KNAPP HICKS & PARTNERS LTD

CONSULTING STRUCTURAL, CIVIL & GEOTECHNICAL ENGINEERS

ISO 9001
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Knapp Hicks & Partners Ltd
Incorporated in England
No. 2886020

Registered office:
191-199 London Road,

8 Antrim Grove

SUDS Proposals

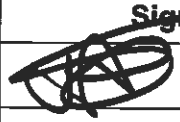
June 2012

30452/R/002/JAS

APPROVAL SHEET AND FOREWORD

8 Antrim Grove
SUDS Proposals

Report Ref: 30452/R/002/JAS

Report Status: FINAL	Date of Issue: 28th June 2012	
	Name	**Signature**
Author	**Jennifer Sturman CEng MICE**	
Checked and Approved	**Darren Cook CEng MIStructE**	

This report has been prepared with all reasonable skill, care and diligence within the terms of the contract with the Client and within reasonable limitations of the resources devoted to it by agreement with the Client.

This report is confidential to the Client and Knapp Hicks & Partners Limited accepts no responsibility whatsoever to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

This report shall not be used for engineering or contractual purposes unless signed by the author and the approver and on behalf of Knapp Hicks & Partners Limited, and unless the report status is "Final".

INTRODUCTION

It is proposed to enlarge the existing residential dwelling at 8 Antrim Grove by constructing a new basement beneath the property which will extend under the rear garden of the property. A small rear ground floor extension will also be constructed. Knapp Hicks & Partners Limited have been commissioned by the property owners to prepare this report to discharge the requirements of Planning Condition 7 which reads as follows:-

> *"Prior to commencement of development details of a sustainable urban drainage system shall be submitted to and approved by the local planning authority and such system shall be implemented as part of the development and thereafter retained and maintained."*

EXISTING SURFACE WATER REGIME

This is an existing residential site. The foul and surface water are currently discharged into a drain which runs alongside the property and then discharges into a public sewer located in the carriageway of Antrim Grove. Thames Water sewer records show this to be a 300mm diameter combined sewer flowing in a north-east to south-westerly direction.

The existing peak rate of surface water discharge has been calculated using the WinDes software from Microdrainage, based upon the following site characteristics (calculation attached in Appendix C):-

Total Site Area = 278m2
Existing Impermeable Area = 141m2

Hydrological Region 6/7
M5-60 = 20.6
r (ratio)= 0.438

The surface water peak rate of runoff generated by a storm of return period 1 yr is calculated as 2.0l/s, and for a storm of return period 100 years, 6.7l/s.

PROPOSED DEVELOPMENT RUN-OFF

It is current planning policy for both Camden Council and Greater London that the peak rate and volume of surface water runoff should not be increased by the development of a site. This is to prevent flooding downstream.

In this case the footprint area of the dwelling will be increased by 53m2 to a new total of 194m2, and thus the uncontrolled discharge would increase as would the volume.

The new uncontrolled peak rate of surface water runoff has been calculated using WinDes, based upon the same characteristics as above, together with the new impermeable area of 194m2. An allowance of 30% has also been added to the rainfall profile to allow for the anticipated increase in frequency and intensity due to climate change as recommended by the Technical Guidance to the National Planning Policy Framework (DCLG, March 2012). This has resulted in the following predicted rates of runoff:-

Post dev surface water runoff 1 yr RP = 4.5 l/s
Post dev surface water runoff 100 yr RP = 14.9 l/s

Current design guidance[1] does not require runoff flow rates to be controlled to less than 5 l/s for practical reasons. Thus the flows off site need only be balanced for the storms of greater return period than 1 year.

[1] Preliminary Rainfall Runoff Management for Developments, HR Wallingford, 2003

It is proposed that this is achieved by the inclusion of sustainable drainage systems (suds) within the scheme.

SELECTION OF SUDS TECHNIQUE

The SUDS selection tool described in CIRIA C609 has been used to assess the most effective techniques for surface water attenuation at this site, and a summary is included at Appendix C. This system applies scores for each technique according to site constraints and requirements. Those with the highest scores are deemed the most appropriate.

The main site constraints at this site are the lack of space available and the poor soakage potential within the ground; consequently no infiltration techniques will be suitable.

The following methods have scored as being appropriate methods of surface water management for this development:-

a) Green roofs
b) Permeable pavements

Green/Brown Roofs

Green and brown roofs are designed to intercept and retain rainfall thus reducing the volume of surface water runoff and attenuating peak flows which may discharge into a piped drainage system. There are several different types ranging from sedum roofs which are planted with low growing, low maintenance plants such as mosses, succulents etc., to intensive roof gardens complete with trees and shrubs. These roof systems will fully attenuate storms up to a two-year return period event, and contribute to attenuation of flows from larger storms.

It is proposed that 16m2 of the basement will extend under the garden and will be covered by up to 500mm of soil and grass which will act as a green roof. Surface water falling on this area will be dissipated in the same manner as before the development i.e. a combination of evapotranspiration and infiltration.

It is also proposed that the ground floor extension will include a 12m2 sedum roof. A substantial planter will also be constructed over the roof of the basement which will also absorb surface water. The controlled outflow from the sedum roof will be discharged to a sump pump located in the lightwell for the basement and thence into the properties gravity drainage system.

