BUILD WARRANTY

Drainage Strategy

At

83 Udney Park Road

Teddington TW11 9BB

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CONTENTS

Job No : 2760

Revision No : A

Written by : RJ Croot *B.Eng C.Eng M.I.Struct.E*

Date : December 2024

1.0 Introduction

1.1 Build Warranty Technical Services (BWTS) have been appointed by Mr N Jarvis, the landowner and client, to prepare a drainage strategy to discharge planning condition U0194312 of London Borough of Richmond Upon Thames Council planning approval 23/2359/FUL for the construction of a pair of new semi-detached residential dwellings.

1.2 The site is in Udney Park Road and is centred on a National Grid Reference (NGR) E 516349 N 516349, 170776 (TQ 16349 70776) with a site area of approximately 0.051 hectares (Ha). The site is located on the eastern side of Udney Park Road as shown in figure 1 below:

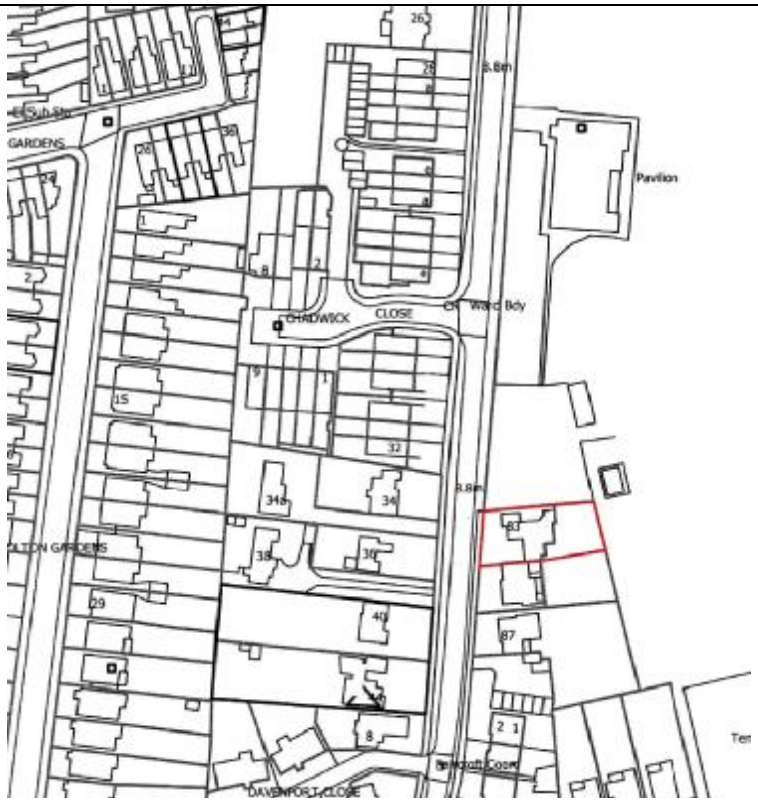


Figure 1 – Site location Plan

1.3 This report has been prepared by Build Warranty Technical Services to consider design of the foul and surface water drainage system and the impact on local infrastructure.

1.4 Mr R J Croot, the author of this report, is BEng CEng & MIStructE qualified and has over 25 years' experience of the civil and structural design and construction of high-end residential properties in the London and surrounding area.

2.0 Existing Ground Conditions

A site investigation carried out by Albury SI for a similar property located at 26 Udney Park Road ref 13/9958/KJC dated October 2013 is contained within appendix B which determined the existing ground conditions as follows.

2.1 Geology

An examination of the 1:50,000 Geological Survey map of the area, together with the Regional Handbook of Geology, indicates that the site is underlain by Kempton Park Gravels of Recent or Pleistocene age, which in turn overlies London Clay of late Eocene age.

2.2 Stratigraphy

A series of boreholes and trial pits were undertaken to a maximum depth of 15.0m below ground level (BGL) and revealed the following stratigraphy:

- Made ground was encountered to a depth of 0.60m BGL.
- Dense clayey sand with gravel becoming gravelly sand, classified as made ground, was observed beneath the made ground to a depth of 2.75m BGL.
- A sandy gravel was exposed beneath the made ground and was shown to extend to 6.4m depth BGL. These soils are indicative of Kempton Park Gravel.
- Beneath the Kempton Park Gravel the London Clay formation was encountered to a depth of 15.0m BGL.

2.3 Groundwater

Groundwater strikes were recorded at 5.70m BGL depth during the investigation. Short-term standing water levels upon completion of the borehole was 5.50mn BGL.

Subsequent return visits recorded a level of 4.25m & 4.27m BGL.

2.4 Soil Contamination

A sample of made ground was tested for contamination was undertaken as part of the site investigation which revealed no contaminants present.

2.5 Infiltration Testing

An infiltration test was undertaken on site in accordance with NHBC Clause 5.3 table 8 procedure using a 200mm diameter hand auger and effective water depth of 400mm at 1.5m depth.

The test took 71 minutes to empty the borehole.

The test concluded a soil infiltration rate of 1.17E-05m/s which is considered reasonable for the Kempton Park Gravels.

3.0 Flood Risk

3.1 A review has been undertaken using the gov.uk mapping tools to identify any risk of flooding from the following elements:

3.2 The site is located within flood zone 1 as shown in figure 3 below:

Figure 3 – Flood Zone Map

3.3 The site is not at risk from flooding from rivers or sea as shown in figure 4 below:

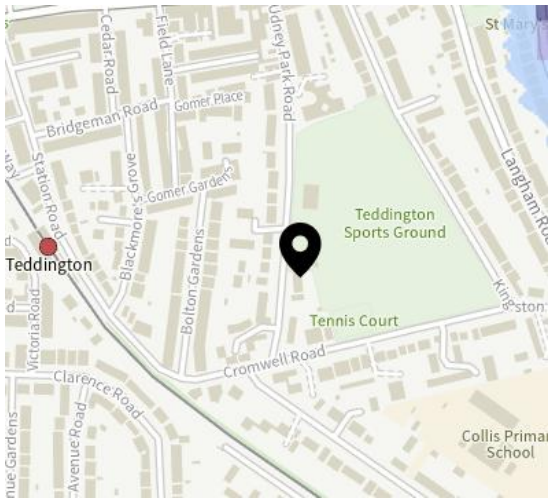


Figure 4 – Extent of Flooding from Rivers and Sea

3.4 The site is at risk from flooding from reservoirs only when there is also flooding from rivers as shown in figure 5 below:

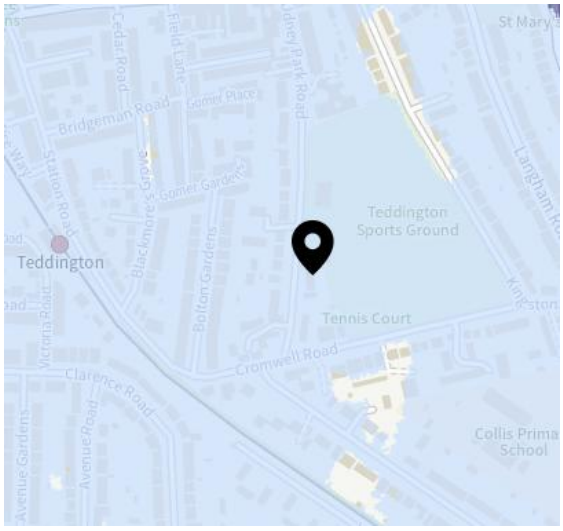


Figure 5 – Extent of Flooding from Reservoirs

3.5 The site is not at risk from flooding from surface water as shown in figure 6 below:

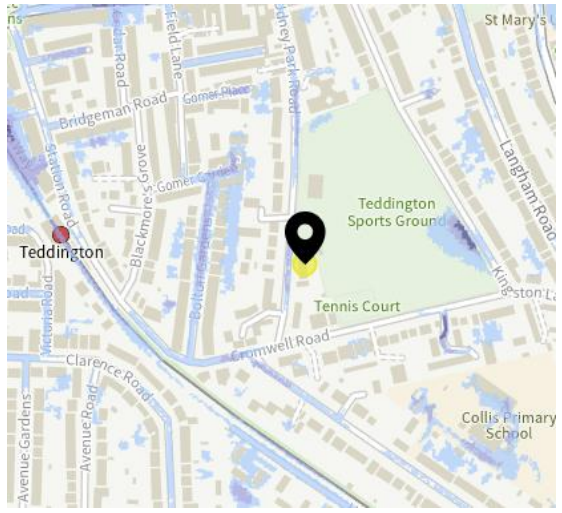


Figure 6 – Extent of Risk Flooding from Surface Water

4.0 Foul Water Drainage Strategy

4.1 All foul drainage will be taken to new demarcation chambers near the western boundary and connect to the existing sewer connection into Udney Park Road subject to Thames Water approval.

4.2 The drainage to the buildings will discharge beneath the ground floor by gravity to the main sewer.

4.3 The gravity drainage system should not require regular maintenance providing unsuitable articles such as disposable nappies and sanitary towels are not flushed down toilets.

5.0 Surface Water Strategy

5.1 Due to the prevailing ground conditions as highlighted in section 2.0, soakaways will be suitable at this location within the Kempton Park Gravels.

5.2 The greenfield run off rate for the existing site has been calculated as 0.49l/s for the 1:100 year storm event as contained within appendix C.

5.3 It is proposed to provide a new surface water drainage network to the properties each discharging to separate soakaways within the rear garden of each property.

Soakaways will be positioned a minimum 5.0m from any building and 2.50m from any boundary.

5.4 The total impermeable roof area to be positively drained to soakaways are as follows:

Building 01 107.0 m²

Building 02 107.0 m²

5.5 The soakaway will be designed in accordance with BRE365 and is contained within appendix D assuming the following parameters:

- 1:10 year storm event with 0% climate change
- 1:30 year storm event with 35% climate change
- 1:100 year storm event with 40% climate change
- Rainfall durations up to 24 hours
- Rainfall depth M5-60 = 20mm
- Rainfall ratio of 60 minute to 2 day rainfalls of 5 year return period = 0.40

5.6 The new houses will include a 50 litre water butt to reuse water as a natural resource, located on the rear elevation of the properties. This will attenuate the runoff from the rear roof initially, then any overflow would continue to discharge into soakaway.

This storage capacity has been ignored in the design of the soakaway.

5.7 The rear patios and footpaths will be formed using permeable paving and be laid to falls away from the building to drain onto the rear soft landscaping area.

5.8 Channel drains will be provided to all door thresholds to prevent any wind-blown surface water entering the building.

5.9 The front driveways will be of permeable resin bound gravel construction.

5.10 In accordance with Interpave publication '*Guide to the Design, Construction and Maintenance of Concrete Block Permeable Pavements'* table 5 the minimum depth of sub-base required for hydraulic design is 210mm assuming:

- Rainfall depth M5-60 = 20mm
- Rainfall ratio of 60 minute to 2 day rainfalls of 5 year return period = 0.40
- 1:30yr, 1:100 yr & 1:100 yr+20% climate change return event
- Rainfall durations up to 24 hours
- Sub-base will empty 50% within 24 hours
- 100% runoff from the permeable pavement is assumed
- Thickness assumes permeable sub-base has a voids ratio of 30%.
- Limited discharge rate 7 l/s/ha.
- For System A infiltration rate greater than 1 x 10-6 m/s.
- Factor of safety on infiltration rate for System A = 1.5 (based on CIRIA Report 156).
- Assumes level site.

5.11 In accordance with Interpave publication '*Guide to the Design, Construction and Maintenance of Concrete Block Permeable Pavements'* figure 23, the minimum depth of sub-base required for structural design is 250mm assuming:

- System A permeable paving
- Minimum CBR=5%
- Loading category 1 for domestic parking (table 7)

6.0 Exceedance Flows

6.1 In the event that the design storm event is exceeded, it is possible that surface water will remain on the surface of the driveways and gardens and flow across the sodden ground following the prevailing ground profile of the site.

6.2 Generally the garden and patios will all be laid to gently fall away from the building for a minimum 5m perimeter to the main building.

6.3 A ramped level access will be provided locally to the doors of the property.

6.4 The site is generally flat, therefore there is no significant direction of exceedance flow off the site.

7.0 Roof Drainage Maintenance Regime

7.1 All gutters should be inspected, and all debris and vegetation removed on a bi-annual basis. One clearance should be scheduled to occur after tree leaf fall in autumn.

7.2 The filter basket within all catch pit manholes located prior to the soakaways should be lifted and thoroughly cleaned with a pressure water jet to remove all silt on a bi-annual basis. One clearance should be scheduled to occur after tree leaf fall in autumn.

7.3 All gulley locations, if present, located around the perimeter of the property at rainwater outlet positions should be cleaned and all debris removed on a bi-annual basis. One clearance should be scheduled to occur after tree leaf fall in autumn.

7.4 The plastic cellular soakaway should not require any maintenance providing the silt traps are regularly cleaned of silt and debris as noted herein.

7.5 The above servicing criteria for the gutters, manhole and gullies will be the responsibility of the property owner.

8.0 Resin Bound Driveway Maintenance Regime

8.1 The landscaping adjacent to the resin bound driveway should be well maintained to prevent soil washout onto the permeable surface. If there is soil washout, it should be cleaned off the pavement immediately to prevent clogging of the pores.

8.2 During the winter, it is very important that sand and abrasives are not used for winter maintenance because they will clog the pores; rather, use de-icing materials. Standard road salt is acceptable as a de-icer.

8.3 Care should be taken not to damage the surface of the driveway from the following abnormal usage:

- *Skips*

  Heavy skips with edges should not be placed directly onto the resin bound driveway. For lighter skips, load bearing planks may be used, but we recommend placing a skip elsewhere if possible.

