
Flood Risk Assessment for the Proposed Peaking Power Generation Plant Development at Blendworth Hampshire

Final Report

Prepared for Rydberg Development Company Ltd

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CONTENTS	Page
ABBREVIATIONS	III
UNITS	IV
EXECUTIVE SUMMARY	V
1 INTRODUCTION	1
1.1 General	1
1.2 Proposed Development	1
1.3 Objectives and Scope	1
1.4 Methodology	2
1.5 Flood Studies and Related Guidance	2
1.6 Other Sources of Information	3
1.7 Consultation	3
2 SITE DESCRIPTION AND DEVELOPMENT PROPOSALS	4
2.1 Description of the Development Site	4
2.2 Description of the Proposed Development for Flood Risk Purposes	5
2.3 Physical Characteristics of the Development Site	7
2.4 Surface Water Runoff Assessment	10
3 SOURCES OF FLOODING	12
3.1 Introduction	12
3.2 Fluvial Flooding	12
3.3 Pluvial Surface Water Flooding	12
3.4 Groundwater Flooding	12
3.5 Upstream Lakes and Ponds	13
3.6 Flooding from Sewers	13
3.7 Reservoir and Canal Breach	13
3.8 Other Sources of Flooding	13
4 FLOOD RISK ASSESSMENT	14
4.1 Introduction	14
4.2 Flood Risk	14
4.3 Flood Risk to Development	14
4.4 Effect of the Development on Surrounding Land and Property	15
4.5 Surface Water Disposal	15
5 MITIGATION	18

5.1	Summary	18
5.2	Design and Construction	18
5.3	Pollution Prevention at the Plant Compound	18
5.4	Residual Flood Risk	19
6	CONCLUSIONS AND RECOMMENDATIONS	21
6.1	Conclusions	21
6.2	Recommendations	21
	REFERENCES	22

TABLES

Table 0	FRA Summary	v
Table 1	Areas of Proposed Residential Development Site	6
Table 2	Soil Associations at the Site	7
Table 3	Local Hydrological and Design Data	10
Table 4	Estimated Greenfield Runoff Rates	10
Table 5	Assessment of Potential Sources of Flooding	12
Table 6	Surface Water Storage Requirement for Plant Compound	17
Table 7	Proposed Mitigation Measures	20

FIGURES

Figure 1	Site Location.....	4
Figure 2	Groundwater Protection Zone Map	9

APPENDICES

Appendix A	Flood Maps and Flood Data
Appendix B	Proposed Site Layout
Appendix C	Commercial Drainage and Water Search Results

ABBREVIATIONS

AEP	Annual (flood) Exceedance Probability
AOD	Above Ordnance Datum
BGS	British Geological Survey
CFMP	Catchment Flood Management Plan
CLG	Communities and Local Government
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
FSR	Flood Studies Report
GL	Ground Level
LCC	Leicestershire County Council
LiDAR	Light Detection and Ranging
MHWS	Mean High Water Spring Tide
MLWS	Mean Low Water Spring Tide
MW	Mega Watts
NGR	National Grid Reference
NPPF	National Planning Policy Framework
OD	Ordnance Datum (Newlyn)
PPS25	Planning Policy Statement 25
RBMP	River Basin Management Plan
SAAR	Standard Period Mean Annual Rainfall
SFRA	Strategic Flood Risk Assessment
STOR	Short Term Operational Reserve
UKCP	United Kingdom Climate Plan

UNITS

d	days
ha	hectares
l	litres
l/s	litres per second
l/s/ha	litres per second per hectare of surface area
m	metres
s	seconds
y	years

EXECUTIVE SUMMARY

Encora Energy on behalf of Rydberg Development Company Ltd commissioned Archon Environmental Consultants (Archon) to develop a flood risk assessment for a proposed power station development on land off the B2149 near Blendworth, Hampshire (Site). The proposed development is a peaking power generation plant (Short Term Operational Reserve or STOR) with a generation capacity of 20MW.

The total development area is approximately 2.34 ha, comprising a plant compound area of 0.33ha and an access track and undeveloped area surrounding the plant compound of 2.01ha.

This Flood Risk Assessment (FRA) comprises an assessment of the risk to the development from flooding and the effects of the development on flood risk to land and property in its vicinity. This report was developed in accordance with Communities and Local Government: National Planning Framework (NPPF), and the associated Technical Guidance (NPPF Technical Guidance). Existing land uses, historical development, drainage patterns, flood levels and potential impact are considered. Recommendations are made for reducing flood risk.

The Environment Agency's map of the Risk of Flooding from Rivers and Sea (RoFRaS) classifies the risk of flooding at the site as Very Low. According to the Agency's Flood Map for Planning purposes, the site of the proposed development is situated in Flood Zone 1, representing areas of land at low risk from a fluvial flood with an annual probability of occurring of 0.1% or less (0.1% AEP). The risk of flooding from pluvial and groundwater sources was assessed as low.