Pervious Surfaces

These are hardstanding areas and roads suitable for pedestrian and/or vehicular traffic which allow rainwater to infiltrate through the surface and into the underlying layers. The water is temporarily stored in a specially designed sub-base before infiltrating to the ground, or discharging to a watercourse or other drainage system. They can either be constructed of a porous material e.g. gravel or a reinforced grass system, or constructed from impermeable materials such as concrete blocks which are laid in manner to permit percolation between the units. Which ever surface solution is adopted they are constructed on identical sub-base systems which have the capacity both to store water and also provide an element of pollutant treatment prior to discharge.

It is proposed that the new terrace area measuring 23m2, is constructed using such a method. The finish can be either pavers or timber decking and the area beneath constructed to form a suitable storage medium with control mechanism. This will be discharged at a controlled rate into the sum pump located in the basement lightwell which will then discharge into the property's gravity drainage system.

MAINTENANCE OF THE SUDS

The freeholder of the property will be responsible for the maintenance of the suds incorporated at this site.

SUDS Management during Construction

Construction activities can generate a heavy sediment load within the surface water runoff from a site and there is also a risk of pollution from other activities such as the storage of fuels.

It is essential that any drainage devices should be protected by sediment traps located at a point upstream. The situation can also be alleviated by maintaining a high degree of good housekeeping on the site and using appropriate plant. For example by keeping stripped areas to a minimum and maintaining grass strips around development areas wherever possible.

Further advice can be obtained from Ciria document C698 Site Handbook for the Construction of SUDS.

Proposed SUDS Maintenance Regime

Pervious Surfaces

Before handing over these pavements to the site owner they should be inspected for clogging, litter, weeds and water ponding and all failures should be rectified. After handover, the facility should be inspected regularly, preferably during and after heavy rainfall to check effective operation and to identify any areas of ponding.

Pervious surfaces need to be regularly cleaned of silt and other sediments so that their infiltration capacity is retained. CIRIA advise a minimum of three surface sweepings per year, as noted below, using a brush and suction cleaner, which can be a lorry-mounted device or a smaller precinct sweeper.

1. End of winter (April) – to collect winter debris.
2. Mid-summer (July/August) – to collect dust, flower and grass-type deposits.
3. After autumn leaf fall (November).

Care should be taken in adjusting vacuuming equipment to avoid removal of jointing material and any lost material should be replaced.

Maintenance Schedule	Required action	Frequency
Regular maintenance	Brushing and vacuuming.	Three times/year as described above, or as required based on site-specific observations of clogging or manufacturers' recommendations.
Occasional maintenance	Removal of weeds	As required
Remedial actions	Remedial work to any depressions or rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users.	As required
	Rehabilitation of surface and upper sub-structure if infiltration performance is reduced as a result of significant clogging.	As required
Monitoring	Initial inspection	Monthly for 3 months after installation
	Inspect for evidence of poor operation and/or weed growth. If required take remedial action.	3-monthly and 48 h after large storms
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.

Table 1 - Pervious Pavement Maintenance

Green Roofs

Extensive green roofs should normally only require bi-annual or annual visits to remove litter, check fire breaks and drains and, in some cases, remove unwanted colonising plants. The most maintenance is generally required in the first three years, and usually this should be made the responsibility of the green roof provider.

Maintenance Schedule	Required action	Frequency
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth.	Six monthly/annually or as required.
	During establishment (ie year one), replace dead plants as required.	Monthly (but usually responsibility of manufacturer).
	Post establishment, replace dead plants as required.	Annually (in autumn).
	Remove fallen leaves and debris from deciduous plant foliage.	Six monthly or as required.
	Remove nuisance and invasive vegetation, including weeds.	Six monthly or as required.
	Mow grasses (if appropriate) as required. Clippings must be removed and not allowed to accumulate.	Six monthly or as required.
Occasional maintenance	-	-
Remedial actions	If erosion channels are evident, these should be stabilised with additional soil substrate similar to the original material. Sources of erosion damage must be identified and controlled.	As required.
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required
Monitoring	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes, and roof structure for proper operation, integrity of waterproofing and structural stability.	Annually/after severe storms.
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually/after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually/after severe storms.
	Inspect underside of roof for evidence of leakage	Annually/after severe storms

Table 2 – Green Roof Maintenance

SUMMARY OF PROPOSED SURFACE WATER DRAINAGE DESIGN

It is proposed that the existing outfall to the public sewer be maintained. A new inspection chamber will be constructed on the existing drain run for new rainwater pipe connections. A sump pump will be installed in the lightwell for the new basement and this will also discharge surface water from the suds components.

