156 West End Lane

a2dominion

FLOOD RISK ASSESSMENT

June 2016

156 WEST END LANE

WEST HAMPSTEAD, LONDON

Project No. SE1229

Flood Risk Assessment

Prepared by:	Tim Trotman	Date: July 2015
Checked by:	Adam Griffiths	Date: July 2015
Approved by:	Tony Ruck	Date: July 2015

Report Issue

Revision	Date	Notes
Initial	July 2015	Initial Issue
Rev A	October 2015	Architects scheme proposals updated
Rev B	November 2015	Minor Amendments
Rev C	November 2015	Site Area Amended
Rev D	November 2015	Minor amendments
Rev E	May 2016	Development proposals updated
Rev F	May 2016	Drainage and Pro-Forma added to report

Contents

1.0 Introduction

This report has been amended to take into account the design changes made to the proposal following additional information requested by Camden Council.

1.1 Commission

A2Dominion Developments Limited commissioned Iesis Special Structures Ltd to prepare this Flood Risk Assessment (FRA) in relation to the proposed redevelopment of No 156 West End Lane in the London Borough of Camden, London. The redevelopment consists of the demolition of all existing buildings and redevelopment of the site to provide 163 mixed-tenure homes (Use Class C3), new floor space for town centre uses (Use Class A1, A2, A3, D1 or D2), new employment floor space (including four dedicated units for start-up businesses) (Use Class B1), a community meeting room and new and improved public open spaces, together with associated new landscaping, on-site access, servicing and disabled car parking.

1.2 Guidance

This Flood Risk Assessment has been compiled in accordance with the recommendations of the National Planning Policy Framework (2012) and the Planning Practice Guidance (2014).

1.3 SUDS Approving Bodies & Regional Policy

The Flood and Water management Act 2010 encourages the use of sustainable drainage in new developments and re-developments. The recommendations of the Flood and Water Management Act will be taken into consideration. Policy 5.13 of the London Plan (Mayor of London 2015) requires that surface water runoff is managed in a sustainable manner. These include a hierarchal approach to SuDS and *aim* to reduce flows back to greenfield run-off.

1.4 Aims and Objectives

The purpose of this FRA is to assess the risk of the site flooding and the impact any changes or development on the site will have on flood risk to adjacent areas. This FRA is prepared in accordance with the guidance provided within the National Planning Policy Framework (NPPF).

2.0 Site Details

2.1 Location

156 West End Lane is located in the heart of West Hampstead in the London Borough of Camden in north west London. The site is bounded to the north by Victorian Villas fronting onto Lymington Road, to the south by a public footpath, (Potteries Path), and railway line, to the west by West End Lane and to the east by the designated open space and play area on Crown Close.

2.2 Grid Reference

The Ordnance Survey National grid reference for the center of the site is 525579E, 184866N

2.3 Topography and Site Description

The development site is currently occupied by an existing 5 storey office building along the frontage of West End Lane with a large storage yard behind which is currently used by Travis Perkins. The development site equates to approximately 0.64 hectares.

The topography of the site predominately falls from west to east with levels along the site frontage of West End Lane set at 55.38m with levels along the eastern boundary set at 52.24m.

To the south of the development site there is an existing retaining structure, approximately 6.2m in height, separating the development site from the adjacent railway line, which runs at a lower elevation. A copy of the topographic survey can be found within Appendix A.

Fig 2.3 – Aerial Image of existing site

3.0 Proposed Development

The redevelopment consists of the demolition of all existing buildings and redevelopment of the site to provide 163 mixed-tenure homes (Use Class C3), new floor space for town centre uses (Use Class A1, A2, A3, D1 or D2), new employment floor space (including four dedicated units for start-up businesses) (Use Class B1), a community meeting room and new and improved public open spaces, together with associated new landscaping, on-site access, servicing and disabled car parking.

Access to the development will be moved northwards along West End Lane and away from the boundary with network rail. Proposals for the development can be found within Appendix B of this report.

4.0 Flood Risk

4.1 Environment Agency Flood Map

The West End Lane development site is situated in the Environment Agency Thames Region and their Flood Zone maps for the area indicate fluvial flooding extents.

The flood map for the development site shown below indicates that all of the site is located within flood zone 1, which is defined as land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any one year.