No other potential sources of flooding were identified.

Table 0 provides a summary of the FRA findings.

The NPPF requires that development is steered to areas with lower flood risk. The proposed development is considered appropriate in Flood Zone 1. For the purposes of the Sequential Test, it is appropriate to classify the proposed development as Essential Infrastructure under Table 2 of CLG 2012b.

Table 0 FRA Summary Findings

Factor	Description	Mitigation (where relevant)
Development	STOR power station	
Site Description	Agricultural land	
Development site areas:		
Total area	2.34 ha	
Total new impermeable at plant compound	0.33 ha	
Access track and other areas outside the compound	2.01	

Topographic Information	Site elevation: nominally 41.8 to 46.2m OD; slope to SSW.	
Design life	50 years	
Risk of fluvial flooding	Less than 0.1% AEP.	
Flood Zone for Planning	Flood Zone 1	
Flood Defences	Currently not defended	Not required.
Tidal Flooding	No risk.	Not required
Fluvial Flooding	Very Low risk.	Not required
Surface water flooding	Negligible risk.	Standard drainage system requirements.
Groundwater flooding	Low risk of groundwater flooding at the Site	Not required.
Principal flood risk	Fluvial	
Safe Refuge	Not required	Not required.
Safe Access and Egress	In Flood Zone 1.	Not required.
Design Formation Levels	No specification required.	

1 INTRODUCTION

1.1 General

Rydberg Development Company Limited commissioned Archon Environmental Consultants (Archon) to develop a flood risk assessment for a proposed peaking power generation plant development on land off the B2149 near Blendworth, Hampshire (Site) together with an associated access route adjacent to an existing Forestry Commission track (access track).

The plant site compound will occupy an area of approximately 0.33 ha and is likely to be mostly or entirely hard surfaced. In addition, there is an access route off the B2149 adjacent to an existing Forestry Commission track, together with an area around the plant compound.

This Flood Risk Assessment comprises an assessment of the risk to the development from flooding and the effects of the development on flood risk to land and property in its vicinity. This report was developed in accordance with: Communities and Local Government: *National Planning Framework* 2012 (NPPF). Existing land uses, historical development, drainage patterns, flood levels and potential impact are considered. Recommendations are made for reducing flood risk.

The main flood risk at the Site is from fluvial flooding from nearby minor watercourses, although this risk is Very Low. According to the Environment Agency's Flood Map for Planning, the proposed development is situated within Flood Zone 1, representing areas of land at risk from fluvial flood with an annual probability of occurrence of 0.1% or less.

The NPPF requires that all planning applications for development sites >1ha should be accompanied by a FRA, demonstrating how flood risk from all sources of flooding will be managed now and taking into account any effects due to climate change. This report provides the required assessment.

1.2 Proposed Development

The proposed development comprises a peaking power generation plant to be built on a site with a total area of approximately 0.33 ha of previously undeveloped land, together with an access track which is approximately 1.7 km long.

1.3 Objectives and Scope

The objective of this report is to satisfy the requirements of FRA under CLG 2012 for the proposed development.

This FRA covers the following aspects:

- Description of the existing site and the proposed development (*Section 2*);

- Description of potential sources of flooding (*Section 3*);
- An assessment of flood risk to the development and the effect of the development on flood risk in the surrounding area (*Section 4*);
- Recommended mitigation measures (*Section 5*), and,
- Conclusions and Recommendations (*Section 6*).

1.4 Methodology

This assessment comprised the following studies:

- Desk study to gather land use, historical development, hydrological, geological, hydrogeological and flood risk information for the site.
- Review of relevant flood studies for the region and local area.
- Assessment of the effects of tidal, fluvial, pluvial and other potential sources of flooding on the proposed development.
- Development of mitigation measures for the development.
- Development of conclusions and recommendations.

1.5 Flood Studies and Related Guidance

Guidance Consulted in the Preparation of this FRA

The following flood studies and guidance were consulted in the preparation of this FRA:

- CLG 2012a “*National Planning Policy Framework*”, Communities and Local Government, March 2012 (NPPF).
- CLG 2012b “*National Planning Policy Framework – Technical Guidance*”, Communities and Local Government, March 2012 (NPPF Technical Guidance).

National Planning Policy Framework

In October 2006 the UK government issued new guidance on the likely effects of climate change, taking into account the latest findings from the UK Climate Impacts Programme (UKCIP). This was incorporated in Planning Policy Statement 25 PPS25, CLG 2010a, originally published in December 2006 to replace Planning Policy Guidance 25 (PPG25) which was published in 2001.

A revision to PPS25 was published in March 2010. Tables D1 and D2 in Annex D were revised to clarify the definition of functional floodplain, and

to amend how the policy is applied to essential infrastructure in flood risk areas, including water treatment works, emergency services facilities, installations requiring Hazardous Substances consent and wind turbines.

PPS25 has since been replaced by the NPPF, CLG 2012a.