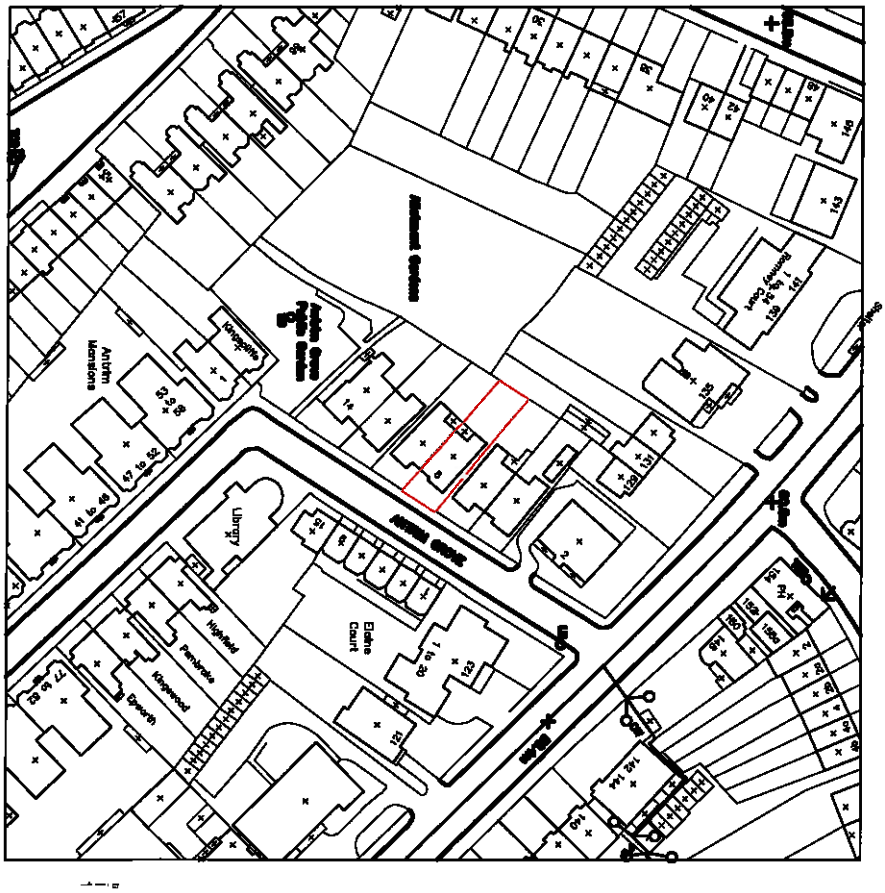
The proposed increase in the footprint area of the property, and the consequent increase in surface water runoff, will be offset by the use of green roofs and pervious surfaces. These will limit the surface water outflow from the site in quantitative terms and will also provide qualitative benefits.

The suds components should be monitored and maintained as summarized in this report for the optimum operation.

APPENDIX A
DRAWINGS

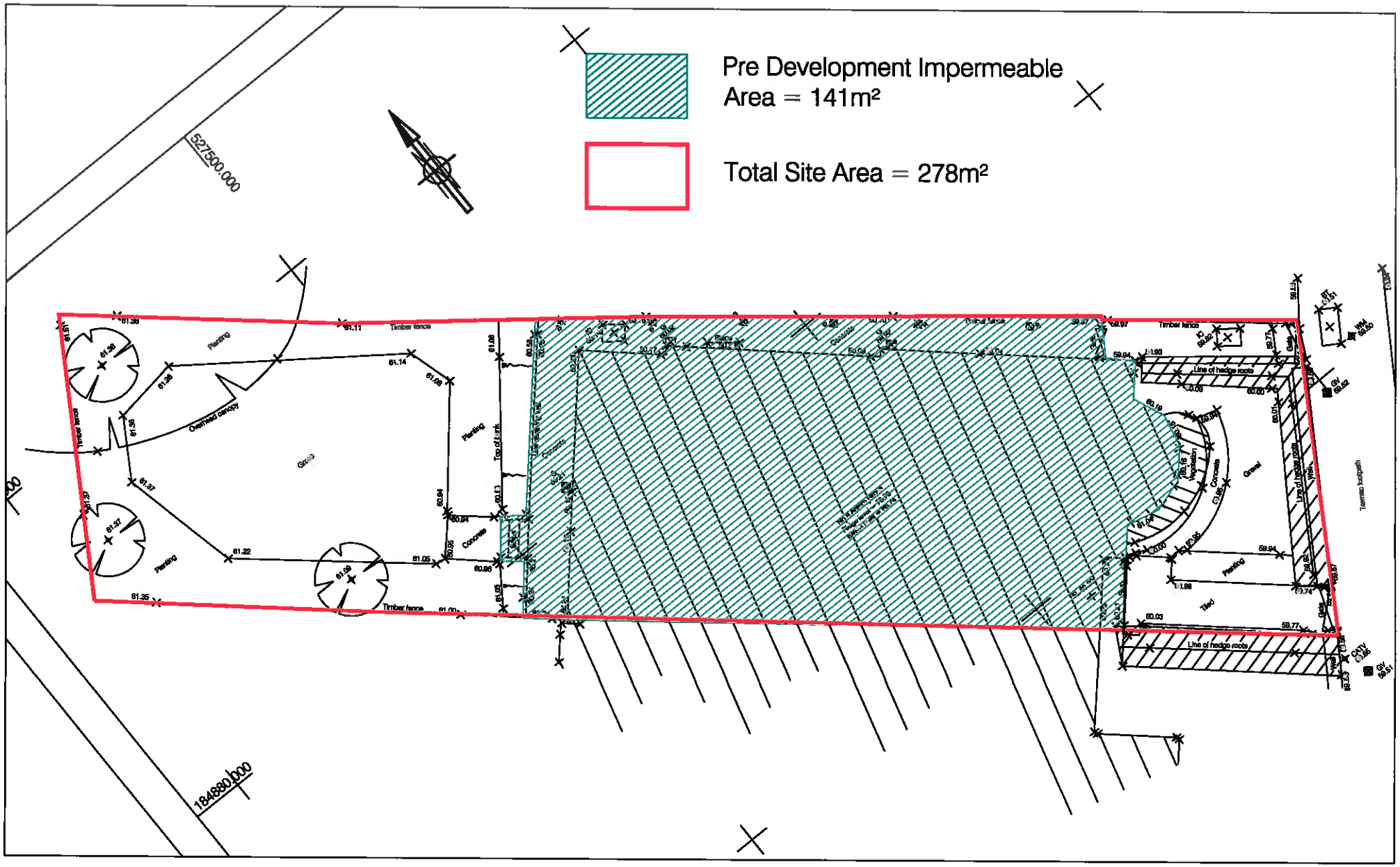
USE FIGURED DIMENSIONS ONLY. DO NOT SCALE FROM THIS DRAWING.
ALL DIMENSIONS MUST BE CHECKED ON SITE & ANY INCONSISTENCIES MUST BE REPORTED BACK TO THE ARCHITECT.
THIS DRAWING AND ANY DESIGNS INDICATED THEREON ARE THE COPYRIGHT OF THE ARCHITECT. ALL RIGHTS ARE RESERVED. NO PART OF THIS PLAN MAY BE REPRODUCED WITHOUT PRIOR PERMISSION IN WRITING FROM THE ARCHITECT.