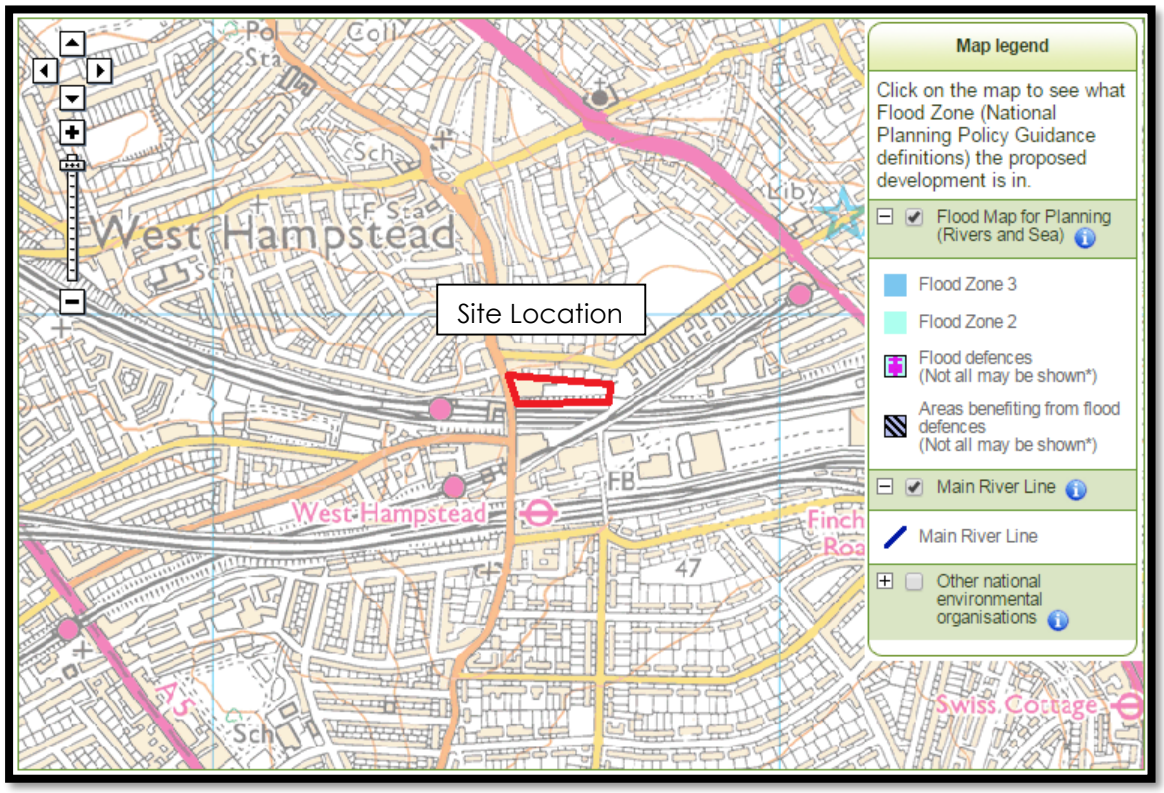


Fig 4.1 – Environment Agency Flood Zone map

4.2 Environment Agency Groundwater and Aquifer Protection

Reference to the Environment Agency Groundwater Protection Zone map shows the area is not sited within any groundwater protection zone classifications.

Reference to the Environment Agency Groundwater Aquifer maps shows the area is not sited within any aquifer zones.

4.3 The National Planning Policy Framework

The National Planning Policy Framework and the accompanying Technical Guidance gives guidance for development with respect to flooding. These documents promote a sequential approach in order to encourage development away from areas that may or are susceptible to flooding. In doing so it categorises flood zones in the context of their probability of flooding, as shown in the table below.

4.4 Flood Zone Definition

The National Planning Policy Framework Definition of Flood Zones

Flood zone	Fluvial	Tidal	Probability of flooding
1	< 1 in 1000 year (<0.1 %)	<1 in 1000 year (<0.1 %)	Low probability
2	Between < 1 in 1000 year (<0.1 %) and 1 in 100 year 1%	Between <1 in 1000 year (<0.1 %) and 1 in 200 year 0.5%	Medium Probability
3a	> 1 in 100 year 1% (>1.0%)	> 1 in 200 year (>0.5%)	High probability
3b	Either > 1 in 20 (5%) or as agreed between the EA and the LPA	Either > 1 in 20 (5%) or as agreed between the EA and the LPA	Functional flood plain

4.5 Flood Zones – Table 1 NPPF

(Note: These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defenses)

Zone 1 - Low Probability
Definition
This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).
Appropriate uses
All uses of land are appropriate in this zone.
FRA requirements
For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the development on surface water run-off, should be incorporated in a FRA. This need only be brief unless the factors above or other local considerations require particular attention.
Policy aims
In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems.

4.6 Flood Risk Vulnerability Classification – Extract from Table 2 NPPF

More Vulnerable

- Hospitals.
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels.
- Non–residential uses for health services, nurseries and educational establishments.
- Landfill and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

4.7 Flood Risk Vulnerability & Flood Zone Compatibility Table

Vulnerability classification flood zone	Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
1	√	√	√	√	√
2	√	√	Exception test required	√	√
3a	Exception test required	√	x	Exception test required	√
3b	Exception test required	√	x	x	x

√ Development is appropriate x Development is not appropriate

The above table, taken from NPPF (table 3), confirms that residential development within flood zones 1 is acceptable.

4.8 Other Flooding Mechanisms

In addition to the potential for assessing flooding from fluvial and tidal sources the National Planning Policy Framework also requires that consideration is given to other mechanisms for flooding -

- Flooding from land – intense rainfall, often in short duration, that is unable to soak into the ground or enter drainage systems, can run rapidly off land and result in local flooding.
- Flooding from groundwater – occurs when water levels in the ground rise above the surface elevations.
- Flooding from sewers – In urban areas, rainwater is frequently drained into surface water sewers or sewers containing both surface and waste water sewers known as combined sewers. Flooding can result causing surcharging when the sewer is overwhelmed by heavy rainfall
- Flooding from reservoirs, canals and other artificial sources – Non-natural or artificial sources of flooding can result from sources such as reservoirs, canals lakes etc, where water is held above natural ground levels.

5.0 Flood Risk To The Development

5.1 Flooding From Fluvial Sources

The proposed development site lies within flood zone 1 which is classified as land assessed as having a less than 1 in 1000 annual probability of river or sea flooding and is appropriate to all uses of land.

It is therefore the consideration of this FRA that the site has a low risk of flooding from fluvial sources.

5.2 Flooding From Overland Flows To The Site

The topographical survey and general topography of the area shows the development site has a general fall from the west to the east. As such and flows generated from the higher areas to the west could potentially run into the development site. A review of the information available suggests that the lower lying railway land to the south of the site and some 6m lower in elevation could become impacted by surface water flooding. Also the records suggest that flooding within Lymington Avenue to the northeast of the development site has occurred. This report considers that both of these areas are caused by surface water sewerage systems becoming inundated during storm events which manifests as surface flooding in low lying areas. Although these area of flooding are close to the site, importantly they do not appear within the site as shown in the image below.

Fig 5.2 – Surface Water Flooding Map

It is therefore the consideration of this FRA that the site has a low risk of flooding from overland flows.

5.3 Flooding From Rising Groundwater

At the time of writing no intrusive site investigation works have been completed, however an assessment of the site topography and suspected impermeable nature of the ground conditions below the site would suggest that any elevated groundwater would be found within the lower land to the south of the development site associated with network rail.

It is therefore the consideration of this FRA that the site has a low risk of flooding from rising groundwater levels.