1.6 Other Sources of Information

In addition to the flood studies listed in *Section 1.5* the following sources of information were used in the preparation of this report:

- Results of flood data and mapping searches using the emapsite proprietary database, www.emapsite.com.
- Results of a soil data search using the National Soils Resources Institute Site Soils Reporter service.
- Results of a Commercial Drainage (CON29) search using Southern Water Ltd's search enquiry service.

1.7 Consultation

No regulator consultation was carried out during the preparation of this report.

2 SITE DESCRIPTION AND DEVELOPMENT PROPOSALS

2.1 Description of the Development Site

2.1.1 Site Location

The proposed development site is located on land near Blendworth between the A3(M) to the west and the B2149 to the east, see *Figure 1*. The site is centred on National Grid Reference (NGR) SU 7082 1046.

The Site is located in the Havant Borough Council local authority area. The majority of the proposed access track is in the East Hants District Council area.

The Lead Local Flood Authority (LLFA) is Hampshire County Council.

The local water utility for water supply and sewerage is Southern Water Ltd.

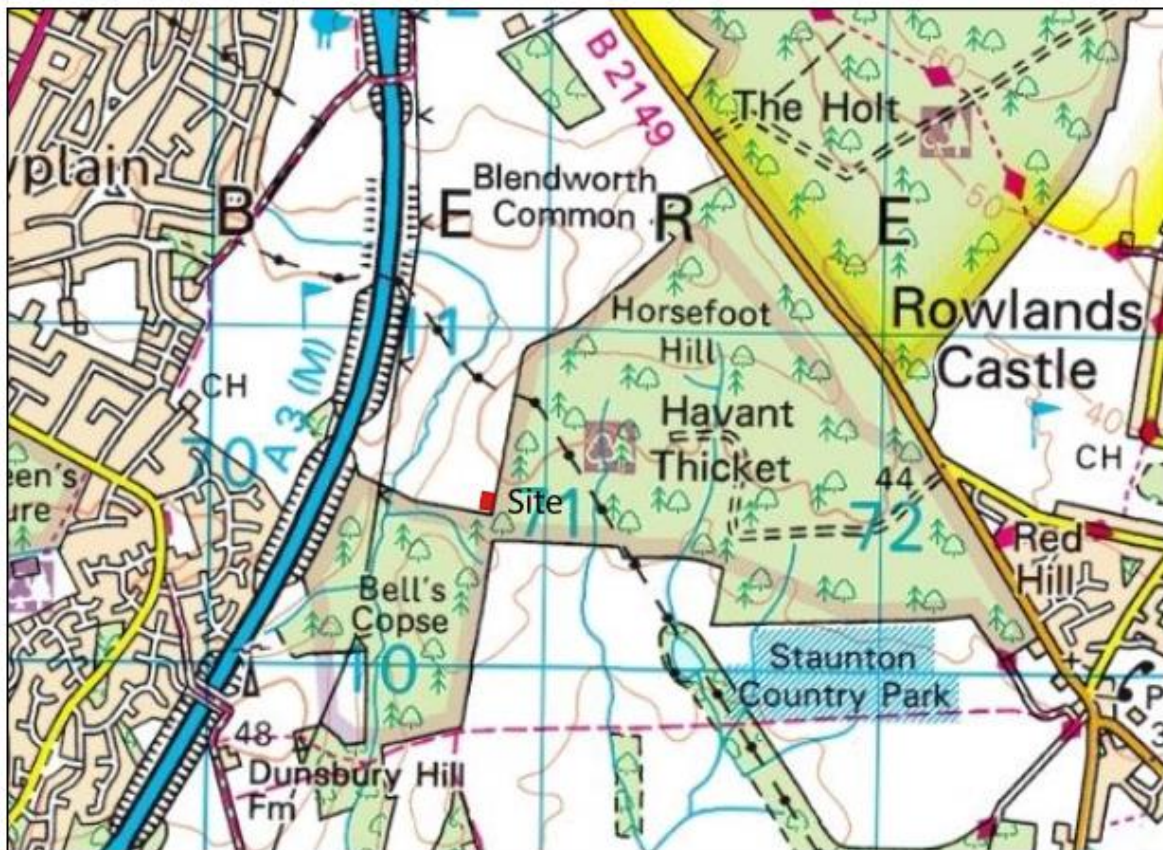


Figure 1 Site Location

2.1.2 Current Land Use

The Site is currently undeveloped land in agricultural use.

2.1.3 Adjacent Land Use

Adjacent land use comprises Forestry Commission land to the east and south, and land in similar agricultural use to the north and west. The A3(M) is located 500m to the west.

2.1.4 Topography

Topographic data was obtained from the Next Map Britain 2m interval topographic data service. Vertical accuracy of the Next map 2m dataset is $\pm 0.6\text{m}$.

Topographic elevation varies from approximately 41.8m OD in the south west corner of the site to approximately 46.2m OD in the north east corner of the Site. The land surface at the Site slopes in the south south westerly (SSW) direction.