1 LOCATION PLAN
1 : 1250



DWG NO/REV: 100/-	JOB NO: 1115	STAGE: 1 : 1250 @A3	DATE: JAN 2012	DRAWN: MK	DRAWING TITLE: LOCATION PLAN	LOCATION: 8 Antrim Grove, Belsize Park London NW3 4XR

Bchitecture
11A Beresford Road London N2 8AT
t 07932 796 407 e Bchitecture@gmail.com



Client	
Project	8 Antrim Grove
Title	Pre Development Impermeable Areas

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CONSULTING ENGINEERS
Kingston House, The Long Barrow
Orbital Park, Ashford. TN24 0GP
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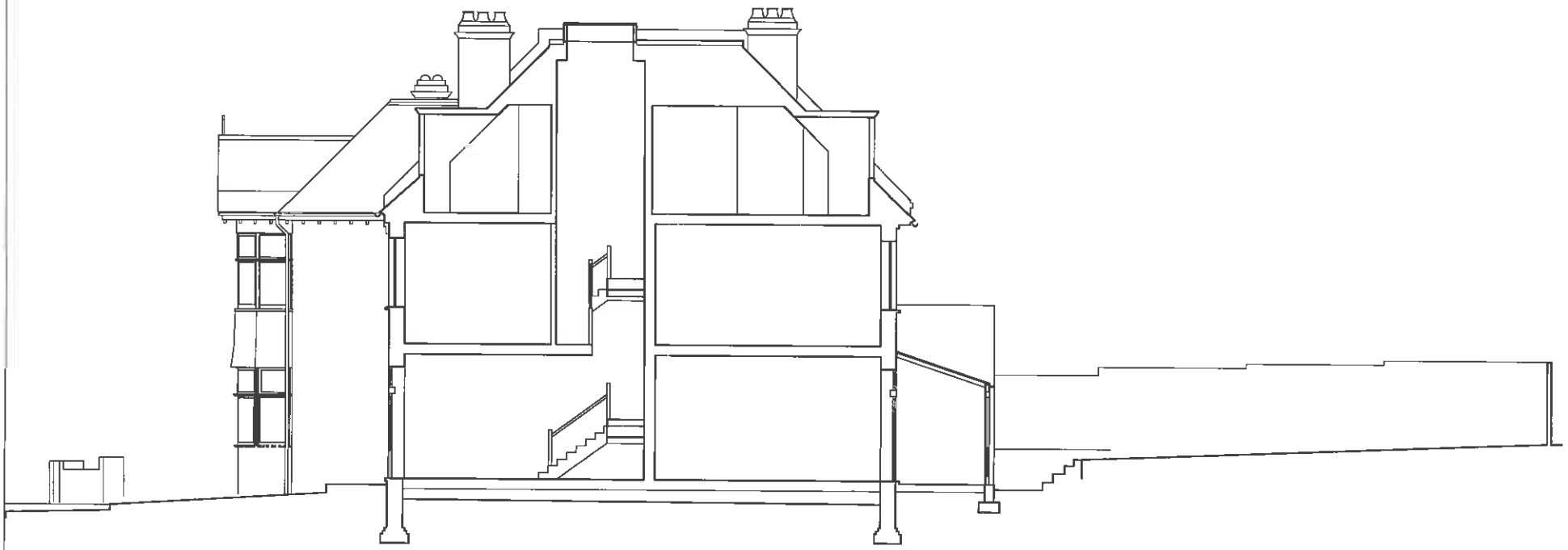
Drn.	JAS
Date	June 2012
Scale	SCALE
Drawing No.	Rev.
30452/SK01	-