5.4 Flooding From The Local Sewerage Network

A review of the Thames Water sewer asset plans confirms that the closest sewer to the development site relates to the existing public combined 1194 x 787 sewer which runs south with West End Lane before turning due southeast and under the corner of the development site before turning due east within Network Rails land to the south.

Within the confines of the site, this system is running at a depth of approximately 4m deep as it enters the site and dives down to almost 9m deep (relative to site levels) within the network rail land. As such any surcharge of this system will originate within the lower lying land to the south of the site.

It is therefore the consideration of this FRA that the site has a low risk of flooding by surcharging of the local sewer network.

5.5 Flooding From Reservoirs, Canals & Other Artificial Sources

Review of location plans for the development site show there to be no signs of manmade water sources within the area, therefore flooding via this possible mechanism has been discounted.

It is therefore the consideration of this FRA that the site has a low risk of flooding by reservoirs, canals or other artificial sources.

6.0 Flood Risk As A Result Of The Development

6.1 Effect Of The Development Generally

Development by its nature usually has the potential to increase the impermeable area with a resultant increased risk of causing rapid surface water runoff to watercourses and sewers, thereby causing surcharging and potential flooding. There is also the potential for pollutants to be mobilised and consequently flushed into the receiving surface water system.

Increases in both the peak runoff rate (usually measured in litres per second l/s) and runoff volume (cubic metres m^3) can result.

6.2 Surface Water Drainage & Sustainable Drainage Systems

Sustainable Drainage techniques (SUDS) covers a range of approaches to manage surface water runoff so that-

'Surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account. This should be demonstrated as part of the flood risk assessment.'

6.3 Peak Storm Design Criteria

The proposed sustainable drainage techniques for the development should accommodate the peak rainfall event for a 1 in 100 year storm event with an additional allowance for climate change. Table 5 of NPPF recommends for developments that have a life expectancy beyond 2085 that an additional factor of 30% is applied to the peak volume of runoff.

7.0 Drainage Strategy & Design

This FRA is not intended to provide a detailed design for the drainage system to serve the proposed development, but to show that a proposed system is feasible in principle given the storage volume required and land availability. A detailed drainage scheme should be submitted to the Local Planning Authority (LPA) prior to the commencement of development and/or to discharge the appropriate planning condition.

The existing surface water discharge from the site appears to be via a conventional piped sewerage system into the adjacent combined sewer running through the site but this will require full substantiation with a CCTV survey. As the site is currently 100% impermeable and based on the site area of 6,647sqm and a 50mm/hr rainfall rate, the existing surface water flows off the development site would be in the order of 92l/s.

In line with Policy 5.13 of the London Plan, development should utilise sustainable 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 following drainage hierarchy:

1 store rainwater for later use

2 use infiltration techniques, such as porous surfaces in non-clay areas

3 attenuate rainwater in ponds or open water features for gradual release

4 attenuate rainwater by storing in tanks or sealed water features for gradual release

5 discharge rainwater direct to a watercourse

6 discharge rainwater to a surface water sewer/drain

7 discharge rainwater to the combined sewer.

The main contributory factor to surface water runoff is usually from the hard standing and roof areas. The current architectural plans indicate the majority of the development site is covered either by the roof area associated with the proposed buildings and an access road, parking and communal landscaped areas in between. As such this report initially finds items 1 to 5 unsuitable given the constraints of the development site.

As such focus should be given to lowering the surface water flows from the development site down to lower rate of 46l/s to offer a significant 50% benefit in reduced flows into the receiving sewer networks.

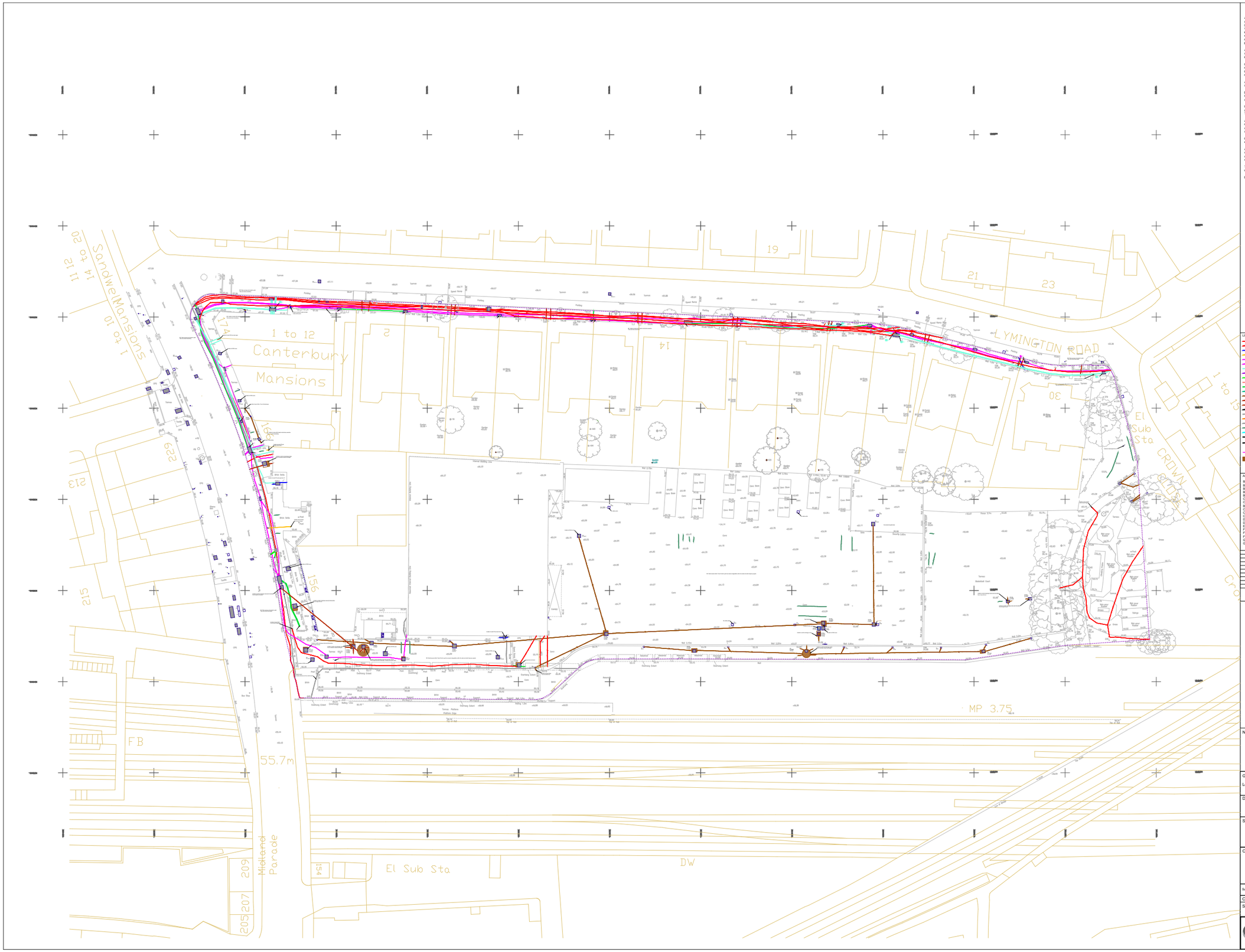
A strategic drainage arrangement drawing has been produced for the development to ensure sufficient space is available for the storage element and this drawing has been included within Appendix C.