2.1.5 Existing Site Access

Access to the site is currently via a Forestry Commission unsurfaced track approximately 1.7 km long.

2.1.6 Existing Drainage

There are no existing drainage systems at or near the Site, see Appendix C.

2.2 Description of the Proposed Development for Flood Risk Purposes

2.2.1 General Description

Planning consent is sought for construction of a peaking power generation plant at the Site, together with the associated access route. The power station will comprise 10 No. gas fired engine-driven electricity generation sets. The associated infrastructure will include gas reception and metering facilities, lubricating oil storage, transformers, electrical switchgear, internal roads and pathways, and vehicle turning and parking areas.

The plant compound will be enclosed within acoustic fences.

The layout of the proposed development is shown on Figures B1 and B2 in Appendix B.

Development will result in partial covering of the Site by impermeable surfacing including buildings, plant on concrete bases, and roads and other paved areas. These areas will be connected to a surface water drainage system.

Access will be via a new track that will partly be constructed adjacent to the west side of the existing Forestry Commission track situated to the west and north of Havant Thicket with the access on to the B2149 approximately 400m north of Havant Thicket.

- 2.2.2** The new access track would be segregated from the existing Forestry Commission track by an existing native hedgerow. The access track would be 1.7km long by 5m wide, within a red line boundary allowance of 8m width, resulting in an area of about 1.16ha within EHDC, and about 0.27ha in HBC. The track would be gravel surfaced, similar in appearance to an agricultural field track. A no-dig construction method would be adopted using a geotextile membrane to spread the weight of vehicles using the track and to avoid damage to the roots of adjacent existing trees. This method would be adopted on the length of the track which lies adjacent to the ancient woodland designation, and then intermittently depending on the occurrence of mature field trees in the adjacent hedgerow to the proposed track.

Table 1 provides the area of the Site and access track together with the approximate area of impermeable surfaces that will drain to the Site drainage system.

Table 1 Areas of Proposed Residential Development Site

Sub-Division	Approximate Areas (ha)
Buildings and structures on hard standing, internal roads, parking areas and other impermeable surfaces within the plant compound drained to Site drainage system.	0.33
Landscaping and permeable cover around plant compound, not connected to Site drainage.	2.01
Access track including widened area at entrance to plant compound, separately drained.	
Total Area	2.34

2.2.3 Design Life of Proposed Development

For flood risk assessment purposes it was assumed that the proposed development will have a design life of 50 years, from 2017 to 2067.

2.2.4 Assessment under NPPF – Sequential and Exception Tests

The NPPF requires Local Authorities to apply the Sequential Test in consideration of new development. The purpose of the Sequential Test is to direct new development to areas with lower probability of flooding.

The Site is located in Flood Zone 1, where there is a low risk of flooding and is therefore compatible with the proposed development under the Sequential Test.

For the purposes of the Sequential Test, it is appropriate to classify the proposed development as Essential Infrastructure under Table 2 of CLG 2012b and compatible with Flood Zone 1.

There is no requirement under the NPPF to apply the Exception Test for development in Flood Zone 1.

2.3 Physical Characteristics of the Development Site

2.3.1 Soils, Geology and Hydrogeology

This sub-section provides a summary of soils, geology and hydrogeology at the Site.

Soils

According to the National Soils Institute Site Soils Planner data search, the natural soils at and in the vicinity of the Site comprise Wickham 4 soil association, derived from the underling London Clay, see *Table 2*. The same soils would be present beneath the Forestry Commission access track, unless they were removed or disturbed during construction of the track and will be present beneath the proposed access track.

Table 2 Soil Associations at the Site

Site Location	Soil Type Reference	Soil Association	Soil Description
Development Site	711h	Wickham 4	<i>Slowly permeable seasonally waterlogged fine loamy over clayey and fine silty over clayey soils associated with similar clayey soils often with brown subsoils</i>
Access Track	711h	Wickham 4	As Site

The hydrological classifications for the natural soils at the site are as follows:

- Hydrology of Soil Types (HOST) classification (IH124, IH 1995): Class 25 *Slowly permeable, seasonally waterlogged soils over impermeable clay substrates with no storage capacity.*
- Standard Percentage Runoff (SPR): 0.5 (IH124, IH 1995)
- Base Flow Index (BFI): 0.17

The Ground Water Protection Policy leaching class classification is

- L - *Soils in which pollutants are unlikely to penetrate the soil layer either because water movement is largely horizontal or because they have a large ability to attenuate diffuse source pollutants.*

Geology

According to British Geological Survey (BGS) geological mapping there are no superficial deposits at the Site and the surface bedrock is London Clay. The London Clay comprises firm to stiff, silty clays.

The London Clay is underlain by the Lambeth Group and below that by the Chalk.

The nearest boreholes to the Site for which records are available from BGS are located 350m east and 400m north west of the Site. The borehole to the east of the Site proved 8m of firm to stiff silty clay, and the borehole 400m north west of the site proved 10m of silty, firm to stiff clay.

