium-term **minor positive to minor negative** effect on TW's Water Supply Network, prior to the implementation of mitigation measures, and therefore **not significant.**

Mitigation

11.8.22. No mitigation required.

Residual Effect

11.8.23. As no mitigation is required, residual effects will remain as reported above.

EFFECTS UPON PUBLIC DRAINAGE NETWORK

11.8.24. The lack of sewer flooding history on-site, as well as no indication of public drainage network capacity issues in the area (based on a TW Pre-development enquiry), indicates that the Proposed Development can be catered for in terms of capacity. As such the sensitivity of the TW's Sewerage network is considered to be low.

11.8.25. During the demolition and construction stage, it is envisaged that the Site will discharge both its surface water and foul water into the TW Sewerage Network. The runoff into the sewerage network will vary depending on the tasks being carried out. As the Site is already in use and entirely impermeable, the demolition and construction activities are not expected to significantly modify the volumetric and/or rate of discharge to the public drainage network from the current site uses, although alterations to the ground levels during construction might cause some minor changes in runoff rates.

11.8.26. As previously discussed, a CEMP will be adopted during this stage. This would include local flood prevention measures that comply with policy and guidance and which will control discharges into the public drainage network. Surface runoff from the construction Site would be discharged to the sewer under consent to be obtained from TW. Surface run-off from the various areas of demolition and construction within the Site will be managed and consideration will be given to the appropriate use of bunding and sediment traps.

11.8.27. At various points in the demolition and construction stage, the demand on the sewerage network could be either higher or lower than the demand from the current site uses. Based on the above the magnitude of change, prior to mitigation, is predicted to be low.

11.8.28. The sensitivity of TW's Sewerage Network is low and the magnitude of change, prior to mitigation, is low. This would result in a direct, temporary, medium-term **minor positive to minor negative** effect on TW's Water Sewerage Network, prior to the implementation of mitigation measures, and therefore **not significant.**

Mitigation

11.8.29. No mitigation required.

Residual Effect

11.8.30. As no mitigation is required, residual effects will remain as reported above.

OPERATIONAL STAGE

EFFECTS UPON FLOOD RISK

Future Site Occupants

11.8.31. The Site is protected against tidal flooding to a high standard of protection therefore it could flood only in an extreme overtopping/breach scenario.

11.8.32. The Site is currently entirely impermeable and therefore the volumetric surface water runoff is not expected to increase as a consequence of the development as there would not be an increase in impermeable area irrespective of any drainage strategy proposed. Volumetric runoff would in fact be slightly reduced through a minor increase in permeable areas such as external landscaping and green roofs, although the change would not be expected to be significant.

11.8.33. The probability of surface water flooding at the Site is further mitigated by the proposed surface water drainage solutions. An outline surface water drainage strategy has been produced for the Proposed

Development, in accordance to best practice and guidance, and can be found within the FRA (**Appendix 11.1**). The proposed drainage system will be designed to manage a 1% annual probability rainfall event including a climate change allowance. This will be achieved through the use of green roofs, attenuation systems and an associated flow control device provided on-site. Surface water discharge rates into the public network will be reduced by 50% as agreed with LBL.

11.8.34. The residual risk, mainly linked to a potential breach in the Thames Tidal Flood Defences has been addressed through design solutions including:

- Locating the majority of residential apartments to the first floor or above;
- Raising the finished floor level of the ground floor residential accommodation to 4.8mAOD; and
- Providing safe refuge at the first floor for all occupants of the Proposed Development.

11.8.35. To further mitigate any residual risk the ground levels of the Proposed Development are going to consist of gentle slopes away from entrances of the buildings and towards Albert Embankment. However, this excludes the listed buildings as they are to be retained.

11.8.36. Due to the design solutions proposed the sensitivity of future residents of the Proposed Development to the risk of flooding has been considered medium rather than high as their vulnerability is significantly reduced through the resilience embedded in the design of the Proposed Development. The sensitivity of other users would be similar or lower as for example commercial spaces would be closed in case of expected flooding and commercial users would not stay overnight. The magnitude of effect in terms of flooding is considered to be low.

11.8.37. The sensitivity of Site occupants (Staff and public) is medium and the magnitude of effect, prior to mitigation, is low. Therefore, there is likely to be a direct, long, permanent term **Minor negative** effect on staff, residents and public, prior to the implementation of mitigation measures, and therefore **not significant.**

Mitigation

11.8.38. In order to further reduce any residual risk a Flood Warning and Evacuation Plan (FWEP) (**Appendix E of Appendix 11.1**) will be produced for the residential element of the Proposed Development; this will provide useful information for future residents including what to do to prepare for flooding and how to act during a flood emergency.