The associated Camden Council drainage pro-forma document has also been completed and is enclosed within Appendix D.

References & Bibliography

- The National Planning Policy Framework.
- Environment Agency indicative flood maps http;//maps.environment- agency gov.uk
- Environment Agency indicative ground water source protection zone maps http;//maps.environment- agency gov.uk
- Environment Agency indicative Aquifer designation maps http;//maps.environment-agency gov.uk
- CIRIA 2007, The Sustainable drainage Systems (SUDS) Manual C697
- Sewers for adoption 6th Edition and interim guidance prior to the introduction of sewers for adoption 7th edition WRC
- Managing Flood Risk in Camden
- Surface Water Management Plan – London Borough of Camden

Appendix A – Topographic Site Survey



IMPORTANT NOTES

All underground details shown have been identified from a non-invasive survey. Cadmap Ltd use electro-magnetic and/or ground penetrating radar (GPR) methods to investigate for underground utilities, services and features. Variations in ground conditions, depth and density of services and features can affect the performance of the equipment and the reliability of the equipment used. As a result these methods are not infallible and we recommend trial excavations are carried out to confirm any identifications, positions and depths.

Any areas on the drawing where services or features have not been shown are not necessarily clear of services or features but are an indication that no items have been identified during our investigations.

Cadmap Ltd have used all reasonable care to research available service records but the completeness or use of the service records supplied to or by Cadmap Ltd cannot be guaranteed. Therefore Cadmap Ltd cannot be held responsible for any features annotated as 'Statutory Records'.

All utility / service depths are in meters and are taken to the top of utility / service unless otherwise stated.

Drainage pipe sizes will be obtained without entering the chamber and therefore should be treated as approximate on deep chambers. All pipe/pipe sizes are in mm unless otherwise stated.

Underground services shown on this drawing are illustrated by a single service line.
This single service line may actually represent multiple cables and /or ducts.

An anomalous feature is an unidentified subsurface area evident within the radar data that differs in response to it surrounding area. Example of anomalous features includes voiding, heavily saturated ground, buried tanks and demolished building foundations.

Cadmap Ltd accepts no responsibility for the completeness or accuracy of either the topographical survey or base mapping on this project.

All critical dimensions and measurements should be checked and verified with any errors or discrepancies notified to Cadmap Ltd immediately. The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work.

Do not scale from this drawing.

LINE-TYPE KEY

- Electricity
- Street Lighting
- Water
- Gas
- BT
- Telecommunications
- CATV
- Fibre Optic
- Traffic Control Signalling
- CCTV
- Empty Duct
- Earth
- Surface Water
- Foul Water
- Combined Sewer
- Oil/Fuel Pipe
- Unknown Pipe
- Unknown Cable
- Metallic Target
- Radar Target
- Possible Target
- Assumed
- (Colour indicates service type)
- Statutory Records
- (Colour indicates service type)
- Scan Area
- Chamber Extents

ABBREVIATIONS

BCD	Bottom of Chamber Depth	GV	Gas Valve
BO	Bollard	IC	Inspection Cover
BO	Bollard	IL	Invert Level
BH	Borehole	LP	Lamp Post
BT	British Telecom Cover	MH	Manhole
CAB	Cabinet	PE	Polyethylene
CATV	CATV Television Cover	PP	Parking Pole
CC	Closed Circuit TV	GY	Gully
CI	Cast Iron	SL	Silt Level
CL	Cover Level	STN	Survey Station
CS	Combined Sewer	SV	Stop Valve
DIA	Diameter	TM	Traffic Meter
DP	Drainage Pipe	TC	Top of Chamber Depth
ER	Earth Road	RS	Unable To Lift
FH	Fire Hydrant	VP	Vent Pipe
FW	Foul Water	WL	Water Level Depth
FWP	Foul Water Pipe	WM	Water Meter
GM	Gas Meter	WSC	Water Stop Cock
GP	Gas Pipe	WSV	Water Stop Valve

Availability of Statutory Records

Utility/Service Type	Record Provided	Record Owner
Electricity	No	n/a
Electricity	No	n/a
Gas	No	n/a
Oil/Fuel	No	n/a
Sewer	No	n/a
Telecom	No	n/a
Water	No	n/a
Other	No	n/a