1 EXISTING SECTION B-B
1 : 100

Bchitecture
11A Beresford Road London N2 6AT
(0)7932 795 407 e.Bchitecture@gmail.com

8 Antrim Grove, Belsize Park
London NW3 4XR

DRAWING TITLE
EXISTING SECTIONS

DATE
JAN 2012

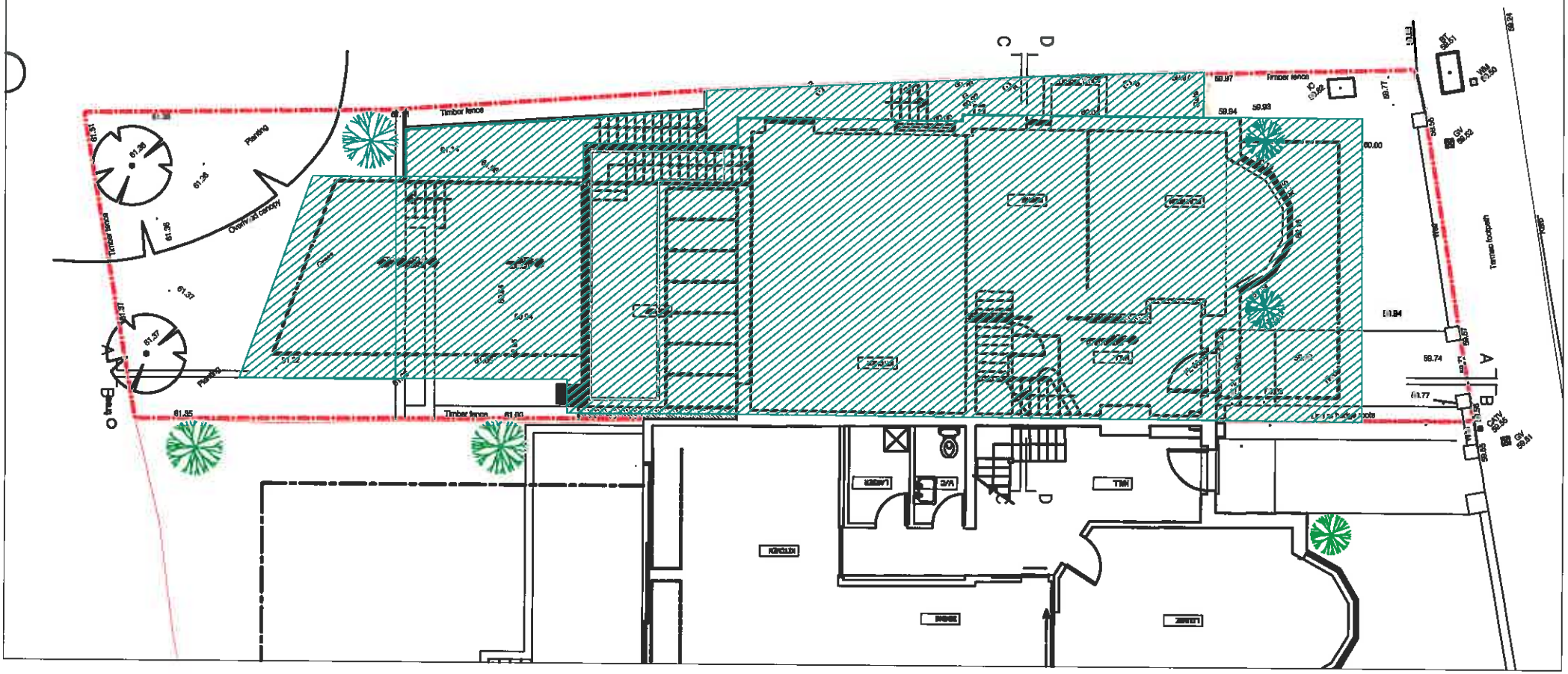
SCALE
1 : 100 @A3

JOB NO
1115

DWG NO/REV
106/-

Post Development
Impermeable Area = 194m²

Total Site Area = 278m²



Client	
Project	8 Antrim Grove
Title	Post Development Impermeable Area

KNAPP HICKS AND PARTNERS LTD.
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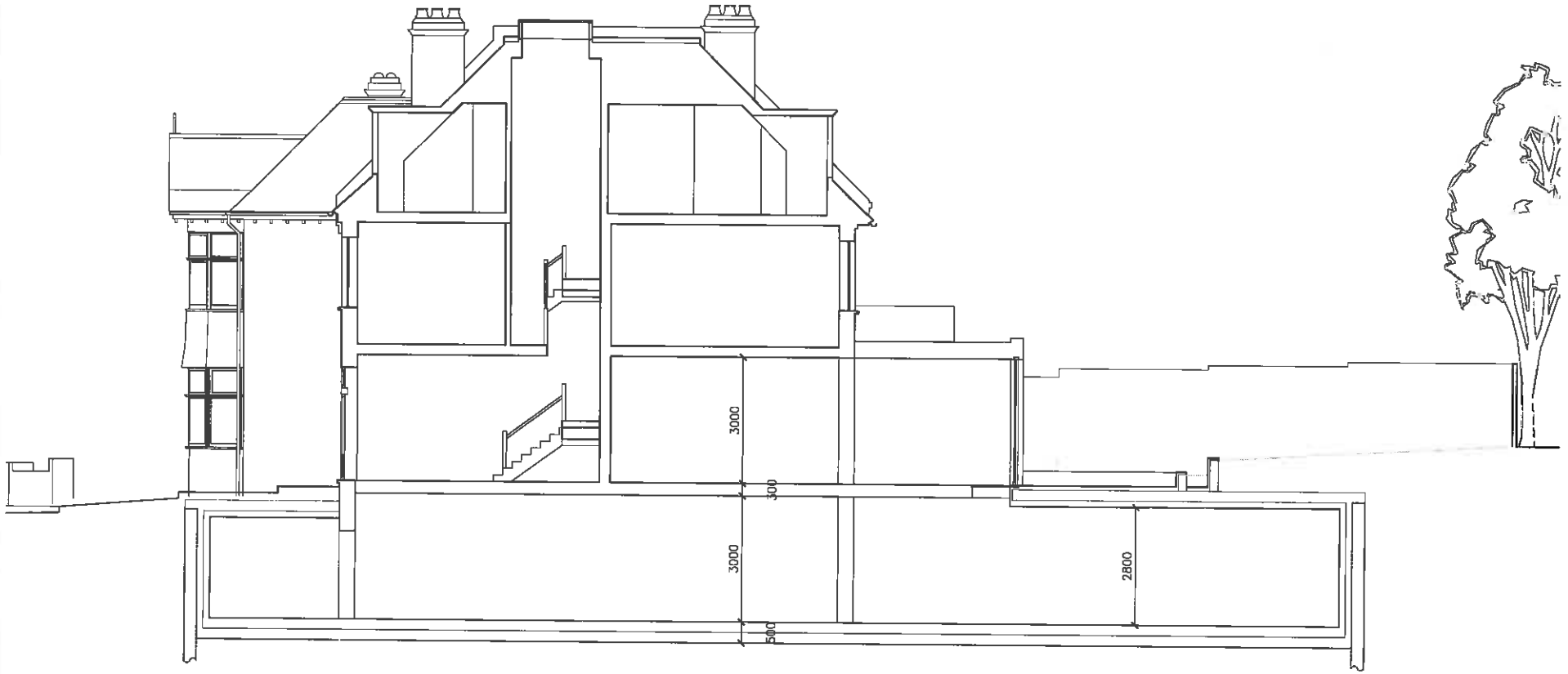
Drn.	JAS
Date	June 2012
Scale	1:100
Drawing No.	Rev.
30452/SK02	-



SECTION B B PROPOSED

1 PROPOSED SECTION B-B

1 : 50

Bchitecture
11A Beresford Road London N2 8AT
t 07932 796 407 e Echitecture@gmail.com

