

Eton Business Park, Radcliffe

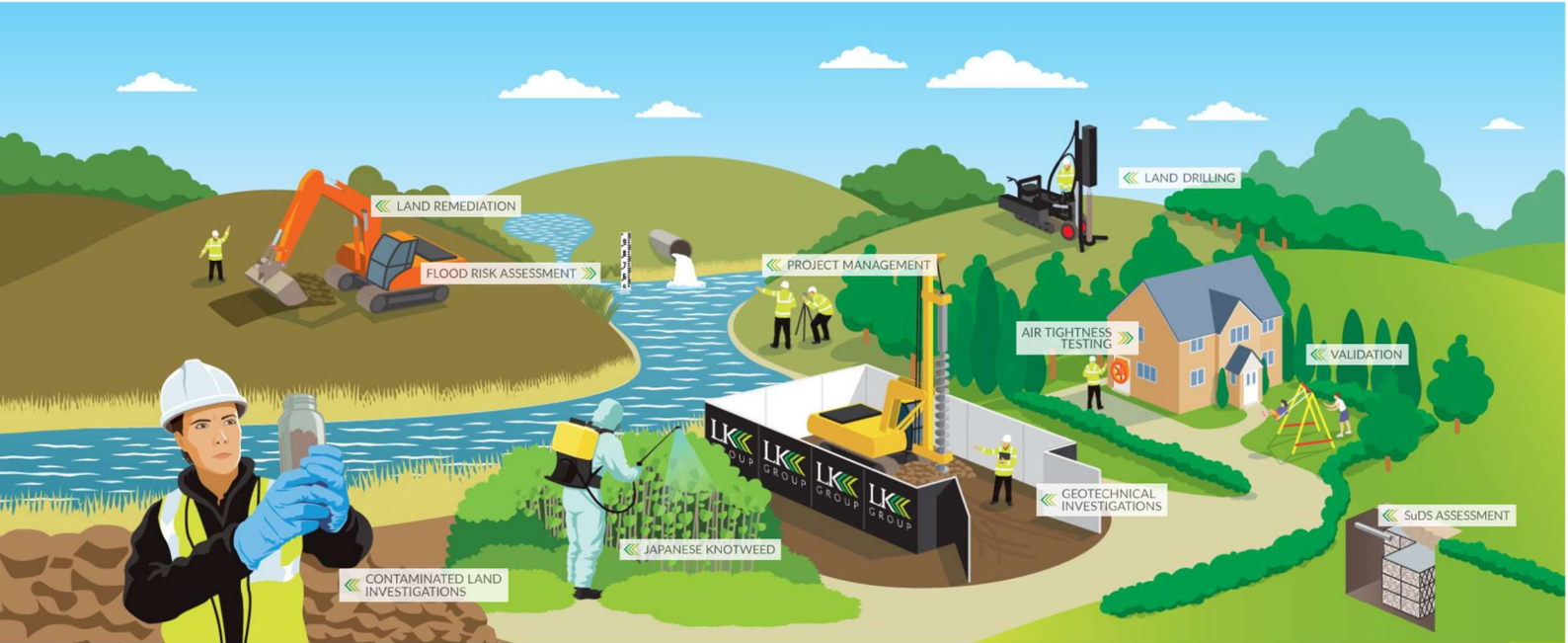
Sustainable Drainage Strategy

Job Number: FRA241048
Date: July 2024
Client: Hamilton Heath Estates Ltd



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>> Eton Business Park, Eton Hill Rd, Radcliffe, Greater Manchester M26 2ZS
 >> 0161 763 7200 >> info@thelkgroup.com >> www.thelkgroup.com

Company registered in England and Wales No. 06767704

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EXECUTIVE SUMMARY

Scope and Background

This Sustainable Drainage (SuDS) Strategy has been undertaken by LK Consult Ltd (LKC) to support a planning application for the development at Eton Hill Business Park, Radcliffe. The development comprises 17no. small commercial units on an extension of the existing yard to the north.

LKC has prepared this SuDS Strategy in line with the NPPF and Technical Guidance where appropriate.

Consultations

Bury Council – Lead Local Flood Authority (LLFA) and United Utilities (UU) have been contacted during preparation of this report.

The Environment Agency (EA) website has been utilised to assess if there are any limitations that may affect the form of SuDS that may be appropriate to this site. The records show that the site is within Flood Zone 1.

Drainage Strategy

Given the existing ground conditions on site, which have been confirmed by the ground investigation and infiltration testing, the use of infiltration SuDS for surface water disposal will not be practical.

The outline drainage strategy considers the use of an infiltration-based SuDS not to be feasible. It is assumed that surface water runoff arising from the development will discharge into watercourse off the northern boundary of the site.

The proposed development will increase the proportion of the site covered by impermeable surfaces and will therefore generate more runoff. Attenuation will be required to allow for climate change and restrictions placed upon the proposed development due to planning requirements and/or water company flow restrictions.

The attenuation required for a 1 in 30 year event, requires a storage volume of **41.26m³** and for the 1 in 100-year event, a storage capacity of **66.14m³** will be required from on-site storage as well as SuDS systems.

A pre-development advice enquiry received from United Utilities considered that no surface water should discharge to the public sewer if infiltration proved to be impractical and surface water should be directed to the adjacent watercourse.

The suitability and depth of a potential connection into the adjacent watercourse should be confirmed on site.

The most effective strategy, in line with the SuDS management train, would be to have a permeable paving for parking bays and filter drains round the edges. A petrol interceptor is also specified before the surface water leaves the site.

All proposed outflow connections from the development should be agreed with the LLFA, United Utilities and the Environment Agency.

The estimated volume can be stored within the site boundary.

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1. Introduction

1.1. Background

LK Consult Ltd (LKC) has been commissioned to carry out a Sustainable Drainage Strategy for Eton Business Park, Radcliffe. The investigation was undertaken in support of a future planning application to develop the site for commercial use.

The following work has previously been undertaken by LKC:

- Preliminary Risk Assessment (PRA) report (Ref: LKC 24 1095-A1-PRA, dated 19th April 2024).

This report will consider the impact of the development on surface water runoff accounting for climate change. The sustainable drainage assessment in Section 4 will provide an overview of the SuDS techniques which could be considered on the site.

This preliminary SuDS assessment complies with the principles presented in the Draft National Standards for Sustainable Drainage Systems (Defra, 2015)¹ and the Planning Practice Guidance (PPG) March 2014². The sustainable drainage assessment is presented with reference to the hydrological and hydrogeological context of the development.

The report findings are based upon professional judgement and are summarised below. The report includes baseline data from the Environment Agency (EA), rainfall data from the Wallingford Studies and Hydrogeological information from the British Geological Survey (BGS). The assessment will summarise and refer to these datasets in the text.

Drainage on the site has been assessed by considering the following key constraints:

- Topography of the site.
- Local water features and hydrological context.
- Underlying geology, soil types and permeability.
- Layout and geometry of the proposed development.

A summary of the site details is presented in Table 1-1. Site location and proposed development plans are provided in Appendix A.

Location	East of Bury Road, north of Eton Hill Business Park, Radcliffe. Centred at National Grid Reference 379486E, 408557N.,
Area	1,872m ² .
Topography	c. 74-71.3 metres above ordnance datum (AOD). Ground levels slightly higher in the western boundary with a slight fall to the east.
Current Site Use	The proposed site area is grassed.
Proposed Development	17no. small commercial units on an extension of the existing yard to the north.

Table 1-1: Summary of site details.

¹ Non-statutory Technical Standards for Sustainable Drainage Systems – DEFRA March 2015

² Planning Practice Guidance – Department for Communities and Local Government July 2021

2. Site Setting

2.1. Phase 1 Preliminary Risk Assessment (PRA)

Pertinent information from the PRA report is summarised in Table 2-1.

Summary of the Environmental Setting			
Geology	Superficial		Glaciofluvial Sheet Deposits, Devensian - Sand and gravel
	Bedrock		Pennine Middle Coal Measures Formation - Mudstone, siltstone and sandstone
	BGS Boreholes		BGS Ref: TF10SE638, 500m south: Sand and gravel to 9.14m, Blue clay to 14.03m, sandstone to 19.96m. Groundwater recorded at 6ft over the weekend.
	Defra Soilscape Mapping		20 - Loamy and clayey floodplain soils with naturally high groundwater
Hydrogeology	Aquifer Designation	Superficial	Secondary A Aquifer.
		Bedrock	Secondary A Aquifer.
	Source Protection Zone (SPZ)		Site not within an SPZ.
	Groundwater Susceptibility	Flooding	Limited potential for groundwater flooding to occur.
Flood Zone	The site is within Fluvial Flood Zone 1. Flood Zone 1: Very Low risk, with annual probability of flooding from rivers and the sea of less than 0.1% (1 in 1000).		
Hydrology	All adjacent and internal surface water		Hutchinson's Goit is present c. 40m east, flowing south. A small length of watercourse known as Eton Goit is indicated c. 14m northeast of the site flowing east into Hutchinson's Goit. Swan Lodge is present c. 100m east.
Site History		Onsite: Tramway, undifferentiated buildings, vehicle storage. Surrounding Area: Colliery, refuse heap, factory, depot firelighters works. Wire Works, Factory, Railway Lines and Embankments.	

Table 2-1: Summary of PRA report.

2.2. Site Reconnaissance

A site reconnaissance was undertaken in April 2024. Relevant features identified on site are summarised below:

- Current site is a vacant grassed area and part of the existing yard to Eton Business Park. The existing yard and vacant grassland are separated by a metal fence running around the perimeter of the yard. No olfactory contamination observed on carpark.
- Site is relatively level, grassed area is raised approximately 1m above the yard area and adjacent ground and slopes down to the northeast.

- Adjacent land uses include fields to the north and west, remainder of Eton Business Park to the south and Motor Sales pitch to the west.
- 3no. hand dug trial pits carried out in the eastern part of the site identified the following:

HD101	HD102	HD103
0.00-0.30m - Made ground: dark brown slightly gravelly sandy silt with rootlets, brick, ceramic and glass fragments. 0.30-1.20m - Dark brown slightly gravelly sandy silt with clay pockets.	0.00-0.40m – Made ground: dark brown very gravelly sandy clayey silt with brick, coal, ceramic and glass fragments. Refusal on obstruction, trial pit terminated.	0.00-1.00m – Made ground: dark brown very gravelly sandy silt with brick, ceramic, metal and plastic fragments. Refusal on obstruction, trial pit terminated.

Relevant photographs are provided in Plate 2-1.

	
Photograph 1: View of entrance from the existing yard to the grassed area.	Photograph 2: Hand dug trial pit on site.
	
Photograph 3: View east along the green / undeveloped area. Existing yard left of photo.	Photograph 4: View of carpark adjacent west associated with motor garage.

Plate 2-1: Site photographs.

2.3. Site Levels

A topographic survey of the site was not provided, therefore opensource LiDAR levels have been extracted to OS GPS datum, and information is included in Appendix B.

The site falls slightly from west (73.3mAOD) to east (72.9mAOD) with the central part of the grassed area at 74.5mAOD.

Ground levels to the north of the site fall slightly towards Elton Goit which is around 71.2mAOD and ground levels to the east fall slightly to Hutchinson's Goit at approximately 70.6m AOD.

The final site levels and ground floor levels of the units have not yet been determined. The existing yard is around 73.3m AOD.

2.4. Ground Investigation

LKC are aware of a ground investigation carried out at the site in 2014 which also included soakaway testing. Pertinent details are provided in Appendix E.

The investigation indicates band of natural sandy material is present below the made ground and the former building foundations in the central part of the adjacent site. The records also indicated a level for the water table in this area so this limits the depth that a soakaway can be excavated to remain 1m above the water table. The water table was recorded at depths of between 2.5m and 3.5m from the surface.

The area to the west (occupied by motor sales pitch) was considered suitable for a soakaway due to a band of sand and gravel; however, infiltration testing on the study site was not successful as this sand and gravel band was generally at or below the water table level due to the natural slope of the deposits. The study area is therefore considered unsuitable for soakaways.

3. Consultation

Information from consultees is summarised in Table 3-1 below and relevant correspondence is provided in Appendix C.

Source	Details	
Lead Local Flood Authority (LLFA)	No information provided at the time of writing.	
United Utilities (UU)	Sewer Map	There is a 300mm diameter surface water sewer adjacent north of the site (possibly encroaching onto the northern tip of the site) flowing in a eastern direction discharging possibly to Eton Goit. A 225mm diameter combined sewer is present in the carriageway of Bury Road to the west of the site.
	Likely conditions for connecting into their sewerage system	No evidence of modelled flood risk in the vicinity of the site. Foul flow from this site will be allowed to drain into the public foul sewer system. UU's preferred point of discharge would be to the 225mm diameter public foul sewer within Bury Road at an unrestricted rate. United Utilities would request conditions for a separate system with only foul draining to foul / sewers and surface water draining to soakaway/SuDS, watercourse or surface water sewer. All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80 of the National Planning Practice Guidance. Surface water should discharge to the ground via infiltration system where feasible. If an evidence-based assessment has been carried out and confirms that infiltration is not feasible, [UU] recommend that [we] contact the Lead Local Flood Authority and/or Environment Agency to discuss a point of discharge to the waterbody located (approx.) 3m north of the proposed site. UU encourage [the developer] to identify and engage with any third-party landowner and riparian owner to agree access and discharge rights to the water body if this is not in your ownership. As there is a watercourse immediately adjacent to the development, UU will not be permitting any Surface Water into the public network at this time. UU indicate the public surface water sewer running through the north of the is in the processes of being devesting as this as it is believed to be a private watercourse. Notwithstanding the above UU also note that as a public sewer they require unrestricted access to the sewer for maintenance purposes and they require a minimum clearance of 6m which is measured 3m from the centre line of the pipe unless there happens to be a formal easement agreement in place, in which case the specified easement width would apply. If this cannot

Source	Details	
		be achieved then the developer should consider diverting and / or abandoning the public sewer. Please be aware that any proposed diversion may require modelling.
Environment Agency	Surface Water Flood Map	No surface water flood risk shown on mapping.
	Fluvial Flood Map	The site is within Fluvial Flood Zone 1. Flood Zone 1: Very Low risk, with annual probability of flooding from rivers and the sea of less than 0.1% (1 in 1000).

Table 3-1: Summary of Consultee Information.

4. Sustainable Drainage Strategy

4.1. Introduction

The NPPF recognises that flood risk and other environmental damage can be managed by minimising changes in the volume and rate of surface run-off from development sites through the use of Sustainable Drainage Systems (SuDS), this being complementary to the control of development within the floodplain.

SuDS will not alleviate flooding in an area prone to flooding; however, properly designed SuDS have the potential to prevent the surface water runoff from new development worsening the flood risk. The effective disposal of surface water from development is a material planning consideration in determining proposals for the development and use of land.

The accepted principles are that surface water arising from a developed area should, as far as 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.

The Building Regulations Requirement H3³ stipulates that rainwater from roofs and paved areas is carried away from the surface to discharge to one of the following, listed in order of priority:

- an adequate soakaway or other adequate infiltration system,
- a watercourse or, where that is not practicable,
- a sewer.

The concept of a sustainable drainage system has been incorporated into the drainage strategy for the study area in order to comply with the Flood and Water Management Act 2010⁴.

Suitability of different SuDS will be governed by prevailing site conditions, such as the type and scale of development, topography, ground conditions (soil permeability, ground stability, depth to water table), local hydrogeology and risk of groundwater contamination (presence of sensitive aquifers and source protection zones) etc.

4.2. Sustainable Drainage Hierarchy

4.2.1. Infiltration

The Groundwater Source Protection Zone mapping from the EA website shows that the site is not within any identified protection zones.

Infiltration testing shows that the study area is unsuitable for soakaways.

³ Building Regulations part H3 2010: Approved Document, Drainage and Waste Disposal.

⁴ Flood and Water Management Act 2010: UK Government.

4.2.2. Watercourses

Eton Goit located c. 14m east of the site flowing into Hutchinson's Goit c. 40m east of the site.

4.2.3. Public Sewer

There is a surface water sewer running adjacent to and possibly in part running through the northern tip of the site. UU are in the process of devesting this as is believed to be a private watercourse.

There is a combined sewer in Bury Road.

4.2.4. Other Sewers

During a previous review of the site, LKC observed the former factory drainage discharged to the surface water sewer in the northern part of the site.

4.3. Surface Water Drainage Strategy

Following the assessment of the site settings and existing constraints to the development. The drainage options relating to the final discharge of surface water for this section of the site are listed in Table 4-1 in order of priority within the NPPF:

Option No:	Drainage Solution	Most feasible solution	Reasoning
a	Soakaway/Infiltration	N/A	Not feasible due to cohesive deposits and granular material present below the groundwater table.
b	Connection to Watercourse	1	There is the possibility that a culverted watercourse flows adjacent to or just outside of the northern boundary as a continuation of the surface water sewer. Access to this may be on 3 rd party land.
c	Discharge into a sewer	N/A	UU note that as there is a watercourse immediately adjacent to the development, UU will not be permitting any Surface Water into the public network at this time. However, UU also note that they may be devesting their interest in this asset as it may be a private watercourse.

Table 4-1: Drainage Options.

Table 4-2 provides a summary of the SuDS options appraisal with consideration of CIRIA C697 (The SUDS Manual)⁵ for the development:

⁵ CIRIA C697 - The SUDS Manual. London 2015

SuDS Option	Appropriate to Development	Comments	Benefits	Description
Infiltration				
Soakaways	X	Not feasible due to ground conditions.	Water quantity Water quality	Soakaways provide stormwater attenuation, stormwater treatment and groundwater recharge. Runoff is treated by physical filtration to remove solids, by absorption into the soil and removal and by biochemical reactions involving micro-organisms growing on the soil.
Infiltration basin	X	Depressions that store and dispose of water via infiltration. May not be appropriate given the ground conditions and site constraints.	Water quantity Water quality Biodiversity Amenity	Infiltration basin reduces the volume of runoff from a drainage area, can be very effective at pollutant removal via filtering through the soils, contributes to groundwater recharge and baseflow augmentation. Runoff is treated by physical filtration to remove solids, by absorption into the soil and removal and by biochemical reactions involving micro-organisms growing on the soil.
Infiltration trench	X	Infiltration trenches are shallow excavations with rubble or stone. May not be appropriate given the ground conditions and site constraints.	Water quantity Water quality Amenity	An Infiltration trench can create temporary subsurface storage of stormwater runoff, thereby enhancing the natural capacity of the ground to store and drain water. Infiltration trenches allow water to dissipate into the surrounding soils from the bottom and sides of the trench where runoff is treated by physical filtration, adsorption and biochemical reactions involving micro-organisms growing in the soil. Infiltration trenches are easy to integrate into a site. They are ideal for use around playing fields, recreational areas, or public open space.
Rain gardens	*	Rain gardens are relatively small depressions in the ground that are planted up with native vegetation. Most likely to be implemented on private property close to buildings on relatively flat areas.	Amenity Biodiversity Water quality Water quantity	Attractive features that can help to improve open space. Can be planned as landscaping features. Flexible layout to fit into landscape. Runoff can be treated by physical filtration to remove solids, by absorption and removal by biochemical reactions involving micro-organisms growing on the soil. They can reduce rate of run off and provide some volume reduction.
Filtration				
Filter drain / trench	*	Linear trenches filled with a permeable granular material, often with a perforated pipe in the base of the trench. May be feasible in the western part of the site.	Water quantity Water quality	Filter trenches create temporary subsurface storage of stormwater runoff and provide stormwater treatment. These trenches can be used to filter and convey stormwater to downstream SuDS components.
Filter strip	✓	Engineered filters that use vegetation to remove and treat runoff. The filter strip is	Water quality	A filter strip offers no storage and is used solely to remove pollutants from surface water. The vegetation traps organic and mineral particles that are then incorporated into the soil, while the vegetation takes up any nutrients. A filter

SuDS Option	Appropriate to Development	Comments	Benefits	Description
		sloped to allow sheet flow across the vegetated strip.	Amenity Biodiversity	strip features medium amenity potential. Local wild grass and flower species can be introduced for visual interest and to provide a wildlife habitat.
Retention & Detention				
Detention basin	X	Dry depressions designed to hold water for a specific retention time. Basins tend to be found towards the end of the SuDS management train, so are used if extended treatment of the runoff is required or if they are required for wildlife or landscape reasons. Not feasible due to site constraints and ground conditions.	Water quantity Water quality Biodiversity Amenity	Detention basins provide flow control through attenuation of stormwater runoff for a wide range of rainfall events. Basins treat runoff in a variety of ways: settlement of solids in still or slow moving water, adsorption by the soil, biological activity. Basins offer many opportunities for the landscape designer. Basins should not be built on but can be used for sports and recreation. Basins can be part of public open space.
Attenuation Ponds	X	Attenuation ponds can be used to offset the increase in surface water flows attributable to increased area of hard standing, in order to minimise the risk of flooding to and from the proposed development. Not feasible due to site constraints and ground conditions.	Water quantity Water quality Biodiversity Amenity	Ponds will attenuate the surface water flow prior to discharging to the public surface water sewers. The storage volume afforded by these features should not include any permanent water in the pond. Ponds treat runoff in a variety of ways: settlement of solids in still water (having plants in the water enhances calm conditions and promotes settlement), adsorption by aquatic vegetation, biological activity. Permanently wet ponds can be used to store water for reuse and offer excellent opportunities for the provision of wildlife habitats. Ponds can be part of public open space.
Geo-cellular storage systems	✓	Modular block systems can be used to provide an underground storage facility. Any geo-cellular storage systems should be lined with a geo-membrane to provide attenuation storage.	Water quantity	Geo-cellular systems can be used to control and manage rainwater surface water runoff either as a soakaway or as a storage tank. Geo-cellular storage systems provide high storage volume capacity High void ratios (up to 96%). Capable of managing high flow events.
Oversized Pipes	✓	Oversizing the pipes that make up the on-site drainage network is a cost-effective method for providing attenuation storage within the network. Such systems could be considered on the parts of the development where gradients are relatively flat.	Water quantity	Oversized pipes can reduce rate of run off and provide some volume reduction.
Tanks	✓	Prefabricated underground tanks could be considered at the detailed design stage in	Water quantity	Storage tanks can be used to control and manage rainwater surface water runoff providing high storage volume capacity. Tanks are capable of managing high flow events.