- *Sharp points*

  Avoid anything that applies a sharp point of pressure onto the surface, such as the stand of a heavy motorcycle.

- *Dragging*

  You should never drag heavy objects across the resin bound driveway.

- *Spillage risks*

  Spillage of solvents should be avoided as these will soften and damage the resin binder.

8.4 Resin Bound surfacing is resistant to a wide range of chemicals. The full chemical resistance builds up over time and care should be taken within the first 7 days of installation to not expose the surface to chemicals.

8.5 Regular sweeping of the resin bound driveway should be undertaken with a stiff brush on a bi-monthly basis to remove leaves and detritus materials and will prevent moss growth.

8.6 Resin bound driveway should be pressure washed on a bi-annual basis considering the following.

- If possible, use a jet washer with a flat nozzle option. This will help to control the flow of the water more precisely.
- Do not use a jet wash/pressure washer setting above 150 bar. Jet flows higher than this pressure could damage the driveway.
- Try to ensure cool, moderate water temperature. Avoid jet washing the resin bound surface on particularly cold days, as water at very low temperatures could damage the resin surface.
- Before starting, use a broom or yard brush to sweep away any larger debris, like leaves and twigs. This helps to ensure that any smaller particles are properly cleared away by the water.
- Keep the nozzle of the jet washer a minimum of 20cm away from the surface of the driveway. Spraying highly pressurised water from a closer distance could damage the surface.
- As the driveway is cleaned, use a sweeping, back-and-forth motion across the entire area to ensure thorough dirt and debris removal.

8.7 An annual inspection should be undertaken to identify any damage to the resin bound material construction and patch repairs made accordingly.

8.8 The responsibility of the maintenance of the road will be the responsibility of the property owner.

9.0 Protection During Construction

9.1 During construction it will be necessary to ensure the SUDS solutions are not damaged or contaminated which will affect their long-term performance upon completion of the development.

9.2 All rainwater pipes to the properties should be connected to the soakaways as soon as practicably possible to prevent excessive water ponding locally around the property.

9.3 All surface and foul water pipes to be laid at depths suitable for construction traffic over without risk of collapse of deformation.

All pipe strength classes to be suitable for their location and anticipated loading.

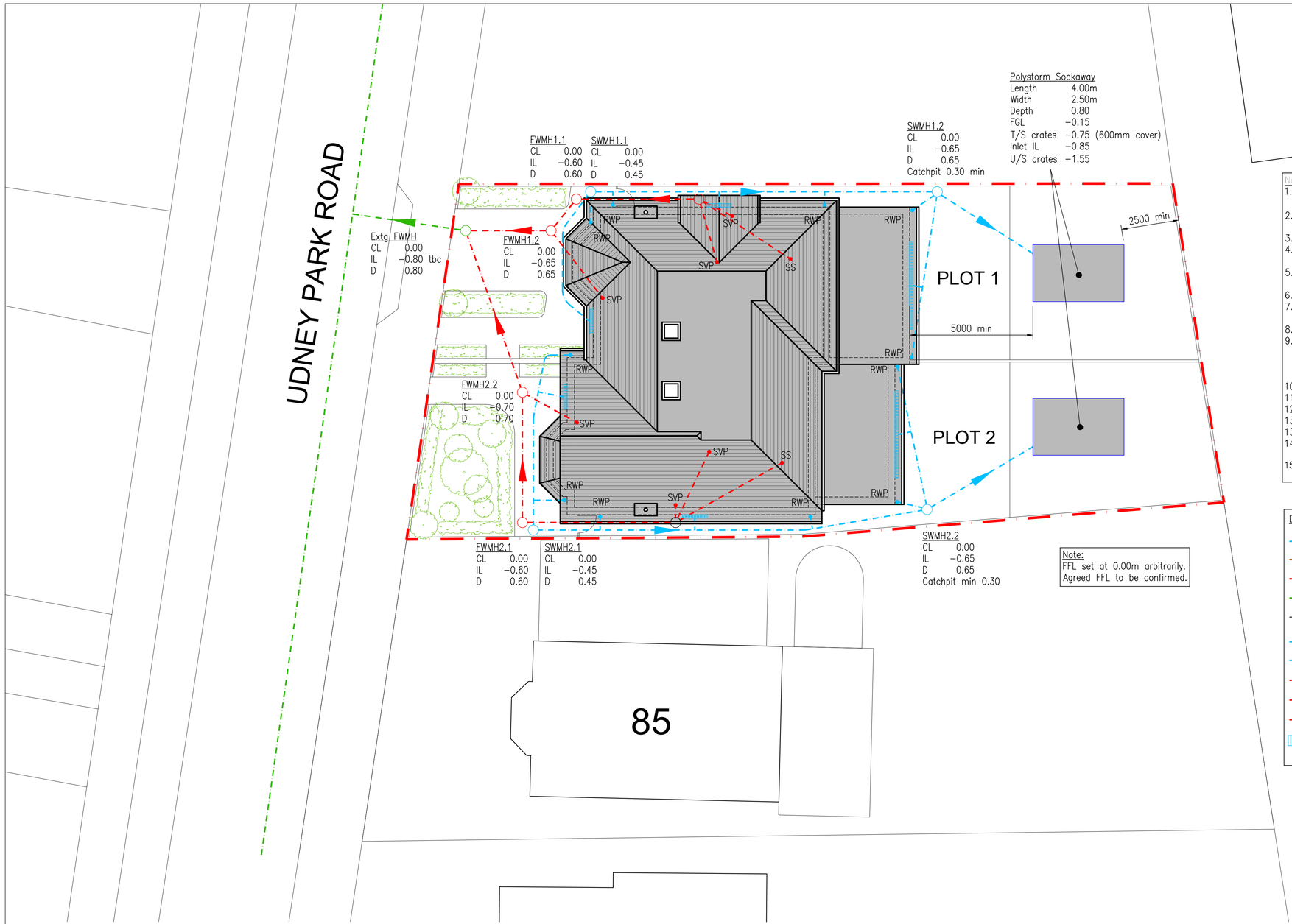
9.4 Construction works should be programmed so that once the sub-base construction layer has been laid to the driveway, footpaths and patio areas, no further services and trenched through the road thus preventing exposure and contamination of the coarse graded aggregate sub-base.

9.5 The finished surface layer of the hard landscaping should be installed as soon as practically possible after the installation of the sub-base to prevent exposure and contamination of the coarse graded aggregate sub-base.

Appendix A

BWTS Drawings

Drawing 2760-100	*'Drainage Layout'*
Drawing 2760-105	*'Drainage Trench & Soakaway Details'*
Drawing 2760-106	*'Demarcation & Access Chamber Details'*



Note:
FFL set at 0.00m arbitrarily.
Agreed FFL to be confirmed.

Notes:
1. All drainage works are to be constructed in accordance with Sewer Sector Guidance Appendix C 'Design & Construction' V2 2020.
2. All pipes are to be selected by the Contractor and to have suitable strength for the service conditions.
3. All pipes are to be suitable for main road traffic unless stated otherwise.
4. The beddings shown are the minimum requirements. The Contractor must ensure the bedding provided is suitable for the selected pipes and loading conditions.
5. 150mm concrete bed and surround to be provided where depth of cover is less than 900mm below finished hardstanding level, or 600mm in soft landscaped areas.
6. Flexcell to be included at all joints as recommended by the manufacturer.
7. All catchpit manholes to have minimum 300 clear void beneath invert of pipe to base of manhole.
8. Pipes of different diameters entering manholes are to be installed with soffits at the same level.
9. The first manhole upstream from the connection to the existing public sewer should, when constructed, be fitted with a screen in order to prevent debris entering the sewer. The screen should be removed immediately prior to the occupation of the premises to be served by the sewer.
10. Cover levels shown are approximate, finished level to match proposed external level
11. All 100mm ø foul water pipes to be laid at 1:80 min gradient unless noted otherwise.
12. All 150mm ø foul water pipes to be laid at 1:150 min gradient unless noted otherwise.
13. All surface water pipes to be 100mm ø laid at 1:80 min gradient unless noted otherwise.
13. All land drain pipes to be 100mm ø laid at 1:200 min gradient unless noted otherwise.
14. All pipes to be unplasticised PVC pipes, joints and fittings in accordance with BS 4660 and BS EN 1401−1.
15. Plastic chambers and rings, including demarcation chambers, shall comply with BS 7158 or BS EN 13598−1.

Drainage Key

	New Surface Water Drainage
	Extg surface Water Drainage to be retained
	New Foul Water Drainage
	Extg Foul Drainage to be retained
	Extg drainage to be removed
RE RWP	Rainwater pipe with slow bend with external rodding eye access
CD	Condensate drain from AHU/condensers
SVP	Soil Vent Pipe
G	Trapped roddable gulley (surface or foul)
BD	Back drop into manhole
	Door threshold channel drain

rev.	date	description	chk.
A	24.12.24	New Drawing – First Issue.	RC

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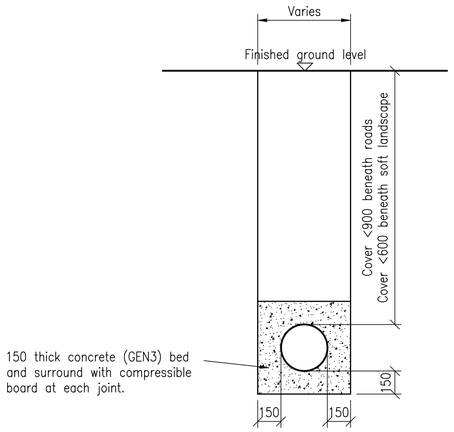
client:
Mr N Jarvis

job title:
83 Udney Park Road
Teddington

drawing title:
Drainage Layout

scale and sheet size
1:100 @A1

job number:	drawing number:	revision:
2760	100	A



Pipe Bedding Type Z
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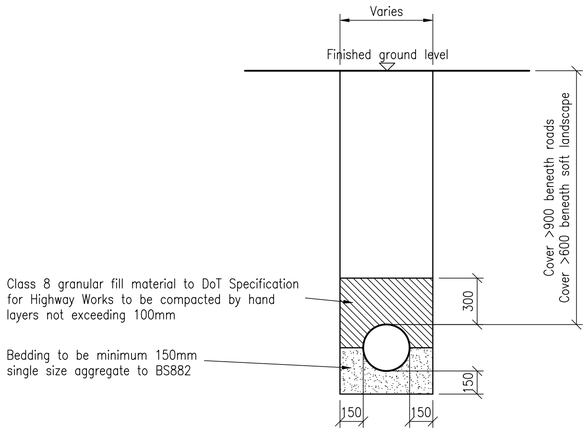

Pipe Bedding Type B
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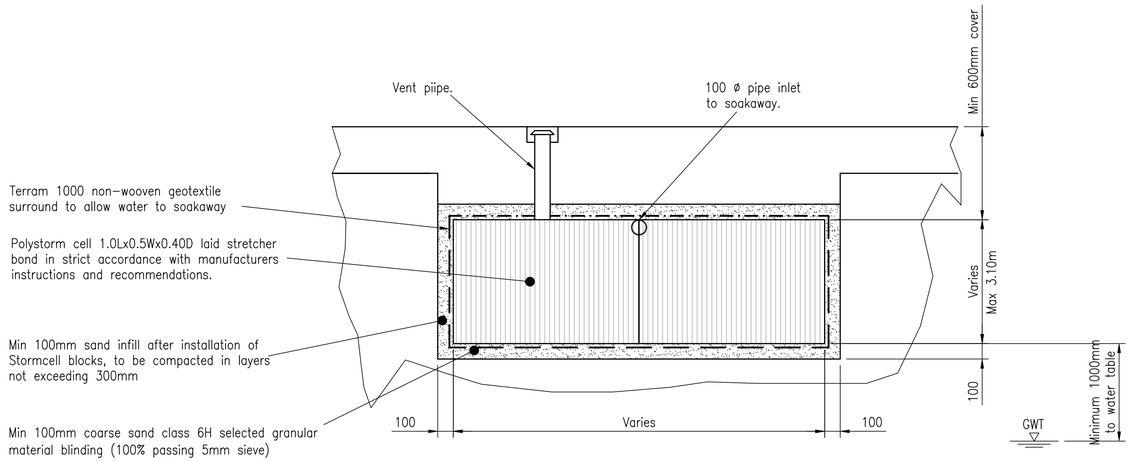