Residual Effect

11.8.39. The FWEP (**Appendix E of Appendix 11.1**) would further reduce the vulnerability of the Proposed Development, however, the effect remains as **Minor negative**, and therefore **not significant.**

RESIDENTS AND USERS OF THE SURROUNDING AREAS

11.8.40. The sensitivity to flooding of Residents and Occupants of the surrounding area is considered high.

11.8.41. As mentioned above, the Site is not located within an active floodplain therefore its re-development would not impact on floodplain storage capacity: therefore, the Proposed Development would not have a negative impact elsewhere from a tidal flood risk perspective.

11.8.42. In addition, from a drainage perspective, the overall drainage discharge rates will reduce as a consequence of the proposed development thanks to the provision of the proposed drainage strategy. As a result of that the probability of flooding elsewhere might reduce, although any change is likely to be negligible in light also of the distance.

11.8.43. The sensitivity of Residents and occupants of the surrounding area is high and the magnitude of effect, prior to mitigation, is negligible. Therefore, there is likely to be a direct, permanent, long-term **negligible** effect on Residents and occupants, prior to the implementation of mitigation measures, and therefore **not significant**.

Mitigation

11.8.44. No additional mitigation required other than inherent 'in-built' mitigation (e.g. surface water drainage strategy).

Residual Effect

11.8.45. As no mitigation is required, residual effects will remain as reported above.

EFFECTS UPON WATER SUPPLY

11.8.46. The Site is currently served by TW's Water Supply Network however the demand is not high as a number of units/floors of specific buildings are vacant. During the occupation stage, it is expected that the future operation uses on-site will increase the demand of water. Therefore, there may be an effect on TW's Water Supply network in terms of additional supply and demand.

11.8.47. As described above, the sensitivity of TW's water supply network is considered low. TW's water supply/point of connection report response confirmed the capability to cater to the Proposed Development (March 2017). As detailed in the report, there is adequate capacity provided that the following connections are made:

- 1x50mm MDPE metered supply from the 4" main in Lambeth Street - serving the West Site
- 1x63mm MDPE metered supply from the 4" main in Lambeth High Street – serving the Central Site
- 1x32mm MDPE metered supply from the 7" main in Black Prince Road. – Serving the East Site

11.8.48. The sensitivity of TW's Water Supply Network is low and the magnitude of change, prior to mitigation, is medium. This would result in a direct, permanent, long-term **Minor negative** effect on TW's Water Supply Network, prior to the implementation of mitigation measures, and therefore **not significant.**

Mitigation

11.8.49. No additional mitigation required.

Residual Effect

11.8.50. As no mitigation is required, residual effects will remain as reported above.

EFFECTS PUBLIC UPON DRAINAGE NETWORK (WATER QUANTITY)

11.8.51. The lack of sewer flooding history on-site, as well as no indication of capacity issues in the public drainage network in the area (based on a TW Pre-development enquiry), indicates that the Proposed Development can be catered for in terms of capacity. As such, the sensitivity of the TW's Sewerage network is considered to be low.

11.8.52. The Site currently discharges both surface water and foul water into the TW's Sewerage Network. During the operational stage, it is envisaged that the Proposed Development will continue to discharge both its surface water and foul water into the TW's Sewerage Network. The proposed surface water drainage strategy will ensure that the combined discharge rate (both surface water and foul water) will reduce post-development. The foul water runoff will increase as a result of the size of the development and number of commercial units proposed. However, the rate of surface water runoff will decrease by

at least 50% in 1:1, 1:30 and 1:100 year return period events and will over compensate the increased foul flow rate. See **Table 11-9** below for an estimate of the proposed reduction in the surface/foul/combined discharge rates in a 1:100 year return period event. The results take into account the impact of climate change on rainfall peaks based on the latest EA Climate Change Guidance.