LOCATION
8 Antrim Grove, Belsize Park
London NW3 4XR

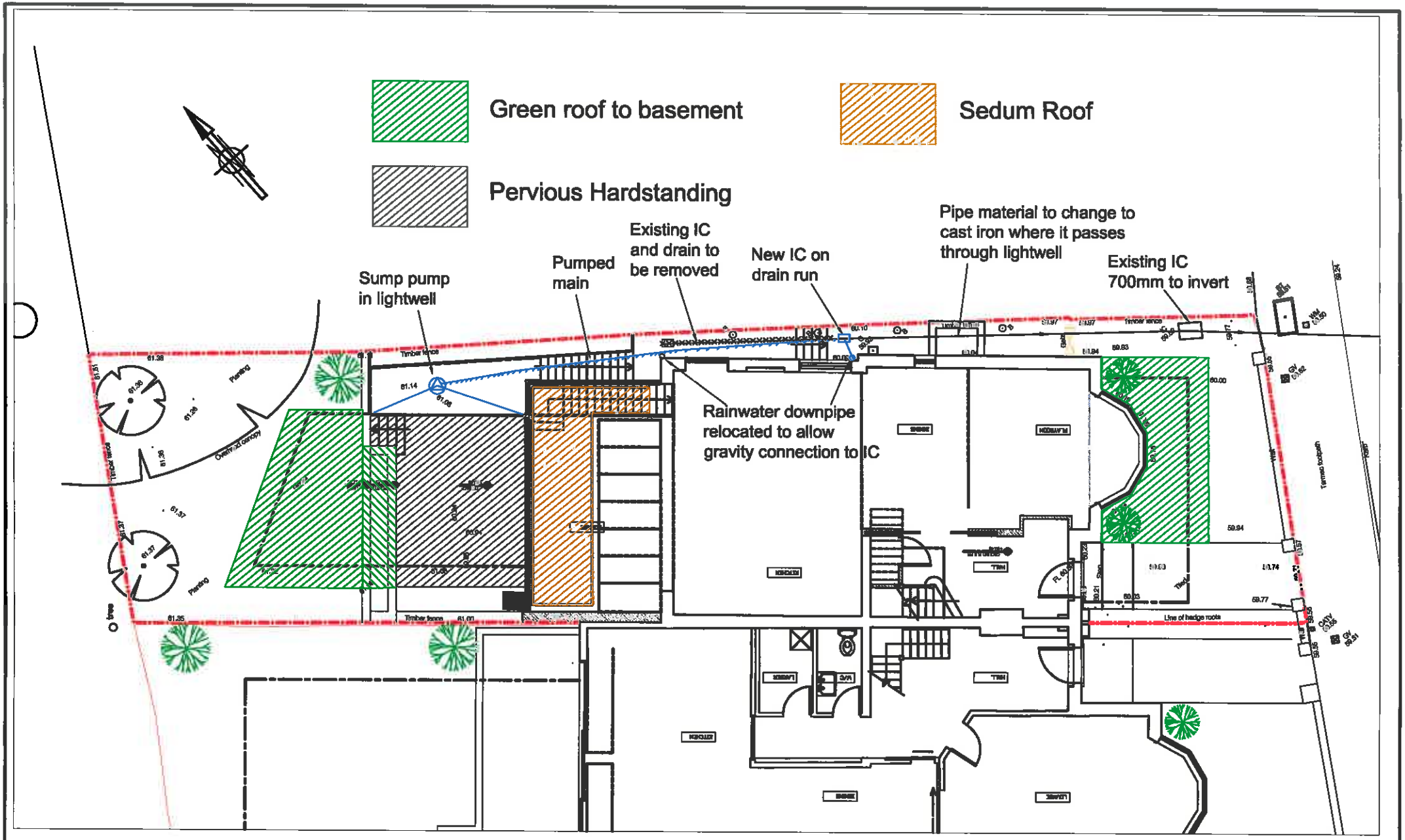
DRAWING TITLE
PROPOSED SECTIONS

DATE
JAN 2012

SCALE
1:50 @A1
1:100@A3

JOB NO
1115

DWG NO/REV
116/-



Client	