Soakaway Details
(Scale 1:20)

rev.	date	description	chk.
A	24.12.24	New Drawing – First Issue.	RC

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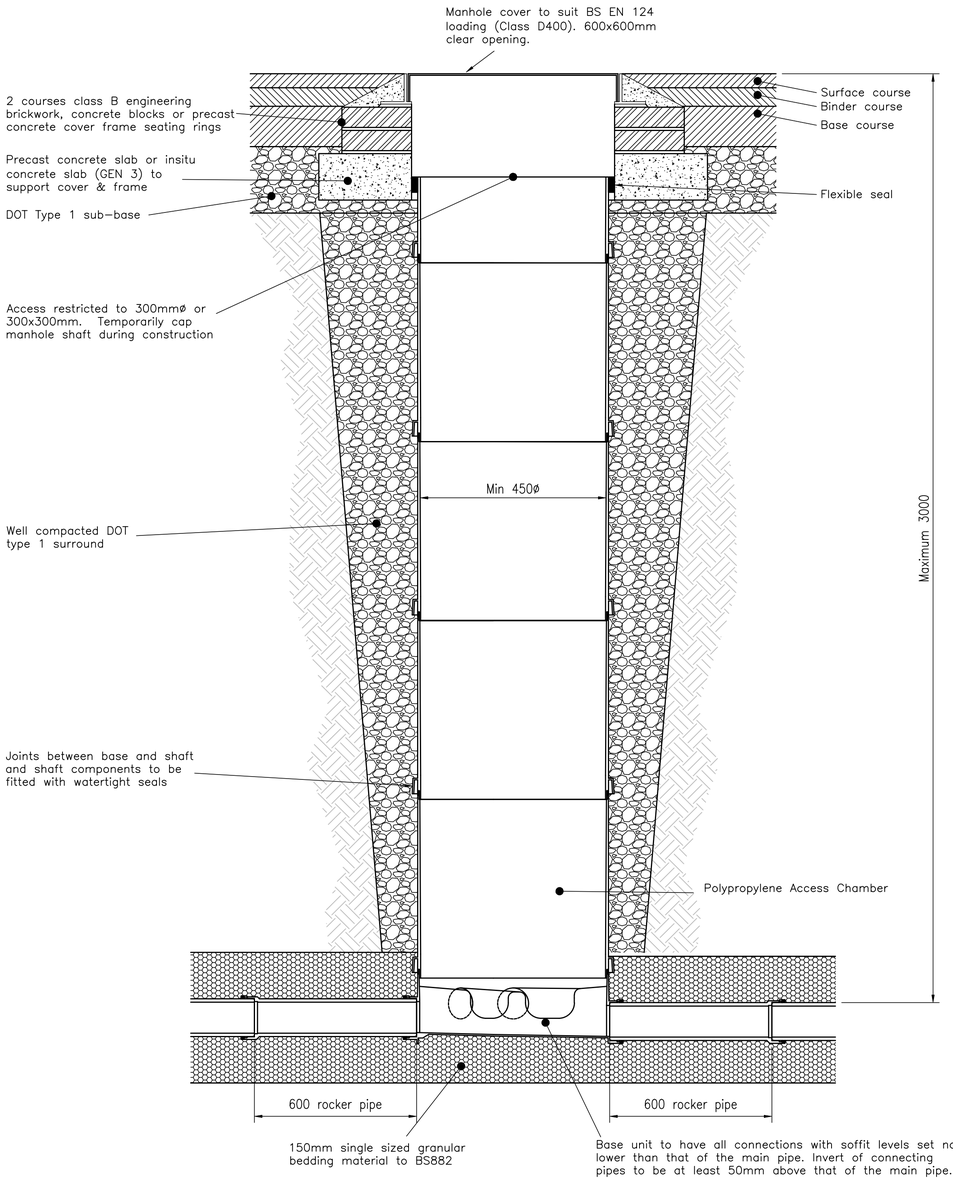
job title:
83 Udney Park Road
Teddington

drawing title:
Drainage Trench Details

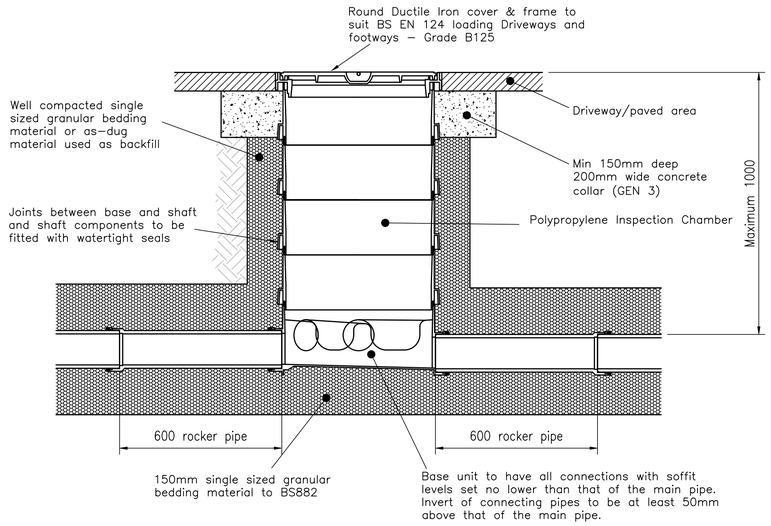
scale and sheet size
As shown @A1

job number:	drawing number:	revision:
2760	105	A



Typical Access Chamber Type 3

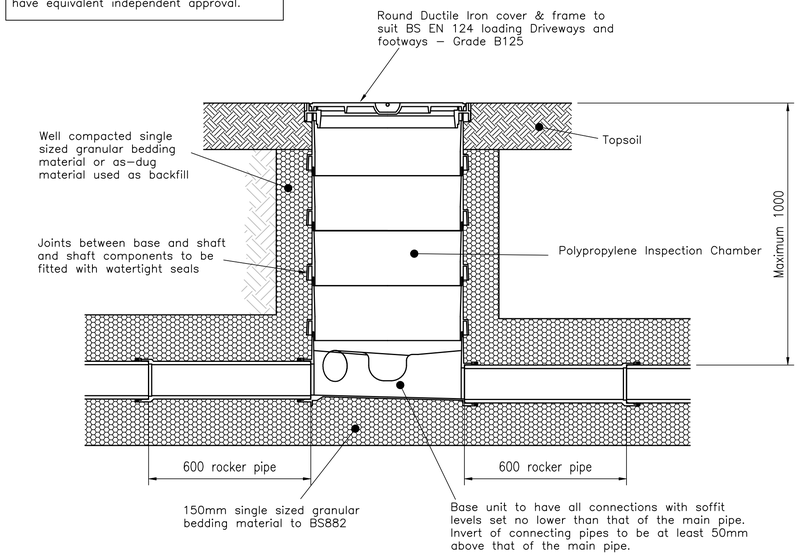
Maximum depth from cover level to soffit of pipe in areas subject to vehicle loading 3m, Non-Entry
(Scale 1:20)



Typical Access Chamber Type 5 in Driveway/Paved Areas

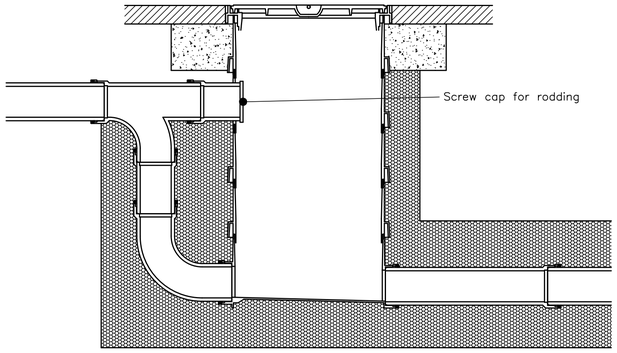
Maximum depth from cover level to soffit of pipe 1m, Non-Entry
(Scale 1:10)

Plastic chambers and rings to comply with BS EN 13598-1 and BS EN 13598-2 or have equivalent independent approval.



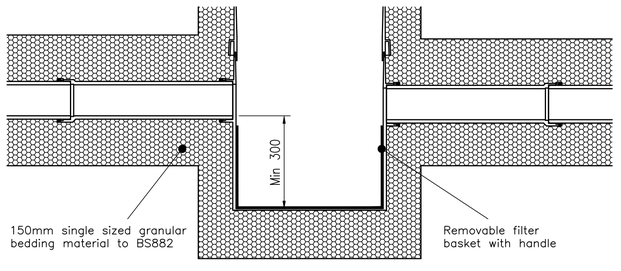
Typical Access Chamber Type 6 in Soft Landscape

Maximum depth from cover level to soffit of pipe 1m, Non-Entry
(Scale 1:10)

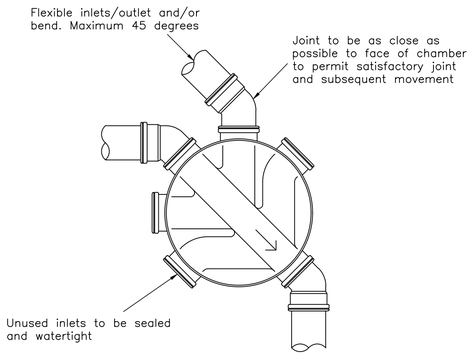


Typical Backdrop Detail

(Scale 1:10)

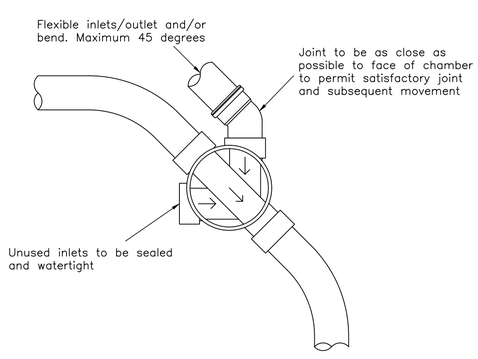


Typical Catchpit Manhole



Typical Access Chamber Types 3 Base Detail

(Not to scale)



Typical Access Chamber Types 5 & 6 Base Detail

(Not to scale)

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client:
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Teddington

drawing title:
Access Chamber Details

scale and sheet size
As shown @A1

job number:	drawing number:	revision:
2760	106	A

Appendix B

Albury SI site investigation report ref 13/9958/KJC dated October 2013

REPORT ON A SITE INVESTIGATION

at

26 UDNEY PARK ROAD, TEDDINGTON, MIDDLESEX TW11 9BG

for

MR D HOBDAY

CONSULTING ENGINEER: TOORC CONSULTING LTD

Report No 13/9958/KJC **October 2013**

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CONTENTS

FOREWORD

The following notes should be read in conjunction with the report. Any variations on the general procedures outlined below are indicated in the text.

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General

The recommendations made and opinions expressed in the report are based on the strata conditions revealed by the fieldworks as indicated on the boring and trialpit records, together with an assessment of the data from insitu and laboratory tests. No responsibility can be accepted for conditions, which have not been revealed by the fieldworks, for example, between borehole and/or trialpit positions. While the report may offer opinions on the possible configuration of strata, both between the excavations and below the maximum depth achieved by the investigation, these comments are for guidance only and no liability can be accepted for their accuracy. For investigations, which include environmental issues, the data obtained relate to the conditions which are relevant at the time of the investigation.

Boring Techniques

Unless otherwise stated, the light cable percussion technique of soft ground boring has been used. This method generally enables the maximum information to be obtained in respect of strata conditions, but a degree of mixing of some layered soils, for example, thin bands of coarse and fine granular soils, is inevitable. Specific attention is drawn to this occurrence where evidence of such a condition is available.

The penetration resistances quoted on the boring records have been determined generally in accordance with the procedure given in BS1377:1990. The suffix '+' donates that the result has been extrapolated from less than 0.3m penetration into undisturbed soil.

Routine Sampling

During construction of boreholes, sampling and insitu testing will be completed in general accordance with Eurocode EN 1997-2:2007 and BS5930:1999. Variations to this code of practice will only occur where the strata conditions preclude implementation or the contract specifies alternatives.

Samples which are required for environmental testing will be stored in suitable glass containers in accordance with current guidelines.

Groundwater

The groundwater observations entered on boring and trialpit records are those noted at the time of the investigation. The normal rate of progress does not usually permit the recording of any equilibrium water level for any one water strike. Moreover, groundwater levels are prone to seasonal variation and to changes in local drainage conditions. The table on each boring record shows the groundwater level at the quoted borehole and casing depths usually at the start and finish of a day's work. The word 'none' indicates that groundwater was sealed off by the borehole casing or that no water was observed in the borehole.

Trialpits

The method of construction employed to form the trialpits is entered in their records. In general, it is not possible to extend machine excavated trialpits to depths significantly below the water table, especially in predominantly granular soils. Except for manually excavated pits, and unless otherwise stated, the trialpits have not been provided with temporary side support during their construction, hence, personnel have not entered them and examined the insitu exposed strata.

Window Sampling

Window sampling comprises driving a probe into the ground. On extraction of the probe the strata encountered are logged and representative disturbed samples recovered. In general, window sampling cannot be completed in granular soils, or below the water table.

Laboratory Testing

Unless stated in the tests, all laboratory tests have been performed in accordance with the requirements detailed in BS1377 (1990): Parts 1-9, or other standards or specifications that may be appropriate.

REPORT ON A SITE INVESTIGATION

at

26 UDNEY PARK ROAD, TEDDINGTON, MIDDLESEX TW11 9BG

for

MR D HOBDAY

CONSULTING ENGINEER: TOORC CONSULTING LTD

Report No 13/9958/KJC **October 2013**

Prepared by **K J Clark BSc Hons**
Senior Geotechnical Engineer

1.0 SYNOPSIS

This investigation has demonstrated that made ground overlies soils thought to be associated with Kempton Park Gravel of Recent or Pleistocene age. At depth, London Clay of late Eocene age has been shown to be present. The groundwater observations noted at the time of the fieldworks suggest that a groundwater profile is present at approximately 4.25m depth below ground level. Hence, problems with respect to the proposed excavations are unlikely to be encountered.

It is understood that it is proposed to extend the existing basement. Strip or spread foundations located at depths of the order of 3m within the Kempton Park Gravel can be designed to apply a maximum increase in load of 150kPa.

2.0 INTRODUCTION

It is understood that it is proposed to extend the existing basement at 26 Udney Park Road, Teddington. Consequently, a site investigation has been undertaken in order to ascertain the nature and engineering properties of the soils underlying this site, and to obtain data which will assist in the formulation of a safe and economical foundation solution.

In accordance with the Client's requirements, the programme of this investigation comprised the construction of a single borehole using light cable percussion boring techniques. During this work, samples were recovered for further examination and laboratory testing. In addition, a number of insitu tests were performed. On completion of the borehole, a standpipe was installed in order to allow the monitoring of the long-term groundwater profile to be completed. This report describes the work undertaken, presents the information obtained and discusses the ground conditions with respect to foundation design and construction.

A copy of the order for these works is presented as Appendix 1. This report is for the benefit of the Client alone and cannot be assigned to a third party without the consent of Albury SI Ltd.