Table 11-9 - Water Discharge Rates Pre- and Post-Development

Discharge Rate	Pre-development (l/s)	Post-development (l/s)
Surface Water	479.4	182.77
Foul Water	5.63	27.82
Combined Water	485.03	210.59

11.8.53. Although there is a significant reduction in the proposed discharge rate, this would have a limited impact on the wider public drainage network; therefore, the magnitude of change, prior to mitigation, is predicted to be low. The sensitivity of TW's Sewerage Network is low. This would result in a direct, permanent, long-term **Negligible to Minor positive** effect on TW's Sewerage Network, prior to the implementation of mitigation measures, and therefore **not significant.**

Mitigation

11.8.54. No additional mitigation required other than the in-built mitigation.

Residual Effect

11.8.55. As no mitigation is required, residual effects will remain as reported above.

11.9. LIMITATIONS AND ASSUMPTIONS

- All of the existing land uses adjoining the Site remain.
- All construction work is undertaken under normal hours as specified by LBL.
- It is assumed that a CEMP will be secured by condition and will be developed and implemented for the Demolition and Construction stage with approval from LBL prior to works commencing.
- It is assumed that the Outline Drainage Strategy, which details the level of protection for surface water discharge, is adopted in the Operation stage of the development.
- The description in **Chapter 4 The Proposed Development** and assessments are based upon the layout plans and schedules submitted as part of the planning application.
- Construction activities will be as outlined in **Chapter 5 Demolition and Construction**, submitted as part of the planning application.

11.10. SUMMARY

11.10.1. This ES chapter has assessed the potential effects of the Proposed Development, on water resources, flood risk and drainage, during the Site preparation, demolition and construction stage and the operational stage. The baseline conditions of the Proposed Development have also been discussed.

11.10.2. The Site is located in the Lambeth area of London. The Site is broadly 100mm to 300mm above the existing carriageway levels. Superficial deposits (River Terrace Deposits) have been found during Site investigations and groundwater has been found in limited quantities, however the Site comprises

existing basements, and therefore permeable layers will have been removed, thus limiting the amount of groundwater.

11.10.3. The River Thames is located 30m west of the Site and is a Main River managed by the EA. There are public combined sewers surrounding the Site and it is presumed that the Site drains both surface water and foul water into the public sewer network.

11.10.4. Thames Water (the water supplier within the Lambeth area) has confirmed that the Proposed Development can be catered for in terms of Proposed Development water demands.

11.10.5. The Site has been assessed as having low to negligible risk of flooding from all potential sources.

11.10.6. A surface water drainage strategy (**Appendix 11.1**) which protects the Site from surface water flooding in the 1:100 year return period event plus 40% climate change allowance is proposed in line with current regulation and best practice. The surface water runoff will be reduced by 50% for 1:1, 1:30 and 1:100 year return period events, as agreed with LBL. TW have not highlighted an issue with the Proposed Development's flow rates. A FWEP (**Appendix E of Appendix 11.1**) has been produced to provide an evacuation route, for the most vulnerable residents of the Site, in case of the extreme catastrophic flood event.

11.10.7. The assessment of effects, mitigation and residual effects have been made in Section 11.9 and concludes that significant effects of/on the Proposed Development have been assessed in relation to flood risk, water supply, and the public sewerage systems. All effects are classed to be **not significant.**

Table 11-10 - Summary of Effects for Water Resources, Flood Risk and Drainage

Description of Significant Effects	Receptor	Significance of Effects					Summary of Mitigation / Enhancement Measures	Significance of Residual Effects				
		Major / Moderate / Minor / Negligible	Positive / Negative	P / T	D / I	ST / MT / LT		Major / Moderate / Minor / Negligible	Positive / Negative	P / T	D / I	ST / MT / LT
Demolition and Construction												
Flood Risk	Construction workers	Minor	Negative	T	D	MT	None additional required.	Minor	Negative/Positive	T	D	MT
	Residents and Occupants of the Surrounding Area	Negligible	N/A	T	D	MT	None additional required	Negligible	N/A	T	D	MT
Water Demand	TW Water Supply System	Negligible to Minor	Positive/ Negative	T	D	MT	None additional required	Negligible to Minor	Positive/ Negative	T	D	MT
Drainage Quantity and Quality	TW Sewerage Network	Negligible to Minor	Negative	T	D	MT	None additional required	Negligible to Minor	N/A	T	D	MT
Operation												
Flood Risk	Site Occupants	Minor	Negative	P	D	LT	Flood Warning and Evacuation Plan (Appendix 11.1)	Minor	Negative	P	D	LT
	Residents and Occupants of the Surrounding Area	Negligible	N/A	P	D	LT	None required	Negligible	N/A	P	D	LT