Survey Legend

FENCES

CLOSE BOARD FENCE	BDF	Trees	
CORRUGATED WEATHERCLIP	CC		
CLOSE BOARD FENCE	CBF	Hedges	
CHESTNUT PALISE FENCE	CPF		
IRON RAILING FENCE	IRF		
POST AND CHAIN FENCE	PCF		
POST AND RAIL FENCE	PRF	Walls	
CHAIN LINK FENCE	CLF		
CHAIN LINK FENCE	CLL		
LARCH LAP FENCE	LLL	Fences	
INTERWEAVEN FENCE	LW		
WIRE MESH FENCE	WMF		

ABBREVIATIONS

BOLLARD	Bo	MARKER	MK
BRITISH TELECOM BC	BT	NOTICE BOARD	NB
CONCRETE PAVING SLABS	CPS	PARKING METER	PM
COVER LEVEL	CL	ROAD MARK PLATE	RMP
DROP KERB	DK	ROAD SIGN	RS
ELECTRIC INSPECTION COVER	EIC	ROSEMOUNTH	RM
ELECTRICITY POLE	EP	RETAINING WALL	Rtw
FLOOD LIGHT	FL	STREET LIGHTING	SLP
FLOWER BED	FB	STOP VALVE	SV
FOOTPATH	FP	TELEGRAPH POLE	TP
GAS VALVE	GV	TELEPHONE CALL BOX	TCB
GULLY	Gy	TRAFFIC LIGHT	TL
INSPECTION COVER	IC	UNABLE TO LIFT	UTL
PIPE INVERT LEVEL	IL	UNKNOWN	UKN
MARK OUTLET	MO	VENT PIPE	VP
MAN HOLE	MH	WATER METER	WM
THRESHOLD	Th	DIAMETER	Ø

North:

Grid:
Levelling: To OS GPS Level and Grid

Drawing Title:
Utility Survey

Site Address:
Travis Perkins
West Hampstead

Client:
ezdominion

Surveyor	SW	Drawn By	SW	Verified By	MPB	Date	27.05.15
CM No:	CM15172			Rev:			
Scale:	1:250m @ A1			Date:	May 2015		

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W: www.cadmap.co.uk

Appendix B – Development Proposals

NOTES

-Do not scale from this drawing, except for planning purposes.
-Check all dimensions on site.
-Subject to survey.
-Subject to site inspection.
-Site boundary lines are indicative only.

Key

- 1B2P
- Community room
- Cycle Store
- Flexible non-residential space
- Refuse Store
- Start-up units

1B2P - 1 Bed 2 person flat
2B4P - 2 Bed 4 Person flat
3B5P - 3 Bed 5 person flat
AR - Affordable rented
SO - Shared ownership
PS - Private sale

Rev	Date	By	Description
F	09.05.16	JV	Flat layouts revised to improve daylighting. Elevations updated follwing planners comments.
E	08/03/2016	AB	Units lost from 5th floor of private block. Adjustments to tenure of remaining units to maintain affordable/ private ratio.
D	21/12/2015	AB	Scale note added
C	16/12/2015	AB	Some amenity areas added.
B	10/12/15	AB	Room areas added
A	19/11/15	AB	Key and notes added
-	13/11/15	AB	Planning Issue

Revision Schedule

key plan

a2dominion

project
156 WEST END LANE
WEST HAMPSTEAD

title
GROUND FLOOR PLAN - WEST BUILDING

drawing status
PLANNING

contract no.	scale
	1 : 250 @ A3
client ref.	date
A2 DOMINION	11/05/15
drawn by	checked by
Author	Checker

project no.	drawing number	revision
13119	PL(00)P020	PF

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NOTES

- Do not scale from this drawing, except for planning purposes.
- Check all dimensions on site.
- Subject to survey.
- Subject to site inspection.
- Site boundary lines are indicative only.

Key

- 1B2P
- 2B4P

1B2P	-	1 Bed 2 person flat
2B4P	-	2 Bed 4 Person flat
3B5P	-	3 Bed 5 person flat
AR	-	Affordable rented
SO	-	Shared ownership
PS	-	Private sale

Rev	Date	By	Description
E	09.05.16	JV	Flat layouts revised to improve daylighting. Elevations updated follwing planners comments.
D	21/12/2015	AB	Scale note added
C	16/12/2015	AB	Some amenity areas added.
B	10/12/15	AB	Room areas added
A	19/11/15	AB	Key and notes added
-	13/11/15	AB	Planning Issue

Revision Schedule

key plan

a2dominion

project
156 WEST END LANE
WEST HAMPSTEAD

title
GROUND FLOOR - EAST BUILDING

drawing status
PLANNING

contract no.	scale: 1 : 250 @ A3
client ref.: A2 DOMINION	date: 11/14/15
drawn by: Author	checked by: Checker