3.0 FIELDWORKS

The borehole was completed on 21st August 2013, at the location as shown on the site plan, drawing no 13/9958/1, which is presented as Appendix 2 to this report. The salient details of this drawing have been extracted from a layout plan supplied by the Client's representative.

The depths and descriptions of the strata encountered in the borehole are given on the borehole record, which comprises Appendix 3 to this report. This record notes the depths at which samples were taken, the results of insitu testing and the groundwater

observations noted at the time of the fieldworks. Upon completion of the borehole a standpipe was installed to allow the monitoring of the long-term groundwater profile.

4.0 GEOLOGY AND STRATA CONDITIONS

An examination of the 1:50,000 Geological Survey map of the area, together with the Regional Handbook of Geology, indicates that the site is underlain by Kempton Park Gravel of Recent or Pleistocene age, which in turn overlies London Clay of late Eocene age. This over-consolidated deposit consists of blue-grey silty clay, which can weather to a brown colouration at, or near surface.

A study of the borehole record indicates that made ground, comprising shingle over gravel grading to dark grey/brown silty sand with gravel, was noted at the investigatory location and was proved to a depth of 0.6m.

Brown clayey sand with gravel becoming gravelly sand was observed beneath the materials classified as made ground. This soil was proved to 2.75m depth. Brown sandy gravel was exposed beneath the gravelly sand and was shown to extend to 6.4m depth. These soils are indicative of the Kempton Park Gravel.

Brown silty clay, rapidly becoming blue-grey silty clay, was revealed beneath the Kempton Park Gravel and was shown to extend to the full depth of this investigation. The borehole was terminated at 15m. The brown and grey-blue soils are typical of the London Clay formation.

A groundwater strike was noted at 5.7m depth. A corresponding short-term standing water level of 5.5m was also recorded. Return visits to site were made on 28th August and 10th September 2013, when depths to water of 4.25m and 4.27m were noted.

Insitu standard penetration tests were performed within the soils associated with the Kempton Park Gravel encountered at this site. Resistances to penetration within the range 23 blows/0.3m and 43 blows/0.3m were recorded, which are indicative of a medium dense to dense condition for a purely granular soil.

5.0 LABORATORY TESTING

A programme of laboratory testing has been undertaken and the results are presented as Appendix 4 to this report. Each type of test is summarised below and the results obtained have been used to assist in the formulation of the discussion of ground conditions.

5.1 Particle Size Distribution

Samples of the granular soils encountered have been subjected to sieve analysis in order to ascertain the soils particle size distribution. This work was extended in once instance by sedimentation analysis to determine the soils clay fraction. The results of this work are presented in the form of grading curves.

5.2 Triaxial Compression

The undrained shear strength characteristics of a sample of the London Clay have been assessed by testing specimens in the triaxial compression apparatus. Under the conditions of this work, cohesions of between 140kPa to 350kPa have been recorded, which are indicative of a stiff to very insitu condition for a purely cohesive soil.

5.3 Chemical Analyses - Soluble Sulphates & pH Values

Selected samples of the soils and groundwater encountered at this site have been subjected to chemical analyses in order to determine their soluble sulphate content and pH values. Under the conditions of this work, generally low levels of soluble sulphates have been recorded in association with near neutral pH values.

5.4 Chemical Analyses - Contamination

A sample of the made ground has been analysed for the presence of contamination in accordance with the current CLEA guidelines together with currently available guidance data. A sample of the made ground has also been subject to Waste

Acceptance Criteria testing. These works have been completed in the *M*CERT*S* and UKAS accredited laboratories operated by Exova Ltd.

6.0 DISCUSSION OF GROUND CONDITIONS

It is understood that it is proposed to redevelop the site by the extension of the existing basement beneath the property under consideration. At the time of the preparation of this report, no precise information was available with regard to the structural loadings. It is likely that the basement structure will extend to depths of the order of 3m.

It cannot be recommended that major structural foundations be located within the made ground revealed by this investigation. Soils of this origin are frequently present in a weak and variable condition, such that unacceptable settlement could occur even under the action of light loading intensities. Therefore, where this condition is likely to arise it would be prudent to extend the foundation excavations through these undesirable materials where they are of less than 1m in thickness to this minimum depth in order to avoid that zone of soil which is subject to normal seasonal moisture variation or frost action. The above precautions need not necessarily be applied to light ancillary structures, which will be formed structurally discrete from the main development and in which a greater degree of settlement can be tolerated.

This is investigation has demonstrated that granular soils associated with the Kempton Park Gravel are likely to be revealed at the basement depth of 3m. It is considered that strip or spread foundations located within these soils can be designed to apply a maximum increase in load of 150kPa. At this loading intensity, a factor of safety of three against general shear failure will be operative. Moreover, settlements should remain within tolerable limits and should be sensibly complete within a normal construction period due to the free draining nature of the Kempton Park Gravel.

It is thought that a satisfactory foundation solution can be formulated on the basis of the foregoing recommendations. Should they be considered unsuitable then an alternative foundation system will be required. Consideration could be given to the use of a piled foundation design. Should the use of piles be considered, it is recommended that the advice of suitably experienced specialist piling contractors be sought in order to arrive at

a satisfactory solution to the problem. The information given in Appendices 3 and 4 of this report may be used in pile design.

Excavations of less than 1m depth should not require temporary support. However, where excavations extend below this level then adequate support should be provided in order to comply with current statutory safety regulations and to maintain the stability of the excavation faces.

The groundwater observations noted at the time of the fieldworks suggest that problems with respect to basement excavations are unlikely. Should slight seepages be encountered or surface water run off drain into foundation excavations, these it is likely that these minor amounts will dissipate through the bases of excavations.

It is evident that support will have to be given to the ground during the construction of the basement as the foundations to the adjacent properties may be present at shallow depth and in close proximity to the basement excavation. It is likely that consideration will have to be given to the use of underpinning beneath the front/rear and flank walls. The groundwater observations have noted a groundwater profile within the soils associated with the Kempton Park Gravel at 4.25m depth. Hence, it is suggested that this work can be completed in dry conditions. Underpinned foundations can be designed on the basis of the maximum increase in load of 150kPa as quoted above.

Alternatively, support can be formed by some form of insitu construction comprising either sheet piling or installation of contiguous bored piling. The final method adopted lies outside the scope of this report as it is dependent upon practical as well as economic considerations together with the construction philosophy of the contractor. However, irrespective of the system employed, it is evident that the installations will extend into the London Clay thereby controlling water inflows within the overlying Kempton Park Gravel. Hence, minimal quantities of groundwater are likely to be anticipated within the basement excavation, which can be dealt with by the use of good engineering practice. The basement should be designed and constructed as a watertight element capable of resisting hydrostatic uplift forces.

In the design of the basement retaining walls account should be taken of the earth pressures derived from the exposed soils and any surcharge loadings that will be applied to the walls. In the design of such structures it is normally necessary to employ the use of effective stress parameters such that the long term stability of the structure can be assured. The table below provides suitable design parameters which are based upon effective stress considerations and therefore reflect the long term performance at this site.

Retaining Wall Design

Soil Parameter	Effective Cohesion c' kPa	Effective angle of friction ∅'	Soil Density kg/cum
Kempton Park Gravel	0	30	1900
London Clay	5	20	1925

It is evident that the basement floor slab will be constructed on naturally occurring soils. Hence, no engineering problems are anticipated in this respect.

7.0 EFFECT OF SULPHATES

The information obtained from this investigation has been compared with the criteria proposed in BRE Special Digest 1; 2005 Edition, Concrete in Aggressive Ground. Using the information in Table C1 (natural ground) of this publication the Aggressive Chemical Environment for Concrete Classification is AC-1s, which coincides with a Design Sulphate Class DS-1. This Design Sulphate Class can be used to establish the design mix for buried concrete in accordance with Part D of the Digest.

A P P E N D I X 1

Order

ALBURY S.I. LTD

Miltons Yard, Petworth Road,
Witley, Godalming, Surrey GU8 5LH
Fax No 01428 685261

Geotechnical and environmental testing specialists

ORDER MANDATE FORM
(to be completed by Client)

Client Company Name:	Mr D Hobday		
Company Address:	26 Udney Park Road Teddington TW11 9BG		
Telephone No:	07909 538294	Email Address:	daveandbean@mac.com
Registered Address: (if different from above)			
Company Registration No:		VAT No:	
Quotation Reference: HMR/29/07/13/b			
Where did you hear of our services?			

I/we hereby confirm acceptance of quotation detailed above from Albury S.I. Limited, and instruct Albury to now programme site investigation works as detailed in their quotation.

Signed..... Dated.....

Print Name..... Position in Company.....

Site Address:	As above
Your Order No:	
Date:	

If Required:
I/we hereby confirm that I authorise my agent, detailed below, to specify works to Albury S.I. Limited required and accept agreed costs on my behalf.

Signed.....See email dated 05/08/13..... Dated...15/08/13.....

Name of Agent/Consulting Engineer/Architect/Project Manager:
Toore Consulting Ltd (Rob Croot)
Address: The Warren, Caunton Road, Bathley, Newark NG23 6DN

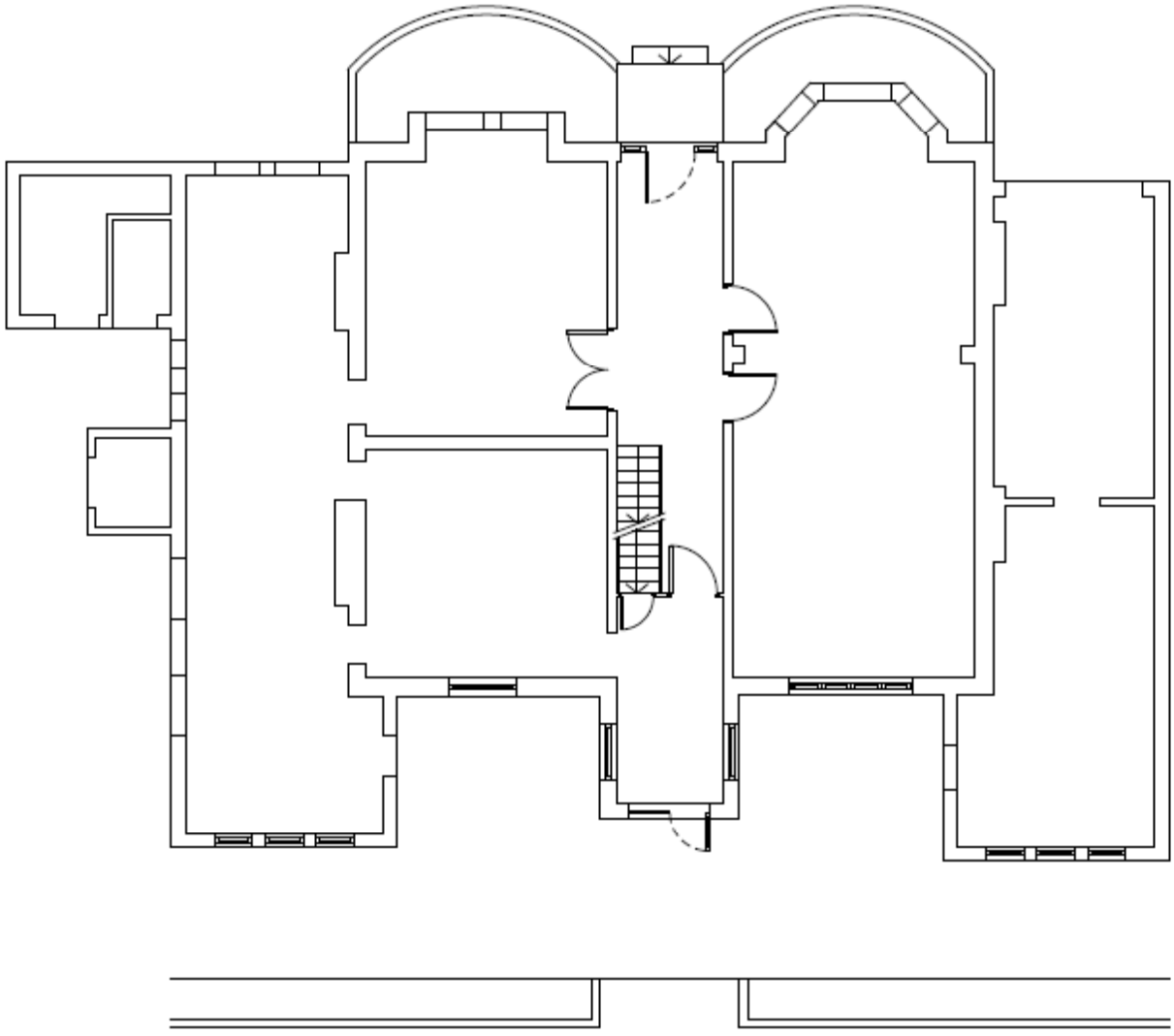
Tel No: 01636 636777 rob.croot@toore.co.uk

On receipt of this form duly completed, the required works will be placed into programme.