Hydrogeology

The Site is directly underlain by a Non-aquifer, the London Clay, with a Principal Aquifer, the Chalk, present at depth beneath the Site.

The London Clay and underlying Lambeth Group provide adequate surface cover to protect the underlying Chalk aquifer from most or all surface-derived pollution incidents.

The Chalk is used for public water supply (PWS) in the vicinity of the Site.

The Site is within the Inner Source Protection zone for Subsurface Activity (Zone 1c) of the PWS sources in the Chalk aquifer, see *Figure 2*. This would place restrictions on intrusive works that can be carried out at the Site including piled foundations, tunnelling and investigation boreholes.

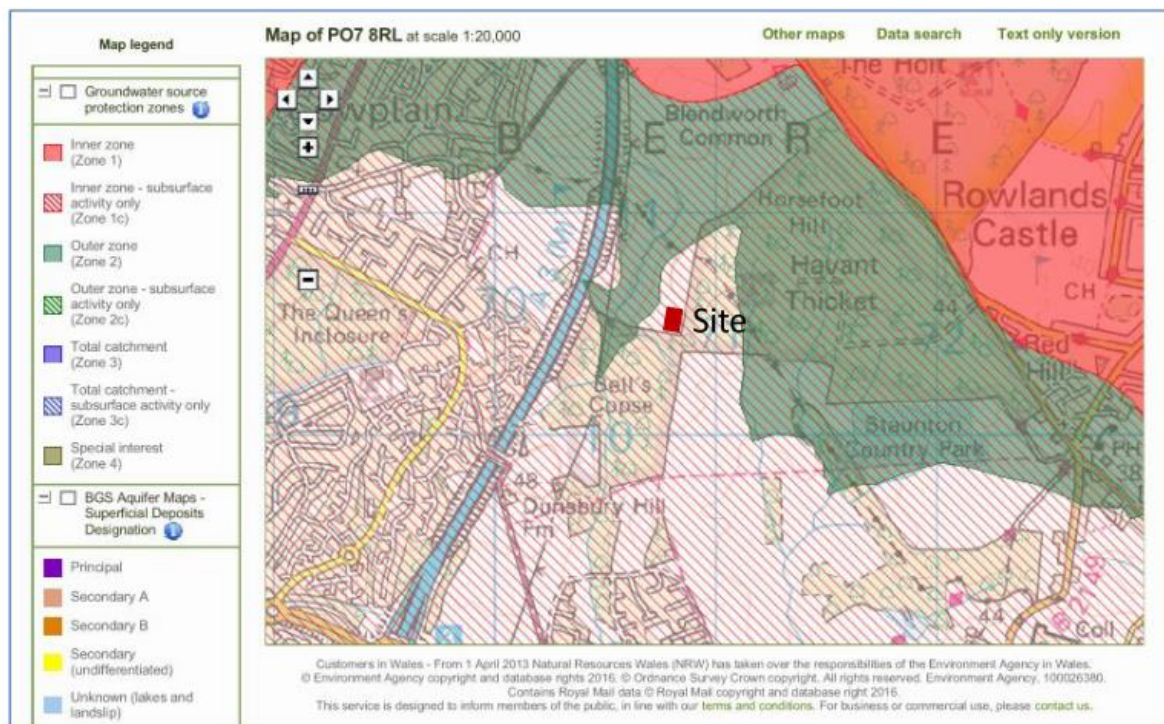


Figure 2 Groundwater Protection Zone Map

2.3.2 Hydrological Setting and Flood Risk

General

The Site is located in the catchment of the Hermitage Stream, which runs from a catchment area west of Waterlooville to its estuary at Havant.

The Site is located in Flood Zone 1.

Watercourses at the Site

There are no watercourses within the Site boundaries.

A small unnamed surface watercourse is located 200m west of the Site, running north to south, see *Figure 1* and *Figure A7* in Appendix A. This watercourse joins the Hermitage Stream approximately 2.5 km south of the Site.

The nearest watercourse to the Site is a drainage ditch which is located to the south of the Site and is 50m from the SW corner of the Site at the closest point; this ditch discharges to the surface watercourse west of the Site.

Local Hydrological and Design Data

Hydrological data for the Site are listed in *Table 3*.

Table 3 Local Hydrological and Design Data

Parameter	Value
Hydrological Region	7
Standard Annual Average Rainfall (SAAR)	799mm
M5-60 Rainfall Depth ¹	20 mm
SPR used for runoff calculation	0.47
Climate Change Factor	1.3 (+30%)

¹ The 5 year 60 minute depth of rainfall

2.3.3 Existing Defences

The site is not protected by any flood defences.

2.3.4 Historical Flood Events

According to the search results there are no records of historical flooding at or near the Site.

2.3.5 Existing Drainage Systems

There are no drainage systems currently installed at the Site.