Project	8 Antrim Grove
Title	SUDS Proposals

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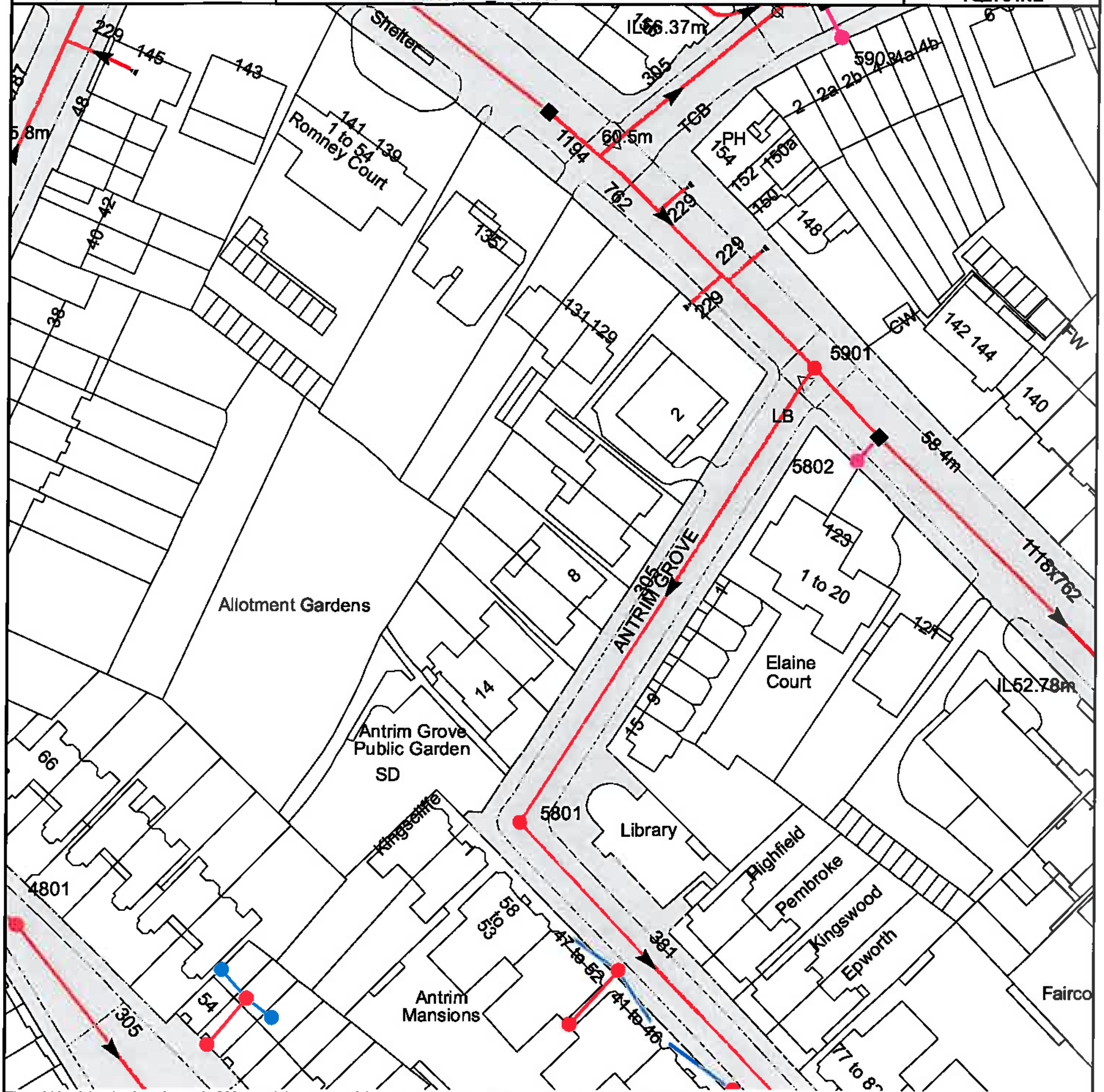
Drn.	JAS
Date	June 2012
Scale	1:100
Drawing No.	Rev.
30452/SK03	-