A P P E N D I X 2

Site Plan

BH 1



Site:	26 UDNEY PARK ROAD, TEDDINGTON
Drawing No:	13/9958/1
Title:	SITE PLAN
Scale:	NTS
Revision:	A
Issue Date:	1.0 – 18/4/2011

Albury S.I. Ltd
Miltons Yard
Petworth Road
Witley,
Surrey, GU8 5LH
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A P P E N D I X 3

Boring Record

Albury S.I. Ltd

Petworth Road, Witley, Godalming, Surrey, GU8 5LH

		Borehole No	1
Contract	Udney Park Road, Teddington	Report No	13/9958/KJC
Client	Mr D Hobday	Ground Level	mOD
Site Address	26 Udney Park Road, Teddington, Middlesex, TW11	Boring Commenced	21/08/13
		Boring Completed	21/08/13

Type and diameter of boring: Light cable percussion (shell and auger): 150mm diameter

Water Strikes, m		Water levels recorded during boring, m							
1.	5.70	Date	21/08	21/08	28/08	10/09			
2.		Hole Depth	15.00	7.00	6.40	6.40			
3.		Casing Depth	6.60	6.40	s/p	s/p			
4.		Water Level	none	5.50	4.25	4.27			

Remarks

Excavation of starter pit to clear services

Standpipe installed to 6.4m

Samples or tests		SPT			Strata Description
Type	Depth, m	N	Depth	Legend	
			0.20		Made ground (shingle over gravel)
D	0.25				Made ground (dark grey/brown silty sand with gravel)
B	0.50		0.60		
					Dense brown clayey sand with gravel
B	1.00-1.50	32			
D	1.75				
B	2.00-2.50	43	2.00		
					Dense brown gravelly sand
D	2.75		2.75		
B	3.00-3.50	39			Medium dense to dense brown sandy gravel
D	4.00				
B	4.50-5.00	33			
D	5.50				
B	6.00-6.50	23			
			6.40		
					Brown silty clay
			6.80		
D	7.00				Stiff blue-grey silty clay
U	7.50-8.00				
D	8.50				
U	9.00-9.50				

Sampling Code: U- Undisturbed, B - Large Disturbed, D - Small Disturbed, W- Water Sample, (U)*- Non-recovery of undisturbed sample

Albury S.I. Ltd

Petworth Road, Witley, Godalming, Surrey, GU8 5LH

Continuation Sheet No 1

Borehole No 1

Contract: Udney Park Road, Teddington

Report No 13/9958/KJC

Samples or tests		SPT			Strata Description
Type	Depth, m	N	Depth	Legend	
					Stiff to very stiff blue-grey silty clay
D	10.00				
U	10.50-11.00				
D	11.50				
U	12.00-12.50				
D	13.00				
U	13.50-14.00				
D	14.50				
U	15.00-15.50		15.00		

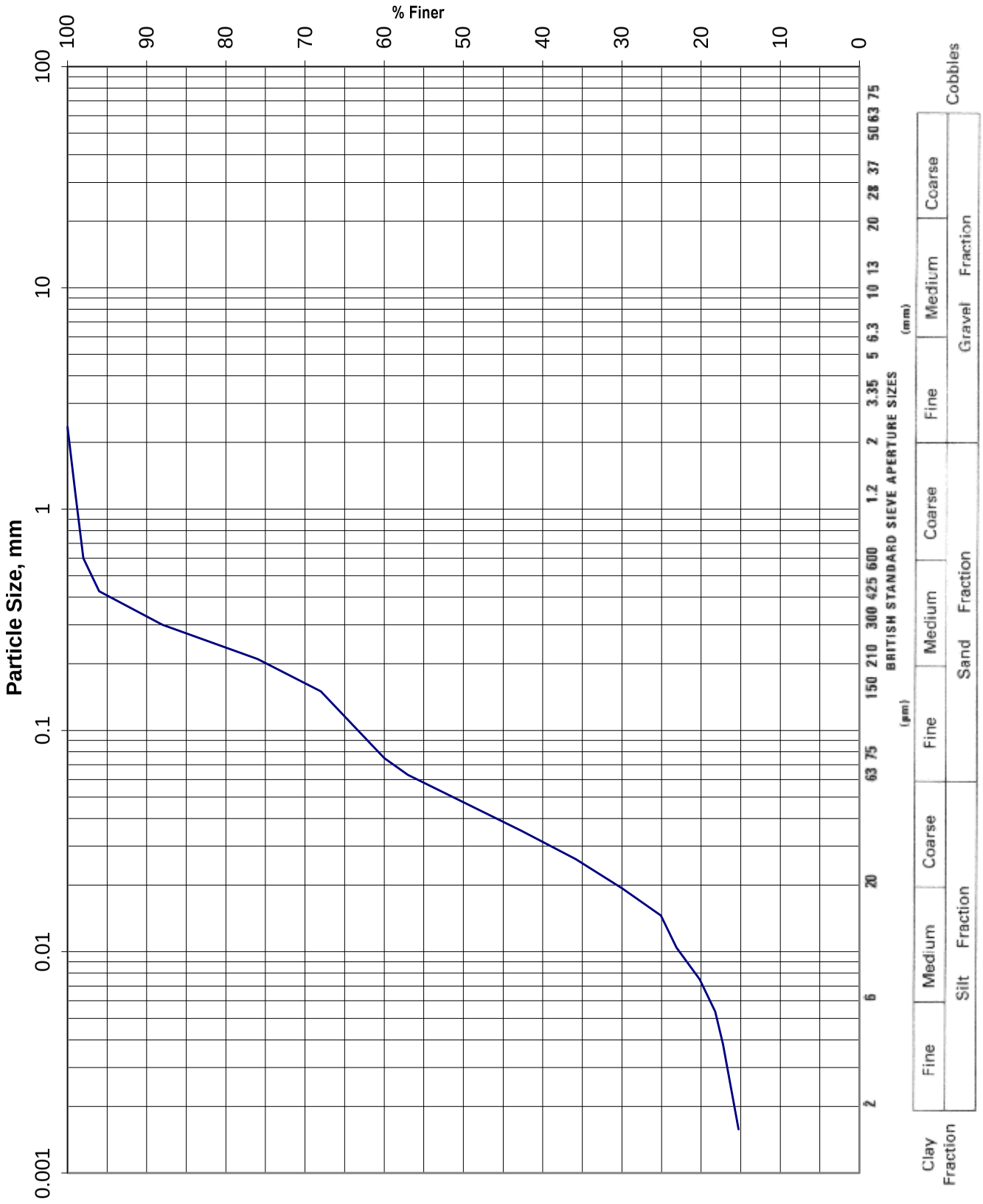
Sampling Code: **U**- Undisturbed, **B** - Large Disturbed, **D** - Small Disturbed, **W**- Water Sample, **(U)***- Non-recovery of undisturbed sample