SuDS Option	Appropriate to Development	Comments	Benefits	Description
		order to provide storage to attenuate surface water runoff.		
Swales & conveyance channels				
Swales	✓	Swales are shallow grass-lined channels that provide capacity for conveying flows at a controlled rate into ponds and watercourses.	Water quality Biodiversity Amenity Water quantity	Swales are effective at removing polluting suspended solids through filtration and sedimentation. The vegetation traps organic and mineral particles that are then incorporated into the soil, while the vegetation takes up any nutrients. Swales are often integrated into the surrounding land use. Local wild grass and flower species can be introduced for visual interest and to provide a wildlife habitat. Swales are usually designed as conveyance systems but can also be designed with check dams to increase attenuation and, where applicable, infiltration.
Channels & rills	✓	Channels and rills are open surface water channels with hard edges.	Water quality Amenity Water quantity Biodiversity	Effective in water & pollution treatment. Can act as pre-treatment to remove silt before water is conveyed into further SuDS features. Can be visually appealing in urban landscapes. Amenity value for the local community and biodiversity value (design dependant).
Control structures				
Flow control devices	✓	Flow control devices e.g. hydro-brake style flow control systems, and restricted orifices enable the discharge to be restricted to a constant rate from the development.	Water quantity	Control the peak flow. Complex controls can reduce upstream storage requirements.
Inlets, outlets and controls	✓	There are many different designs and variations, including landscaped pipes, perforated pipes, weirs.	Water quality Amenity	Inlets, outlets and other control structures are key elements of well-designed SuDS. Inlet and outlet features allow water to flow into and out of features and also limit the rate at which water flows along and out of the system. There are many different approaches and products available and they can be easily designed to add interest to the urban landscape. Can provide accurate flow control from one SuDS feature to another.
Source control				
Green roofs	*	Green roofs comprise a multi-layered system that covers the roof of a building or podium structure with vegetation cover/landscaping.	Water quality Water quantity Amenity	Green roof installations can help to reduce surface water runoff from roof areas depending on the system specified. Good removal capability of atmospherically deposited urban pollutants. Ecological, aesthetic and amenity benefits.

SuDS Option	Appropriate to Development	Comments	Benefits	Description
			Biodiversity	
Blue roofs	*	A blue roof is a roof design that is explicitly intended to store water, typically rainfall.	Water quantity Amenity Biodiversity	Blue roofs are designed to attenuate and manage stormwater on a flat roof in urban areas where options for ground-based attenuation systems are limited, and in particular, where construction is being carried out within flood sensitive areas. Amenity value for the local community
Rainwater harvesting	*	Rainwater harvesting collects the rain which falls onto roofs, then stores it in a tank until required for a non-potable use.	Water quantity	In the process, a volume of water is kept out of the storm-water management system, thereby helping to reduce flooding risks. When required, the water is pumped to the point of use, thus displacing what would otherwise be a demand for mains-water. Reduces demand on mains water.
Permeable Pavements – with granular and geo-cellular storage systems	✓	Permeable pavements allow inflow of rainwater into underlying construction. Any geo-cellular storage systems would have to be lined with an impermeable membrane to provide storage rather than infiltration for runoff from highways.	Water quality Water quantity	Reduced peak flows to watercourses, reducing the risk of flooding downstream. Reduced effects of pollution in runoff on the environment.
Other SuDS				
Wetlands	X	These comprise of shallow ponds and marshy areas, covered almost entirely in aquatic vegetation. Not feasible due to site constraints.	Water quality Water quantity Amenity Biodiversity	Wetlands provide both stormwater attenuation and treatment. Wetlands detain flows for an extended period to allow sediments to settle, and to remove contaminants by facilitating adhesion to vegetation and aerobic decomposition. They also provide significant ecological benefits.

Table 4-2: Summary of the SuDS options appraisal.

Notes

✓ Suitable for use given the nature and scale of the development

* Possibly suitable for use – not included in the client and architect design proposal at present

X Not suitable.

4.4. Surface Water Attenuation Requirements

In line with typical LLFA requirements the flow from this development should be reduced by the minimum of 30% from the existing runoff rates for estimating the attenuation volumes required.

It is estimated from the supplied plans (see Appendix A) that the site will have the following designated areas (Table 4-3).

Designated Areas	Plot Area (m ²)
Total area	1,872
Existing Impermeable Area	779
Green Infrastructure	1,093
Eastern Catchment	
Catchment Area	1,872
Impermeable Area	1,872
Permeable Area	0.0
Green Infrastructure	0.0

Table 4-3: Assumed plot areas.

It can be seen that there is an increase in impermeable area from the existing usage to the proposed. This is likely to require attenuation to reduce the proposed flow off site to a level which is acceptable to the LLFA and to UU, including an allowance for climate change.

4.4.1. Attenuation Estimate

Surface water storage and greenfield runoff estimations based on the HR Wallingford procedure have been undertaken for the development and the output report is presented in Appendix D.

For the contributing catchment an estimate has been produced assuming a developable area of 1,872m². This gives the following runoff rates and attenuation requirements for this section based on the Wallingford method:

Greenfield Runoff Rates:

- Q_{bar} : 1.44 l/s
- 1 in 1-year greenfield runoff rate: 1.25 l/s
- 1 in 30-year greenfield runoff rate: 2.44 l/s
- 1 in 100-year greenfield runoff rate: 2.99 l/s

Brownfield Runoff Rates:

- Q_{bar} : 14.1 l/s
- 1 in 1-year peak runoff rate: 10.2 l/s
- 1 in 30-year peak runoff rate: 28.0 l/s
- 1 in 100-year peak runoff rate: 35.5 l/s

This reduced by 30% would give the following rates:

- Q_{bar} : 9.87 l/s
- 1 in 1-year peak runoff rate: 7.14 l/s
- 1 in 30-year peak runoff rate: 19.6 l/s
- 1 in 100-year peak runoff rate: 24.85 l/s

4.4.2. Discharge Rate

Where the drainage system discharges to a surface water body that can accommodate uncontrolled surface water discharges without any impact on flood risk from that surface water body (e.g., the sea or a large estuary) the peak flow control standards (S2 and S3 below) and volume control technical standards (S4 and S6 below) need not apply.

Peak flow control

S3 For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

Volume control

S5 Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.

The following attenuation has been estimated for the development using 7l/s runoff rates for all storms up to and including 100 year probability plus climate change and utilises the FSR methodology⁶ as:

- Attenuation storage volume: **41.26m³** (1 in 30 year event + 35% Climate Change)
- Retention on site volume: **66.14m³** (1 in 100 year + 45% Climate Change)

Attenuation storage aims to limit the peak rate of runoff from the development to the corresponding 7l/s runoff for a range of annual flow rate probabilities before discharging into a water course.

⁶ Flood Studies Report Wallingford NERC 1975.

The attenuation required for a 1 in 30-year storm event, requires a storage volume of **41.26m³**. For the 1 in 100-year event, a storage capacity of **66.14m³** will be required from on-site storage as well as SuDS systems. All volumes can be stored within the site boundary and discharges will be limited by flow control devices to the adjacent sewer.

4.5. Site Specific SuDS

The use of attenuation SuDS are deemed to be the most feasible and practical option for the development. The attenuation tank or similar will provide the required storage volume to limit peak runoff arising from the development.

Utilisation of a flow control device at the end of the system will control the peak flow rates.

The use of permeable paving may be viable dependant on the detailed design of the proposed development. If this drainage technique is considered to be feasible then it will reduce the requirement for attenuation as it will reduce the contributing impermeable area. The permeable paving will also provide some level of water treatment reducing effects of pollution in runoff on the environment.

The proposals for the site have been assessed against the CIRIA SuDS Manual C753 to determine the requirements for the treatment of surface water prior to its discharge from the site to the Adjacent water course. The SuDS features incorporated within the site should be designed to have a total pollution mitigation index that is equal to or greater than the pollution hazard index. Owing to the proposed use of the site, containing residential properties with individual driveways and with infrequent traffic (<300 movements per day), the pollution hazard level is considered within Table 4-4 below.

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons (HCs)
Other Roofs Typically commercial/ industrial roof	Low	0.3	0.2	0.05
Commercial Yard and delivery areas, non-residential car parking with frequent charge (e.g. hospitals, retail), all roads accept low traffic roads and trunk roads/motorways'	Medium	0.7	0.6	0.7

Table 4-4. Pollution Hazard Index adopted from Table 26.2 CIRIA SuDS Manual C753.

A Simple Index Approach has been undertaken to determine Sufficiency of Pollution Mitigation Indices for selected SuDS components, based on the land use featuring the highest pollution hazard level.

The SuDS pollution mitigation indices for permeable paving (TSS: 0.7, Metals: 0.6, HCs: 0.7) and SuDS pollution mitigation indices for A filter drain (TSS: 0.4, Metals: 0.4, HCs: 0.5) are greater than (or equal to) the pollution hazard index for each land use within the proposal.

5. Conclusion

The site is currently an area of undeveloped land and an existing yard area to Eton Business Park. The proposal is to 17no. small commercial units on an extension of the existing yard to the north.

An assessment of the site settings and existing constraints in conjunction with the development proposals have resulted in the following recommendations for the safe development of the site:

- Given the existing ground conditions on site, which have been confirmed by the ground investigation and infiltration testing, the use of infiltration SuDS for surface water disposal will not be practical.
- The attenuation required for a 1 in 30 year event, requires a storage volume of **41.26m³** and for the 1 in 100-year event, a storage capacity of **66.14m³** will be required from on-site storage as well as SuDS systems.
- A pre-development advice enquiry received from United Utilities considered that no surface water should discharge to the public sewer if infiltration proved to be impractical and surface water should be directed to the adjacent watercourse.
- The suitability and depth of a potential connection into the adjacent watercourse should be confirmed on site.
- All proposed outflow connections from the development should be agreed with the LLFA, United Utilities and the Environment Agency.

Appendix A – Figures, Plans and Drawings



Client: Hamilton Heath Estates Ltd				Title: Site Location & Boundary Plan				
Site: Eton Hill Business Park								
Job No.: LKC241048		Drawn By: CC	Checked By: SH	Drawn: XXX 2024	Scale (see scale bar): 1:25,000 & 1:1,000 @ A4			

Appendix B – Site Information



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drawn by
Ordnance Survey

date	December 2023
------	---------------

scale @ A3
1:1000

+44 (0)1706 631347
info@cjpartnership.com
www.cjpartnership.com

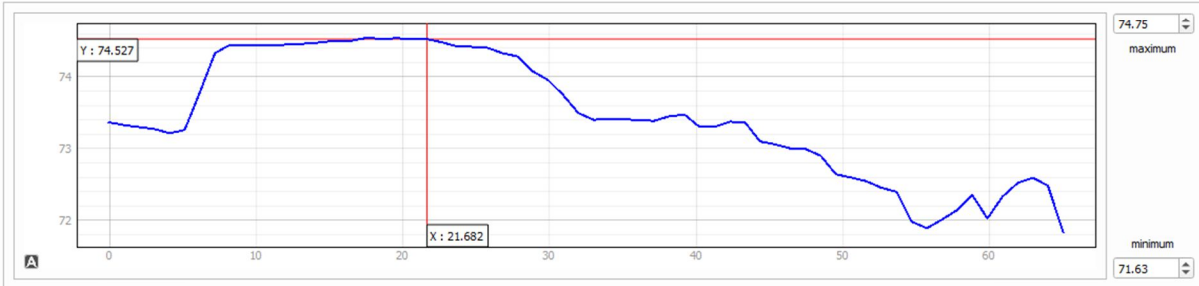
CJ PARTNERSHIP
ENVIRONMENTAL ARCHITECTS

LiDAR DTM Extract



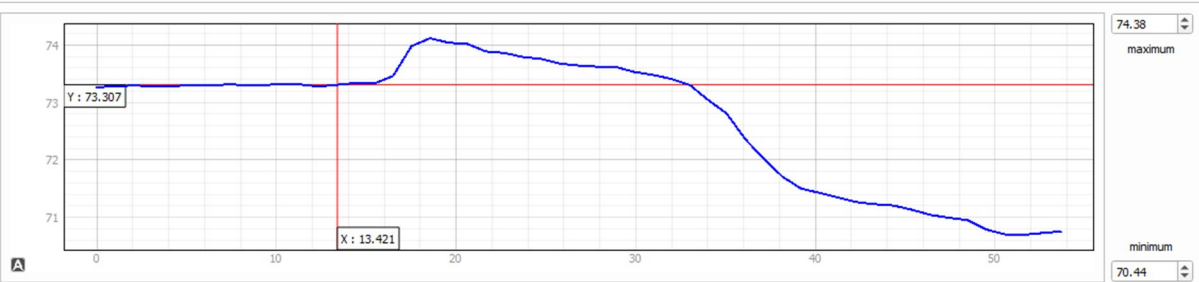
Profile Tool

Profile Table Settings



Profile Tool

Profile Table Settings



Appendix C – Consultee Correspondence

LKGroup**Unit 29
Eton Hill Road,
Radcliffe,
m26 2zs****FAO:****How to contact us:****United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP****Telephone: 0370 7510101****E-mail: propertysearches@uuplc.co.uk****Your Ref: FRA 24 1048
Our Ref: UUPS-ORD-561720
Date: 11/04/2024****Dear Sirs****Location: Eton Business Park**

I acknowledge with thanks your request dated 09/04/2024 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <http://www.unitedutilities.com/work-near-asset.aspx>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please [contact us](#).

Yours Faithfully,



Karen McCormack
Property Searches Manager

TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.



The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Reho	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
4401	73.41	CO	255	255		VC	6.964795		
2206		CO	69.68	150		VC	10		1 in 63
4604	74.33	SW	73.31	100		VC	18.78829		
2302	72.81	CO	71.82	150		VC	18.07248		1 in 60
2403		FO	0	150		VC	34.63335		
3701	74.94	CO	72.44	225		VC	5.912519		1 in 671
4703		CO		150		VC	20.12491		
2303	72.52	FO	71.31	225		VC	9.42555		
3413		FO	0	150		VC	20.89174		
3416		FO	0	150		VC	35.85176		
3419		CO		225		VC	10.77033		1 in 90
4601	74.11	CO	72.41	225		VC	20.81553		
4605		SW	0	100		PVC	8.855235		1 in 29
2405		FO		100		VC	9.219544		
4602	74.1	CO	72.16	225		VC	33.01515		
3602	74.54	SW	0	225		VC	14.0414		
7317		SW		150		VC	89.27109		1 in 55
4400	73.8	CO	71.18	300		VC	7.700739		1 in 366
3607		SW	0	225		VC	51.24451		
3405	73.75	SW	72.36	225		VC	9.47247		
2404		FO	0	100		VC	94.59387		
3501	74.44	CO	0	300		VC	11.24851		1 in 113
3412		FO	0	150		VC	35.1141		
4600	74.22	CO	72.75	225		VC	27.20294		
3605		CO	0	300		VC	15.81139		
3604	74.14	SW	71.57	225		VC	64.13307		
4603	74.15	CO	71.78	225		VC	22.52741		1 in 123
3402	73.76	CO	71.61	225		VC	19.72038		
2203	72.35	CO	71.04	225		VC	9.294525		
3406		SW	0	750		VC	140.4871		
3601	74.75	SW	72.84	300		VC	30.59412		1 in 382
7251	68.24	SW	66.99	300		PVC	8.455206		1 in 100
2401		FO		100		PVC	20.81553		1 in 103
2301	72.78	CO	71.84	150		VC	45.22186		1 in 188
4701	74.44	CO	73	225		VC	11.52864		
3607		SW		225		VC	10.77033		1 in 338
3603	74.34	SW	71.66	225		VC	67.6322		1 in 371
4200	72.85	CO	69.09	424		VC	44.55334		1 in 163
4300	73.2	CO	69.21	450		VC	35.8469		1 in 118
3603	74.34	SW		225		VC	65.44599		1 in 838
2204	72.43	CO	71.27	225		VC	10.26563		1 in 43
4503		CO	0	225		VC	103.9423		1 in 274
3603	74.4	SW	72.21	225		VC	3.789244		
4402	73.79	CO	69.3	375		VC	11.50839		
2201	72.67	CO	71.38	150		VC	9.749103		1 in 2666
3300	72.97	CO	70.82	225		VC	24.98753		1 in 130
3612		SW		150		VC	34.9871		
3610		SW	0	750		PVC	1.945481		1 in 51
3407		SW	0	750		VC	10.24845		
7319		SW		150		VC	16.82012		
2202	72.31	CO	70.87	225		VC	21.2052		1 in 582
2406		FO		100		VC	87.32124		1 in 85
3700	75.31	VC	70.81	300		VC	7.615773		
3409		SW	0	750		VC	6.873143		
3417		FO	0	150		VC	7.520957		1 in 115
3410		SW	0	750		VC	23.98879		
2200	72.53	CO	70.37	225		VC	19.94448		1 in 112
7252	68.36	SW	67.09	300		VC	8.94272		1 in 371
3502		FO		100		VC	33.37664		
3415		FO	0	150		VC	55.71355		
4500	73.95	SW	71.81	225		VC	6.263897		1 in 270
3414		FO	0	150		VC	24.33105		
2402		SW	0	750		VC	12.25869		
3403	73.73	SW	72.45	150		VC	0.2440866		
4202	72.3	CO	69.31	300		VC	10.88113		
3600	74.93	CO	70.52	300		VC	2.860168		
4205		FO		150					
5201	71.72	CO	69.51	300					
3504		FO		100					
3411		SW	0	225					
3615		CO		100					
3614		CO		100					

Reho	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
4401	73.41	CO	255	255		VC	6.964795		
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2403		FO	0	150		VC	34.63335		
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4703		CO		150		VC	20.12491		
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3413		FO	0	150		VC	20.89174		
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3605		CO	0	300		VC	15.81139		
3604	74.14	SW	71.57	225		VC	64.13307		
4603	74.15	CO	71.78	225		VC	22.52741		1 in 123
3402	73.76	CO	71.61	225		VC	19.72038		
2203	72.35	CO	71.04	225		VC	9.294525		
3406		SW	0	750		VC	140.4871		
3601	74.75	SW	72.84	300		VC	30.59412		1 in 382
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2301	72.78	CO	71.84	150		VC	45.22186		1 in 188
4701	74.44	CO	73	225		VC	11.52864		
3607		SW		225		VC	10.77033		1 in 338
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4200	72.85	CO	69.09	424		VC	44.55334		1 in 163
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3612		SW		150		VC	34.9871		
3610		SW	0	750		PVC	1.945481		1 in 51
3407		SW	0	750		VC	10.24845		
7319		SW		150		VC	16.82012		
2202	72.31	CO	70.87	225		VC	21.2052		1 in 582
2406		FO		100		VC	87.32124		1 in 85
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3409		SW	0	750		VC	6.873143		
3417		FO	0	150		VC	7.520957		1 in 115
3410		SW	0	750		VC	23.98879		
2200	72.53	CO	70.37	225		VC	19.94448		1 in 112
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3414		FO	0	150		VC	24.33105		
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4202	72.3	CO	69.31	300		VC	10.88113		
3600	74.93	CO	70.52	300		VC	2.860168		
4205		FO		150					
5201	71.72	CO	69.51	300					
3504		FO		100					
3411		SW	0	225					
3615		CO		100					
3614		CO		100					

LEGEND

Abandoned

Foul

Surface Water

Combined

Public Sewer

Private Sewer

Section 104

Rising Main

Sludge Main

Overflow

Water Course

Highway Drain

All point assets follow the standard colour convention:
red - combined
blue - surface water
brown - foul
purple - overflow

Manhole

Head of System

Extent of Survey

Rodding Eye

Inlet

Discharge Point

Vortex

Penstock

Washout Chamber

Valve

Air Valve

Non Return Valve

Soakaway

Gully

Cascade

Flow Meter

Hatch Box

Oil Interceptor

Summit

Drop Shaft

Orifice Plate

Side Entry Manhole

Outfall

Screen Chamber

Inspection Chamber

Bifurcation Chamber

Lamp Hole

T Junction / Saddle

Catchpit

Valve Chamber

Vent Column

Vortex Chamber

Penstock Chamber

Network Storage Tank

Sewer Overflow

Ww Treatment Works

Septic Tank

Control Kiosk

Change of Characteristic

MANHOLE FUNCTION	
FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE			
CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL	
AC	Asbestos Cement
BR	Brick
PE	Polyethylene
RP	Reinforced Plastic Matrix
CO	Concrete
CSB	Concrete Segment Bolted
CSU	Concrete Segment Unbolted
CC	Concrete Box Culverted
PSC	Plastic / Steel Composite
GRC	Glass Reinforced Plastic
DI	Ductile Iron
PVC	Polyvinyl Chloride
CI	Cast Iron
SI	Spun Iron
ST	Steel
VC	Vitrified Clay
PP	Polypropylene
PF	Pitch Fibre
MAC	Masonry, Coursed
MAR	Masonry, Random
U	Unspecified

Colin Crompton

From: wastewaterdeveloperservices@uuplc.co.uk
Sent: 22 April 2024 08:41
To: Helen Finch
Subject: Pre-Development Enquiry for: Eton Business Park, Radcliffe UU Reference Number: 05564916

Good morning, Helen,

Pre-Development Enquiry for: Eton Business Park, Radcliffe UU Reference Number: 05564916

We have carried out an assessment of your application which is based on the information provided. This pre-development advice on your drainage strategy will be valid for 12 months. Your drainage strategy will need to be reviewed by other competent authorities as part of the planning process, and we advise that you carry out the necessary site investigations to confirm the viability of your proposals.

If your investigations require access to our public sewer network, we ask that you contact our network engineers with a request for an access certificate via our main contact telephone number 0345 6723 723 or refer to the link below:

<https://www.unitedutilities.com/builders-developers/working-near-our-assets/>

Modelled Flood Risk

I can confirm that we do not have modelled flood risk within the vicinity of the proposed development.

Please note that United Utilities Water Limited (Uuw) can only record and check flooding events which are reported to us and we have to comply with our Regulators instructions on the qualification of flooding events.

Our response does not include:

- any sewer flooding events caused by blockages or collapses which are the result of third-party actions, natural events, or other actions over which Uuw has no control and not a facet of sewer capacity; or
- any historical sewer flooding events that have been resolved as a result of investment in our infrastructure.