project no.	drawing number	revision
13119	PL(00)P010	PE

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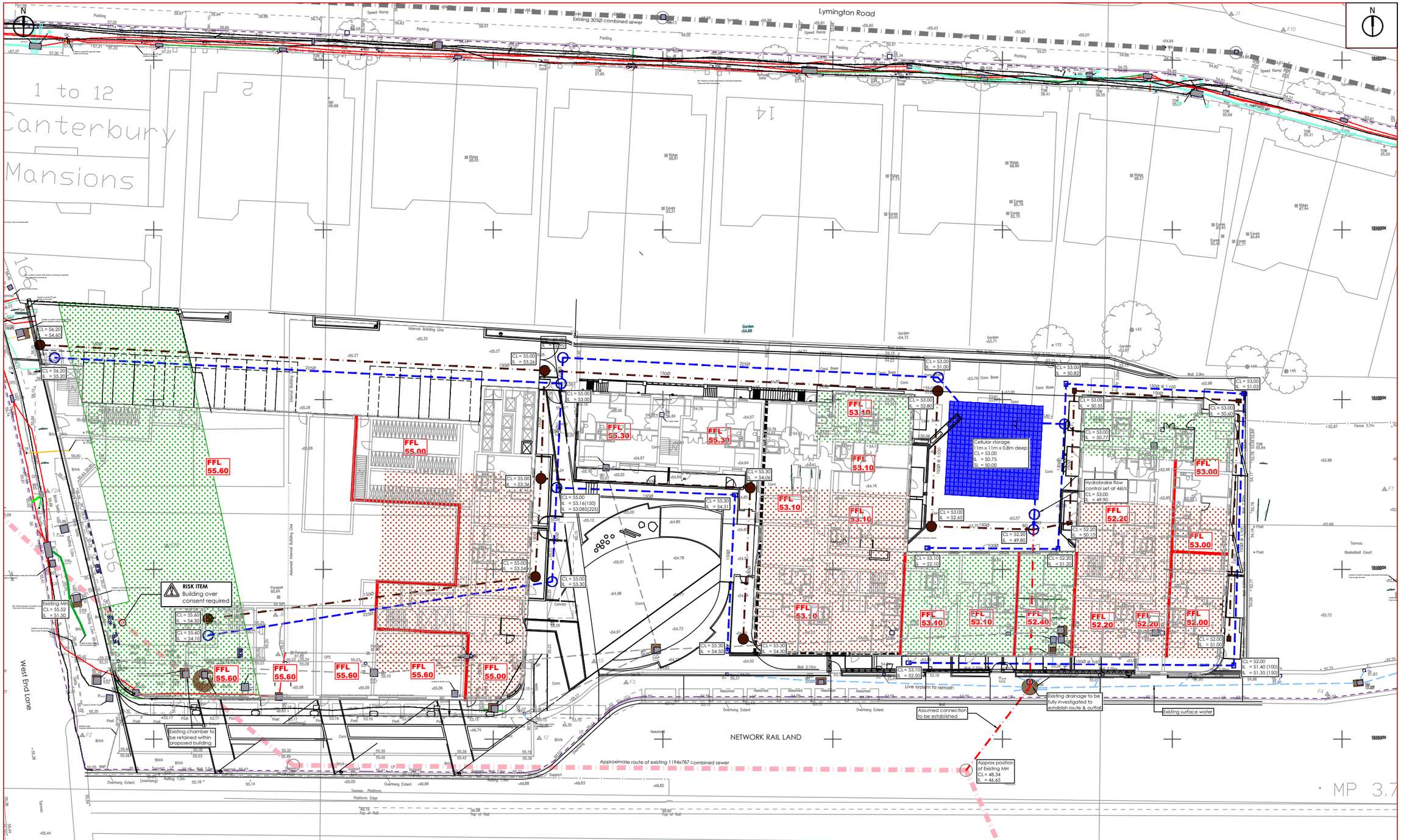
Appendix C – Strategic Drainage Arrangement



KEY:

- Foul water sewer (Adoptable)
- Surface water sewer (Adoptable)
- Combined water sewer (Adopted)
- Existing combined water sewer (Adopted)
- Existing foul water drain (To be made redundant)
- Existing foul water drain (To remain live)
- Existing surface water drain (To be made redundant)
- Existing surface water drain (To remain live)
- Existing combined sewer (To remain live)
- Manhole
  Depth 1.25 to 1.5m *
  Depth 1.55 to 3.0m *
- Cellular storage (refer to drawing for sizes)
- Step in FFL
- Approximate extent of Brown roof
- Approximate extent of Green roof

NOTES:

- System shown indicates suitable drainage arrangement without re-use of existing drainage laterals. All existing drainage to be fully investigated to establish route and outfall for possible re-use within new scheme.
- Scheme shown reliant on off-site connection potentially through third party land.
- FFL's are indicative. To be confirmed once layout has been finalised.

MARK	DATE	BY	CHKD.	REVISION NOTES
P03	20/05/16	NJ	DJ	Layout proposals updated
P02	30/10/15	NJ	DJ	Layout and outfalls updated
P01	19/10/15	TST	DJ	Issued for information

C.D.M.

SIGNIFICANT RISKS AND HAZARDS:

- Building over existing sewer
- No CCTV information
- No buried services information
- Lack of offsite survey data

PROJECT:

West End Lane
West Hampstead

DRAWING TITLE:

Drainage Strategy Plan

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STATUS: INFORMATION

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:200	19/10/2015	NJ	DJ

JOB NUMBER:	DRAWING NUMBER:	REVISION:
SE1229	300	P03

15-1779

Appendix D – Surface Water Pro-Forma

Surface Water Drainage Pro-forma for new developments

This pro-forma accompanies our advice note on surface water drainage. Developers should complete this form and submit it to the Local Planning Authority, referencing from where in their submission documents this information is taken. The pro-forma is supported by the Defra/EA guidance on Rainfall Runoff Management and uses the storage calculator on www.UKsuds.com. This pro-forma is based on current industry best practice and focuses on ensuring surface water drainage proposals meet national and local policy requirements. The pro-forma should be considered alongside other supporting SuDS Guidance.

1. Site Details

Site	WEST END LANE, CAMDEN
Address & post code or LPA reference	156 WEST END LANE, WEST HAMPSTEAD
Grid reference	TQ 25579 84870
Is the existing site developed or Greenfield?	BROWNFIELD
Is the development in a LFRZ or in an area known to be at risk of surface or ground water flooding? If yes, please demonstrate how this is managed, in line with DP23?	NONE, SURFACE FLOODING TO THAMESLINK RAILWAY TO SOUTH AT LOWER ELEVATION.
Total Site Area served by drainage system (excluding open space) (Ha)*	0.65 Ha

* The Greenfield runoff off rate from the development which is to be used for assessing the requirements for limiting discharge flow rates and attenuation storage from a site should be calculated for the area that forms the drainage network for the site whatever size of site and type of drainage technique. Please refer to the Rainfall Runoff Management document or CIRIA manual for detail on this.