A P P E N D I X 4

Laboratory Test Results

PARTICLE SIZE DISTRIBUTION - GRADING CURVE

Contract: Udney Park Road, Teddington | Report No. 13/9958/KJC

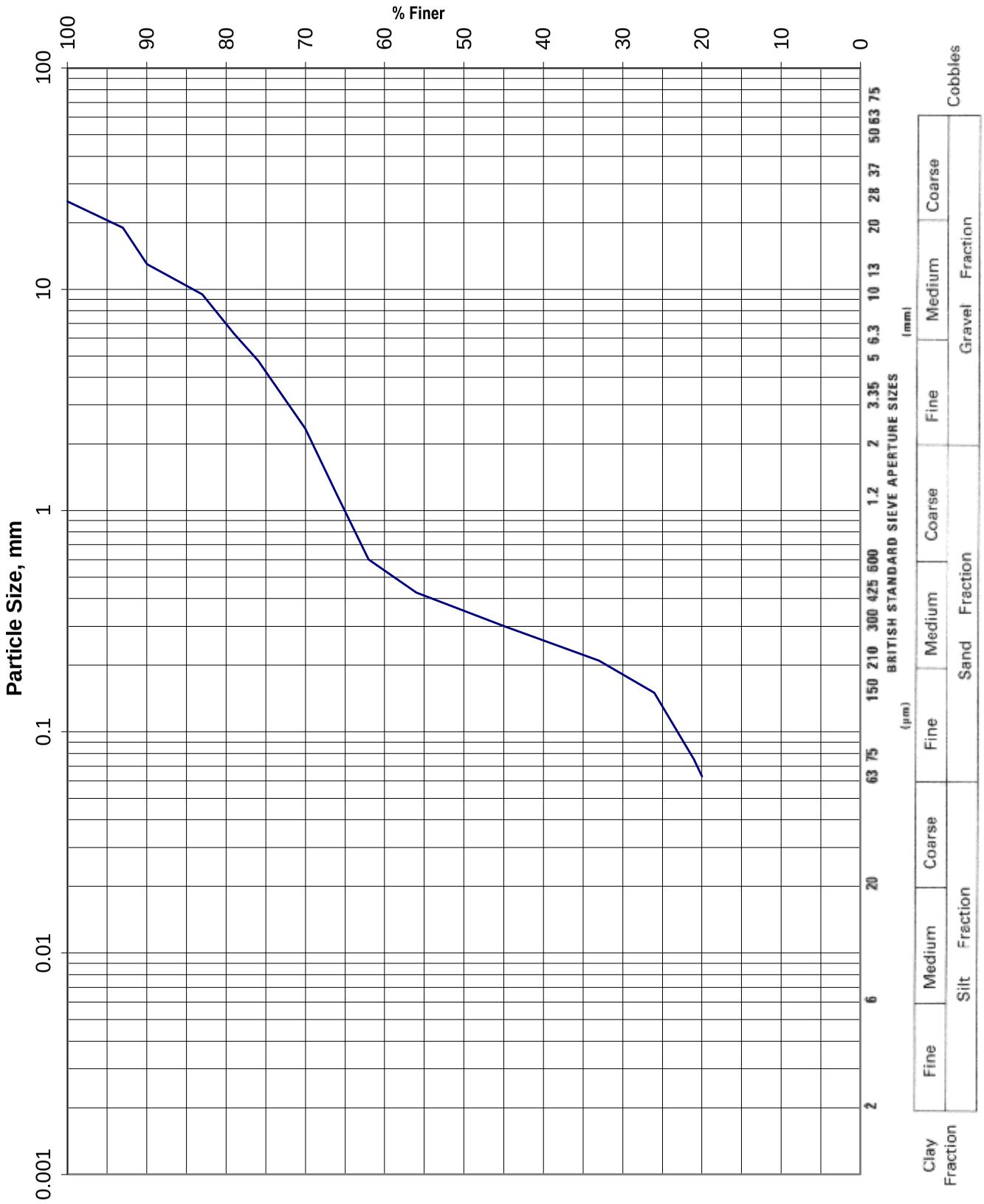


Borehole No. 1 | Depth of Sample, m: 1.00-1.50

Visual Description: Brown clayey sand with occasional gravel

PARTICLE SIZE DISTRIBUTION - GRADING CURVE

Contract: Udney Park Road, Teddington | Report No. 13/9958/KJC

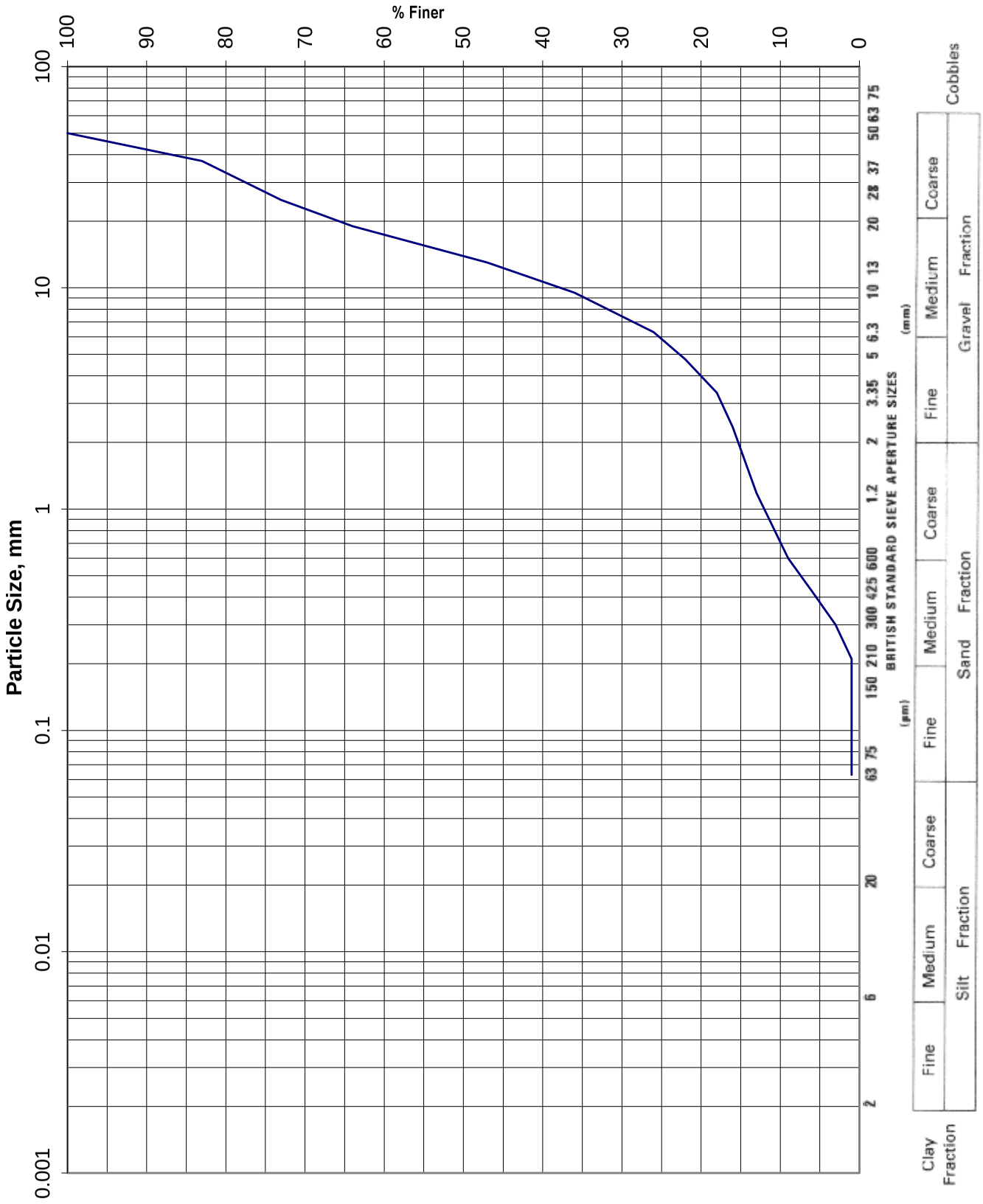


Borehole No. 1 | Depth of Sample, m: 2.00-2.50

Visual Description: Brown gravlley sand

PARTICLE SIZE DISTRIBUTION - GRADING CURVE

Contract: Udney Park Road, Teddington | Report No. 13/9958/KJC



Borehole No. 1 | Depth of Sample, m: 3.00-3.50

Visual Description: Brown sandy gravel

RESULTS OF TRIAXIAL COMPRESSION TESTS

Contract: Udney Park Road, Teddington
Report no: 13/9958/KJC

BH No	Depth of Sample m	Description of Sample	INDEX PROPERTIES				TRIAXIAL COMPRESSION						
			Liquid Limit %	Plastic Limit %	Plasticity Index %	Soil Classification	Code	Lateral Pressure kPa	Compression Strength kPa	Cohesion kPa	Angle of Friction (degrees)	Bulk Density kg/m^3	Water Content (% dry wt)
1	7.50-8.00	Blue-grey silty clay					38U	150 300 450	280 320 250	140	0	1915 1950 1925	26.3 25.8 26.4
	9.00-9.50	Blue-grey silty clay					38U	150 300 450	345 320 280	160	0	1935 1935 1935	27.8 27.5 27.7
	10.50-11.00	Blue-grey silty clay					38U	150 300 450	450 520 475	240	0	1960 1950 1970	26.2 26.0 26.4
	12.00-12.50	Blue-grey silty clay					38U	150 300 450	425 350 280	175	0	1880 1915 1900	27.7 27.0 26.9
	13.50-14.00	Blue-grey silty clay					38U	150 300 450	690 750 655	350	0	1995 2005 2020	26.0 26.1 25.0
	15.00-15.50	Blue-grey silty clay					38U	300 450 600	450 350 345	190	0	1985 1985 1995	25.6 25.5 25.0

Sheet No 1 of 1

TRIAXIAL COMPRESSION TEST CODE: **38-38mm dia specimen** **100-100mm dia specimen**
U-Undrained **CD-Consolidated Drained** **CU-Consolidated Undrained** **P-Pore water pressure measurement** **M-Multistage** **F-Functional** **R-Remoulded** **LV-Laboratory Vane Test**

Albury S. I. Ltd **Miltons Yard Petworth Road Witley Surrey GU8 5LH**

RESULTS OF CHEMICAL ANALYSES

Determination of Sulphate Content and pH value

Contract: Udney Park Road, Teddington **Report No:** 13/9958/KJC

BH No	Depth of sample, m	Description	Concentrations of Sulphates expressed as SO_4			pH value
			In soil		In ground-Water *g/l*	
			Total SO_4 (%)	2:1 water:soil extract *g/l*		
1	1.00-1.50	Clayey sand		0.82		5.5
	2.00-2.50	Gravelly sand		0.64		6.1
	4.50-5.00	Sandy gravel		<0.25		7.9
	6.00-6.50	Clay		<0.25		8.6
	(4.25)	Water			<0.08	6.7

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E: info@exova.com
W: www.exova.com

Test Certificate

Client: Albury SI Ltd
Miltons Yard, Petworth Road, Witley, Surrey, GU8 5LH
Site: Udney Park Road. Teddington
Date Tested: 02/09/13, 03/09/13, 04/09/13, 05/09/13, 06/09/13, 09/09/13
Date Reported: 9 September, 2013
Date Received: 30 August, 2013
Sample Type: Solid

Certificate No: 13/2331/R/S/C1
File No: 13/2331/R/S
Client Ref: 10317

Lab sample ref:	**B453317**
Client sample ref:	**BH1**
	0.5m
Date sampled:	**28/08/13**
Sample matrix (see notes page):	**S**

Determinand	Method	Units	ISO17025	MCERTS	LOD	
Deviation Assessment						
Deviation(s)	C. Review	N/A	N/A	N/A	N/A	N/A
MCERTS Sample Prep						
% Stones	Stones	%	N/A	N/A	0	0.0
Moisture Content @ 35°	CTP01	% w/w	N/A	N/A	0.1	8.2
Sample Description^	SGP5		N/A	N/A		4
Misc						
pH	CTP07		Y	Y		7.0
Sulphate (total)	CTP14	mg/kg	Y	Y	200	340
Sulphate (water soluble)	CTP29	g/l	Y	Y	0.01	0.02
Sulphide M	CTP16	mg/kg	N	N	2	<2
Sulphur (elemental)	SOP11	mg/kg	Y	Y	20	<20
Cyanide (total) M	CTP18c	mg/kg	Y	Y	10	<10
Phenols (screen) M	CTP20	mg/kg	Y	N	1	<1
TOC	CTP22	% w/w	N	N	0.1	3.2
Arsenic	CTP11A 2	mg/kg	Y	Y	2	17
Beryllium	CTP11A 1	mg/kg	Y	Y	1	<1
Boron (water soluble)	CTP12	mg/kg	Y	N	1	1
Cadmium	CTP11A 0.5	mg/kg	Y	Y	0.5	0.6
Chromium (III)	CTP11I	mg/kg	N	N	3	20
Chromium (VI)	CTP15a	mg/kg	Y	N	1	<1
Copper	CTP11A 3	mg/kg	Y	Y	3	35
Lead	CTP11A 1	mg/kg	Y	Y	1	317
Mercury	CTP11A 0.5	mg/kg	Y	Y	0.5	<0.5
Nickel	CTP11A 2	mg/kg	Y	Y	2	15
Selenium	CTP11A 2	mg/kg	Y	Y	2	<2
Vanadium	CTP11A 1	mg/kg	Y	Y	1	34
Zinc	CTP11A 2	mg/kg	Y	Y	2	141
Asbestos Screen*	Asb subcon		Y	N/A		NAD
PAH (USEPA16)						
Acenaphthene M	GCM 501	mg/kg	Y	Y	0.1	<0.1
Acenaphthylene M	GCM 501	mg/kg	Y	Y	0.1	<0.1
Anthracene M	GCM 501	mg/kg	Y	Y	0.1	<0.1
Benz(a)anthracene M	GCM 501	mg/kg	Y	Y	0.1	0.4
Benzo(a)pyrene M	GCM 501	mg/kg	Y	Y	0.1	0.5
Benzo(b)fluoranthene M	GCM 501	mg/kg	Y	Y	0.1	0.7
Benzo(ghi)perylene M	GCM 501	mg/kg	Y	Y	0.1	0.3
Benzo(k)fluoranthene M	GCM 501	mg/kg	Y	Y	0.1	0.2
Chrysene M	GCM 501	mg/kg	Y	Y	0.1	0.5
Dibenz(a,h)anthracene M	GCM 501	mg/kg	Y	Y	0.1	<0.1
Fluoranthene M	GCM 501	mg/kg	Y	Y	0.1	1.0
Fluorene M	GCM 501	mg/kg	Y	Y	0.1	<0.1
Indeno(1,2,3-cd)pyrene M	GCM 501	mg/kg	Y	Y	0.1	0.3
Naphthalene M	GCM 501	mg/kg	Y	Y	0.1	<0.1
Phenanthrene M	GCM 501	mg/kg	Y	Y	0.1	0.3
Pyrene M	GCM 501	mg/kg	Y	Y	0.1	0.9

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Test Certificate

Client: Albury SI Ltd
Miltons Yard, Petworth Road, Witley, Surrey, GU8 5LH
Site: Udney Park Road. Teddington
Date Tested: 02/09/13, 03/09/13, 04/09/13, 05/09/13, 06/09/13, 09/09/13
Date Reported: 9 September, 2013
Date Received: 30 August, 2013
Sample Type: Solid

Certificate No: 13/2331/R/S/C1
File No: 13/2331/R/S
Client Ref: 10317

Lab sample ref:	**B453317**
Client sample ref:	**BH1**
	0.5m
Date sampled:	**28/08/13**
Sample matrix (see notes page):	**S**

Determinand	Method	Units	ISO17025	MCERTS	LOD	
TPH Banded						
C8-C15 M	SOP03b	mg/kg	N	N	10	<10
>C15-C20 M	SOP03b	mg/kg	N	N	10	<10
>C20-C30 M	SOP03b	mg/kg	N	N	10	12
>C30-C36 M	SOP03b	mg/kg	N	N	10	<10

Notes
1. All analyses performed on the sample dried at 35ºC, except analyses suffixed with 'M'.
2. Analyses suffixed 'M' were performed on the sample as received and corrected for '% moisture at 35ºC' where applicable.
3. All results are expressed as dry weight.
4. MCERTS accreditation applicable to Sample Matrix 'S' only.
5. Natural stones (pebbles, gravels etc.) which do not pass a 2mm sieve are excluded from dried analyses.
6. Tests marked * indicate subcontracted analyses.
7. NAD denotes 'No Asbestos Detected'.
8. The laboratory has tested the material/items supplied by the client as sampled in accordance with the client's own requirements.
9. ^Sample Description key: 1. - Sand, 2. Loam, 3. Clay, 4. Sandy loam, 5. Sandy clay, 6. Clayey loam, 7. Other.
   suffixed with: A - Stones, B - Construction rubble, C - Visible Hydrocarbons
10. Dates of testing for all parameters are available on request.
11. Please note 'Asbestos screen' testing has been analysed at Exova (Glasgow). This laboratory holds UKAS accreditation (UKAS No. 0568) for both 'Asbestos Screen' and 'Identification' as per document 'HSG 248'.

Signed for, and on behalf of Exova (UK) Ltd.

Prepared by:

S Blemings
Account Manager

Approved by:

A Young
Operations Manager

0871

REPORT FOR WASTE ACCEPTANCE CRITERIA TESTING - BSEN 12457 - 3

Client:	Albury SI Ltd	Certificate No:	13/2332-34/R/C1
Site:	Udney Park Road. Teddington	File No:	13-2332to2334
Date Received:	30 August, 2013	Client Ref:	10317
Date Tested:	02/09/13, 03/09/13, 04/09/13, 05/09/13, 06/09/13, 09/09/13	Sample Ref:	BH1 0.5m
Date Reported:	9 September, 2013	Lab Sample ref:	B453318

Solid Waste Analysis(Dry Basis)	Accrediataion	Method	Units	Concentration in Solid(Dry weight basis)	Landfill Waste Acceptance Criteria Limit Values: Inert waste Landfill	Stable Non-reactive Hazardous waste in Non hazardous Landfill	Hazardous waste Landfill
Total Organic Carbon	N	CTP33	%w/w	**4.4**	3	5	6
Loss On Ignition	N	CTP01	%w/w	**4.2**			10
BTEX $_{M}$	Y	SOP01	µg/kg	**<10**	6000		
PCB(Congeners) $_{M}$	Y	SOP10	µg/kg	**<5**	1000		
Mineral Oil $_{M}$	N	CTP40	mg/kg	**<10**	500		
PAH(total)	Y	SOP04	mg/kg	**4.4**	100		
pH	Y	CTP07	pH units	**7.1**		>6	
Acid Neutralisation Capacity	N	CTP41	mol/kg	**0.7**		ND	ND
Base Neutralisation Capacity	N	CTP41	mol/kg			ND	ND

Leachate Analysis	Accreditation	Method	2:1 Leachate(mg/l)	8:1 Leachate(mg/l)	Calculated amount leached at 2:1 (mg/kg)	Calculated cumulative amount leached at 10:1(mg/kg)	Landfill Waste Acceptance Criteria Values for BSEN 12457-3 for L/S 10l/kg (mg/kg dry weight): Inert waste Landfill	Stable Non-reactive Hazardous waste in Non hazardous Landfill	Hazardous Waste Landfill
pH (pH units)	N	CTP07	8.0	7.9					
Conductivity(µs/cm)	N	CTP08	217	100					
Arsenic	N	CTP30	0.027	0.011	0.054	**0.125**	0.5	2	25
Barium	N	CTP30	0.02	0.02	0.04	**0.20**	20	100	300
Cadmium	N	CTP30	<0.0005	<0.0005	<0.001	**<0.001**	0.04	1	5
Chromium	N	CTP30	0.0011	0.0013	0.002	**0.013**	0.5	10	70
Copper	N	CTP30	0.0684	0.0210	0.137	**0.253**	2	50	100
Mercury	N	CTP30	<0.0001	<0.0001	<0.0002	**<0.0002**	0.01	0.2	2
Molybdenum	N	CTP30	0.013	0.002	0.026	**0.030**	0.5	10	30
Nickel	N	CTP30	0.005	0.003	0.010	**0.032**	0.4	10	40
Lead	N	CTP30	0.002	0.006	0.004	**0.056**	0.5	10	50
Antimony	N	CTP30	0.026	0.006	0.052	**0.078**	0.06	0.7	5
Selenium	N	CTP30	<0.001	<0.001	<0.002	**<0.002**	0.1	0.5	7
Zinc	N	CTP30	0.011	0.011	0.022	**0.110**	4	50	200
Chloride	N	CTP09	<5	<5	<10	**<10**	800	15000	25000
Fluoride	N	CTP09	<1	<1	<2	**<2**	10	150	500
Sulphate	N	CTP09	20	<10	40	**18**	1000	20000	50000
Total Dissolved Solids	N	CTP04	140	75	280	**809**	4000	60000	100000
Phenols	N	CTP20	0.3	0.2	1	**2**	1		
Dissolved Organic Carbon	N	CTP33	52	39	104	**402**	500	800	1000

Notes: 1. Analyses suffixed 'S' were performed on the sample dried at 35ºC. 2. Analyses suffixed 'SM' were performed on the sample as recievd. 3. The laboratory has tested the material/items supplied by the client as sampled in accordance with the client's own requirements. 4. UKAS accrediatation does not include leachate preparation.