2.4 Surface Water Runoff Assessment

The IH 124 method, IH 1994, was used to estimate greenfield runoff from the Site and access track in its present condition, based on HOST soil type 25. These estimates are provided in *Table 4*. These estimates were made without any allowance for climate change.

Table 4 Estimated Greenfield Runoff Rates

Return Period (years)	Greenfield Runoff (l/s)			Greenfield Runoff (l/s/ha)		
	1 in 1	1 in 30	1 in 100	1 in 1	1 in 30	1 in 100
Plant Compound (0.33 ha)	1.5	4.2	5.8	4.7	12.6	17.4
Access Track and area around plant compound (2.01 ha)	8.3	13.0	36.1	4.8	13.0	18.0

Greenfield runoff rates were estimated by running the IH 124 method using two alternative calculations:

1. Directly using actual site areas indicated in Table 4.

2. By setting the impermeable area to a value >50 ha and then adjusting the calculated runoff rate pro rata by area, as recommended by Environment Agency 2013.

The resultant runoff rates from the two method differed by small margins and within the accuracy of the estimation method. The rates listed in Table 4 were derived by Method 2 above.

3 SOURCES OF FLOODING

3.1 Introduction

Table 5 summarises potential sources of flooding and their significance to the proposed development.

The risk of flooding and mitigation measures are discussed respectively in Sections 4 and 5.

Table 5 Assessment of Potential Sources of Flooding

Source	Description	Requires further Assessment
Tidal	No tidal waters in vicinity	No risk to Site.
Fluvial: Streams and Rivers	Watercourses south and west of Site. Flood Zone 1.	No risk to Site.
Pluvial Flooding - surface runoff	Low risk according to JBA mapping, see Appendix A.	No risk to Site.
Groundwater	London Clay non-aquifer. Low risk according to BGS mapping, see Appendix A.	No risk to Site.
Upstream Lakes / Ponds	There are no upstream lakes or ponds of any significance on watercourses in the vicinity of the Site.	No risk to Site.
Sewers	According to CON29 search there are no sewers at the Site	No risk to Site.
Reservoirs	There are no upstream reservoirs or canals on watercourses near the Site. No risk according to search results, see Appendix A.	No risk to Site.
Canals		No risk to Site.
Other	None identified	No risk to Site.

3.2 Fluvial Flooding

The Site and the access track are located in Flood Zone 1, see Figures A1 and A2 in Appendix A.

3.3 Pluvial Surface Water Flooding

According to modelling by JBA Consulting, Appendix A, surface water modelling indicates there is a low risk of pluvial flooding at the Site, see Figure A3 in Appendix A.

There may be a local risk of surface water flooding of the access track.

3.4 Groundwater Flooding

The Site is directly underlain by London Clay, which is a Non-aquifer formation with low permeability. Therefore there is a low risk of groundwater flooding.

Furthermore, the Site is not susceptible to groundwater flooding according to British Geological Survey (BGS) mapping, see Figure A4 in Appendix A.

3.5 Upstream Lakes and Ponds

There are no upstream lakes or ponds of any significance on the watercourses to the west and south of the Site.

There are no upstream lakes or ponds of any significance on the watercourses that are in the vicinity of the access track.

3.6 Flooding from Sewers

There are no sewers at or near the Site according to Southern Water records as disclosed by the CON29 Commercial search results.

3.7 Reservoir and Canal Breach

There are no reservoirs or canals on water courses in the vicinity of the Site or access track and therefore no flood risk associated with either. According to JBA canal breach mapping, Appendix A, there is no risk of flooding at the Site due to canal breach.

3.8 Other Sources of Flooding

No other sources of flooding were identified that would affect the Site or the access track.

4 FLOOD RISK ASSESSMENT

4.1 Introduction

This section provides a review and assessment of:

- Flood Risk
- Risk of flooding of the Site.
- Potential effects of the development on surrounding land and property.

4.2 Flood Risk

The Site is at low to negligible risk of flooding from all plausible sources of flooding, including fluvial, surface water, groundwater and upstream lakes/ponds. No potential sources of sewer, reservoir or canal flooding were identified.

The access track may be at risk of local surface water flooding. This would be dealt with by provision of appropriate road drainage if the track were to be surfaced with impermeable tarmac or similar material. The submitted proposal that the access track would be gravel surfaced, similar in appearance to an agricultural field track. A no-dig construction method would be adopted using a geotextile membrane to spread the weight of vehicles using the track and to avoid damage to the roots of adjacent existing trees. This method would be adopted on the length of the track which lies adjacent to the ancient woodland designation, and then intermittently depending on the occurrence of mature field trees in the adjacent hedgerow to the proposed track.

4.3 Flood Risk to Development

4.3.1 Flood Risk - Construction Phase

There is a low risk of inundation of the proposed development Site during construction. No mitigation measures are required.

4.3.2 Flood Risk - Post-Construction

Key findings relevant to the proposed development are:

- The proposed development is Essential Infrastructure within the terms of NPPF, see Table 2 of CLG 2012b.
- The risk of flooding from Rivers is classified by the Environment Agency as Very Low (less than 0.1% AEP).
- The development site is in Flood Zone 1 according to Environment Agency Planning Maps.