Foul Water

Foul flow from this site will be allowed to drain into the public foul water/combined sewer system.

Our preferred point of discharge would be to the 225mm diameter public combined sewer within Bury Road located to the East of your proposed development at an unrestricted rate.

If you can identify an alternative, more suitable point of discharge, we request that you contact us at your earliest convenience so that we can assess suitability.

Surface Water

All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80, (Reference ID: 7-080-20150323), of the National Planning Practice Guidance. We also recommend you prioritise the use of multi-functional sustainable drainage systems for the management of surface water in accordance with national planning policy.

Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.

This is outlined as follows, in order of priority:

1. **into the ground (infiltration);**
2. **to a surface waterbody;**
3. **to a surface water sewer or highway drain;**
4. **to a combined sewer.**

For guidance, The [North West SuDS Pro-Forma](#) provides information on the appropriate evidence required at each stage of the hierarchy, to demonstrate how each level has been discounted.

The Lead Local Flood Authority has responsibility for all surface water drainage concerns and their input to your proposal is critical. You should also consider whether it is necessary to discuss your proposal with the Environment Agency, or Internal Drainage Board (if operating in your area).

The Local Planning Authority are the determining authority for any application for planning permission and the appropriate authority for determining cost viability of a proposed drainage scheme, such assessments are outside of the jurisdiction of United Utilities.

Infiltration

Surface water runoff generated from this development should discharge to the ground via infiltration system where feasible.

A detailed evidence based feasibility assessment must be carried out in line with Chapter 25 of the CIRIA SuDS Manual 2015 to determine whether infiltration is a suitable method of surface water disposal.

Particular attention must be paid to Ground Water Source Protection Zones to ensure that the risk of pollution to these valuable resources is not compromised. Details can be obtained from the government website:

<https://www.gov.uk/guidance/groundwater-source-protection-zones-spzs#find-groundwater-spzs>

If your site is in a Groundwater Source Protection Zone, you should have regard to the Environment Agency's approach to Groundwater Protection. Information on this is available via the link below:

<https://www.gov.uk/government/publications/groundwater-protection-position-statements>

Please note that such a location could have implications for the principle of your development and the need for additional mitigating measures to protect the groundwater environment and public water supply in the detailed design of your site.

Waterbody

If an evidence-based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you contact the Lead Local Flood Authority and/or Environment Agency to discuss a point of discharge to the waterbody located (approx.) 3m north of the proposed site.

We would encourage you to identify and engage with any third-party landowner and riparian owner to agree access and discharge rights to the water body if this is not in your ownership.

Public Sewer

As there is a watercourse immediately adjacent to the development, we will not be permitting any Surface Water into the public network at this time.

Levels

For low-lying sites, (where the ground level of the site or the level of a basement is below the ground level at the point where the drainage connects to the public sewer), care should be taken to ensure that the property is not at increased risk of flooding. If these circumstances exist, we recommend that you contact us to discuss further. It could affect the detailed design of your site and result in the need to incorporate appropriate mitigating measures in your drainage scheme.

Land drainage / Overland flows / track drainage

United Utilities have no obligation, and furthermore we do not accept land drainage, overland flows or track drainage into the public sewerage network under any circumstances

Existing Wastewater Assets Crossing the Site

Please note: there is currently a public surface water sewer running through the north of your site, however we are in the process of devesting this as it is believed to be a private watercourse.

According to our public sewer records there are public sewers located within your site boundary. We will require unrestricted access to the sewer for maintenance purposes, we would ask that you maintain a minimum clearance of 6m which is measured 3m from the centre line of the pipe unless there happens to be a formal easement agreement in place, in which case the specified easement width would apply. If you cannot achieve this then you may wish to consider diverting and or abandoning the public sewer.

Please be aware that any proposed diversion may require modelling. This process may take up to 6 months to reach

an acceptable design.

Please refer to the link below to obtain full details of the processes involved with sewer diversions:

<https://www.unitedutilities.com/builders-developers/larger-developments/wastewater/sewer-diversions/>

Existing Water Assets Crossing the Site

It is the developer responsibility to identify utilities on-site. Where clean water assets are shown on our records, we recommend that you contact our Water Pre-Development Team, via the following email address:

DeveloperServicesWater@uuplc.co.uk. Further information for this service can be found on our website via the link below:

<https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/water-pre-dev/>

Connection Application

Although we may discuss and agree discharge points and rates in principle, please be aware that you will have to apply for a formal sewer connection. This is so that we can assess the method of construction, Health & Safety requirements and to ultimately inspect the connection when it is made. Details of the application process and the form itself can be obtained from our website by following the link below:

<https://www.unitedutilities.com/builders-developers/wastewater-services/sewer-connections/sewer-connection/>

We recommend that the detailed design should confirm the locations of all utilities in the area and ensure that any proposed drainage solution considers routing and clash checks where required.

If we can be of any further assistance, please don't hesitate to contact us further.

Kind regards



Lana Jaundrell

Assistant Developer Engineer
Developer Services & Metering
Customer Services

T: 07876854801
[unitedutilities.com](https://www.unitedutilities.com)

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*****Please note my working days are: 07:30-15:30 Tuesday, Thursday & Friday *****

----- Original Message -----

From: Helen Finch [h.finch@thelkgroup.com]

Sent: 09/04/2024 12:31

To: wastewaterdeveloperservices@uuplc.co.uk

Subject: Request for Information - Eton Business Park, Radcliffe, FRA 24 1048

To whom it may concern,

LK Consult Ltd. has been commissioned to undertake a Sustainable Drainage Systems (SuDS) Strategy, for Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS, centred at approximate National Grid Reference 379470, 408550.

The area of interest appears to be within Flood Zone 1.

The site location and Wastewater Pre-Development Enquiry form are attached to this email.

To complete the SuDS Strategy, we would be grateful if you could supply us with the following, if available, for the vicinity of the site:

1. Records of any historic flood events and potential sources of flooding from foul and surface water sewers on site and in the area.
2. Any restrictions to discharge into the sewers.

If you have any queries, please do not hesitate to get in touch.

We are, of course, happy to pay your reasonable charge for this service. Please let me know by return what information is available, what the charge will be, and we will pay the relevant fees by debit card as soon as possible.

Any advice or recommendations you may have regarding the potential discharges from the development of this site would also be appreciated.

We will be in contact with all other relevant authorities to get a more complete understanding of the issues in the area.

Kind regards,

Helen

[Image is no longer available]

[Image is no longer available]

Helen Finch
Group Operations & Compliance Manager
07772 756411 | 0161 763 7200
Manchester | Swindon | Liverpool | Glasgow
www.thelkgroup.com

Appendix D – Calculations

Calculated by:	Shada Hasan
Site name:	Eton Business Park
Site location:	Bury

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:	53.57317° N
Longitude:	2.31123° W
Reference:	2443561131
Date:	Jul 05 2024 13:57

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	0.187
-----------------------	-------

Methodology

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

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.

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

(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.

Hydrological characteristics

	Default	Edited
SAAR (mm):	1042	1042
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

(3) Is $SPR/SPRHOST \leq 0.3$?

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):	1.44	1.44
1 in 1 year (l/s):	1.25	1.25
1 in 30 years (l/s):	2.44	2.44
1 in 100 year (l/s):	2.99	2.99
1 in 200 years (l/s):	3.41	3.41

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.



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Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 1		
Date 05/07/24		
By	Checked	Reviewed

Project	Peak 1yr 10.2 eton
Title	Peak runoff calculations for Eton Business Park

Area data:-

FSR data

M5-60 = 20

Soil index = 0.50

WRAP value = 5

r = 0.47

SAAR = 1042

Nat grid = SD7940

Site data:-

Ret. period (yrs) = 1

Time of entry = 8.00

Impervious area drained = 779 m²

Site slope = Medium 2% - 3.5%

Length of overland flow = 0.00

ToC = 8.0 mins

Overland flow time = 0.0 mins

Pervious area drained = 1093 m²

Soil type = Clay

Climate change factor = 0.0 %

Calculated data:-

Calculated runoff factor = 40.0%

Rainfall rate= 56.0 mm/Hr

UCWI = 106.4

Runoff rate (gross)= 10.2 l/s

Methods

Runoff factor (RF) = 40.0, calculated from:-

Runoff factor = $(0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$

where

PIMP = $\text{Impervious Area} \times 100 / (\text{Impervious Area} + \text{Pervious Area})$

UCWI = Calculated value for Wetness Index

Calculations produced by MasterDrain Surface Water design program



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Eton Hill Road,
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Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 1		
Date 05/07/24		
By	Checked	Reviewed

Project	Peak 30yrs 28.0 eton
Title	Peak runoff calculations for Eton Business Park

Area data:-

FSR data

M5-60 = 20

Soil index = 0.50

WRAP value = 5

r = 0.47

SAAR = 1042

Nat grid = SD7940

Site data:-

Ret. period (yrs) = 30

Time of entry = 4.00

Impervious area drained = 779 m²

Site slope = Medium 2% - 3.5%

Length of overland flow = 0.00

ToC = 4.0 mins

Overland flow time = 0.0 mins

Pervious area drained = 1093 m²

Soil type = Clay

Climate change factor = 0.0 %

Calculated data:-

Calculated runoff factor = 40.0%

Rainfall rate= 154.0 mm/Hr

UCWI = 106.4

Runoff rate (gross)= 28.0 l/s

Methods

Runoff factor (RF) = 40.0, calculated from:-

Runoff factor = $(0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$

where

PIMP = $\text{Impervious Area} \times 100 / (\text{Impervious Area} + \text{Pervious Area})$

UCWI = Calculated value for Wetness Index

Calculations produced by MasterDrain Surface Water design program



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Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 1		
Date 05/07/24		
By	Checked	Reviewed

Project	Peak 100yrs 35.5 eton
Title	Peak runoff calculations for Eton Business Park

Area data:-

FSR data

M5-60 = 20

Soil index = 0.50

WRAP value = 5

r = 0.47

SAAR = 1042

Nat grid = SD7940

Site data:-

Ret. period (yrs) = 100

Time of entry = 4.00

Impervious area drained = 779 m²

Site slope = Medium 2% - 3.5%

Length of overland flow = 0.00

ToC = 4.0 mins

Overland flow time = 0.0 mins

Pervious area drained = 1093 m²

Soil type = Clay

Climate change factor = 0.0 %

Calculated data:-

Calculated runoff factor = 40.0%

Rainfall rate= 194.9 mm/Hr

UCWI = 106.4

Runoff rate (gross)= 35.5 l/s

Methods

Runoff factor (RF) = 40.0, calculated from:-

Runoff factor = $(0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$

where

PIMP = $\text{Impervious Area} \times 100 / (\text{Impervious Area} + \text{Pervious Area})$

UCWI = Calculated value for Wetness Index

Calculations produced by MasterDrain Surface Water design program



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Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 1		
Date 05/07/24		
By	Checked	Reviewed

Project	Peak QBar 14.1 eton
Title	Peak runoff calculations for Eton Business Park

Area data:-

FSR data

M5-60 = 20

Soil index = 0.50

WRAP value = 5

r = 0.47

SAAR = 1042

Nat grid = SD7940

Site data:-

Ret. period (yrs) = 2.33

Time of entry = 6.00

Impervious area drained = 779 m²

Site slope = Medium 2% - 3.5%

Length of overland flow = 0.00

ToC = 6.0 mins

Overland flow time = 0.0 mins

Pervious area drained = 1093 m²

Soil type = Clay

Climate change factor = 0.0 %

Calculated data:-

Calculated runoff factor = 40.0%

Rainfall rate = 77.7 mm/Hr

UCWI = 106.4

Runoff rate (gross) = 14.1 l/s

Methods

Runoff factor (RF) = 40.0, calculated from:-

Runoff factor = $(0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$

where

PIMP = $\text{Impervious Area} \times 100 / (\text{Impervious Area} + \text{Pervious Area})$

UCWI = Calculated value for Wetness Index

Calculations produced by MasterDrain Surface Water design program



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Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 1		
Date 05/07/24		
By	Checked	Reviewed

Project	storage eton 30 yrs
Title	Pump storage calcs for Eton Business Park

Data:-

FSR Hydrology:-

Location = Eton Business Park
M5-60 (mm) = 20
Soil index = 0.50
Return period = 30
UCWI = 109.0

Grid reference = SD7940
r = 0.47
SAAR (mm/yr) = 1042
WRAP = 5
Climate change = 35

Soils of wet uplands -

- i) with peaty or humose surface horizons and impermeable layers at shallow depth;
- ii) deep raw peat associated with gentle upland slopes or basin sites;
- iii) bare rock cliffs and screes;
- iv) shallow, permeable rocky soils on steep slopes.

Runoff factor (RF) = 83.0, calculated from:-

$$\text{Runoff factor} = (0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$$

where

PIMP = Impervious Area*100/(Impervious Area+Pervious Area)

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 1872 m²
Total area (TA) = 1872 m²
Mean pump disch. rate = 7.000 l/s
Additional flow = 0.00 l/s

Pervious area = 0 m²
Equiv area = 1554 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 35

Calculated data:-

Time to max = 38.0 mins
Rainfall at max = 58.15 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 41.3 m³
Allowed discharge rate = 7.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 10.00 mm/hr

Calculated storage volume = 0.0 m³
Allowed discharge rate = 7.000 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	5254.4	1125	41.5	400 x 600	229.2	500 x 500	165.0
150	2335.3	1200	36.5	600 x 900	99.8	500 x 750	110.0
225	1037.9	1275	32.3	800 x 1200	56.1	500 x 1000	82.5
300	583.8	1350	28.8			750 x 1000	55.0
375	373.6	1425	25.9			750 x 1200	45.8
450	259.5	1500	23.4			750 x 1500	36.7
525	190.6	1575	21.2			1000 x 1000	41.3
600	146.0	1650	19.3			1000 x 1200	34.4
675	115.3	1725	17.7			1000 x 1500	27.5
750	93.4	1800	16.2			1000 x 1800	22.9
825	77.2	1875	14.9			1000 x 2000	20.6
900	64.9	1950	13.8			1500 x 1500	18.3
975	55.3	2025	12.8			1500 x 1800	15.3
1050	47.7	2100	11.9			1500 x 2000	13.8



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Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 2		
Date 05/07/24		
By	Checked	Reviewed

Project **storage eton 30 yrs**

Title **Pump storage calcs for Eton Business Park**

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
20	90.0	46.791	8.400	38.391
40	56.0	58.052	16.800	41.252
60	42.0	64.629	25.200	39.429
80	33.0	69.318	33.600	35.718
100	28.0	72.979	42.000	30.979
120	24.0	75.990	50.400	25.590
140	22.0	78.552	58.800	19.752
160	19.0	80.782	67.200	13.582
180	18.0	82.759	75.600	7.159
200	16.0	84.534	84.000	0.534
220	15.0	86.146	92.400	0.000
240	14.0	87.621	100.800	0.000
260	13.0	88.981	109.200	0.000
280	12.0	90.243	117.600	0.000
300	12.0	91.419	126.000	0.000
320	11.0	92.520	134.400	0.000
340	11.0	93.556	142.800	0.000
360	10.0	94.533	151.200	0.000
380	10.0	95.490	159.600	0.000
400	9.0	96.417	168.000	0.000
420	9.0	97.304	176.400	0.000
440	9.0	98.156	184.800	0.000
460	8.0	98.974	193.200	0.000
480	8.0	99.763	201.600	0.000
500	8.0	100.524	210.000	0.000
520	8.0	101.259	218.400	0.000
540	7.0	101.970	226.800	0.000
560	7.0	102.658	235.200	0.000
580	7.0	103.326	243.600	0.000
600	7.0	103.975	252.000	0.000
620	7.0	104.605	260.400	0.000
640	6.0	105.217	268.800	0.000
660	6.0	105.814	277.200	0.000
680	6.0	106.396	285.600	0.000
700	6.0	106.962	294.000	0.000
720	6.0	107.516	302.400	0.000
740	6.0	108.056	310.800	0.000
760	6.0	108.584	319.200	0.000
780	5.0	109.100	327.600	0.000
800	5.0	109.605	336.000	0.000
820	5.0	110.099	344.400	0.000
840	5.0	110.583	352.800	0.000
860	5.0	111.057	361.200	0.000
880	5.0	111.522	369.600	0.000
900	5.0	111.978	378.000	0.000
920	5.0	112.425	386.400	0.000
940	5.0	112.865	394.800	0.000
960	5.0	113.296	403.200	0.000
980	4.0	113.720	411.600	0.000
1000	4.0	114.136	420.000	0.000
1020	4.0	114.545	428.400	0.000
1040	4.0	114.948	436.800	0.000
1060	4.0	115.344	445.200	0.000
1080	4.0	115.733	453.600	0.000
1100	4.0	116.117	462.000	0.000
1120	4.0	116.495	470.400	0.000
1140	4.0	116.867	478.800	0.000
1160	4.0	117.233	487.200	0.000
1180	4.0	117.594	495.600	0.000
1200	4.0	117.950	504.000	0.000

Storage volume (m³) = 41.3 m³



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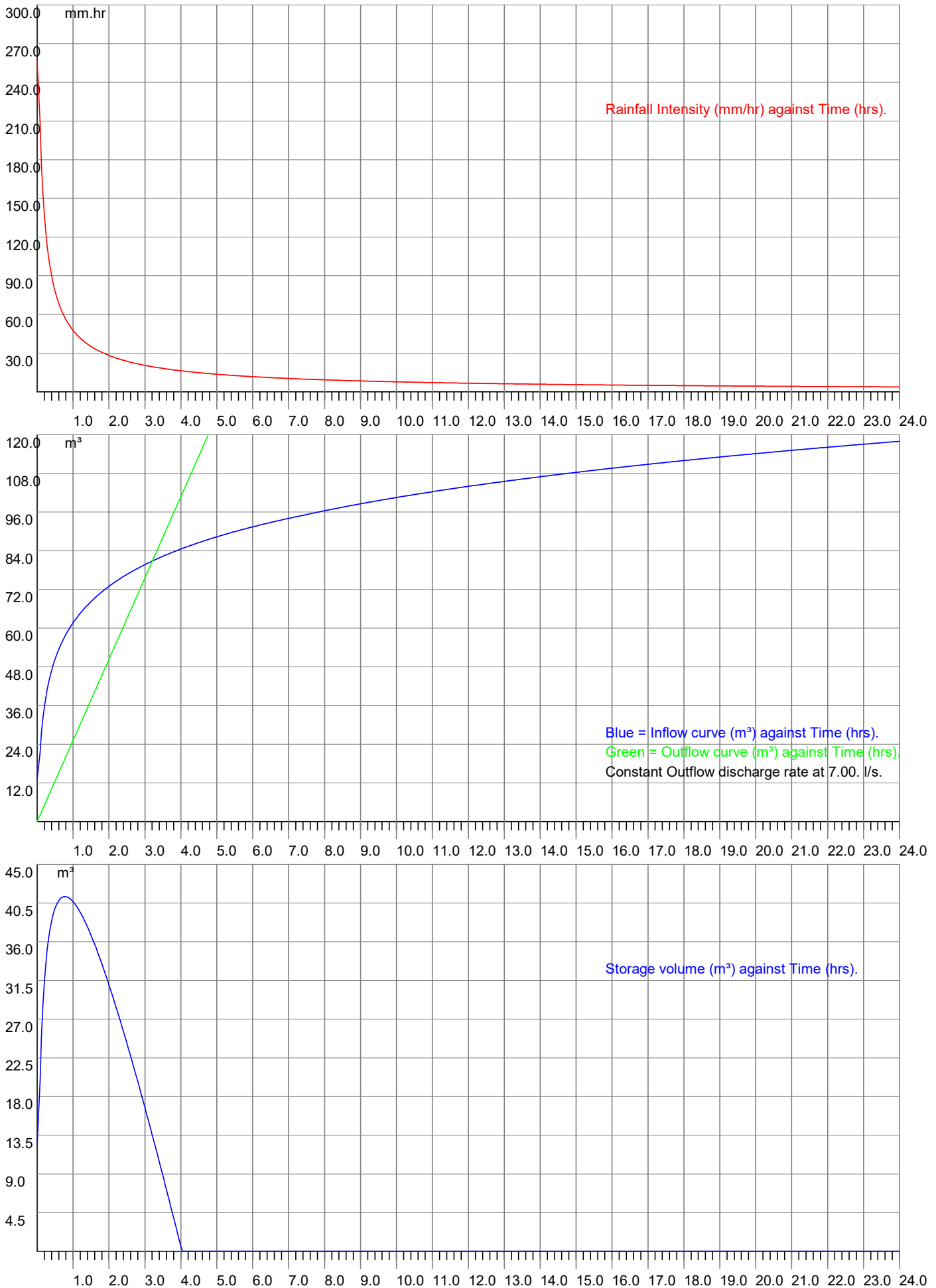
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www.thelkgroup.com

Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 3		
Date 05/07/24		
By	Checked	Reviewed

Project **storage eton 30 yrs**
Title **Pump storage calcs for Eton Business Park**





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				Sheet no. 4		
				Date 05/07/24		
Project storage eton 30 yrs				By	Checked	Reviewed
Title Pump storage calcs for Eton Business Park						

Explanatory notes for Peak Flow Storage

- 1) This system uses the rainfall intensity/ duration curve calculated using either the Wallingford or FEH method as selected.
- 2) The balance is calculated from the inflow minus the outflow.
- 3) The storage volume is the maximum value of the balance curve.
- 4) This method was described by Davis (1963) - see Butler & Davies, 2nd edition, p294
- 5) References to 'storm duration' relate only to the hydrograph method (qv).
- 6) There are always 600 steps in the calculation process, thus a 'run' time of 10 hours will be sampled every minute,

Explanatory notes for Hydrograph Storage

- 1) The user has the choice of Summer or Winter curves
- 2) The mean intensity varies with the duration of the storm curve
- 3) There are always 120 steps in the calculation process, irrespective of storm duration.
- 4) The balance is calculated from the inflow minus the outflow.
- 5) The storage volume is the sum of the balance values for each step.
- 6) Varying durations should be tried to find the maximum storage value - this can be narrowed down very closely.

*Modelling using the flow characteristics of the restrictor is available using Vortex Control modelling function. Please be aware that this function needs the full design data file to function.

Why do the two methods give different results?

The rainfall characteristics for each method are very different.