Signed for, and on behalf of Exova Ltd.

Prepared by:

S Blemings
Account Manager

Approved by:

A Young
Operations Manager

A P P E N D I X 5

Contamination Guidelines

Soil Generic Assessment Criteria for Human Health - Inorganics

Determinand	GAC Land-use category (mg/kg^{-1})				GAC Source
	Residential with consumption of home-grown produce	Residential without consumption of home-grown produce	Allotments	Commercial	
Arsenic*	32	ND	43	640	EA SGV, 2009
Antimony	ND	550	ND	7500	EIC/AGS/CL:AIRE, 2010
Barium	ND	1300	ND	22000	EIC/AGS/CL:AIRE, 2010
Beryllium*	51	ND	55	420	LQM/CIEH, 2009
Boron*	291	ND	45	192000	LQM/CIEH, 2009
Cadmium*	10	ND	1.8	230	EA SGV, 2009
Chromium III*	3000	ND	34600	30400	LQM/CIEH, 2009
Chromium VI*	4.3	ND	2.1	35	LQM/CIEH, 2009
Copper*	2330	ND	524	71700	LQM/CIEH, 2009
Inorganic Mercury (Hg^{2+})	170	ND	80	3600	EA SGV, 2009
Elemental Mercury (Hg^{4})	1	ND	26	26	EA SGV, 2009
Methyl Mercury (Hg^{+4})*	11	ND	8	410	EA SGV, 2009
Molybdenum	ND	670	ND	17000	EIC/AGS/CL:AIRE, 2010
Nickel*	130	ND	230	1800	EA SGV, 2009
Selenium*	350	ND	120	13000	EA SGV, 2009
Vanadium*	75	ND	18	3160	LQM/CIEH, 2009
Zinc*	3750	ND	618	665000	LQM/CIEH, 2009

*based on a sandy loam with soil organic matter of 6% and pH 7.0 (Environment Agency, 2009)
ND: Not Derived

Soil Generic Assessment Criteria for Human Health - Organics

Determinand	GAC Land-use category (mg/kg^{-1})				GAC Source
	Residential with consumption of home-grown produce	Residential without consumption of home-grown produce	Allotments	Commercial	
Benzene	0.33	ND	0.07	95	EA SGV, 2009
Phenol	420	ND	280	32000	EA SGV, 2009
Ethyl benzene	350	ND	90	2.8×10^3	EA SGV, 2009
Toluene	610	ND	120	4.4×10^3	EA SGV, 2009
o-xylene	250	ND	160	2.6×10^3	EA SGV, 2009
m-xylene	240	ND	180	3.0×10^3	EA SGV, 2009
p-xylene	230	ND	160	3.2×10^3	EA SGV, 2009

based on a sandy loam with soil organic matter of 6% and pH 7.0 (Environment Agency, 2009)
ND: Not Derived

The above GAC are presented above for reference only and should be considered with their respective technical notes.

References:

Environment Agency, 2009. Updated technical background to the CLEA model. Science Report SC050021/SR3
LQM/CIEH, 2009. Generic Assessment Criteria for Human Health Risk Assessment (2nd Edition)
EIC/AGS/CL:AIRE, 2010. Soil Generic Assessment Criteria for Human Health Risk Assessment.

WASTE TREATMENT

The Landfill (England and Wales) Regulations 2002 require that waste (including inert arisings and contaminated soil) must be treated before it is disposed of at non-hazardous and inert landfills. The proposed treatment option must be compared against a 'three-point test'.

1) It must be a physical, thermal, chemical or biological process including sorting.
2) It must change the characteristics of the waste; and
3) It must do so in order to:
   a) reduce its volume; or
   b) reduce its hazardous nature; or
   c) facilitate its handling; or
   d) enhance its recovery.

There are limited exceptions to the above:

- it is inert waste for which treatment is not technically feasible
- it is waste other than inert waste and treatment would not reduce its quantity or the hazards that it poses to human heath or the environment

The waste producer should either

- treat their own waste and provide information about the treatment for subsequent holders, or
- ensure that the waste would be treated by a subsequent holder prior to landfilling

The waste producer or holder should produce a written statement detailing the type of treatment and if relevant the amount of waste sorted out for recovery or alternative treatment.

Based on the foregoing Guidance, it is evident that the current methods of simply removing "contaminated" soil from the site will have to be amended. Preferably as much soil as possible should remain on site, where possible; for example, under areas of hard cover, paths, drives etc. Soils that are to be removed from site must be treated and this may simply be sorting for example the removal of brick and concrete, which can be crushed and used elsewhere. Contaminated soils will require treatment either on site or at a specialist facility prior to disposal. It will be important therefore to ensure that the new guidelines are followed during the development of the site. This is likely to have implications on the development both in terms of cost and these should be carefully considered prior to commencement.

Appendix C

Greenfield Run-Off rate calculation

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Rob Croot
Site name:	83 UPR
Site location:	83 UPR

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.42405° N
Longitude:	0.32801° W
Reference:	2281452312
Date:	Jan 02 2025 12:57

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): .1

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	600	600
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	0.15	0.15
1 in 1 year (l/s):	0.13	0.13
1 in 30 years (l/s):	0.35	0.35
1 in 100 year (l/s):	0.49	0.49
1 in 200 years (l/s):	0.57	0.57

Appendix D

BRE365 Soakaway Design

Client	**Mr N Jarvis**
Project	**83 Udney Park Road**
Job No	**2760**
Date	**24.12.24**

BUILD WARRANTY

Soakaway/Attenuation design in accordance with BRE Digest 365

Soil Infiltration Rate in accordance with NHBC Clause 5.3 table 8 procedure

Diameter	D	0.20	m
Effective Depth	d	0.40	m
Volumne of outflow between 75% & 25% effective depth	Vp_{75-25}	0.00628319	m3
Mean surface area over 50% effective depth of pit	ap50	0.13	m2
Time betweeen 75% & 25% outflow		71	minutes

Minimum soil infiltration rate **1.17E-05** m/s

Soakaway Details	Dimension	Units
Length	5.00	m
Width	2.00	m
Depth of soakaway	0.80	m
Mean surface area over 50% effective depth of pit	5.60	m2
Soakaway storage volume @95% for open crate soakaway	7.60	m3

Results	Capacity	50% empty time
1:10 year storm event	Pass	Pass
1:30 year storm event	Pass	Pass
1:100 year storm event	Pass	Pass

Climate Change & Urban Creep	Storm Return Period (years)		
	10	30	100
Climate change allowance (%)	0	35	40
Urban Creep Allowance (%)	0	0	0
Total (%)	**0**	**35**	**40**

Area of impermeable surface	Area (m2)
Main roof	107.0
Total	**107.0**

Rainfall Data	Map	Symbol	Result	Comments
Rainfall Depth	1	M5-60	20	
Rainfall ratio of 60 minute to 2 day rainsfalls of 5 year return period	2	r	0.4	Governs Z1 factor

1:10 year storm return period

Storm Duration D		Factor Z1	Climate Change & Urban Creep	M5-D M5-60xZ1	Growth Factor Z2	M10-D M5-DxZ2	Inflow I=AxR	Outflow O=as50xfxd	Storage req S	Soakaway/Attenuation Capacity	Balance	Pass/fail
minutes	mins/hours	Table 1	%	mm	Table 2	mm	m3	m3	m3	m3	m3	
5	5 mins	0.37	0	7.5	1.20	9.0	0.963	0.020	0.94	7.60	6.66	Pass
10	10 mins	0.52	0	10.5	1.22	12.8	1.368	0.039	1.33	7.60	6.27	Pass
15	15 mins	0.63	0	12.7	1.23	15.6	1.668	0.059	1.61	7.60	5.99	Pass
30	30 mins	0.80	0	16.1	1.24	19.9	2.132	0.118	2.01	7.60	5.59	Pass
60	1 hour	1.00	0	20.0	1.24	24.8	2.654	0.237	2.42	7.60	5.18	Pass
120	2 hour	1.21	0	24.1	1.24	29.9	3.202	0.473	2.73	7.60	4.87	Pass
240	4 hour	1.45	0	28.9	1.22	35.4	3.790	0.946	2.84	7.60	4.76	Pass
360	6 hours	1.60	0	32.1	1.21	38.9	4.165	1.420	2.74	7.60	4.86	Pass
600	10 hours	1.79	0	35.9	1.20	43.1	4.614	2.366	2.25	7.60	5.35	Pass
1440	24 hours	2.24	0	44.8	1.18	52.9	5.658	5.679	-0.02	7.60	7.62	Pass

Minimum storage required 2.84 m3

Time to empty 50% Ts50 6.0 hour **Pass**

1:30 year storm return period

Storm Duration D		Factor Z1	Climate Change & Urban Creep	M5-D M5-60xZ1	Growth Factor Z2	M10-D M5-DxZ2	Inflow I=AxR	Outflow O=as50xfxd	Storage req S	Soakaway/Attenuation Capacity	Balance	Pass/fail
minutes	mins/hours	Table 1	%	mm	Table 2	mm	m3	m3	m3	m3	m3	
5	5 mins	0.37	35	10.1	1.52	15.3	1.640	0.020	1.62	7.60	5.98	Pass
10	10 mins	0.52	35	14.1	1.54	21.8	2.336	0.039	2.30	7.60	5.30	Pass
15	15 mins	0.63	35	17.1	1.56	26.6	2.851	0.059	2.79	7.60	4.81	Pass
30	30 mins	0.80	35	21.7	1.57	34.0	3.636	0.118	3.52	7.60	4.08	Pass
60	1 hour	1.00	35	27.0	1.55	41.9	4.484	0.237	4.25	7.60	3.35	Pass
120	2 hour	1.21	35	32.6	1.53	49.8	5.333	0.473	4.86	7.60	2.74	Pass
240	4 hour	1.45	35	39.1	1.50	58.7	6.285	0.946	5.34	7.60	2.26	Pass
360	6 hours	1.60	35	43.3	1.48	64.2	6.872	1.420	5.45	7.60	2.15	Pass
600	10 hours	1.79	35	48.4	1.46	70.6	7.553	2.366	5.19	7.60	2.41	Pass
1440	24 hours	2.24	35	60.5	1.42	85.7	9.166	5.679	3.49	7.60	4.11	Pass

Minimum storage required 5.45 m3

Time to empty 50% Ts50 11.0 hour **Pass**

1:100 year storm return period

Storm Duration D		Factor Z1	Climate Change & Urban Creep	M5-D M5-60xZ1	Growth Factor Z2	M10-D M5-DxZ2	Inflow I=AxR	Outflow O=as50xfxd	Storage req S	Soakaway/Attenuation Capacity	Balance	Pass/fail
minutes	mins/hours	Table 1	%	mm	Table 2	mm	m3	m3	m3	m3	m3	
5	5 mins	0.37	40	10.5	1.92	20.0	2.144	0.020	2.12	7.60	5.48	Pass
10	10 mins	0.52	40	14.7	1.98	29.1	3.111	0.039	3.07	7.60	4.53	Pass
15	15 mins	0.63	40	17.7	2.01	35.7	3.817	0.059	3.76	7.60	3.84	Pass
30	30 mins	0.80	40	22.5	2.02	45.4	4.862	0.118	4.74	7.60	2.86	Pass
60	1 hour	1.00	40	28.0	1.99	55.6	5.950	0.237	5.71	7.60	1.89	Pass
120	2 hour	1.21	40	33.8	1.94	65.5	7.012	0.473	6.54	7.60	1.06	Pass
240	4 hour	1.45	40	40.5	1.89	76.4	8.174	0.946	7.23	7.60	0.37	Pass
360	6 hours	1.60	40	44.9	1.85	83.1	8.891	1.420	7.47	7.60	0.13	Pass
600	10 hours	1.79	40	50.2	1.81	90.8	9.717	2.366	7.35	7.60	0.25	Pass
1440	24 hours	2.24	40	62.7	1.72	108.1	11.567	5.679	5.89	7.60	1.71	Pass

Minimum storage required 7.47 m3

Time to empty 50% Ts50 15.0 hour **Pass**

Client	**Mr N Jarvis**
Project	**83 Udney Park Road**
Job No	**2760**
Date	**24.12.24**