Description of Significant Effects	Receptor	Significance of Effects					Summary of Mitigation / Enhancement Measures	Significance of Residual Effects				
		Major / Moderate / Minor / Negligible	Positive / Negative	P / T	D / I	ST / MT / LT		Major / Moderate / Minor / Negligible	Positive / Negative	P / T	D / I	ST / MT / LT
Water Demand	TW Water Supply System	Minor	Negative	P	D	LT	None required	Minor	Negative	P	D	LT
Drainage Quantity	TW Sewerage Network	Negligible to Minor	Positive	P	D	LT	None required	Negligible to Minor	Positive	P	D	LT

Key to table:

P / T = Permanent or Temporary, D / I = Direct or Indirect, ST / MT / LT = Short Term, Medium Term or Long Term

N/A = Not Applicable

11.11. REFERENCES

Ref. 11.1 European Commission. (2000), The Water Framework Directive 2000/60/EC.

Ref. 11.2 HM Government (2003) The Water Environment (Water Framework Directive) (England and Wales) Regulations, 2003.

Ref. 11.3 HM Government (2009), The Flood Risk Regulations 2009.

Ref. 11.4 HM Government (1991), The Water Resources Act 1991.

Ref. 11.5 HM Government (1995), The Environment Act 1999.

Ref. 11.6 HM Government (1995), The Water Act, 2003.

Ref. 11.7 HM Government (2014), The Water Act, 2014.

Ref. 11.8 HM Government (1995), The Anti-Pollution Works Regulations, 1999.

Ref. 11.9 HM Government (1995), The Water Industry Act, 1991.

Ref. 11.10 HM Government (1995), The Land Drainage Act,1991.

Ref. 11.11 HM Government (1995), The Flood and Water Management Act, 2010.

Ref. 11.12 HM Government (2015) (The Environmental Damage (Prevention and Remediation (England) (Amendment) Regulations 2015.

Ref. 11.13 HM Government (2010) Environmental Permitting (England and Wales) Regulations 2010.

Ref. 11.14 HM Government, (2016); Environmental Permitting (England and Wales) Regulations 2016.

Ref. 11.15 Communities and Local Government, 2019, “National Planning Policy Framework” NPPF.

Ref. 11.16 Department for Environment, Food and Rural Affairs (2015); "Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems. March 2015”.

Ref. 11.17 Communities and Local Government, 2015), “Flood Risk and Coastal Change - ‘Planning Practice Guidance’.

Ref. 11.18 Communities and Local Government, 2015), “Water Supply, Wastewater and Water Quality - ‘Planning Practice Guidance’.

Ref. 11.19 Greater London Authority (2016), The London Plan: Spatial Development Strategy for Greater London (Adopted March 2016) (Minor Alterations to the London Plan).

Ref. 11.20 London Borough of Lambeth, (2015), *Lambeth Local Plan.*

Ref. 11.21 London Borough of Lambeth, (2015), *Preliminary Flood Risk Assessment.*

Ref. 11.22 London Borough of Lambeth, (2015), *Strategic Flood Risk Assessment.*

Ref. 11.23 London Borough of Lambeth, (2015), *Surface Water Management Plan.*

Ref. 11.24 London Borough of Lambeth, (2015), *Sequential Test Document.*

Ref. 11.25 London Borough of Lambeth, (2015), *Local Flood Risk Management.*

Ref. 11.26 HM Government, (2008); Future Water – The Government's Water Strategy for England.

Ref. 11.27 CIRIA, (2015); The SuDS Manual (2015).

Ref. 11.28 Thames Water (2014) Final Water Resources Management Plan (WRMP) 2015 – 2040.

Ref. 11.29 Water Research Centre, (2012); Sewers for Adoption 7th Edition.

Ref. 11.30 Department for Transport, (2014); TAG Unit 3 Environmental Impact Appraisal.

Ref. 11.31 Design Manual for Roads and Bridges (2009) Volume 11, Section 3, Part 10 Road Drainage and the Water Environment.

Ref. 11.32 Environment Agency, (2013); PPG1, Understanding Your Environmental Responsibilities.

Ref. 11.33 Environment Agency, (2011); PPG2, Above ground oil storage tanks.

Ref. 11.34 Environment Agency, (2006); PPG3, Choosing and using oil separators: prevent pollution.

Ref. 11.35 Environment Agency, (2006); PPG4: Treatment and disposal of sewage where no foul sewer is available.

Ref. 11.36 Environment Agency, (2007); PPG5: Works in, near or over or over watercourses: prevent pollution.

Ref. 11.37 Environment Agency, (2012); PPG6: Construction and demolition sites: prevent Pollution.

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