The Peak flow (using the Intensity/Duration/Frequency curve) does not model the actual rainfall. This curve is joined points which represent the mean intensity of a storm at a given duration i.e. a value of 19.5 mm/hr for a 60 minute storm indicates that over the sixty minute period, the mean intensity was 19.5 mm/hr. The calculation method samples the IDF curve for a given location and frequency (Return Period) and calculates the storage for that rate and duration less the outflow volume. The maximum value is displayed as the 'worst case' storage. The outflow volume is constant throughout the process at the specified discharge rate.

The hydrograph method uses a standard curve for either Winter or Summer storms. Traditionally these are symmetrical about the central peak. UK rainfall does not fit into this convenient curve, so the calculations are dealing with a stylised set of data. The mean intensity for the storm is calculated from the IDF curve and applied to the curve data, calculating the storage for that step less the outflow volume. The final storage volume is the sum of the storage for all the steps. The outflow volume varies with the hydraulic head on the control device using flow equations provided by the control manufacturer. This is a far more accurate method than the peak flow method and often results in bigger storage volumes.

It can be seen that these two methods are very different, and the user may have the choice of which result to use. This is not an exact science, though is often treated as such by those that do not understand the principles of the calculations.



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www.thelkgroup.com

Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 1		
Date 05/07/24		
By	Checked	Reviewed

Project **storage eton 100 yrs**

Title **Pump storage calcs for Eton Business Park**

Data:-

FSR Hydrology:-

Location = Eton Business Park

M5-60 (mm) = 20

Soil index = 0.50

Return period = 100

UCWI = 109.0

Grid reference = SD7940

r = 0.47

SAAR (mm/yr) = 1042

WRAP = 5

Climate change = 45

Soils of wet uplands -

i) with peaty or humose surface horizons and impermeable layers at shallow depth;

ii) deep raw peat associated with gentle upland slopes or basin sites;

iii) bare rock cliffs and screes;

iv) shallow, permeable rocky soils on steep slopes.

Runoff factor (RF) = 83.0, calculated from:-

Runoff factor = $(0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$

where

PIMP = Impervious Area * 100 / (Impervious Area + Pervious Area)

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 1872 m²

Total area (TA) = 1872 m²

Mean pump disch. rate = 7.000 l/s

Additional flow = 0.00 l/s

Pervious area = 0 m²

Equiv area = 1554 m² (TA x RF).

Areal reduction factor = 1.000

Climate change factor = 45

Calculated data:-

Time to max = 56.0 mins

Rainfall at max = 61.83 mm/hr

Pipeline storage = 0.0 m³

Offline storage = 0.0 m³

Calculated storage volume = 66.1 m³

Allowed discharge rate = 7.000 l/s

Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours

Rainfall rate = 14.00 mm/hr

Calculated storage volume = 0.0 m³

Allowed discharge rate = 7.000 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	8423.4	1125	66.6	400 x 600	367.5	500 x 500	264.6
150	3743.7	1200	58.5	600 x 900	160.0	500 x 750	176.4
225	1663.9	1275	51.8	800 x 1200	90.0	500 x 1000	132.3
300	935.9	1350	46.2			750 x 1000	88.2
375	599.0	1425	41.5			750 x 1200	73.5
450	416.0	1500	37.4			750 x 1500	58.8
525	305.6	1575	34.0			1000 x 1000	66.1
600	234.0	1650	30.9			1000 x 1200	55.1
675	184.9	1725	28.3			1000 x 1500	44.1
750	149.7	1800	26.0			1000 x 1800	36.7
825	123.8	1875	24.0			1000 x 2000	33.1
900	104.0	1950	22.2			1500 x 1500	29.4
975	88.6	2025	20.5			1500 x 1800	24.5
1050	76.4	2100	19.1			1500 x 2000	22.0



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Data:-

The LK Group

www.thelkgroup.com

Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
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Job No.		
Sheet no. 2		
Date 05/07/24		
By	Checked	Reviewed

Project **storage eton 100 yrs**

Title **Pump storage calcs for Eton Business Park**

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
20	127.0	65.579	8.400	57.179
40	79.0	81.836	16.800	65.036
60	59.0	91.266	25.200	66.066
80	47.0	97.933	33.600	64.333
100	40.0	103.094	42.000	61.094
120	35.0	107.304	50.400	56.904
140	31.0	110.856	58.800	52.056
160	27.0	113.926	67.200	46.726
180	25.0	116.624	75.600	41.024
200	23.0	119.030	84.000	35.030
220	21.0	121.197	92.400	28.797
240	20.0	123.166	100.800	22.366
260	19.0	124.969	109.200	15.769
280	17.0	126.629	117.600	9.029
300	16.0	128.167	126.000	2.167
320	16.0	129.596	134.400	0.000
340	15.0	130.931	142.800	0.000
360	14.0	132.181	151.200	0.000
380	14.0	133.432	159.600	0.000
400	13.0	134.653	168.000	0.000
420	12.0	135.822	176.400	0.000
440	12.0	136.941	184.800	0.000
460	12.0	138.017	193.200	0.000
480	11.0	139.051	201.600	0.000
500	11.0	140.049	210.000	0.000
520	10.0	141.011	218.400	0.000
540	10.0	141.942	226.800	0.000
560	10.0	142.842	235.200	0.000
580	10.0	143.715	243.600	0.000
600	9.0	144.561	252.000	0.000
620	9.0	145.383	260.400	0.000
640	9.0	146.181	268.800	0.000
660	9.0	146.958	277.200	0.000
680	8.0	147.715	285.600	0.000
700	8.0	148.452	294.000	0.000
720	8.0	149.171	302.400	0.000
740	8.0	149.872	310.800	0.000
760	8.0	150.557	319.200	0.000
780	7.0	151.227	327.600	0.000
800	7.0	151.881	336.000	0.000
820	7.0	152.521	344.400	0.000
840	7.0	153.148	352.800	0.000
860	7.0	153.761	361.200	0.000
880	7.0	154.362	369.600	0.000
900	7.0	154.952	378.000	0.000
920	7.0	155.530	386.400	0.000
940	6.0	156.096	394.800	0.000
960	6.0	156.653	403.200	0.000
980	6.0	157.199	411.600	0.000
1000	6.0	157.736	420.000	0.000
1020	6.0	158.263	428.400	0.000
1040	6.0	158.781	436.800	0.000
1060	6.0	159.291	445.200	0.000
1080	6.0	159.792	453.600	0.000
1100	6.0	160.285	462.000	0.000
1120	6.0	160.770	470.400	0.000
1140	5.0	161.248	478.800	0.000
1160	5.0	161.718	487.200	0.000
1180	5.0	162.182	495.600	0.000
1200	5.0	162.638	504.000	0.000

Storage volume (m³) = 66.1 m³



MasterDrain
SW

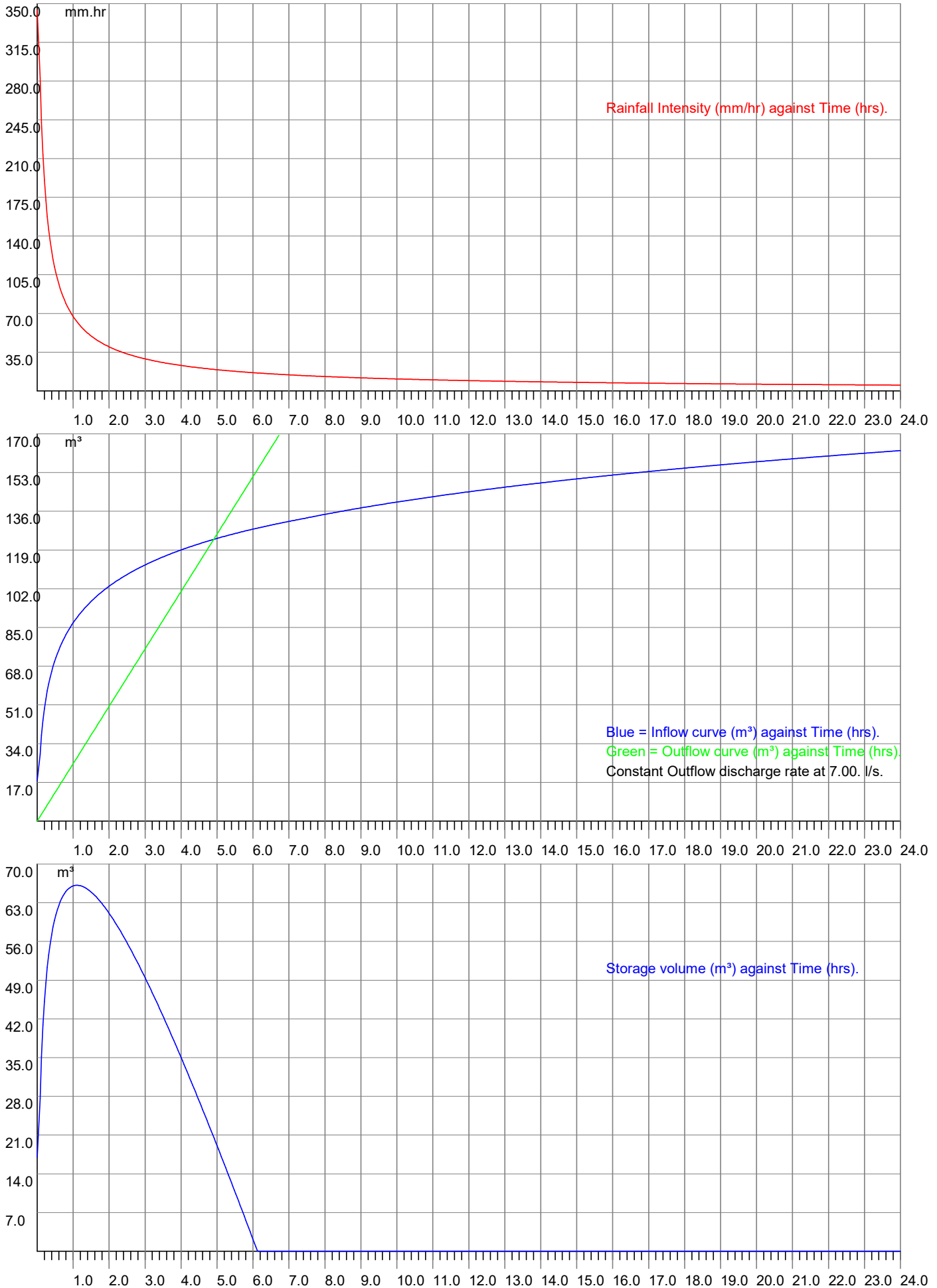
The LK Group

www.thelkgroup.com

Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 3		
Date 05/07/24		
By	Checked	Reviewed

Project **storage eton 100 yrs**
Title **Pump storage calcs for Eton Business Park**





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SW

The LK Group www.thelkgroup.com		Eton Business Park, Eton Hill Road, Radcliffe M26 2ZS Tel: 0161 763 7200 email: m.jones@thelkgroup.com		Job No.	
				Sheet no. 4	
				Date 05/07/24	
Project storage eton 100 yrs		By		Checked	Reviewed
Title Pump storage calcs for Eton Business Park					

Explanatory notes for Peak Flow Storage

- 1) This system uses the rainfall intensity/ duration curve calculated using either the Wallingford or FEH method as selected.
- 2) The balance is calculated from the inflow minus the outflow.
- 3) The storage volume is the maximum value of the balance curve.
- 4) This method was described by Davis (1963) - see Butler & Davies, 2nd edition, p294
- 5) References to 'storm duration' relate only to the hydrograph method (qv).
- 6) There are always 600 steps in the calculation process, thus a 'run' time of 10 hours will be sampled every minute,

Explanatory notes for Hydrograph Storage

- 1) The user has the choice of Summer or Winter curves
- 2) The mean intensity varies with the duration of the storm curve
- 3) There are always 120 steps in the calculation process, irrespective of storm duration.
- 4) The balance is calculated from the inflow minus the outflow.
- 5) The storage volume is the sum of the balance values for each step.
- 6) Varying durations should be tried to find the maximum storage value - this can be narrowed down very closely.

*Modelling using the flow characteristics of the restrictor is available using Vortex Control modelling function. Please be aware that this function needs the full design data file to function.

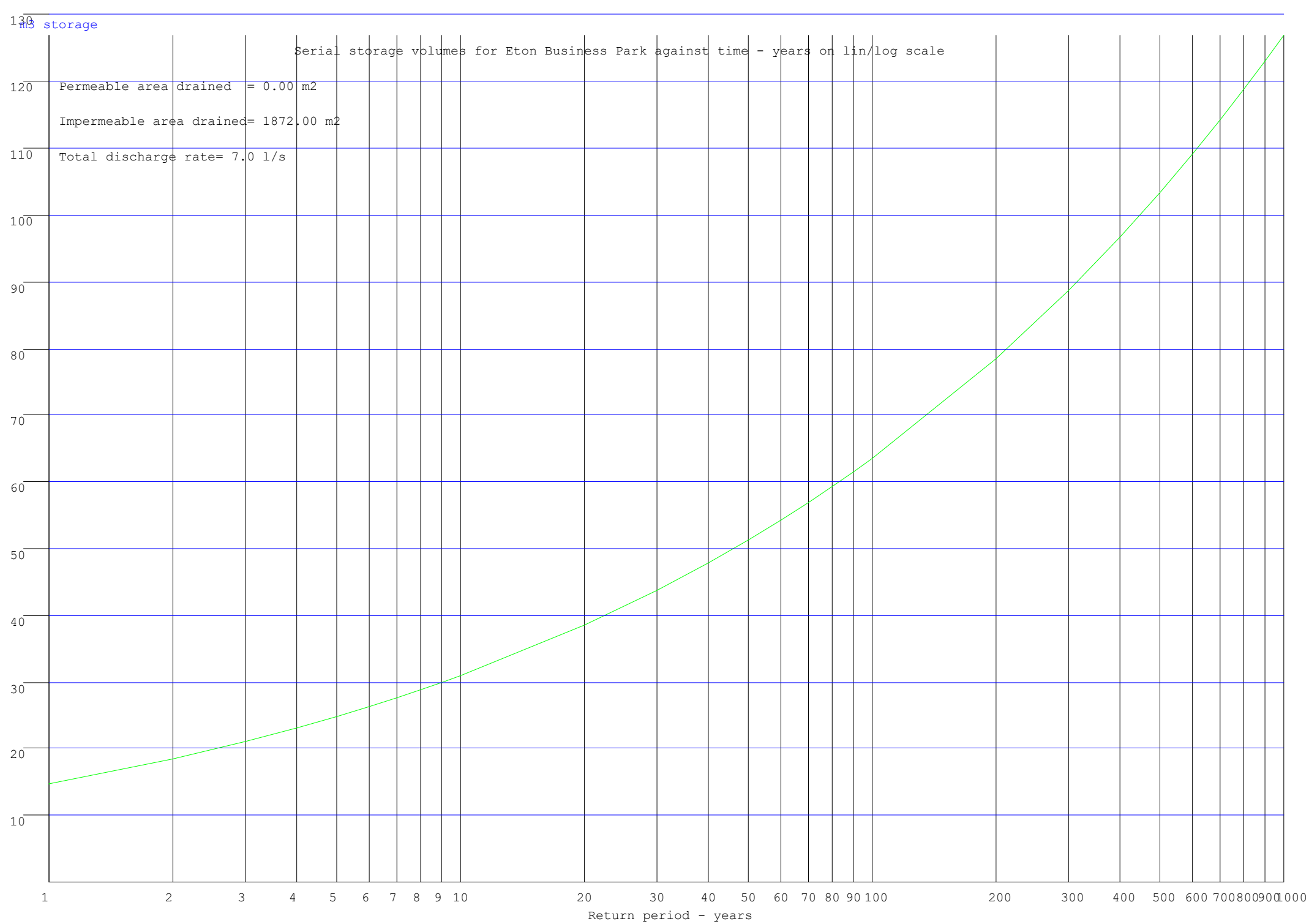
Why do the two methods give different results?

The rainfall characteristics for each method are very different.

The Peak flow (using the Intensity/Duration/Frequency curve) does not model the actual rainfall. This curve is joined points which represent the mean intensity of a storm at a given duration i.e. a value of 19.5 mm/hr for a 60 minute storm indicates that over the sixty minute period, the mean intensity was 19.5 mm/hr. The calculation method samples the IDF curve for a given location and frequency (Return Period) and calculates the storage for that rate and duration less the outflow volume. The maximum value is displayed as the 'worst case' storage. The outflow volume is constant throughout the process at the specified discharge rate.

The hydrograph method uses a standard curve for either Winter or Summer storms. Traditionally these are symmetrical about the central peak. UK rainfall does not fit into this convenient curve, so the calculations are dealing with a stylised set of data. The mean intensity for the storm is calculated from the IDF curve and applied to the curve data, calculating the storage for that step less the outflow volume. The final storage volume is the sum of the storage for all the steps. The outflow volume varies with the hydraulic head on the control device using flow equations provided by the control manufacturer. This is a far more accurate method than the peak flow method and often results in bigger storage volumes.

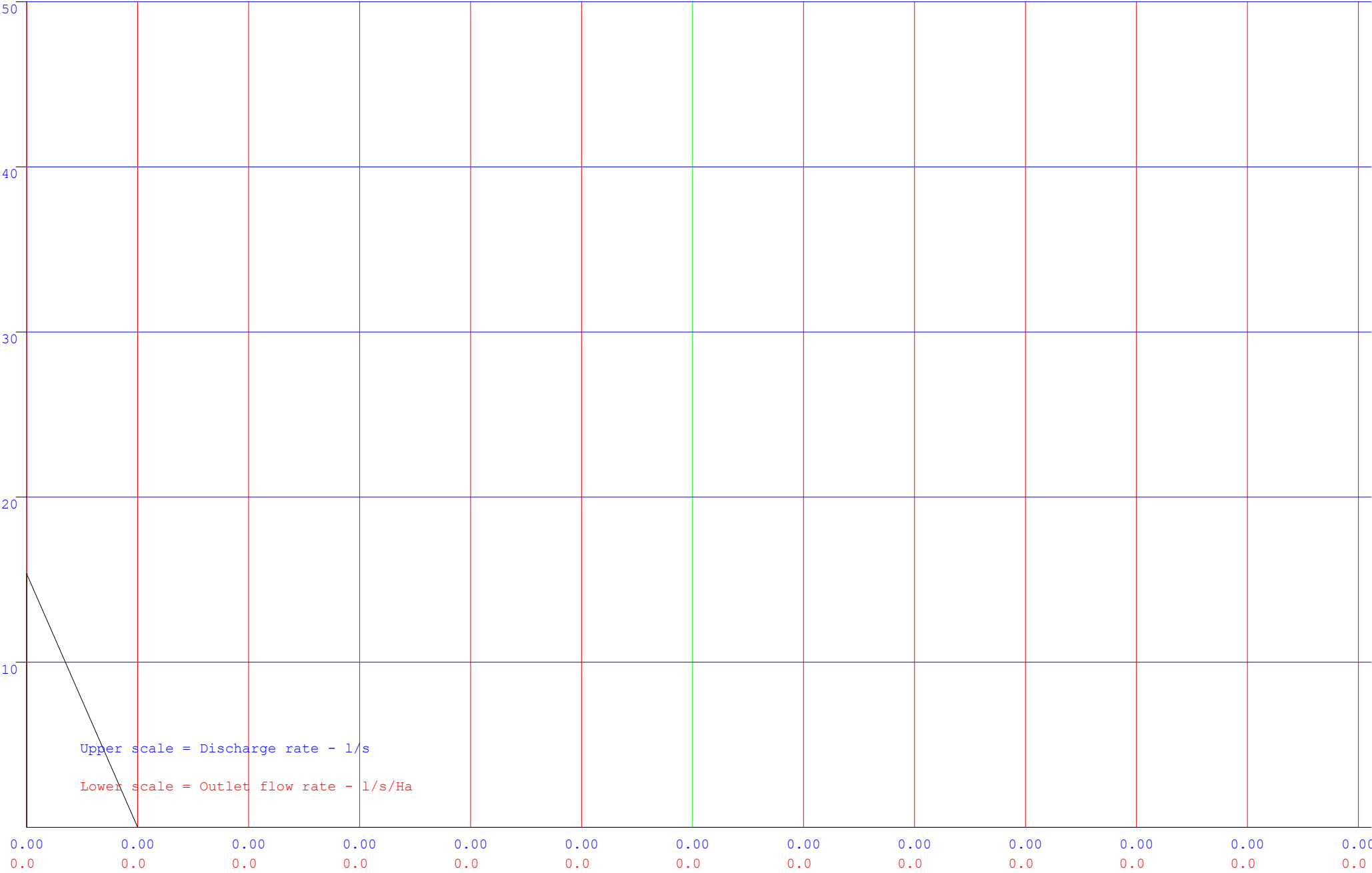
It can be seen that these two methods are very different, and the user may have the choice of which result to use. This is not an exact science, though is often treated as such by those that do not understand the principles of the calculations.



Storage volumes for Eton Business Park against varying discharge rates

m3 storage

Design discharge rate= 0.0



Appendix E – Infiltration Testing

ROGERS **GEOTECHNICAL SERVICES LTD**

The **Ground Investigation** Specialists



OFFICES 1&2 BARNCLIFFE BUSINESS PARK
NEAR BANK
SHELLEY
HUDDERSFIELD
HD8 8LU

Tel 0843 50 666 87

Fax 0843 51 599 30



REPORT ON A GEO-ENVIRONMENTAL INVESTIGATION

at

**LAND ADJACENT TO ETON BUSINESS PARK,
BURY ROAD, RADCLIFFE.**

for

SOUTHDALE Ltd AND CUBE GREAT PLACES Ltd.

Report No J2807/14/E

October 2014

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APPENDIX 6 – LABORATORY TESTING – GEOTECHNICAL

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A REPORT ON A GEO-ENVIRONMENTAL INVESTIGATION

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1. SYNOPSIS

This investigation has demonstrated that significant thicknesses of made ground was revealed to between 1.4m and 2.7m depth. Underlying this material, variably loose and medium dense silty gravelly sand was observed to around 3.0m, whereupon firm silty clays were proved to the base of the boreholes. Due to the extended levels of fill and variability in the strata, it is considered that piles will represent the most appropriate foundation solution at this site. Soakaway testing has been undertaken, which indicates that soakaways could be adopted. Contamination testing has revealed some contamination, which is considered to be confined to the eastern part of the site. Additionally, whilst no asbestos or PCBs were revealed, some carbon dioxide is present, which will require some remedial action.