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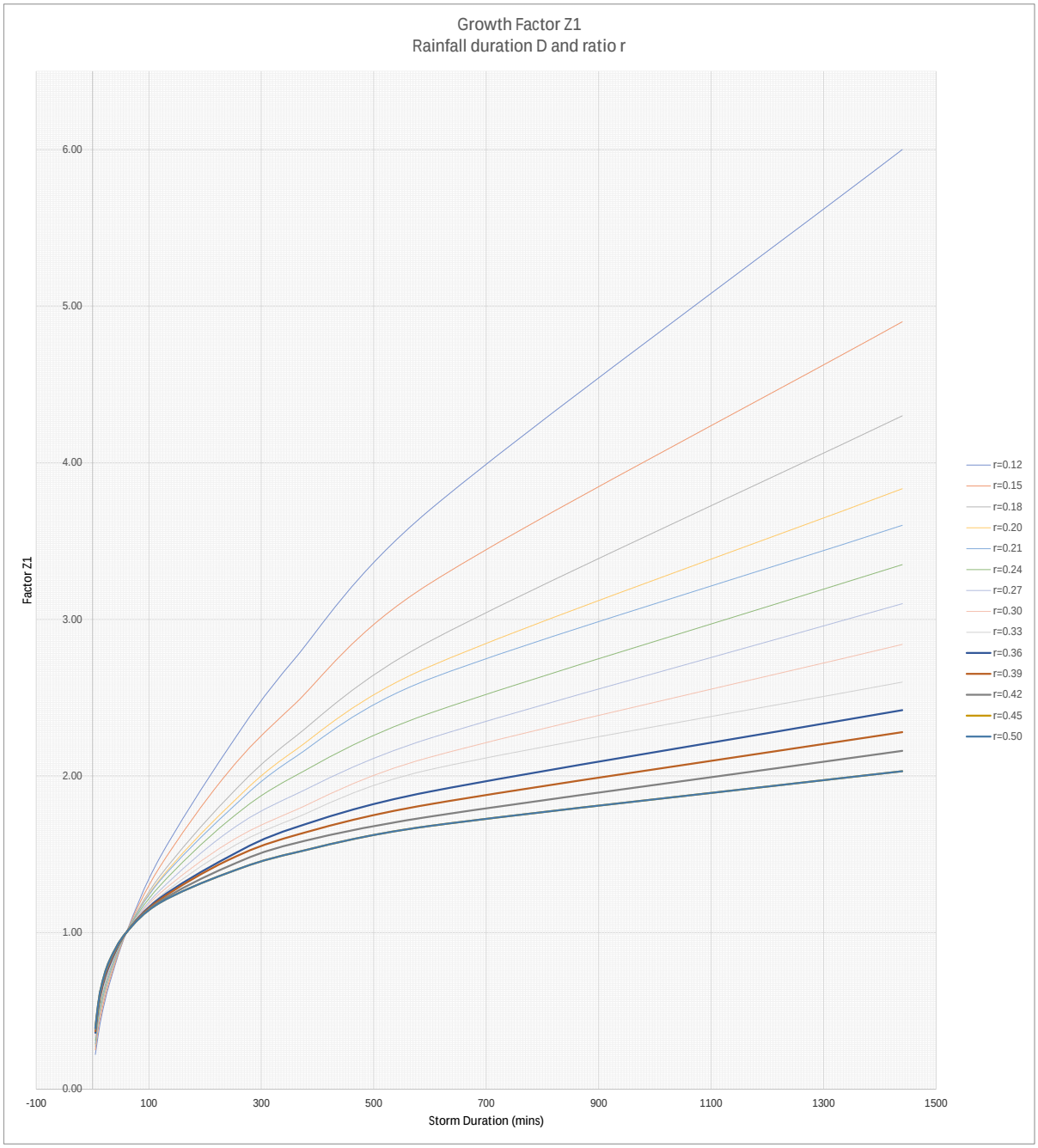
Table 1 Factor Z1 : rainfall duration D and ratio r

Rainfall ratio r	Storm Duration (mins/hours)									
	5 5	10 10	15 15	30 30	1 60	2 120	4 240	6 360	10 600	24 1440
0.12	0.22	0.34	0.45	0.67	1.00	1.48	2.17	2.75	3.70	6.00
0.15	0.25	0.38	0.48	0.69	1.00	1.42	2.02	2.46	3.23	4.90
0.18	0.27	0.41	0.51	0.71	1.00	1.36	1.86	2.25	2.86	4.30
0.20	0.28	0.42	0.53	0.72	1.00	1.34	1.80	2.16	2.70	3.83
0.21	0.29	0.43	0.54	0.73	1.00	1.33	1.77	2.12	2.62	3.60
0.24	0.31	0.46	0.56	0.75	1.00	1.30	1.71	2.00	2.40	3.35
0.27	0.33	0.48	0.58	0.76	1.00	1.27	1.64	1.88	2.24	3.10
0.30	0.34	0.49	0.59	0.77	1.00	1.25	1.57	1.78	2.12	2.84
0.33	0.35	0.50	0.61	0.78	1.00	1.23	1.53	1.73	2.04	2.60
0.36	0.36	0.51	0.62	0.79	1.00	1.22	1.48	1.67	1.90	2.42
0.39	0.37	0.52	0.63	0.80	1.00	1.21	1.46	1.62	1.82	2.28
0.42	0.38	0.53	0.64	0.81	1.00	1.20	1.42	1.57	1.74	2.16
0.45	0.39	0.54	0.65	0.82	1.00	1.19	1.38	1.51	1.68	2.03
0.50	0.39	0.54	0.65	0.82	1.00	1.19	1.38	1.51	1.68	2.03



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Job No	**2760**
Date	**24.12.24**

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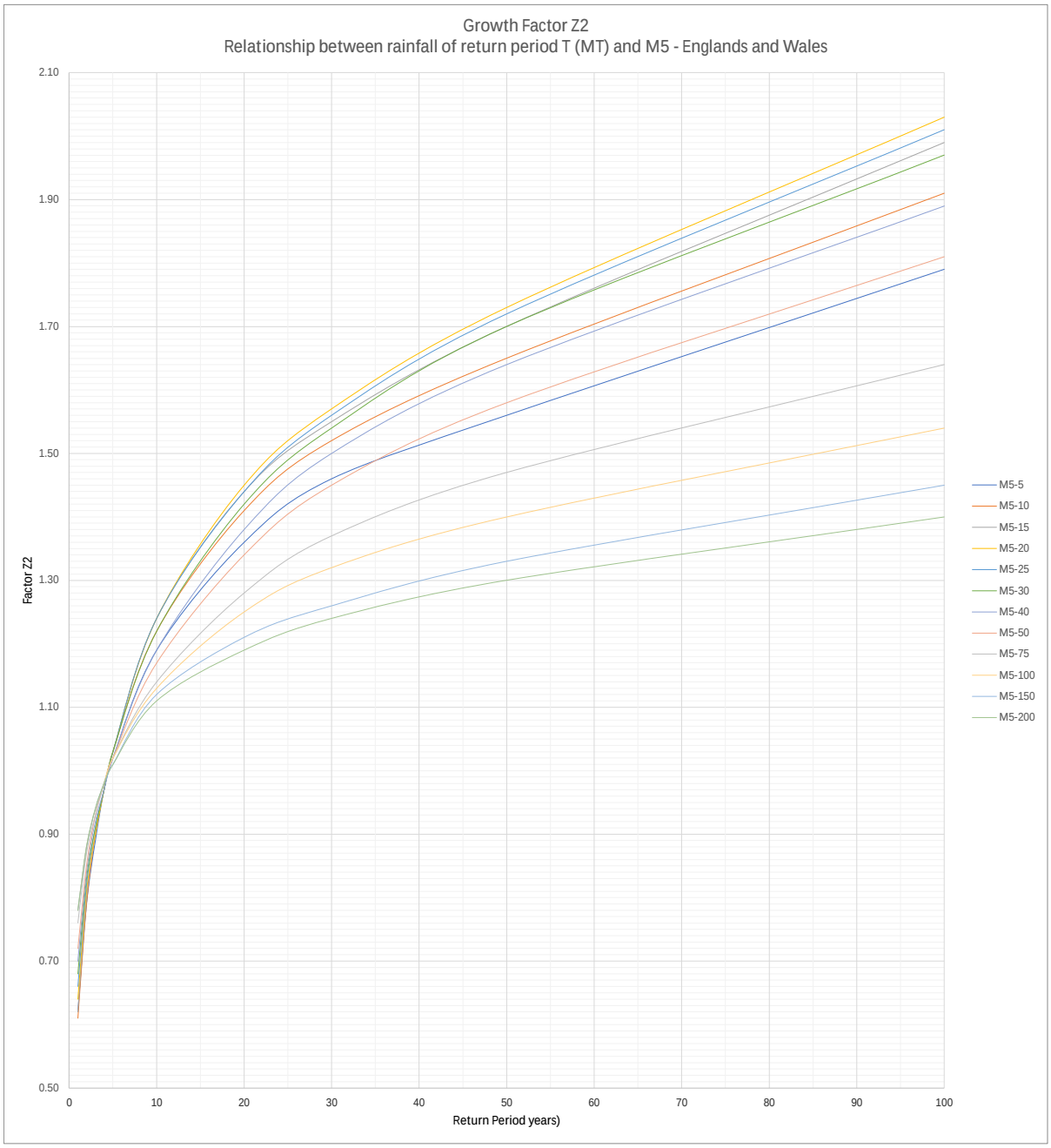
Table 2 Growth Factor Z2 : relationship between rainfall of return period T (MT) and M5 - Englands and Wales

M5 Rainfall mm	Storm Return Period (Years)									
	1	2	3	4	5	10	20	30	50	100
5	0.62	0.79	0.89	0.97	1.02	1.19	1.36	1.46	1.56	1.79
10	0.61	0.79	0.90	0.97	1.03	1.22	1.41	1.52	1.65	1.91
15	0.62	0.80	0.90	0.97	1.03	1.24	1.44	1.55	1.70	1.99
20	0.64	0.81	0.90	0.97	1.03	1.24	1.45	1.57	1.73	2.03
25	0.66	0.82	0.91	0.97	1.03	1.24	1.44	1.56	1.72	2.01
30	0.68	0.83	0.91	0.97	1.03	1.22	1.42	1.54	1.70	1.97
40	0.70	0.84	0.92	0.97	1.02	1.19	1.38	1.50	1.64	1.89
50	0.72	0.85	0.93	0.98	1.02	1.17	1.34	1.45	1.58	1.81
75	0.76	0.87	0.93	0.98	1.02	1.14	1.28	1.37	1.47	1.64
100	0.78	0.88	0.94	0.98	1.02	1.13	1.25	1.32	1.40	1.54
150	0.78	0.88	0.94	0.98	1.01	1.12	1.21	1.26	1.33	1.45
200	0.78	0.88	0.94	0.98	1.01	1.11	1.19	1.24	1.30	1.40



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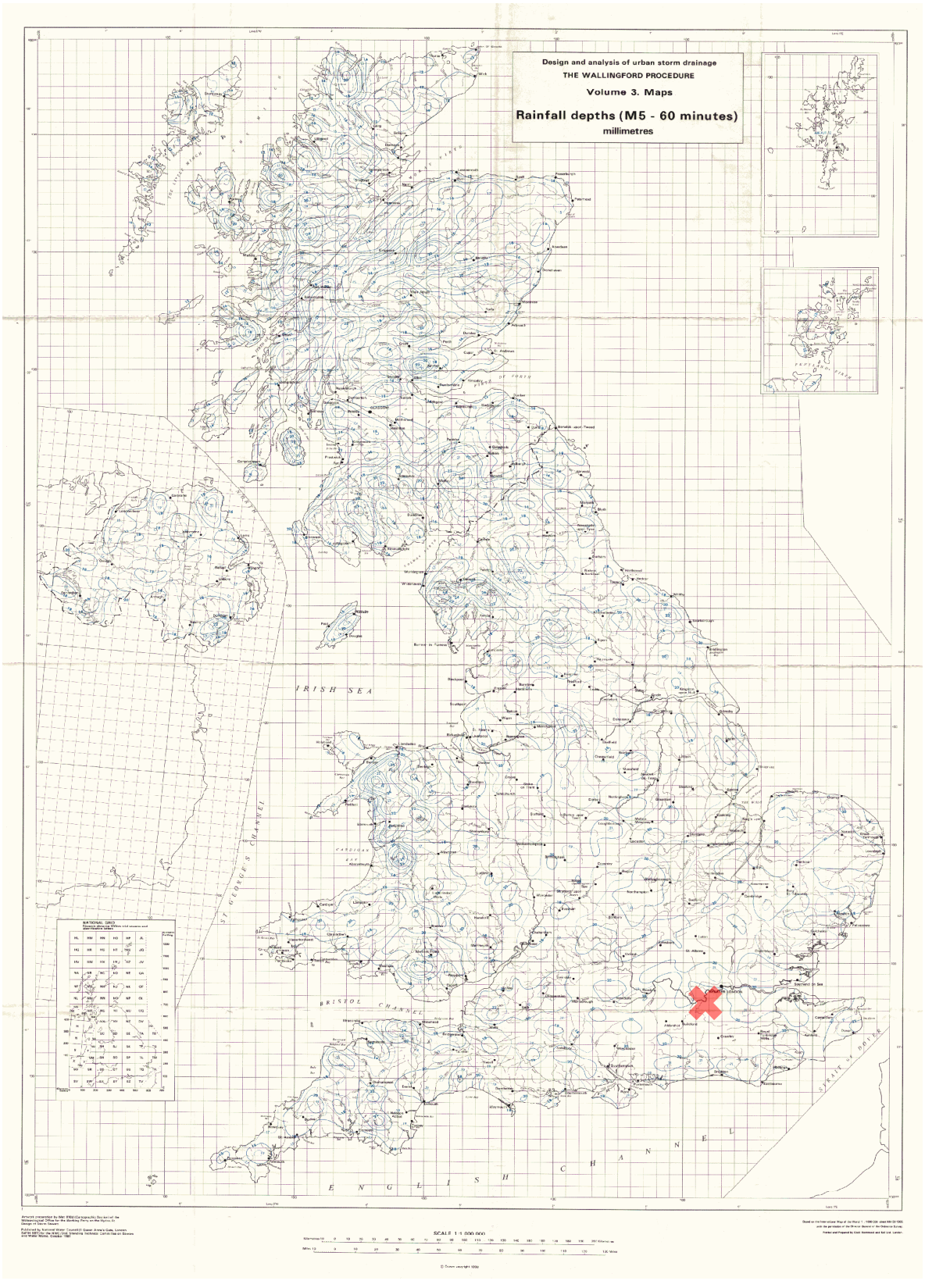
Map 1 - Rainfall Depths (M5-60 minutes)



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Map 2 - Ratio of M5-60 to M5-2 day rainfalls