2. Impermeable Area

	Existing	Proposed	Difference (Proposed-Existing)	Notes for developers
Impermeable area (ha)	0.65	~~0.56~~ 0.472	~~0.09~~ 0.178	If the proposed amount of impermeable surface is greater, then runoff rates and volumes will increase. Section 6 must be filled in. If proposed impermeability is equal or less than existing, then section 6 can be skipped and section 7 filled in.
Drainage Method (infiltration/sewer/watercourse)	SEWER	SEWER	N/A	If different from the existing, please fill in section 3. If existing drainage is by infiltration and the proposed is not, discharge volumes may increase. Fill in section 6.

3. Proposing to Discharge Surface Water via

	Yes	No	Evidence that this is possible	Notes for developers
Existing and proposed MicroDrainage calculations	✓		Refer to Microdrainage calcs for proposed system	Please provide MicroDrainage calculations of existing and proposed run-off rates and volumes in accordance with a recognised methodology or the results of a full infiltration test (see line below) if infiltration is proposed.
Infiltration		✓		e.g. soakage tests. Section 6 (infiltration) must be filled in if infiltration is proposed.
To watercourse		✓		e.g. Is there a watercourse nearby?
To surface water sewer	✓		As Existing Outfall	Confirmation from sewer provider that sufficient capacity exists for this connection.
Combination of above		✓		e.g. part infiltration part discharge to sewer or watercourse. Provide evidence above.
Has the drainage proposal had regard to the SuDS hierarchy?	✓		Yes. Green & Brown roofs proposed & attenuation	Evidence must be provided to demonstrate that the proposed Sustainable Drainage strategy has had regard to the SuDS hierarchy as outlined in Section 2.5 above.
Layout plan showing where the sustainable drainage infrastructure will be located on site.	✓		SE1229 -300 - P02	Please provide plan reference numbers showing the details of the site layout showing where the sustainable drainage infrastructure will be located on the site. If the development is to be constructed in phases this should be shown on a separate plan and confirmation should be provided that the sustainable drainage proposal for each phase can be constructed and can operate independently and is not reliant on any later phase of development.

4. Peak Discharge Rates – This is the maximum flow rate at which storm water runoff leaves the site during a particular storm event.

	Existing Rates (l/s)	Proposed Rates (l/s)	Difference (l/s) (Proposed-Existing)	% Difference (difference /existing x 100)	Notes for developers
Greenfield QBAR	3.7	N/A	N/A	N/A	QBAR is approx. 1 in 2 storm event. Provide this if Section 6 (QBAR) is proposed.
1 in 1	100.10	46	-54.1	54	Proposed discharge rates (with mitigation) should aim to be equivalent to greenfield rates for all corresponding storm events. As a minimum, peak discharge rates must be reduced by 50% from the existing sites for all corresponding rainfall events.
1 in 30	237.60	46	-191.60	80	
1in 100	301.70	46	-255.70	84	
1 in 100 plus climate change	N/A	46	–	84	The proposed 1 in 100 +CC peak discharge rate (with mitigation) should aim to be equivalent to greenfield rates. As a minimum, proposed 1 in 100 +CC peak discharge rate must be reduced by 50% from the existing 1 in 100 runoff rate sites.

5. Calculate additional volumes for storage –The total volume of water leaving the development site. New hard surfaces potentially restrict the amount of stormwater that can go to the ground, so this needs to be controlled so not to make flood risk worse to properties downstream.

	Greenfield runoff volume (m^3)	Existing Volume (m^3)	Proposed Volume (m^3)	Difference (m^3) (Proposed-Existing)	Notes for developers
1 in 1		121.00	67.9	-53.1	Proposed discharge volumes (with mitigation) should be constrained to a value as close as is reasonably practicable to the greenfield runoff volume wherever practicable and as a minimum should be no greater than existing volumes for all corresponding storm events. Any increase in volume increases flood risk elsewhere. Where volumes are increased section 6 must be filled in.
1 in 30		265.90	173.4	-89.5	
1in 100 6 hour		394.6	230.70	-113.90	
1 in 100 6 hour plus climate change		447.90	305.90	-142	The proposed 1 in 100 +CC discharge volume should be constrained to a value as close as is reasonably practicable to the greenfield runoff volume wherever practicable. As a minimum, to mitigate for climate change the proposed 1 in 100 +CC volume discharge from site must be no greater than the existing 1 in 100 storm event. If not, flood risk increases under climate change.

6. Calculate attenuation storage – Attenuation storage is provided to enable the rate of runoff from the site into the receiving watercourse to be limited to an acceptable rate to protect against erosion and flooding downstream. The attenuation storage volume is a function of the degree of development relative to the greenfield discharge rate.

		Notes for developers
Storage Attenuation volume (Flow rate control) required to meet greenfield run off rates (m^3)	254m³	Volume of water to attenuate on site if discharging at a greenfield run off rate. Can't be used where discharge volumes are increasing
Storage Attenuation volume (Flow rate control) required to reduce rates by 50% (m^3)	Approx 100 m³	Volume of water to attenuate on site if discharging at a 50% reduction from existing rates. Can't be used where discharge volumes are increasing
Storage Attenuation volume (Flow rate control) required to meet [OTHER RUN OFF RATE (as close to greenfield rate as possible] (m^3)	N/A	Volume of water to attenuate on site if discharging at a rate different from the above – please state in 1st column what rate this volume corresponds to. On previously developed sites, runoff rates should not be more than three times the calculated greenfield rate. Can't be used where discharge volumes are increasing
Storage Attenuation volume (Flow rate control) required to retain rates as existing (m^3)	N/A	Volume of water to attenuate on site if discharging at existing rates. Can't be used where discharge volumes are increasing
Percentage of attenuation volume stored above ground,	Approx 46% (By drained area)	Percentage of attenuation volume which will be held above ground in swales/ponds/basins/green roofs etc. If 0, please demonstrate why.

7. How is Storm Water stored on site?

Storage is required for the additional volume from site but also for holding back water to slow down the rate from the site. This is known as attenuation storage and long term storage. The idea is that the additional volume does not get into the watercourses, or if it does it is at an exceptionally low rate. You can either infiltrate the stored water back to ground, or if this isn't possible hold it back with on site storage. Firstly, can infiltration work on site?