2. INTRODUCTION

It is understood the land adjacent to Eton Business Park, Bury Road, Radcliffe is to be developed by the construction of a number of residential dwellings with associated gardens, driveways and access roads. Accordingly, a site investigation has been undertaken in accordance with the information provided and as instructed by the client. This work was required in order to determine the nature of the underlying soils, to assess their engineering properties, to determine the suitability for soakaways and to assist in the design of safe and economical foundations for the proposed development. Additionally, contamination testing of the made ground and groundwater has been undertaken to enable an assessment of the levels of contamination at this site. Furthermore, testing for the UKWIR suite, presence of asbestos and PCBs has also been undertaken.

This report presents the data obtained and discusses the ground conditions in relation to the proposed development.

3. LIMITATIONS

The recommendations made and opinions expressed in this report are based on the ground conditions revealed by the site works, together with an assessment of the site and of the laboratory test results. Whilst opinions may be expressed relating to sub-soil conditions in parts of the site not investigated, for example between borehole positions, these are for guidance only and no liability can be accepted for their accuracy.

This report has been prepared in accordance with our understanding of current best practice. However, new information or legislation, or changes to best practice may necessitate revision of the report after the date of issue.

4. DESK STUDY

A Phase 1 Desk Study has been undertaken by Rogers Geotechnical Services Ltd in July 2014 and the results were presented as report number J2808/14/EDS. This report has been used extensively during the current intrusive investigation.

5. FIELDWORKS

The fieldworks were undertaken on the 19th September 2014 and included the following:

- Four windowless sample boreholes.
- Three dynamic probes.
- Three machine excavated trial pits.
- Two trial pit soakaway tests.
- Three gas monitoring standpipes.

The investigatory locations are shown on the site plan which is presented in Appendix 1 to this report. It should be appreciated that there was a concrete slab across much of the site western part of the site, thus precluding the excavation of trial pits in this area. Furthermore, due to time constraints, WS4 was undertaken only to 1.0m in order to obtain sufficient sample for the chemical testing.

5.1 Windowless Sample Boreholes

These boreholes were sunk using a drive-in windowless sampler. The cores were undertaken in 1m lengths and reduced in diameter from 90mm for the first 1m through 80mm, 70mm and 60mm for subsequent 1m increments. The recovered cores were sealed and returned to the laboratory for logging and

subsequent testing. The soils were described in general accordance with BS5930: 1999, as amended in 2007, and full descriptions are given on the window sample records which are presented in Appendix 2. Also included on these records are the percentages of core recovered.

5.2 Dynamic Probes

Dynamic penetration tests were undertaken adjacent to windowless sample boreholes WS1 to WS3 in accordance with the procedure given in BS1377: 1990: Part 9, using the super heavy penetrometer (DPSH). This probe consists of a 63.5kg mass falling through 750mm onto an anvil, which drives a 50mm diameter cone into the ground. The number of blows required to drive the cone through successive 100mm increments are recorded as the N_{100} values. The results of the dynamic penetration tests are tabulated and presented as bar charts of N_{100} values versus depth in Appendix 3.

5.3 Machine Excavated Trial Pits

A total of three trial pits were excavated in order to reveal the nature of the near surface soils using a JCB 3CX excavator. The soils were logged on site in general accordance with BS5930: 1999, as amended in 2007, and full descriptions are given on the trial pit records which are presented in Appendix 4. Samples were taken from the trial pits for both geotechnical and chemical testing. The chemical test specimens were retained in the appropriate air tight containers within cool boxes for onward transition to the chemical laboratory.

5.4 Soakaway Tests

Soakaway tests were conducted in two of the trialpits excavated. The soakage tests undertaken at the base of the pits, were conducted and calculated in general accordance with the method given by BRE Digest 365. The results of the soakaway tests are presented in Appendix 5.

5.5 Gas Monitoring Standpipes

Gas monitoring standpipes were installed to 5.0m in WS1, 4.0m in WS2 and WS4. Details of the installations are shown on the appropriate borehole records. In all cases, the monitoring standpipe consisted of a perforated pipe from the base of the borehole to 1.0m below surface, with a non-perforated pipe to ground level. The response zone was filled with pea gravel, with a bentonite seal above and the installation was capped with a stop box cover in a concrete surround.

6. **GEOLOGY**

The 1: 50 000 scale British Geological Survey map of the area¹ along with other published geological data for the site has been examined and the following table presents the anticipated geology.

Table 1: Geological Data for the Site

Strata Type	Strata Name ²	Description ³
Superficial Geology	Glaciofluvial Sheet Deposits	Sand and gravel, locally with lenses of silt, clay or organic material. [Generic description].
Solid Geology	Pennine Middle Coal Measures Formation	Inter-bedded grey mudstone, siltstone, pale grey sandstone, commonly with mudstones containing marine fossils in the base and several such fossil bearing mudstones in the upper part.

It should be appreciated that deposits of alluvium are present in close proximity to the eastern boundary of the site. Furthermore, the geological data shows a number of inferred coal seams in the area of the site, which suggest that the DOE Mine coal seam is likely to sub-crop the site at a shallow depth. As the superficial deposits cannot be included as competent cover above the seam, a collapse could migrate upwards and cause surface movement. However, borehole data nearby suggest a significant thickness of superficial deposits, which would be water-logged, thus precluding coal extraction via bell pits and other illicit methods.

7. **STRATA CONDITIONS**

In accordance with the geology of the area, the succession has been shown to include the following:

Table 2: Generalised strata profile

Depth (m)	Strata type	Boreholes/Trial pits strata was revealed in	Groundwater strikes (m)
0.20	Concrete	WS2, WS3 and WS4	None
0.30	Sub-base	WS2	None
0.30 – 0.40	Topsoil	WS1, TP1, TP2, TP3	None
1.4 – 2.7	Made Ground	WS1, WS2, WS3, WS4 and TP1	None
+2.2 – +5.0	Glaciofluvial Sheet Deposits	All	None

This profile is considered in more detail below.

¹ Sources: British Geological Survey (NERC) Map Sheet 85; Manchester; Solid Edition, Drift Edition and Geology of Britain Viewer [online resource from www.bgs.ac.uk]

² BGS Geology of Britain Viewer

³ Sources: BGS Lexicon of Named Rock Units

7.1 Concrete

At the locations of boreholes WS2, WS3 and WS4, the site was found to be capped by 0.2m of concrete. At the location of WS2, a 100mm thick layer of sub-base comprising light grey silty sandy gravel of brick and siltstone was encountered.

7.2 Topsoil

At the locations of WS1, TP1, TP2 and TP3, the site was found to be capped by between 0.2m and 0.4m of topsoil. It should be appreciated that within TP1, cobbles and gravel of brick were also present within this material.

7.3 Made Ground

Underlying the concrete and topsoil in WS2, WS3, WS4 and in TP1, made ground was revealed to between 0.3m and 1.4m below ground level. This was described as brown (light grey in WS2 and WS3) silty gravelly sand. Underlying this material in WS3 and from below the topsoil in WS1, very soft silty sandy clay with pockets of dark grey organic matter was revealed to 1.7m in WS3 and 2.7m in WS1. The gravel within the made ground was noted to comprise of brick, mortar, concrete, and pottery fragments. It should also be noted that cobbles of brick were present in this material.

7.4 Glaciofluvial Sheet Deposits

Underlying the made ground in WS3, soft greyish brown silty clay with occasional gravel was revealed to 2.0m, whereupon a zone of no recovery was encountered to 2.80m. From this depth and beneath the made ground at the remaining locations, loose to medium dense greyish brown silty gravelly sand with well rounded cobbles and gravel of mixed lithologies was revealed to the base of WS4, TP1, and between 3.0m and 3.5m in WS1, WS2, WS3 and TP3.

In WS2, WS3 and TP3, a further deposit of soil described as, firm becoming stiff brown silty clay with well rounded gravel of mixed lithologies was revealed to the base of the boreholes and trial pit, at 4.0m below ground level.

However, in WS1 sample recovery was not achieved between 3.0m and 3.85m, whereupon, soft brown silty clay with pockets of dark grey organic matter was revealed to 4.0m. No further recovery was possible to borehole termination at 5.0m below ground level. It is considered that the soil encountered between 3.85m and 4.0m is representative of the overlying fill that has fallen into the borehole during the drilling process, thus should be discounted. The naturally occurring soils collectively described above are considered to be representative of the superficial Glaciofluvial Sheet deposits known to underlie the site.

7.5 Groundwater

The groundwater conditions entered on the borehole records are those observed at the time of the investigation. The normal rate of boring does not permit the

recording of an equilibrium water level for any one strike. Moreover, groundwater levels are subject to seasonal variation or changes on local drainage conditions. Notwithstanding the above, groundwater strikes were recorded at 3.4m in WS1 and 2.8m in WS2.

8. INSITU TESTING

8.1 Dynamic Penetration Tests

Dynamic penetration tests were conducted adjacent to windowless sample boreholes WS1 to WS3. It should be appreciated that in DP3-1 the probe rods were noted to be entering the ground at an angle, so it was stopped at 1.0m and re driven (now numbered DP3-2).

Within DP1, results of between 1 and 3 blows/100mm with occasional zones of no resistance were observed to around 4.0m. Results of between 4 and 5 blows/100mm were noted to 3.0m in DP2 and to 1.3m in DP3-2. However, in DP3-2 a zone of no resistance to penetration was then encountered to 2.5m depth.

From these depths at all locations, results of between 3 and 4 blows/100mm were then observed to 4.5m in DP3-2 and 5.7m in DP1 and DP2. The results then increased to between 11 and 16 blows/100mm at around 8m, before continuing to increase until effective refusal⁴ was achieved at depths of between 10.3m and 11.6m below ground level.

8.2 Soakaway Tests

The results obtained from the soakaway tests are summarised below:

Table 3: Soakaway Test Results

TP	Depth (m)	Soakage Area Dimensions (average)	Soil Description (Base of Trial pit)	Infiltration Rate (m/sec)	Drainage Characteristics
TP1	2.2	1.3m (L) x 0.3m (W)	Silty gravelly SAND	7.6×10^{-5}	Good
TP2	2.3	2.5m (L) x 0.3m (W)	Sandy SILT with gravel	*	Practically impermeable

* Unable to obtain infiltration rate as 25% effective depth could not be achieved.

8.3 Landfill Gas and Water Level Monitoring

The standpipes were monitored between the 7th and 23rd of October 2014. Further testing will be undertaken and the results will be issued under separate cover. The results of the gas monitoring undertaken to date are tabulated below.

⁴ 25 blows/100mm

Table 4: Landfill gas monitoring

Borehole No	Date	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	Flow	Barometric Pressure (mb)	Water Level (m)	Standpipe Depth (m)
WS1	07/10/2014	0.0	4.0	18.3	0.1	983	3.3	5.0
	23/10/2014	0.0	0.5	19.9	0.0	1006	2.78	
WS2	07/10/2014	0.0	4.7	13.1	0.0	984	2.75	4.0
	23/10/2014	0.0	0.5	20.0	0.0	1005	2.27	
WS3	07/10/2014	0.0	5.5	14.4	0.2	984	2.58	4.0
	23/10/2014	0.0	0.4	20.2	0.0	1004	2.62	

This work was undertaken using a Geotechnical Instruments (UK) Ltd. GA2000+ (serial No GA08272) which was calibrated on the 9th October 2013 and again on the 1st October 2014.

9. LABORATORY TESTING - GEOTECHNICAL

A programme of laboratory testing has been undertaken in accordance with BS1377 unless stated otherwise and the results are presented in Appendix 6. Each type of test is briefly summarised below and the results have been used to assist in the formulation of the discussion of ground conditions.

9.1 Moisture Content Determinations (Part 2 : 1990 : 3)

Selected samples of the more cohesive soils revealed at this site have been subject to moisture content determinations. The results indicate that the natural water content varied between 13% and 32%.

9.2 Index Property Tests (Part 2 : 1990 : 4, 5 and 6.5)

The liquid and plastic limits of the cohesive soils were determined and the results yielded liquid limits of between 27% and 44%, in association with plastic limits of 12% to 27%. Therefore, with respect to the recorded moisture content, consistency indices of between 0.7 and 0.9 were revealed. These results demonstrate that the cohesive soils may be generally classified as low to intermediate plasticity clay. The linear shrinkage tests conducted indicated that these soils exhibit a moderate shrinkage potential.

On the basis of the consistency indices the clay generally possesses a firm to stiff consistency⁵. In addition, the NHBC classification⁶ indicates that the clay revealed at this site possesses a medium volume change potential in the most onerous case.

9.3 Particle Size Distribution (Part 2: 1990: 9.2)

One sample of the Glaciofluvial Sheet deposits has been subjected to sieve analysis in order to establish its particle size distribution. The result of this test

⁵ BS EN ISO 14688-2, Table 6 – Consistency index of silts and clays

⁶ NHBC Standards, Chapter 4.2, *Building near trees*, Table 1 – Volume change potential

indicates that this sample may be classified as well graded sandy gravel. It should be appreciated that the material in its natural state also contained cobbles.

9.4 Sulphate Content and pH Values

Sulphate content and pH values of selected samples of soil were determined and the results are presented on the chemical test results sheet. Soluble sulphate contents of between 18mg/l and 160mg/l were recorded, these being associated with pH values of between 6.0 and 8.3.

10. LABORATORY TESTING - ENVIRONMENTAL

A suite of testing was undertaken on both water and soil samples from across the site and the following testing regime was undertaken.

- Metals – Cd, Cu, Hg, Ni Pb, V and Zn.
- Semi and Non-Metals - As, Se, Free CN⁻ and Phenols.
- Polycyclic aromatic hydrocarbons (PAHs).
- Petroleum hydrocarbons (TPHs).
- Others – pH, organic content and sulphide/soluble SO₄²⁻.
- Asbestos identification
- Polychlorinated biphenyls (PCB)
- UKWIR suite.

This testing was undertaken by Chemtest Ltd and the results of all of the chemical testing are presented in Appendix 7 of this report.

11. DISCUSSION OF GROUND CONDITIONS - ENVIRONMENTAL

11.1 Discussion of Test Results

It is understood that the site is to be developed by the construction of a number of residential dwellings with associated driveways and gardens and access roads. Therefore the site may be classified as being residential with plant uptake.

11.1.1 Soil Samples

The results of the chemical testing undertaken on soil samples obtained during this investigation have been compared to the ATRISK soil screening values (SSVs) as compiled by WS Atkins plc. These values have been derived in such a way as to adhere to the principles within the revised CLEA model and include the most current release of the SGVs. A list of subscribers is provided within the website⁷ and these include many local authorities.

⁷ <http://www.atrisksoil.co.uk/pages/general/subscribers.asp>

A comparison of the results of the testing, together with the data given above, can be found within Appendix 7. These results indicate the following:

Table 5: Summary of contaminated areas.

Borehole/ Trial pit Location	Contaminants found to be exceeding SSVs (Residential with Plant Uptake)
TP1	None.
TP2	Lead, arsenic, PAH [Chrysene, benzo(a)pyrene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene].
TP3	PAH [Benzo(a)pyrene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene].
WS1	Lead, arsenic, PAH [Indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene].
WS2	None.
WS3	None.

Concentrations of chromium, free cyanide, phenols and petroleum hydrocarbons (aliphatic C5 to C35 and aromatic C5 to C12) were below the detection limits for the tests. Detectable levels of all other contaminants were recorded, but these fell below the associated At-risk Soil Screening Values.

It should be appreciated that the soil screening values for the PAHs represents vapour saturation limits. The inhalation of vapour pathway contributes less than 10% of total exposure which is unlikely to significantly affect the combined assessment criterion⁸. In view of this, the ATRISK soil SSVs notes that the users may wish to consider using a combined assessment criterion given by CLEA if free product is not observed, the values for which are also provided on the summary of contamination analysis. In this case, no free product was observed, therefore it is considered that the CLEA criteria should be adopted for the PAHs at this site. The results of the contaminants found to exceed these screening values are tabulated below:

Table 6: Summary of areas contaminated by PAHs.

Borehole/ Trial pit Location	Contaminants found to be exceeding CLEA Criterion (Residential with Plant Uptake)
TP1	None.
TP2	PAH [Benzo(a)pyrene].
TP3	PAH [Benzo(a)pyrene].
WS1	None.
WS2	None.
WS3	None.

⁸ Ref: ATRISK soil, SSVs derived using CLEA v1.04 for 6% SOM, Residential with home grown produce land use, 14.12.09.

On the basis of all the information provided above, it is considered that contamination by lead, arsenic and benzo(a)pyrene is present in the area of WS1, TP2 and TP3. It should be appreciated, however, that the benzo[a]pyrene is typically associated with products derived from the incomplete combustion of organic materials. As there is no commercial production of it, or known uses for it, it is likely to be a component of the organic material within the made ground and as such is not likely to be mobile.

As the contamination was only revealed in the eastern part of the site, the historical maps have been reviewed. This indicates that between 1930 and 1956, earth-works were conducted in this part of the site. It is possible that the imported fill used in the operations may have introduced these contaminants and thus it is considered that only this part of the site is contaminated. The affected area is shown on the site plan, which is presented in Appendix 1 of this report.

11.1.2 Water Samples

There are no statutory guidelines in respect of groundwater contamination levels. However, Waste Management Paper No 26A sets out leachate levels below which the risk of pollution of water resources is considered to be very low. These levels are based upon ten times the acceptable drinking water criteria in the *Water Supply (Water Quality) Regulations (2000)* for England Wales and Scotland. For contaminants where there is no accepted leachate level, the results have been compared to the ATRISK^{water} screening values (WSVs) as compiled by WS Atkins plc. where inhalation exposure pathways are considered.

A comparison of the results of the testing, together with the data given above, can be found within Appendix 9. These results indicate the following:

Table 7: Summary of leachate levels and ATRISK^{water} comparison.

Borehole Location	Contaminants found to be exceeding 10xWater Supply Regulations/WSVs
WS3	None.

Concentrations of all contaminants fell below the detection limits for the tests with the exception of nickel, zinc, arsenic and selenium which fell below the chosen screening values.

In view of the above, it is considered that there is no contamination at the site with respect to ground waters.

11.1.3 Asbestos Identification

Three samples of soil were tested for asbestos identification. No asbestos was detected, thus it is considered that the site is not contaminated by asbestos.

11.1.4 Polychlorinated biphenyl (PCB) Testing

Three samples were tested for the presence of polychlorinated biphenyls (PCBs). Levels of all PCBs were found to be below the detection limits for the test. Therefore, it is considered that the site is not contaminated by PCBs.

11.1.5 UKWIR Tests

Three samples were tested in accordance with the UKWIR suite for the selection of water supply pipes in brownfield sites. The results are summarised below:

Table 8: Summary of UKWIR testing results⁹

Test Group	PE ¹⁰ threshold (mg/kg)	Laboratory detection limit (µg/kg)	Maximum Site Concentration	Results above PE Threshold
Total VOCs	0.5	0.0002	0.00094	None
Total BTEX & MTBE	0.1	0.0002	0.00056	None
Total SVOCs (excluding PAHs)	2	0.0005	<0.05	None
EC5-EC10 aliphatic and aromatic hydrocarbons	2	0.1	<0.01	None
EC10-EC16 aliphatic and aromatic hydrocarbons	10	1.0	3.1	None
EC16-EC40 aliphatic and aromatic hydrocarbons	500	1.0	53.5	None
Phenols (from SVOC analysis)	2	0.05	<0.05	None
Cresols and chlorinated phenols (from SVOC analysis)	2	0.05	<0.05	None

11.1.6 Gas Concentrations

With respect to ground gas, the results of the monitoring visits to date has indicated methane gas concentrations of 0.0%. Levels of carbon dioxide were noted to range between 4.0% and 5.5% during the first visit (983mb to 984mb) but reduced on the subsequent visit. These results were in association with oxygen levels of between 13.1% and 18.3%. It should be appreciated that on non contaminated sites there is generally about 20% by volume of oxygen, associated with low levels of carbon dioxide. In addition, a maximum flow rate recorded of 0.2 litres per hour will be employed in any calculations.

The principal driving force for initiating the movement of gas in the ground is a change in barometric pressure. The most onerous gas condition on a site is usually observed on days of low or falling barometric pressure, preferably below 1000mb. It has been noted that measurements undertaken solely during high

⁹ Extracted from Table 1 from UUW Supplementary Guidance to UKWIR Guidance. Document number UUENG/RL/V4/Sept2012.

¹⁰ PE – polyethylene pipe.

pressure conditions may be of lesser value. At this site the readings undertaken to date were at atmospheric pressures of 983mb and 1006mb.

It should be noted that further monitoring is required and the full set of results will be issued under separate cover.

In order to establish the gas screening value (GSV) for carbon dioxide or methane, the maximum gas concentration (expressed as a decimal) is multiplied by the borehole flow rate (l/hr). In this case there was 0.0% methane and a maximum of 5.5% (0.055) carbon dioxide, in association with a maximum flow rate of 0.2l/hr. This results in a GSV of zero for methane and 0.011 l/hr for carbon dioxide.

In accordance with Table 8.5, *Modified Wilson and Card classification* of the CIRIA report C665, *Assessing risks posed by ground gasses to building*, the site may be characterised as *Characteristic Situation Level 1*. However, as the level of carbon dioxide is over 5%, this should be upgraded to *Characteristic Situation Level 2*. Therefore it is considered that there is a low risk of harm to end user and site operatives, and some precautionary measures are required.

It should be appreciated that this assessment is based upon two readings thus could change. Further gas monitoring readings are to be undertaken to further quantify any risk.