APPENDIX B
DRAINAGE MAPS

Asset Location Search Sewer Map - ALS/ALS Standard/2012_2252033	TQ2784NE



The width of the displayed area is 200m and the centre of the map is located at OS coordinates 527506,184879

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

APPENDIX C
CALCULATIONS

PRE DEV

Knapp Hicks & Partners Ltd		Page 1
Kingston House Long Barrow Road Orbital Park Ashford	8 Antrim Grove Pre Development	
Date June 2012 File hev test 1.mdx	Designed by JAS Checked by	
Causeway	Network W.12.6	

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	15.000	0.320	46.9	0.010	5.00	0.0	0.600	o	150
1.001	8.500	4.620	1.8	0.004	0.00	0.0	0.600	o	150

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.17	59.440	0.010	0.0	0.0	0.0	1.47	26.0	1.4
1.001	50.00	5.19	59.120	0.014	0.0	0.0	0.0	7.49	132.4	1.9

PRE DEV

1 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 100
Climate Change (%) 0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	1	0%					
1.001	15 Winter	1	0%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	ic1	59.464	-0.126	0.000	0.06	0.0	1.5	OK
1.001	ic2	59.132	-0.138	0.000	0.02	0.0	2.0	OK

PRE DEV

100 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 100
Climate Change (%)	0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	100	0%					
1.001	15 Winter	100	0%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	ic1	59.485	-0.105	0.000	0.20	0.0	4.8	OK
1.001	ic2	59.143	-0.127	0.000	0.06	0.0	6.7	OK

POST DEV
+30% CC

Knapp Hicks & Partners Ltd		Page 1
Kingston House Long Barrow Road Orbital Park Ashford	8 Antrim Grove Post Development	Micro Drainage
Date June 2012 File TEST2.MDX	Designed by JAS Checked by	
Causeway	Network W.12.6	

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	10.000	0.220	45.5	0.013	1.00	0.0	0.600	o	150
1.001	8.500	4.620	1.8	0.006	0.00	0.0	0.600	o	150

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	1.11	59.440	0.013	0.0	0.0	0.0	1.50	26.4	1.8
1.001	50.00	1.13	59.220	0.019	0.0	0.0	0.0	7.49	132.4	2.6

POST DEV
+30% CC

1 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 100
Climate Change (%) 30, 30

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Summer	1	+30%					
1.001	15 Summer	1	+30%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	ic1	59.482	-0.108	0.000	0.16	0.0	3.9	OK
1.001	ic2	59.240	-0.130	0.000	0.04	0.0	4.5	OK

POST DEV
+30% CC

Knapp Hicks & Partners Ltd		Page 3
Kingston House Long Barrow Road Orbital Park Ashford	8 Antrim Grove Post Development	
Date June 2012 File TEST2.MDX	Designed by JAS Checked by	
Causeway	Network W.12.6	

100 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 100
Climate Change (%) 30, 30

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Summer	100	+30%					
1.001	15 Summer	100	+30%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	ic1	59.520	-0.070	0.000	0.49	0.0	11.6	OK
1.001	ic2	59.258	-0.112	0.000	0.13	0.0	14.9	OK

APPENDIX D
SUDS SELECTION

8 Antrim Grove

SUDS SELECTION TOOL
(from CIRIA C609)

		Weighting	Permeable pavements	Green roofs	Bioretention	Filtration techniques	Grassed filter strips	Swales	Infiltration devices	Filter drains	Infiltration basin	Extended detention ponds	Wet ponds	Stormwater wetlands	On/offline storage
CRITERIA	Assessment														
Is pollutant removal a priority?	Desirable	1	5	5	5	4	2	4	0	3	0	3	4	5	1
Is water quantity control a priority?	Desirable	1	5	4	2	2	2	3	0	3	0	4	5	3	5
Is peak flow rate a priority?	Yes	2	8	8	4	4	4	8	0	8	0	6	6	6	6
Is groundwater recharge required?	No	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Suitability to type of development	urban infill	1	5	5	3	4	1	2	0	3	0	1	1	1	5
Catchment area	0.39 Ha	1	5	5	5	5	5	5	0	5	0	1	1	1	5
Site slope	0-10%	1	5	5	5	5	5	5	0	5	0	5	5	5	5
Space required	0.06 Ha in private space	1	5	5	3	5	2	2	0	3	0	1	1	1	5
Soil infiltration rate	$<10^{-6}$m/s	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water table depth	>1m	1	5	5	5	5	5	5	0	5	0	5	5	4	5
Total			**43**	**42**	**32**	**34**	**26**	**34**	**0**	**35**	**0**	**26**	**28**	**26**	**37**