- The Site and access track are locally at risk of flooding from fluvial sources, during flood events rarer than 1% AEP.

No mitigation measures are required other than appropriate surface water drainage systems.

4.4 Effect of the Development on Surrounding Land and Property

Surface Water Management

Construction of the proposed plant compound will result in an increase in runoff compared to greenfield runoff. Surface water runoff will require management in accordance with current Environment Agency guidance including Environment Agency 2013 and 2010.

Mitigation of additional surface water discharge potentially generated by the proposed development is considered in Section 5.

4.5 Surface Water Disposal

Surface Water Disposal Options

There is a need to manage surface water runoff from the proposed development so that it does not increase flood risk to the development itself, to surrounding properties or river systems into which surface water is discharged.

The following surface water disposal options were considered:

1. Soakaways, swale and other infiltration systems.
2. Watercourse (in conjunction with on-site surface water storage).
3. Connection to an existing public surface water sewer with or without on-site storage.

Infiltration systems: Ground conditions are characterised by low permeability London Clay and overlying clay soils derived from London Clay. Soakaway and infiltration systems will have limited capacity to accept surface water flows. It is considered unlikely that infiltration systems will be feasible to control stormwater from the plant compound due to the limited area available at the Site for soakaways or swales. Soakaways and/or swales should be feasible for control of runoff from the access track if this is hard-surfaced.

Watercourse: A watercourse is available approximately 100m west of the Site, and there is a smaller drainage ditch to the south of the Site. Discharge to watercourse is a feasible option for surface water management at the Site subject to consent from the Environment Agency or LLFA. However, to

comply with Environment Agency guidance it would be necessary to provide surface water storage at the Site to attenuate the discharge to a prescribed rate as described below.

Sewer: There are no public sewers in the vicinity of the Site and access track, see Appendix C. Therefore Option 3 is not feasible.

Therefore the recommended systems for surface water disposal are as follows:

Plant Compound: Discharge to watercourse at a controlled rate. On-site surface water storage will be required.

Access track: (if hard-surfaced): discharge to local soakaways and/or swales.

Consent Requirement

Consent would be required from the Environment Agency (or the LLLFA if the watercourse is an Ordinary watercourse) to discharge to any local watercourse.

Consent would be required from Southern Water Ltd for discharge to a public sewer.

Surface Water System Design

The surface water disposal system for the proposed plant compound will be designed generally in accordance with Environment Agency Surface Water Guidance Note No. 3, Environment Agency 2010, based on the following principles:

- New impermeable surface area will be limited to that needed for the proposed development. Surfaces not required for development will be covered in gravel or landscaped with vegetation to retain existing rainfall infiltration characteristics.
- Surface water will be discharged by one of three options described above, and most probably to watercourse.
- Water will be allowed to flood paved surfaces in a controlled manner, and will be routed away from buildings, other structures and emergency routes.
- As far as possible sufficient storage and infiltration capacity will be provided in the Site drainage system to contain rainfall events of $\leq 5\text{mm}$ such that no discharge occurs during such events (Interception Storage).
- Where attenuation storage is provided:

- The drainage system will be designed to contain the 1 in 30 storm event in the new subsurface drainage system with no surcharging. The design will be based on a range of summer and winter storms of duration 15 minutes to 7 days.
- The drainage system will be designed on the 1 in 100 storm event with 30% increase in peak rainfall to allow for climate change. The design will be based on a range of summer and winter storms of duration 15 minutes to 7 days, or on the 100 year 6 hour event. Surface water from storms with return periods longer than 30 years and up to 100 years will be contained on site but some surcharging of site drainage is acceptable, which may result in local accumulation of surface water on roads, car parking and other hard paved areas.

Surface Water Storage at the Site

Surface water should be discharged from the Site at a rate ideally no higher than 2 l/s and in any case no higher than the greenfield runoff rate, as required by Environment Agency guidance including Environment Agency 2013.

An estimate was made of the required attenuation storage required for the plant compound based on the greenfield runoff rates in *Table 4*, see *Table 6*.

Table 6 Surface Water Storage Requirement for Plant Compound

Storage Component	Storage Volume (m³)
Interception (rainfall events <5mm)	13.2
Attenuation	380.8
Total	394

This is a preliminary value based on a development area of 0.33ha and 100% impermeable surfacing discharged to the Site drainage system, and is based on limiting the discharge rate to 2 l/s. The required attenuation storage will change if the foregoing criteria are changed during detailed design of the development.

5 MITIGATION

5.1 Summary

Table 7 provides a summary of the proposed flood management and mitigation measures.

5.2 Design and Construction

General

The design life for flood risk assessment purposes is to 2067.

No development will take place within 9m of any watercourse, or within 9m of the landward toe of the bank where there is a water course with an embankment.