11.2 Site Specific Risk Assessment

11.2.1 Chemical Contamination

The presence of contamination hazards and the risks associated with them has been assessed in accordance with industry practice and the 'suitable for use' approach. This has been conducted with reference to The Department for Environment, Food and Rural Affairs (DEFRA) and The Environment Agency¹¹ advice on the assessment of risks arising from the presence of contamination in soils and using the source-pathway-receptor approach.¹² This method dictates that there must be a risk of contaminant produced at a 'source' in sufficient concentration to cause harm and there must be a 'pathway' for the contaminant to reach an identifiable 'receptor' for the linkage to be proved and a contamination hazard to be considered present. Not all substances are contaminants and not all contaminants are considered to be a risk. Indeed DEFRA and The Environment Agency state that 'a contaminant is a substance which has the potential to cause harm, while a risk itself is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.'¹³

¹¹ R&D Publication CLR 8, 'Assessment of Risks to Human Health from Land Contamination: An overview of the Development of Soil Guideline Values and Related Research'.

¹² The pollution linkage approach was developed by 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990' which provides meanings for the terms contained in The Environmental Protection Act 1990 Part IIA, the primary legislation for addressing the issues of contaminated land.

¹³ See 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990', appendix A.

It should be appreciated that only the eastern part of the site has been found to be contaminated, which is considered to be associated with historical ground-works. Therefore, a site specific risk assessment for chemical contamination is required for the western part of the site (see site plan for affected area). The remainder of the site is not contaminated thus specific remedial measures will not be required.

11.2.2 Ground Model (Eastern Part of Site)

In view of the results of the chemical testing undertaken the conceptual site model has been prepared.

Potential sources of contamination include made ground.

Table 9: Potential harm to humans and animals (fauna)

SOURCES: MADE GROUND (Eastern part of the site). CONTAMINATION: Lead and Arsenic		
Pathways	Receptor	Linkage Present?
Direct contact/dermal absorption/soil ingestion	Operative	Yes - Contaminants exceed trigger values for residential with plant uptake.
	End User	Yes - Contaminants exceed trigger values for residential with plant uptake. Site to be developed by residential with gardens.
	Neighbours	No - Contaminants are not mobile, thus should not affect neighbours.
Inhalation of Dust/Vapours	Operative	Yes – Inhalation of dust during construction is possible. No vapour present.
	End User	No - Dust is not likely to represent a significant issue to the end user. No vapour present.
	Neighbours	Yes - Inhalation of dust during construction is possible. No vapour present.
Ingestion of fruit/vegetables and/or waters	Operative	No – No edible plants or water sources on site.
	End User	Yes – Contaminants exceed trigger values for residential with plant uptake and gardens are to be included as part of the development.
	Neighbours	Yes - Contaminants exceed trigger values for residential with plant uptake and populated residential area surrounds the area.

Table 10: Potential harm to controlled waters and groundwater

SOURCES: MADE GROUND (Eastern part of the site). CONTAMINATION: Lead and Arsenic		
Pathways	Receptor	Linkage Present?
Spillage/loss/run off direct to receiving water	Controlled Waters	Yes – Contaminants exceed trigger values for residential with plant uptake and controlled waters within 250m.
Migration via permeable unsaturated strata	Controlled Waters	Yes – Contaminants exceed trigger values for residential with plant uptake and secondary A aquifer beneath site.
Run off via drainage/sewers etc	Controlled Waters	Yes – Contaminants exceed trigger values for residential with plant uptake.

Table 11: Potential harm to plants (flora)

SOURCES: MADE GROUND (Eastern part of the site). CONTAMINATION: Lead and Arsenic		
Pathways	Receptor	Linkage Present?
Direct contact with contaminated soils	Plants	Yes – Contamination present and site development to include gardens.
Uptake via root system	Plants	Yes – Contamination present and site development to include gardens.

Table 12: Potential harm to buildings/structures

SOURCES: MADE GROUND (Eastern part of the site). CONTAMINATION: Lead and Arsenic		
Pathways	Receptor	Linkage Present?
Direct contact with contaminated soils	Building Materials	No - Contamination revealed at the site is not considered to represent a significant hazard in relation to building materials. The site may be classified as class DS-1. Additionally, as the benzo(a)pyrene is present only in particulate form, thus degradation of buried plastic services from PAH's is not considered to represent a significant issue.
Direct contact with contaminated groundwater	Building Materials	No – Testing of water samples indicate that the ground water is not contaminated at this site

11.2.3 Ground Model (Ground Gasses)

It is evident that comparatively high levels of carbon dioxide are present across the site. Therefore, a site specific risk assessment in relation to ground gasses is required for the whole site.

Table 13: Site specific risk assessment (ground gas)

SOURCES: Made ground or offsite sources. CONTAMINATION: Carbon Dioxide.		
Migration of hazardous gases via permeable strata.	Operative	Yes – Carbon dioxide present.
	End User	Yes – Carbon dioxide present.
	Neighbours	No – Site is not a generating source.

11.3 Risk Assessment

11.3.1 Risk Assessment – Made Ground (Eastern Part of Site)

The preliminary risk assessment has been evaluated with reference to the following ratings and definitions:

Low - A pollution linkage is unlikely and/or the likelihood of harm occurring is low and of minor consequence.

Moderate - The linkage exists but further field or laboratory data is required to confirm that the contaminant has reached the receptor and the levels of contaminant are harmful.

High - The linkage exists and the available data indicates that significant harm may be caused and remedial action could be necessary.

Table 14: Site Specific Risk Assessment (Eastern Part of Site)

SOURCES: MADE GROUND (EASTERN PART OF SITE). CONTAMINATION: LEAD, ARSENIC & PAH's[Benzo(a)pyrene]			
Pathways	Receptor	Risk Rating	Notes
Direct contact/dermal absorption/soil ingestion	Operative	High	Contamination present. Precautions for site operatives and remediation to protect end users will be required.
	End User		
Inhalation of Dust	Operative	High	Contamination present. Precautions for site operatives and neighbours will be required during the construction phase.
	Neighbour		
Ingestion of fruit/vegetables and/or waters	End User	High	Contamination present. Remediation to protect end users and neighbours will be required.
	Neighbours		
Spillage/loss/run off direct to receiving water	Controlled Waters	Low	Contamination is not present as free product and therefore not mobile. Moreover, testing of a water sample indicates that it is not contaminated
Migration via permeable unsaturated strata	Controlled Waters		
Run off via drainage/sewers etc	Controlled Waters		
Direct contact with contaminated soil	Plants	High	Contamination present. Remediation to protect plants will be required.
Uptake via root system	Plants		

11.3.2 Risk Assessment – Ground Gas (Whole Site)

Table 15: Site Specific Risk Assessment (Ground Gas)

SOURCES: Made ground and offsite sources			
Pathways	Receptor	Risk Rating	Notes
Migration of hazardous gases via permeable strata	Operative	High	Levels of carbon dioxide present. Site is Characteristic Situation Level 2.
	End User		

11.4 Remediation Strategy

In view of the site specific risk assessment it is considered that remediation will be required at this site. Such a strategy should include the following main elements.

11.4.1 Remediation Objectives

In the eastern portion of the site, where the chemical contamination is present and in accordance with the site specific risk assessment, the object of the remediation likely to be as follows.

- To protect the site operatives during the construction process from the ingestion of soil or dust, dermal contact with the soil and inhalation of dust.
- To protect the end user and neighbour from the ingestion of soil or dust, dermal contact with the soil and inhalation of dust.
- To protect the end user and neighbours from the ingestion of contaminated fruit and vegetables.
- To protect the plants from the uptake of contamination from direct contact and uptake via the root system.

Additionally, due to the high levels of carbon dioxide across the entire site, the remediation objective should also include:

- Protection of the end user and operatives from the elevated levels of carbon dioxide revealed across the site.

11.4.2 Development Requirements

It is understood that a number of residential dwellings with associated driveways and gardens are to be constructed at the site. In view of the above a site specific remediation strategy should be undertaken after the proposed development has been finalised. However, for preliminary design and costing the following remediation proposals are offered. It should be noted that these proposals are limited to the eastern part of the site, as shown on the site plan.

11.4.3 Strategy (Chemical Contamination)

In order to fulfil the objectives defined above it is likely that the following remedial strategy could be utilised. It is recommended that a pragmatic approach be undertaken, with observational techniques being employed at each stage of the work.

Ground-works

During the ground-works phase of the development, protection to the site operatives is required. The risk to site operatives is considered under the Health and Safety at Work Act 1974, together with regulations made under the act, which includes the Control of Substances Hazardous to Health (COSHH) regulations. Therefore the risks to site personnel must be considered under the Construction Design and Management (CDM) regulations at the planning stage and be included in the contractor's Health and Safety Plan and site specific

Method Statements. These documents should include the following main elements.

- Site operatives at all levels should be made aware of the hazards of working with contaminated soils.
- Personal hygiene facilities, including washing and messing, must be provided and site operatives encouraged to use them.
- Where work is undertaken in dry weather the site should be dampened down to avoid dust. In addition, dust masks must be provided to all site operatives for use in dry weather.
- Where vehicles are transferring soil to the landfill site they should be covered to prevent contamination of the surrounding area by dust.
- Any stockpiles of contaminated soil on site should be sheeted over to prevent excessive amounts of airborne dust.
- Where work is undertaken in wet weather, vehicle and wheel washing facilities are required to ensure that the vehicles leaving the site do not transfer contamination to surrounding areas.

On completion of the ground-works a careful site inspection of the sub-grade would be required. Should visual or olfactory evidence of contamination be revealed then further testing may become necessary.

Construction

During the construction phase of the contract the following items are required to protect the end user from the potential contaminants revealed at this site.

- Beneath buildings, pavements and hard-standings clean inert granular sub-base should be employed.
- Good practice dictates that plastic services should be constructed in a surround of clean inert material and the results of the UKWIR test should be used to select a suitable pipe.
- For buried concrete the results of the sulphate and pH testing indicate that the design sulphate class for the site should be DS-1.
- Any redundant services revealed at this site should be de-commissioned and piped services sealed. Existing services that are to be employed in the new development should be carefully inspected to ensure that they are serviceable.

Soft Landscaped and Garden Areas

In the eastern portion of the site where the chemical contamination is present, remediation will be required to negate the contamination risk. This should include the provision of a capping layer of a minimum 500mm of inert material, which provide a suitable growing media for vegetation. At the base of this layer a granular capillary break of a minimum 100mm of free draining granular soil should be placed. This expedient should also provide a suitable root barrier to isolate the plants from the underlying contaminated ground.

It should be appreciated that this could be achieved by removing 600mm of the soil to an appropriate landfill, replacing it with clean inert fill. Alternatively, the site level could be raised by the same amount.

In any event it will be necessary to validate the thickness of the remedial works. This may be undertaken by the excavation of shallow hand auger boreholes through the topsoil and subsoil to the gravel capillary break. These should be undertaken on a random grid giving a minimum coverage of one borehole every 25m², although confirmation of this should be sought from any statutory authorities.

11.4.4 Strategy (Ground Gas)

Due to the levels of CO₂ and in according to Table 8.6, *Typical scope of gas protection measures*, of CIRIA report C665, two levels of protection are considered necessary and should include:

- Reinforced concrete cast *in situ* floor slab (suspended, non-suspended or raft) with at least 1200g DPM and under floor venting.
- Beam and block or pre-cast concrete slab and 2000g DPM / reinforced gas membrane and under floor venting.

Note: All joints and penetrations must be sealed.

It should be appreciated that this is based on the two readings thus should be re-evaluated once the final results of the gas monitoring are available.

11.5 Imported Fill Material

It should also be appreciated that any imported fill should be subjected to the following validation testing to assess its suitability.

Table 16: Validation testing

Contaminant	Screening Value (mg/kg)	Reference
As	32	Atrisk soil screening values, 6% soil organic matter
Cd	10	Atrisk soil screening values, 6% soil organic matter
Cr	14.7	Atrisk soil screening values, 6% soil organic matter
Cu	4020	Atrisk soil screening values, 6% soil organic matter
Hg	1	Atrisk soil screening values, 6% soil organic matter
Ni	130	Atrisk soil screening values, 6% soil organic matter
Pb	168	Atrisk soil screening values, 6% soil organic matter
V	115	Atrisk soil screening values, 6% soil organic matter
Zn	17200	Atrisk soil screening values, 6% soil organic matter
TPH CWG	-	See Atrisk soil screening values
PAH 16 EPA	-	See Atrisk soil screening values

The frequency of such testing should be sufficient to give statistical confidence for the validation results. For sub-soil the frequency should be 1 per 250m³ or a minimum of three samples, whichever is the greater.

12. DISCUSSION OF GROUND CONDITIONS – GEOTECHNICAL

It is understood that a number of residential dwellings with associated driveways and gardens are to be constructed at the site. At the time of writing this report the layout and construction details have not been finalised, thus the discussion below is of a generalised nature.

It cannot be recommended that foundations be constructed directly within the made ground revealed at this site. These soils are present in a weak and variable condition such that excessive total and/or differential settlement could occur under moderately light surface loading. Additionally, it should be appreciated that any relict underground structures should be removed as these could form 'hard-spots' under the new structures.

It should be appreciated that the soils revealed at this site are variable in both composition and consistency. This variation is clearly shown on the probe results, where extremely weak soils were revealed to depths of 3.7m in DP1 and 2.5m in DP3-2. Below these levels it is anticipated that firm becoming stiff silty clay with occasional gravel of mixed lithology will be revealed. It is possible that deep strip or spread footings could be constructed within these soils,

12.1 Strip and Spread Foundations

It is considered that the cohesive Glaciofluvial Sheet Deposits will provide a suitable bearing stratum, provided that the foundations are placed within soil generally described as being present in a firm insitu condition. It is considered that strip or spread foundations constructed within this material at a minimum depth of say 3m could be designed assuming an allowable increase in load given in the following table.

Table 17: Allowable increase in stress

Foundation type	Strip Footings			Spread Footings		
Foundation Breadth (B)	0.6	1.0	1.5	0.6	1.0	2.0
Foundation Depth (D)	3.0			3.0		
Allowable Increase in Stress (kN/m ²)	100	95	90	155	150	140

The allowable increase in stress given above assumes a factor of safety of 3 against general shear failure, with cohesion of 40kN/m² at the foundation depths. Settlements at the above loading intensities should remain within tolerable limits for the type of structure proposed provided that the underlying soils are carefully inspected immediately final trimming has taken place. Should any soft or weak material be encountered they should be locally removed and replaced with lean-mix concrete or compacted granular soil.

The stability of excavation faces cannot be guaranteed thus temporary support to the excavation faces may become necessary. Under no circumstances should operatives be allowed to enter unsupported excavations.

In view of the presence of weak made ground, it is considered that fully suspended ground-floor slabs be adopted for the houses constructed at this site.

Should seepages of groundwater be encountered it is considered that they could be dealt with using a simple form of de-watering. Such a system could include the excavation of sumps from which the water could be pumped.

12.2 Piled Foundations

For preliminary design purposes it is considered that driven pre-cast concrete piles are likely to represent the most economical foundation solution. It is anticipated that the piles will achieve 'set' at depth in excess of 8.0m below ground level.

It should be appreciated that the phase one desk study indicates a secondary A aquifer within both the superficial and solid geology. Thus, at this site contaminated cohesive made ground is present at surface over granular Glaciofluvial Sheet Deposits with cohesive Glaciofluvial Deposits beneath. Thus, piles penetrating the cohesive strata (forming an aquiclude) could inadvertently form a pathway for contamination from the made ground to the aquifer beneath. For guidance on this issue the National Groundwater and Contaminated Land Centre produced a booklet on *Piling into contaminated sites*. (Environment Agency 2002). In that guide Pollution Scenario 5 would apply for driven piles. Consequently, it is considered that driven displacement piles could be utilised, but these should include pointed ends to reduce the risk of pushing a plug of contamination into the underlying aquifer.

In view of the above comments consideration may be given to alternative piling solutions, which could include continuous flight auger piles or helical displacement piles, both of which would provide a suitable foundation solution and reduce the risk of cross contamination. However, in order to formulate a suitable design it is recommended that the advice of specialist piling contractors be sought. The advice should include consideration of the effects of negative skin friction on the piles as a result of settlement of the made ground and underlying weak cohesive deposits.

In view of the relatively weak near surface soils it will be necessary to construct a working platform for the piling rig and any other plant required during the works. Such a design should be undertaken in accordance with the procedures given in the BRE publication entitled *Working platforms for tracked plant*. If sub-base material extends across the area for the new works then this material could be utilised as part of the platform, thus reducing the requirement for additional imported material.

12.3 Soakaways

The soakaway tests undertaken on site have demonstrated two very different results. A soakage rate could not be determined for the test undertaken within TP2 due a fall from 75% to 25% effective depth not being achieved. It should be noted that the soil within TP2 was described as a sandy silt which generally has poor soakage rates.

Contrastingly within TP1, in soil described silty gravelly sand an infiltration rate of 7.6×10^{-5} m/s was obtained which is indicative of a good soakage rate. Therefore, it is considered that soakaways could be used within the silty sand revealed at this site. However, it should be appreciated that some siltation is possible within this material, thereby reducing the permeability over time. In view of this, it is suggested that the soakage rate be limited to 1×10^{-5} m/s for design purposes.

12.4 Effect of Sulphates

In view of the nature of the underlying soils it is considered that the design sulphate class be assessed with reference to Table C2¹⁴, which is provided in BRE Special Digest 1, *Concrete in aggressive ground*: Part C. On the basis of this table and considering the soluble sulphate contents recorded, it can be shown that well compacted buried concrete should be designed in accordance with Class DS-1 requirements. Assuming mobile groundwater, the table also indicates that the aggressive chemical environment for concrete (ACEC) classification is AC-2z.

In order to evaluate the design chemical (DC) class for the buried concrete at this site reference should be made to Table D1¹⁵, which can be found in Part D, *Specifying concrete for general cast-in-situ use*, of BRE Special Digest 1. From this table it may be shown that for an intended working life of at least 50 years the concrete design class DC-2z is required.

13. REFERENCES

- British Standards Institution (1990) BS1377: *British standard methods of test for soils for civil engineering purposes*, B.S.I., London.
Part 9: 1990: *In situ tests*.
- British Standards Institution (1999) BS5930: *Code of practice for site investigations*, B.S.I., London.
- Building Research Establishment (BRE) Special Digest 1 (2005), Third Edition: *Concrete in aggressive ground*.
Part C: *Assessing the aggressive chemical environment*.
Part D: *Specifying concrete for general cast-in-situ use*.
- Building Research Establishment (BRE), *Working platforms for tracked plant: Good practice guide to the design, installation, maintenance and repair of ground-supported working platforms*, 2004.
- Building Research Establishment. 1999. *Radon: Guidance on protective measures for new dwellings*.

¹⁴ Table C2, *Aggressive Chemical Environment for Concrete (ACEC) classification for brown field sites*

¹⁵ Table D1, *Selection of the DC Class and the number of APMs for concrete elements where the hydraulic gradient due to groundwater is 5 or less: for general in-situ use of concrete*.

- Building Research Establishment (BRE) Digest BD365 (1991): *Soakaway Design*, BRE Press, Garston.
- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – Final SC050021/SR2, *Human Health toxicological assessment of contaminants in soil*. Environment Agency, Bristol.
- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – SC050021/SR3, *Updated technical background to the CLEA model*. Environment Agency, Bristol.
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- UK Water Industry Research (UKWIR) (2011), *Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* - (Ref 10/WM/03/21).

For and on behalf of
Rogers Geotechnical Services Ltd,

I Sakoor BEng
Geotechnical Engineer

S.P. Rogers CEng, CGeol, MICE, MCIHT, FGS
Technical Director

APPENDIX 1

SITE PLAN



Title: **Site Location Plan**



Rogers Geotechnical Services Ltd

Site Name:

**Land off Bury Road, Radcliffe
Southdale and Cube Great Places Ltd**

Job No:

J2807/14/E

APPENDIX 2

WINDOWLESS SAMPLE BOREHOLE RECORDS



Borehole Log

Borehole No.

WS1

Sheet 1 of 1

Project Name: Land adjacent to Bury Road

Project No.
J2807/14/E

Co-ords: -

Hole Type
WLS

Location: Radcliffe

Level:

Scale
1:50

Client: Southdale Ltd and Cube Great Places Ltd.

Dates: 19/09/2014 -

Logged By
IMY

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.40			Brown sandy TOPSOIL.	
								MADE GROUND (Very soft to soft brown sandy clay with pockets of dark grey organic matter and occasional gravel of sandstone, siltstone, brick, coal, glass and pottery fragments).	1
					2.70			<i>Slight odour noted.</i>	2
					3.00			Loose light grey clayey silty SAND with well rounded, fine to coarse gravel of mixed lithologies. No recovery.	3
					3.85 4.00			Soft light brown silty sandy CLAY with pockets of dark grey organic matter. <i>Possible collapse of material from shallow depth.</i> No recovery.	4
					5.00			End of borehole at 5.00 m	5
									6
									7
									8
									9
									10

Remarks

Core recovery: 0-1m; 70%, 1-2m; 25%, 2-3m; 60%, 3-4m; 10%, 4-5m; 0%.





Borehole Log

Borehole No.

WS2

Sheet 1 of 1

Project Name: Land adjacent to Bury Road

Project No.
J2807/14/E

Co-ords: -

Hole Type
WLS

Location: Radcliffe

Level:

Scale
1:50

Client: Southdale Ltd and Cube Great Places Ltd.

Dates: 19/09/2014 -

Logged By
IMY

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND (Concrete).	
					0.30			MADE GROUND (Light grey silty sandy gravel. Gravel sub-angular to sub-rounded, fine to coarse of brick and siltstone). Medium dense light sandy gravelly SILT with cobbles. Cobbles and gravel are well rounded of mixed lithologies.	1
					2.70			<i>Observed to be slightly wet.</i> Medium dense light grey silty SAND with occasional well rounded gravel of mixed lithologies.	3
					3.20			<i>Slightly clayey.</i> Firm becoming stiff brown silty CLAY with occasional well rounded gravel of mixed lithologies.	4
					4.00			End of borehole at 4.00 m	4
									5
									6
									7
									8
									9
									10

Remarks

Core recovery: 0-1m; 70%, 1-2m; 90%, 2-3m; 100%, 3-4m; 85%.





Borehole Log

Borehole No.

WS3

Sheet 1 of 1

Project Name: Land adjacent to Bury Road

Project No.
J2807/14/E

Co-ords: -

Hole Type
WLS

Location: Radcliffe

Level:

Scale
1:50

Client: Southdale Ltd and Cube Great Places Ltd.