			Notes for developers
Infiltration	**State the Site's Geology and known Source Protection Zones (SPZ)**	LONDON CLAY NO SPZ	Avoid infiltrating in made ground. Infiltration rates are highly variable and refer to Environment Agency website to identify and source protection zones (SPZ)
	Are infiltration rates suitable?	NO	Infiltration rates should be no lower than $1x10^{-6}$ m/s.
	State the distance between a proposed infiltration device base and the ground water (GW) level	N/A	Need 1m (min) between the base of the infiltration device & the water table to protect Groundwater quality & ensure GW doesn't enter infiltration devices. Avoid infiltration where this isn't possible.

8. Please confirm

		Notes for developers
Which Drainage Systems measures have been used, including green roofs?	Green / Brown Roof	SUDS can be adapted for most situations even where infiltration isn't feasible e.g. impermeable liners beneath some SUDS devices allows treatment but not infiltration. See CIRIA SUDS Manual C697.
Drainage system can contain in the 1 in 30 storm event without flooding	Yes	This a requirement for sewers for adoption & is good practice even where drainage system is not adopted.
Will the drainage system contain the 1 in 100 +CC storm event? If no please demonstrate how buildings and utility plants will be protected.	Yes, but flood exceedance to be considered in detailed design.	National standards require that the drainage system is designed so that flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.
Any flooding between the 1 in 30 & 1 in 100 plus climate change storm events will be safely contained on site.	Yes. Within car parks	**Safely:** not causing property flooding or posing a hazard to site users i.e. no deeper than 300mm on roads/footpaths. Flood waters must drain away at section 6 rates. Existing rates can be used where runoff volumes are not increased.
How will exceedance events be catered on site without increasing flood risks (both on site and outside the *development*)?	Mirror current routing	**Safely:** not causing property flooding or posing a hazard to site users i.e. no deeper than 300mm on roads/footpaths. Flood waters *must drain away at section 6 rates.* Existing rates can be used where runoff volumes are not increased. Exceedance events are defined as those larger than the 1 in 100 +CC event.
How are rates being restricted (vortex control, orifice etc)	Vortex or orifice	Detail of how the flow control systems have been designed to avoid pipe blockages and ease of maintenance should be provided.
Please confirm the owners/adopters of the entire drainage systems throughout the development. Please list all the owners.	End Client	If these are multiple owners then a drawing illustrating exactly what features will be within each owner's remit must be submitted with this Proforma.
How is the entire drainage system to be maintained?	End Client but TBC.	If the features are to be maintained directly by the owners as stated in answer to the above question please answer yes to this question and submit the relevant maintenance schedule for each feature. If it is to be maintained by others than above please give details of each feature and the maintenance schedule. Clear details of the maintenance proposals of all elements of the proposed drainage system must be provided. Details must demonstrate that maintenance and operation requirements are economically proportionate. Poorly maintained drainage can lead to increased flooding problems in the future.

	Were infiltration rates obtained by desk study or infiltration test?	N/A	Infiltration rates can be estimated from desk studies at most stages of the planning system if a back up attenuation scheme is provided..
	Is the site contaminated? If yes, consider advice from others on whether infiltration can happen.	UNKNOWN	Advice on contaminated Land in Camden can be found on our supporting documents webpage Water should not be infiltrated through land that is contaminated. The Environment Agency may provide bespoke advice in planning consultations for contaminated sites that should be considered.
In light of the above, is infiltration feasible?	**Yes/No? If the answer is No, please identify how the storm water will be stored prior to release**	NO. Storage via buried cellular crates & green/brown roofs.	If infiltration is not feasible how will the additional volume be stored?. The applicant should then consider the following options in the next section.

Storage requirements

The developer must confirm that either of the two methods for dealing with the amount of water that needs to be stored on site.

Option 1 Simple – Store both the additional volume and attenuation volume in order to make a final discharge from site at the greenfield run off rate. This is preferred if no infiltration can be made on site. This very simply satisfies the runoff rates and volume criteria.

Option 2 Complex – If some of the additional volume of water can be infiltrated back into the ground, the remainder can be discharged at a very low rate of 2 l/sec/hectare. A combined storage calculation using the partial permissible rate of 2 l/sec/hectare and the attenuation rate used to slow the runoff from site.

		Notes for developers
Please confirm what option has been chosen and how much storage is required on site.	1 - 100m³ plus Green/Brown roofs.	The developer at this stage should have an idea of the site characteristics and be able to explain what the storage requirements are on site and how it will be achieved.

9. Evidence Please identify where the details quoted in the sections above were taken from. i.e. Plans, reports etc. Please also provide relevant drawings that need to accompany your proforma, in particular exceedance routes and ownership and location of SuDS (maintenance access strips etc

Pro-forma Section	Document reference where details quoted above are taken from	Page Number
Section 2	SE1229 - 300 - P02	
Section 3	MICRODRAINAGE & SE1229 - 300 - P02	
Section 4	MICRODRAINAGE	
Section 5	MICRODRAINAGE	
Section 6	MICRO DRAINAGE	
Section 7	MICRODRAINAGE	
Section 8	MICRODRAINAGE	

The above form should be completed using evidence from the Flood Risk Assessment and site plans. It should serve as a summary sheet of the drainage proposals and should clearly show that the proposed rate and volume as a result of development will not be increasing. If there is an increase in rate or volume, the rate or volume section should be completed to set out how the additional rate/volume is being dealt with.

This form is completed using factual information from the Flood Risk Assessment and Site Plans and can be used as a summary of the surface water drainage strategy on this site.

Form Completed By..... TIM TROTMAN .....
Qualification of person responsible for signing off this pro-forma ..... M.Eng (Hons) C.Eng, C.WEM, MCIWEM, FIHE .....

Company..... IESIS SPECIAL STRUCTURES .....
On behalf of (Client's details) ..... A2D .....
Date:..... 15/09/2016 .....