Surface Water Management – Plant Compound

Attenuation storage will be provided to limit discharge to 2 l/s or at a maximum of the pre-existing greenfield rate, and the following will apply:

- The drainage system will be designed to contain the 1 in 30 storm event in the new subsurface drainage system with no surcharging.
- The proposed stormwater system will be designed on the 1% AEP critical storm with climate change based on 30% increase in rainfall, in accordance with Environment Agency guidance¹.
- Excess water during storms rarer than 1 in 30 years will be stored on site temporarily. Excess water will be allowed to pond on paved surfaces in a controlled manner. As far as possible the on-site drainage system will be designed to prevent runoff in excess of the pre-existing greenfield rate to adjacent properties for storms up to the 1% AEP with climate change (1% AEP CC) event.

Surface Water Management – Access Track if Hard-Surfaced

Surface water will be disposed to local infiltration systems designed to contain the 1 in 30 storm event in the new subsurface drainage system with no surcharging.

5.3 Pollution Prevention at the Plant Compound

Pollution prevention measures will be included in the detailed design generally in accordance with Environment Agency guidance. The following standards will be achieved as a minimum:

¹ Environment Agency *Surface Water Guidance Note No. 3* dated 12 May 2010

Hard Paved Areas including all Plant, Roads and Car parking: Stormwater from these areas will be routed through oil interceptors, sized in accordance with drainage area.

Bulk oil storage including lubricating oil: Single skin tanks in bunds with 110% storage capacity or double skin tanks, in accordance with the Control of Pollution (Oil Storage) (England) Regulations 2001.

Other Oil and Chemical Storage: Oils and chemicals in drums, IBCs and smaller packaging will be stored in buildings or in external areas enclosed within secure fencing to ensure that containers remain secure during any future flood event. Oils and liquid chemicals will be stored in areas with secondary containment systems.

5.4 Residual Flood Risk

Residual flood risks to the protected development relate to the impact of flood events exceeding those considered in design:

- A fluvial flood event of greater magnitude than 0.1% AEP.
- Rainfall events exceeding the capacity of the on-site drainage system have the potential to cause localised flooding at the development Site.

Table 7 Proposed Mitigation Measures

Source	Source Description	Flooding Mechanisms	Probability	Consequences	Mitigation	Residual Risk
Fluvial:	Local water course	River flows out of bank	Low	Inundation of Site.	None required	Negligible
Pluvial: surface water	Accumulation of rainfall.	Rainfall intensity exceeds stormwater system capacity.	Moderate.	Local Ponding.	Design of site drainage system, .	Negligible
Groundwater	Seepage of groundwater to surface.	Increase in groundwater levels during flood event.	Low	Saturation of shallow soils.	None required.	Negligible

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The following conclusions have been made in the development of this FRA:

- The risk of flooding from rivers at the Site is assessed by the Environment Agency as “Very Low”, which means that the probability in any year of flooding from these sources has been assessed as less than 1 in 1000 (0.1%AEP).
- The Site is in Flood Zone 1 on the Environment Agency Flood Map for Planning.
- The risk of flooding from pluvial, groundwater and upstream lakes/ponds is low.
- No other potential sources of flooding were identified.
- Access to the Site will be in Flood Zone 1.
- The Site is within the Inner Source Protection zone for Subsurface Activity (Zone 1c) of the PWS sources in the Chalk aquifer. This will place restrictions on certain intrusive subsurface works including borehole drilling, piled foundations and tunnelling.
- The most appropriate method of surface water management at the plant compound is likely to be discharge to local surface water course with provision of storage to control the discharge rate.

6.2 Recommendations

The following recommendations are made:

- Surface water from the proposed plant compound should be discharged to on-site attenuation storage prior to controlled discharge to the nearby watercourse, subject to consent.
- The detailed design of the plant compound drainage system should, as far as possible, provide for (i) containment of the 1 in 30 year storm event in subsurface drainage systems without surcharge, (ii) surface water storage based on the 1 in 100 year critical storm event with climate change and (iii) discharge limited to 2 l/s or the pre-existing greenfield runoff rate as defined in Section 2.5 of this report.
- The Environment Agency should be consulted before any subsurface works involving significant intrusion into the London Clay or underlying formations are carried out.

REFERENCES

CLG 2012a *National Planning Policy Framework*. Communities and Local Government, March 2012.

CLG 2012b *National Planning Policy Framework – Technical Guide*. Communities and Local Government, March 2012.

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Environment Agency 2013 *Rainfall Runoff Management for Developments*. Environment Agency Report SC030219, October 2013.

Environment Agency 2012a *Flood Risk Assessment (FRA) Guidance Note 3. All development in Flood Zones 2 and 3 when standing advice does not apply*. Version 3.1 April 2012.

Environment Agency 2012b *Flood Risk Assessment (FRA) Guidance Note 1. Development greater than 1 Hectare (ha) in Flood Zone 1 (and Critical Drainage areas less than 1ha)*.

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