Dates: 19/09/2014 -

Logged By
IMY

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND (Concrete).	
								MADE GROUND (Light grey silty gravelly sand with occasional brick cobbles. Gravel is sub-angular to sub-rounded, fine to coarse of brick, mortar and concrete fragments).	1
					1.40			MADE GROUND (Very soft brown silty CLAY with gravel of sub-angular to sub-rounded, fine to coarse of brick and occasional pockets of organic matter).	
					1.70				
					2.00			Soft greyish brown silty sandy CLAY with orangish staining and occasional well rounded gravel of mixed lithologies. No recovery.	2
					2.80			Loose clayey gravelly SILT. Gravel is well rounded of mixed lithologies.	3
					3.20			Firm becoming stiff brown silty CLAY with occasional well rounded gravel of mixed lithologies.	
								Lens of light grey silt.	
					4.00			Becoming sandy.	4
								End of borehole at 4.00 m	
									5
									6
									7
									8
									9
									10

Remarks

Core recovery: 0-1m; 50%, 1-2m; 80%, 2-3m; 35%, 3-4m; 100%.





Borehole Log

Borehole No.

WS4

Sheet 1 of 1

Project Name: Land adjacent to Bury Road

Project No.
J2807/14/E

Co-ords: -

Hole Type
WLS

Location: Radcliffe

Level:

Scale
1:50

Client: Southdale Ltd and Cube Great Places Ltd.

Dates: 19/09/2014 -

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND (Concrete).	
					0.40			MADE GROUND (Brown slightly clayey gravelly silt. Gravel is sub-angular to sub-rounded, fine to coarse of brick, clinker and sandstone).	
					1.00			Light brown becoming greyish brown silty gravelly SAND with occasional cobbles. Cobbles and gravel are well rounded of mixed lithologies). End of borehole at 1.00 m	1
									2
									3
									4
									5
									6
									7
									8
									9
									10

Remarks

Core recovery: 0-1m; 90%.



APPENDIX 3

DYNAMIC PROBE RECORDS



Probe Log

Borehole No.

DP1

Sheet 1 of 2

Project Name: Land adjacent to Bury Road

Project No.
J2807/14/E

Co-ords: -

Hole Type
DCP

Location: Radcliffe

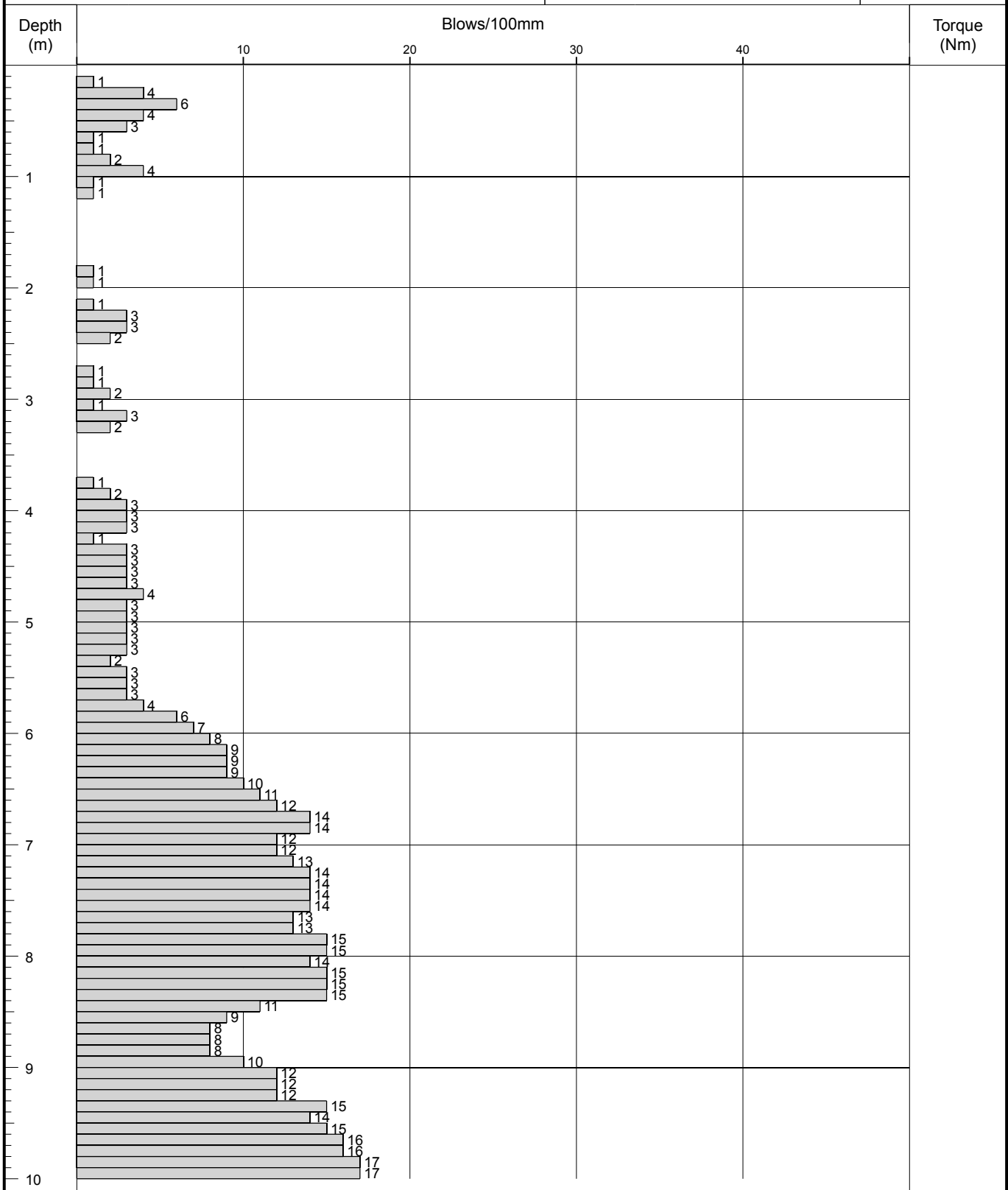
Level:

Scale
1:50

Client: Southdale Ltd and Cube Great Places Ltd.

Dates: 19/09/2014 -

Logged By



Remarks

Fall Height 750

Cone Base Diameter

Hammer Wt 64

Final Depth 11.70

Probe Type DPSH-B

Log Scale 1:50





Probe Log

Borehole No.

DP1

Sheet 2 of 2

Project Name: Land adjacent to Bury Road

Project No.
J2807/14/E

Co-ords: -

Hole Type
DCP

Location: Radcliffe

Level:

Scale
1:50

Client: Southdale Ltd and Cube Great Places Ltd.

Dates: 19/09/2014 -

Logged By

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
10	16	18			
	17	19			
	19	20			
	19	22			
	22	24			
11	20				
	17				
	15				
	17				
	20	23			
	24	28			
12					
13					
14					
15					
16					
17					
18					
19					
20					
Remarks		Fall Height	750	Cone Base Diameter	
		Hammer Wt	64	Final Depth	11.70
		Probe Type	DPSH-B	Log Scale	1:50





Probe Log

Borehole No.

DP2

Sheet 1 of 2

Project Name: Land adjacent to Bury Road

Project No.
J2807/14/E

Co-ords: -

Hole Type
DCP

Location: Radcliffe

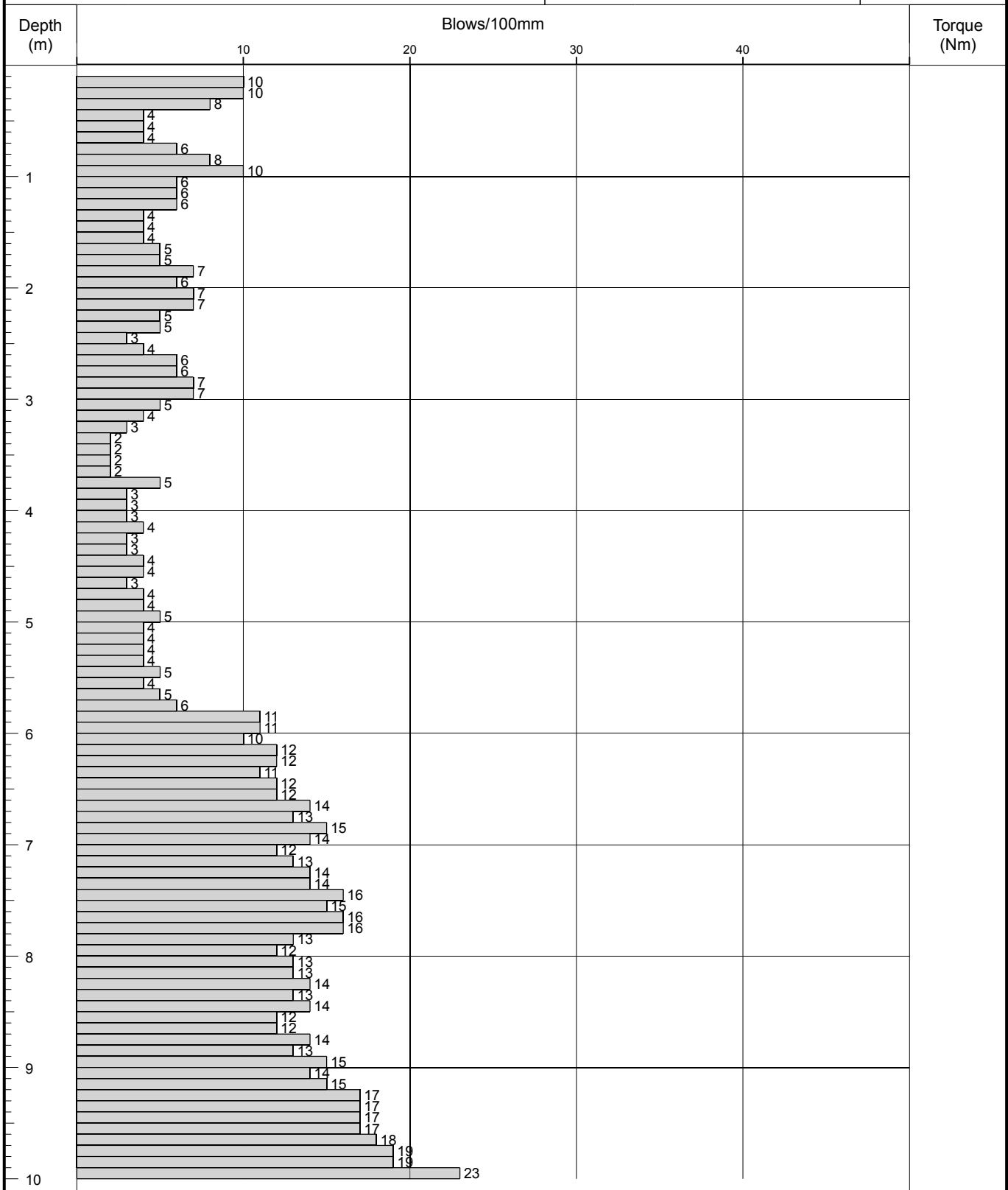
Level:

Scale
1:50

Client: Southdale Ltd and Cube Great Places Ltd.

Dates: 19/09/2014 -

Logged By



Remarks

Fall Height 750

Cone Base Diameter

Hammer Wt 64

Final Depth 11.60

Probe Type DPSH-B

Log Scale 1:50





Probe Log

Borehole No.

DP2

Sheet 2 of 2

Project Name: Land adjacent to Bury Road

Project No.
J2807/14/E

Co-ords: -

Hole Type
DCP

Location: Radcliffe

Level:

Scale
1:50

Client: Southdale Ltd and Cube Great Places Ltd.

Dates: 19/09/2014 -

Logged By

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
10		22			
		20			
		17			
		17			
		17			
		19			
		20			
		19			
		22			
11		23			
		21			
		20			
		22			
		22			
		23			
		24			
		24			
12					
13					
14					
15					
16					
17					
18					
19					
20					
Remarks		Fall Height	750	Cone Base Diameter	
		Hammer Wt	64	Final Depth	11.60
		Probe Type	DPSH-B	Log Scale	1:50





Probe Log

Borehole No.

DP3-1

Sheet 1 of 1

Project Name: Land adjacent to Bury Road

Project No.
J2807/14/E

Co-ords: -

Hole Type
DCP

Location: Radcliffe

Level:

Scale
1:50

Client: Southdale Ltd and Cube Great Places Ltd.

Dates: 19/09/2014 -

Logged By

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
1	6 8 9 7 13 8 4 6				
2					
3					
4					
5					
6					
7					
8					
9					
10					

Remarks

Fall Height 750

Cone Base Diameter

Hammer Wt 64

Final Depth 1.00

Probe Type DPSH-B

Log Scale 1:50



Probe Log

Borehole No.

DP3-2

Sheet 1 of 2

Project Name: Land adjacent to Bury Road

Project No.	J2807/14/E
-------------	------------

Co-ords: -

Hole Type
DCP

Location: Radcliffe

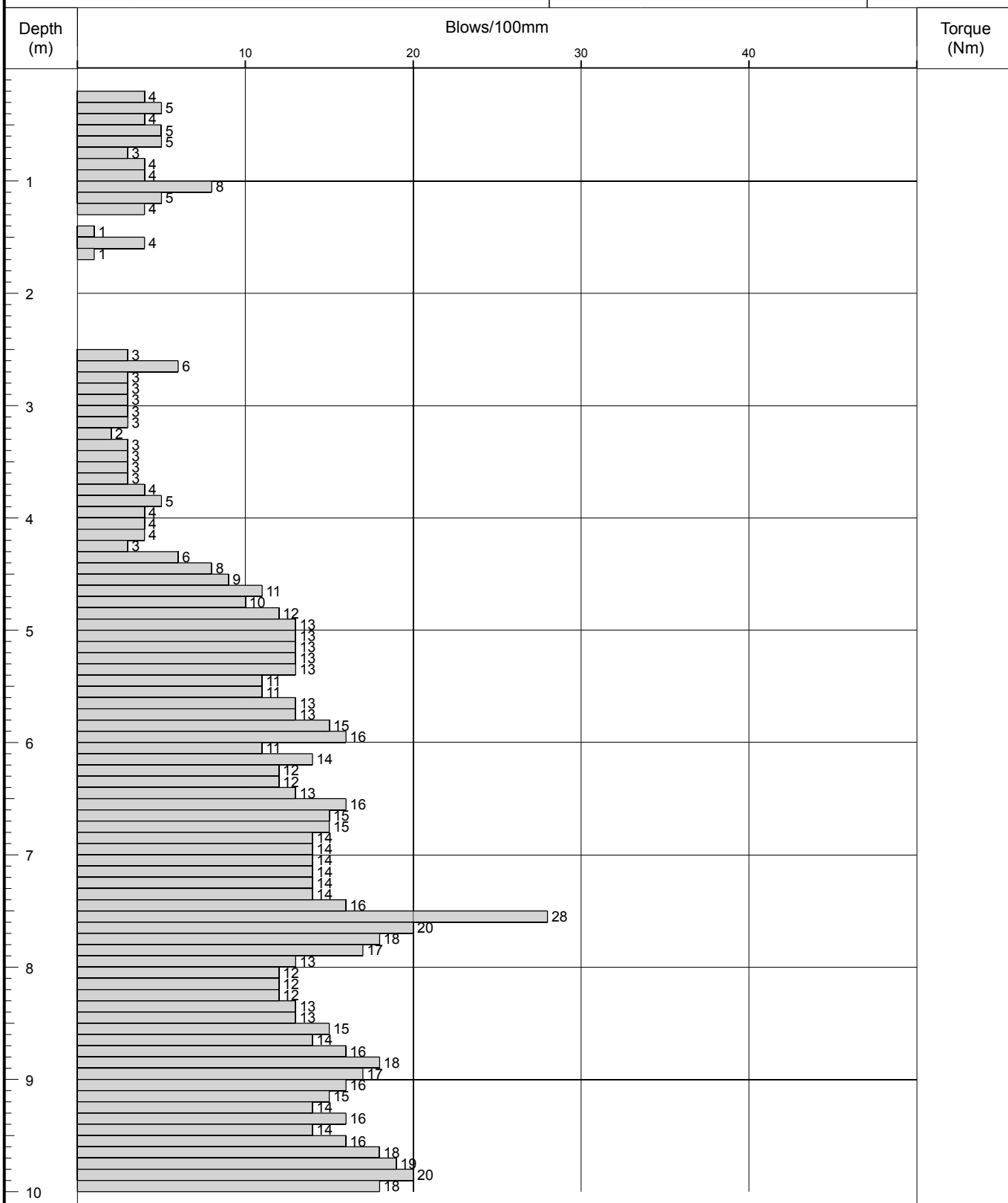
Level:

Scale
1:50

Client: Southdale Ltd and Cube Great Places Ltd.

Dates: 19/09/2014 -

Logged By



Remarks

Fall Height	750
-------------	-----

Cone Base Diameter

Hammer Wt	64
-----------	----

Final Depth	11.30
-------------	-------

Probe Type	DPSH-B
------------	--------

Log Scale	1:50
-----------	------





Probe Log

Borehole No.

DP3-2

Sheet 2 of 2

Project Name: Land adjacent to Bury Road

Project No.
J2807/14/E

Co-ords: -

Hole Type
DCP

Location: Radcliffe

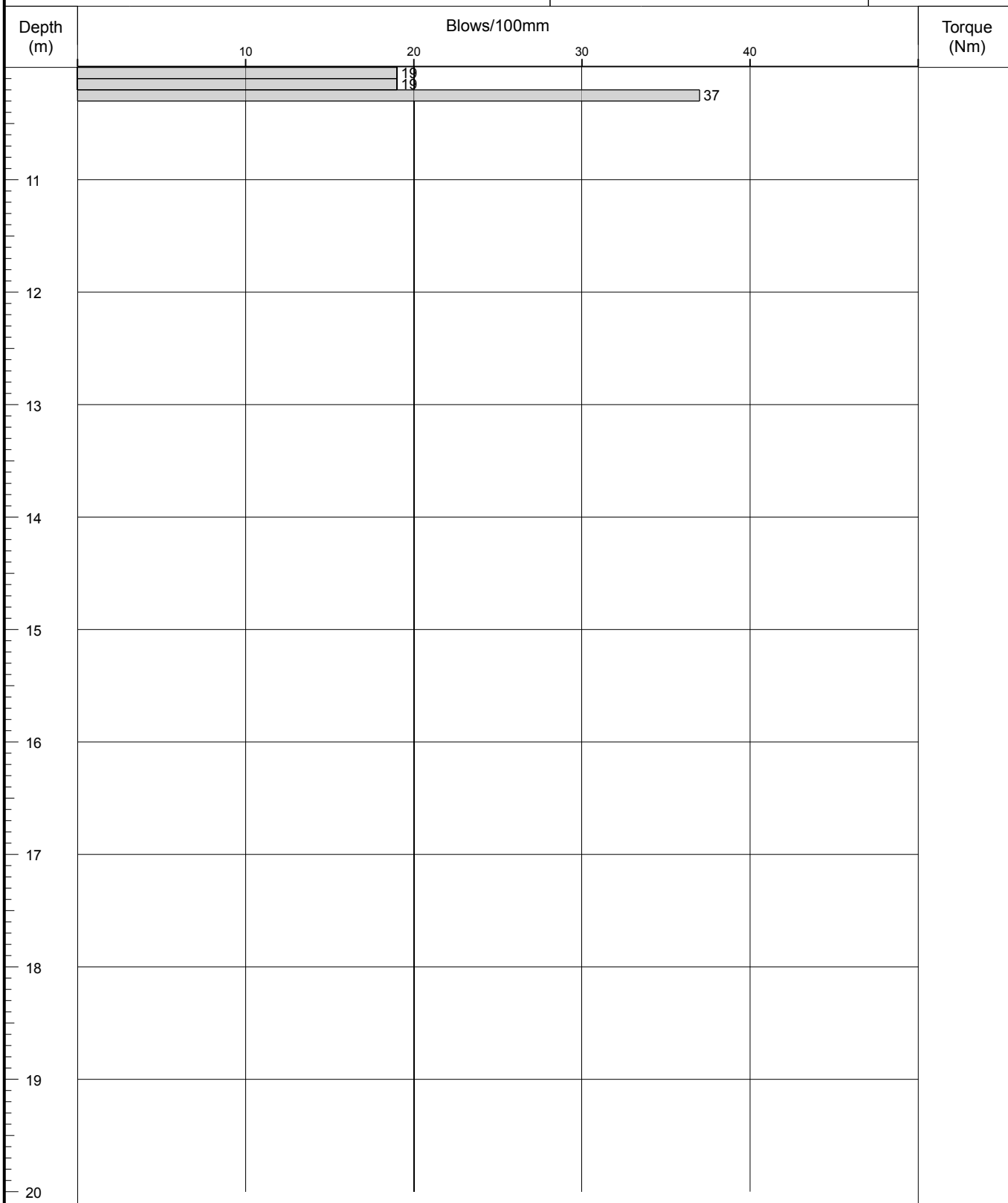
Level:

Scale
1:50

Client: Southdale Ltd and Cube Great Places Ltd.

Dates: 19/09/2014 -

Logged By



Remarks

Fall Height 750

Cone Base Diameter

Hammer Wt 64

Final Depth 11.30

Probe Type DPSH-B

Log Scale 1:50



APPENDIX 4

MACHINE EXCAVATED TRIAL PIT RECORDS



Trial Pit Log

Trialpit No

TP1

Sheet 1 of 1

Project Name: Land adjacent to Bury Road

Project No.
J2807/14/ECo-ords: -
Level:Date
19/09/2014

Location: Radcliffe

Dimensions
(m):

2.3

0.3

Depth
2.20Scale
1:50Logged
IMY

Client: Southdale Ltd and Cube Great Places Ltd.

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			TOPSOIL with cobbles and gravel of brick.	
							MADE GROUND (Brown silty gravelly sand with large cobbles of brick. Gravel is sub-angular to sub-rounded brick and concrete fragments).	1
				1.40			Brown silty gravelly SAND with cobbles. Cobbles and gravel are well rounded of mixed lithologies.	2
				2.20			End of pit at 2.20 m	
								3
								4
								5
								6
								7
								8
								9
								10

Remarks:

Stability:





Trial Pit Log

Trialpit No

TP2

Sheet 1 of 1

Project Name: Land adjacent to Bury Road

Project No.
J2807/14/ECo-ords: -
Level:Date
19/09/2014

Location: Radcliffe

Dimensions
(m):

2.5

0.3

Depth
2.30Scale
1:50Logged
IMY

Client: Southdale Ltd and Cube Great Places Ltd.

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			TOPSOIL.	
							Brown silty gravelly SAND with occasional cobbles. Cobbles and gravel are well rounded of mixed lithologies.	1
				2.00			Becoming slightly clayey. Greyish brown sandy SILT with gravel. Gravel is well rounded of mixed lithologies.	2
				2.30			Observed to be slightly moist.	
							End of pit at 2.30 m	
								3
								4
								5
								6
								7
								8
								9
								10

Remarks:

Stability:





Trial Pit Log

Trialpit No

TP3

Sheet 1 of 1

Project Name: Land adjacent to Bury Road

Project No.
J2807/14/ECo-ords: -
Level:Date
19/09/2014

Location: Radcliffe

Dimensions
(m):

2.8

0.7

Depth
4.00Scale
1:50Logged
IMY

Client: Southdale Ltd and Cube Great Places Ltd.

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			TOPSOIL.	
				0.90			Brown silty gravelly SAND with occasional cobbles. Cobbles and gravel of mixed lithologies.	
							Light brown silty gravelly SAND with cobbles. Cobbles and gravel are well rounded of mixed lithologies.	1
							<i>Observed to be moist.</i>	2
				3.50			Firm light grey silty CLAY with well rounded gravel of mixed lithologies.	3
				4.00			<i>Shear Vane test at 3.6m: 126 kPa, 153 kPa, 96 kPa.</i>	4
							End of pit at 4.00 m	4
								5
								6
								7
								8
								9
								10

Remarks:

Stability:



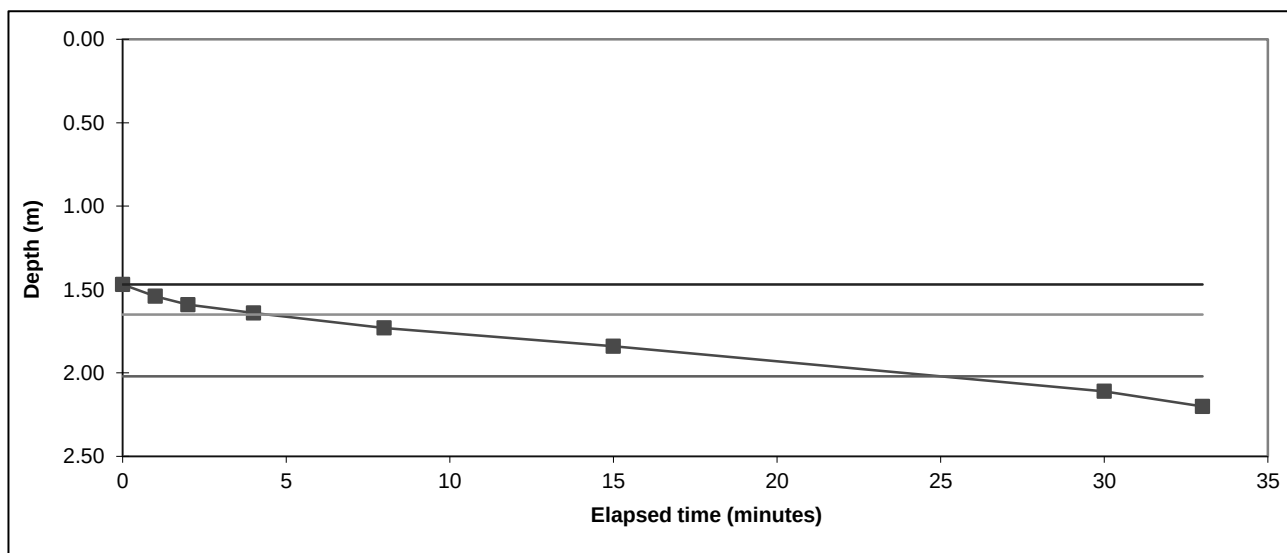
APPENDIX 5

SOAKAWAY TEST RESULTS

Rogers Geotechnical Services Ltd

Soakaway Test

Trial Pit No:	TP1	Test No:	1	Date:	19/09/2014
Length (m):	1.300	Datum Height:			0.00 m agl
Width (m):	0.30	Granular infill:	None		
Depth (m):	2.20	Porosity of infill:	1	(assumed)	
Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)		
0	1.470				
1	1.540				
2	1.590				
4	1.640				
8	1.730				
15	1.840				
30	2.110				
33	2.200				



Start water depth for analysis (mbgl):	1.47		
75% effective depth (mbgl):	1.65	Elapsed time (mins):	4.4
50% effective depth (mbgl):	1.84		
25% effective depth (mbgl):	2.02	Elapsed time (mins):	25.0
Base of soakage zone (mbgl):	2.20		
Volume outflow between 75% and 25% effective depth (m ³):			0.144
Mean surface area of outflow (m ²):			1.54
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			20.6

Soil infiltration rate (m/s):	7.6E-5
--------------------------------------	---------------

Remarks	Results processed following BRE 365 (2007).
----------------	---

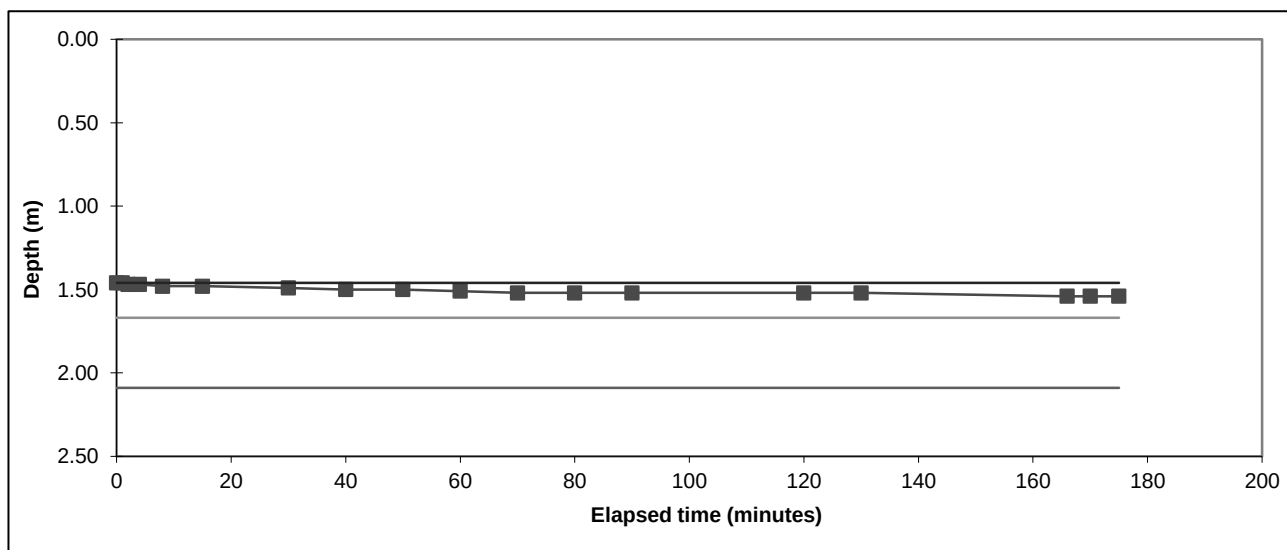
Client:	Southdale Ltd. and Cube Great Places Ltd.	TP1
Site:	Land adjacent to Bury Road, Radcliffe	

Rogers Geotechnical Services Ltd

Soakaway Test

Trial Pit No:	TP2	Test No:	2	Date:	19/09/2014
Length (m):	2.500	Datum Height:			0.00 m agl
Width (m):	0.30	Granular infill:	None		
Depth (m):	2.30	Porosity of infill:	1	(assumed)	

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.460	130	1.520
1	1.460	166	1.540
2	1.470	170	1.540
4	1.470	175	1.540
8	1.480		
15	1.480		
30	1.490		
40	1.500		
50	1.500		
60	1.510		
70	1.520		
80	1.520		
90	1.520		
120	1.520		



Start water depth for analysis (mbgl):	1.46		
75% effective depth (mbgl):	1.67	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	1.88		
25% effective depth (mbgl):	2.09	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	2.30		
Volume outflow between 75% and 25% effective depth (m³):			
Mean surface area of outflow (m²):			3.10
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			

Soil infiltration rate (m/s):	Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.
--------------------------------------	--

Remarks	Results processed following BRE 365 (2007).
----------------	---

Client:	Southdale Ltd and Cube Great Places Ltd.	TP2
Site:	Land adjacent to Bury Road, Radcliffe	

APPENDIX 6

LABORATORY TESTING – GEOTECHNICAL

Fax : 0843 5159930

J2807/14/E

Bury Rd, Radcliffe

17.10.14

Southdale Ltd. and Cube Great Places Ltd.

1

BS. 1377 : PART 2 : 1990 : 3.2, 4 and 5

sample preparation:		test method (liquid limit):
A - as recieved	D - oven dried (50°C)	X - cone penetrometer (test 4.3)
B - washed on 0.425mm sieve	E - not known	Y - one point cone penetrometer (test 4.4)
C - air dried		Z - Casagrande apparatus (test 4.5)

Offices 1&2 Barncliffe Business Park,
Near Bank, Shelley
Huddersfield
HD8 8LU
www.rogersgeotech.co.uk

J2807/14/E

Bury Rd, Radcliffe

Southdale Ltd and Cube Great Places Ltd.

17.10.14

2

Fax : 0843 5159930

BS. 1377 : PART 2 : 1990 : 6.5

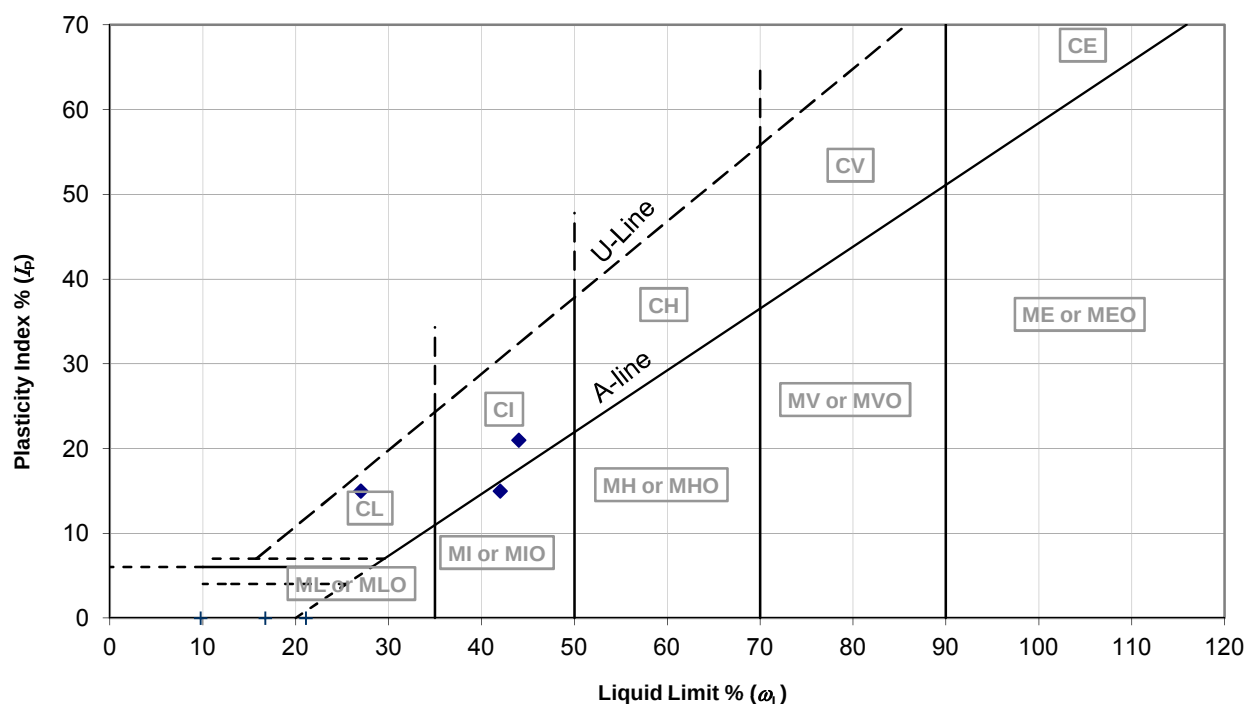
remarks:	
MG = Made Ground	

sample preparation:

D - not known

B - washed on 0.425mm sieve

C - air dried



Rogers Geotechnical Services Ltd.

Particle Size Distribution

BS 1377 : Part 2 : 1990 : 9.2 / 9.3

Client: Southdale Ltd and Cube Great Places Ltd.

BH/TP No. WS2

Site: Bury Rd, Radcliffe

Sample No. C2

Tested by: CJN/GSP

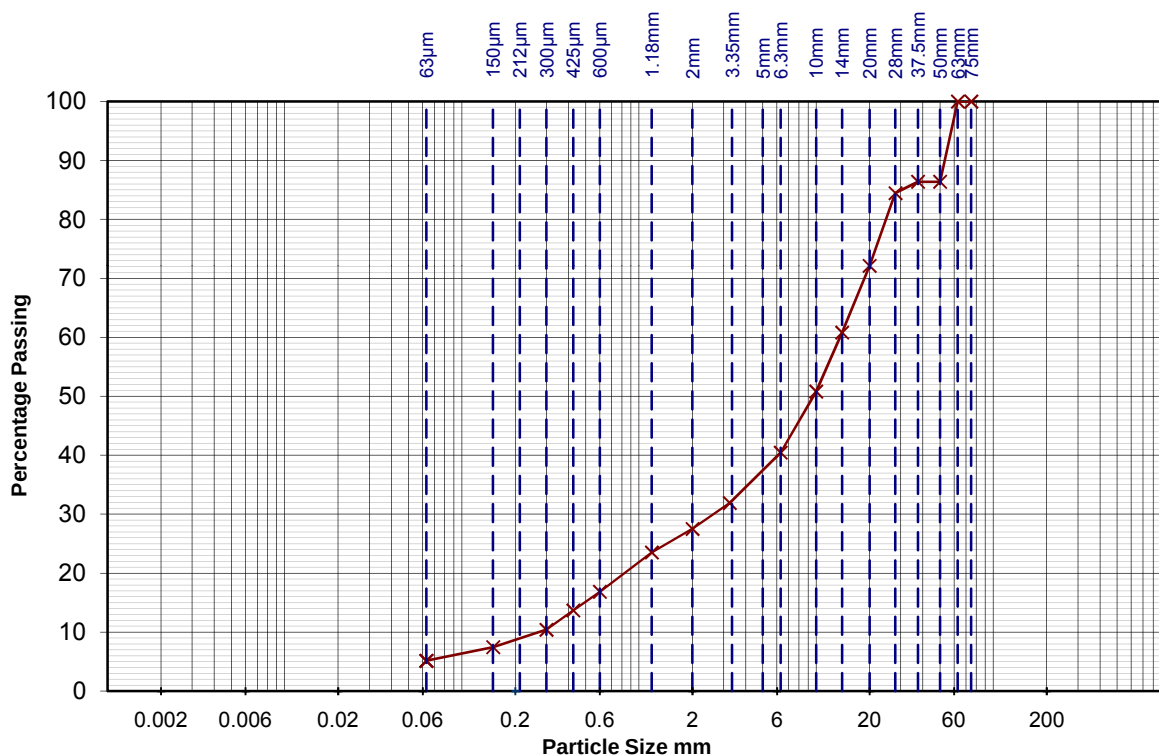
Chkd by: CJN

Depth: 1.70m

Date: 13.10.14

Date: 13.10.14

Sieve Size	75	63	50	37.5	28	20	14	10	6.3	
Percentage Passing	100.0	100.0	86.4	86.4	84.5	72.1	60.8	50.8	40.4	
Sieve Size	5	3.35	2	1.18	0.6	0.425	0.3	0.212	0.15	0.063
Percentage Passing	-	31.9	27.5	23.5	16.9	13.7	10.4	-	7.5	5.1



Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
	Silt			Sand			Gravel				

DESCRIPTION: Well graded sandy GRAVEL.

Remarks:	Project Number J2807/14/E
	Figure number 4

APPENDIX 7

LABORATORY TESTING – ENVIRONMENTAL



Amended Report

Report Number: 14-11220 Issue-3

Initial Date of Issue: 06-Oct-14 **Date of Re-Issue:** 24-Oct-14

Client: Rogers Geotechnical Services Ltd

Client Address: Offices 1 & 2, Barncliffe Business
Near Bank Shelley
Huddersfield
West Yorkshire
HD8 8LU

Contact(s): Imran Sakoor
James Farnsworth

Project: J2807/14/E- Bury Rd, Radcliffe

Quotation No.: **Date Received:** 02-Oct-14

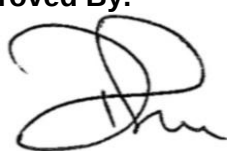
Order No.: 1014-01 **Date Instructed:** 02-Oct-14

No. of Samples: 15 **Results Due:** 06-Oct-14

Turnaround: 3
(Weekdays)

Date Approved: 24-Oct-14

Approved By:

Details: Darrell Hall, Laboratory Director
Keith Jones, Technical Manager

Results Summary - Soil

Project: J2807/14/E- Bury Rd, Radcliffe

Client: Rogers Geotechnical Services Ltd	Chemtest Job No.:				14-11220	14-11220	14-11220	14-11220	14-11220	14-11220	14-11220	14-11220	14-11220
Quotation No.:	Chemtest Sample ID.:				54871	54872	54873	54874	54875	54876	54877	54878	54879
Order No.: 1014-01	Client Sample Ref.:				RGS Suite	RGS Suite	RGS Suite	RGS Suite	RGS Suite	RGS Suite	Asbestos	Asbestos	Asbestos
	Client Sample ID.:				TP1	TP2	TP3	WS1 - C1	WS2 - C1	WS3 - C1	TP1	TP2	TP3
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.60	0.60	0.50	0.50	0.30	0.40	0.60	0.60	0.50
	Bottom Depth(m):												
	Date Sampled:				30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14
Determinand	Accred.	SOP	Units	LOD									
ACM Type	U	2192									-	-	-
Asbestos Identification	U	2192	%	0.001							No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.02	8.6	17	16	16	10	12			
Soil Colour	N				brown	brown	brown	brown	brown	brown			
Other Material	N				stones	stones	stones	stones	stones	stones			
Soil Texture	N				sand	sand	sand	sand	sand	sand			
pH	M	2010			8.3	6.4	6.0	6.4	7.5	8.3			
Electrical Conductivity (2:1)	N	2020	µS/cm	1									
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/L	0.01	0.10	0.033	0.024	0.018	0.15	0.082			
Redox Potential	N	2150	mV										
Cyanide (Free)	M	2300	mg/kg	0.5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50			
Sulphate (Total)	M	2430	%	0.01	0.058	0.072	0.068	0.080	0.76	0.53			
Arsenic	M	2450	mg/kg	1	8.5	45	30	36	16	16			
Cadmium	M	2450	mg/kg	0.1	0.55	0.77	0.69	0.86	0.15	0.18			
Copper	M	2450	mg/kg	1	33	150	97	140	29	26			
Mercury	M	2450	mg/kg	0.1	0.13	0.82	0.55	0.50	0.21	0.22			
Nickel	M	2450	mg/kg	1	25	25	23	24	20	17			
Lead	M	2450	mg/kg	1	70	210	140	210	29	81			
Selenium	M	2450	mg/kg	0.2	0.81	1.6	1.5	1.2	0.81	0.71			
Vanadium	U	2450	mg/kg	5	23	46	37	40	26	24			
Zinc	M	2450	mg/kg	1	140	150	170	220	45	51			
Chromium (Hexavalent)	N	2490	mg/kg	0.5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50			
Organic Matter	M	2625	%	0.4	1.3	7.8	7.4	11	1.4	4.5			
Aliphatic TPH >C5-C6	N	2675	mg/kg	0.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10			
Aliphatic TPH >C6-C8	N	2675	mg/kg	0.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10			
Aliphatic TPH >C8-C10	M	2675	mg/kg	0.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10			
Aliphatic TPH >C10-C12	M	2675	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0			
Aliphatic TPH >C12-C16	M	2675	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0			
Aliphatic TPH >C16-C21	M	2675	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0			
Aliphatic TPH >C21-C35	M	2675	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0			
Aliphatic TPH >C35-C44	M	2675	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0			
Total Aliphatic Hydrocarbons	M	2675	mg/kg	5	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0			

Results Summary - Soil

Project: J2807/14/E- Bury Rd, Radcliffe

Client: Rogers Geotechnical Services Ltd	Chemtest Job No.:					14-11220	14-11220	14-11220	14-11220	14-11220	14-11220	14-11220	14-11220	14-11220
Quotation No.:	Chemtest Sample ID.:					54871	54872	54873	54874	54875	54876	54877	54878	54879
Order No.: 1014-01	Client Sample Ref.:					RGS Suite	RGS Suite	RGS Suite	RGS Suite	RGS Suite	RGS Suite	Asbestos	Asbestos	Asbestos
	Client Sample ID.:					TP1	TP2	TP3	WS1 - C1	WS2 - C1	WS3 - C1	TP1	TP2	TP3
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.60	0.60	0.50	0.50	0.30	0.40	0.60	0.60	0.50
	Bottom Depth(m):													
	Date Sampled:					30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14
Determinand	Accred.	SOP	Units	LOD										
Aromatic TPH >C5-C7	N	2675	mg/kg	0.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10			
Aromatic TPH >C7-C8	N	2675	mg/kg	0.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10			
Aromatic TPH >C8-C10	M	2675	mg/kg	0.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10			
Aromatic TPH >C10-C12	M	2675	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0			
Aromatic TPH >C12-C16	M	2675	mg/kg	1	< 1.0	5.1	1.8	3.3	< 1.0	< 1.0	< 1.0			
Aromatic TPH >C16-C21	M	2675	mg/kg	1	< 1.0	13	6.4	14	< 1.0	< 1.0	< 1.0			
Aromatic TPH >C21-C35	M	2675	mg/kg	1	< 1.0	33	17	31	< 1.0	< 1.0	< 1.0			
Aromatic TPH >C35-C44	N	2675	mg/kg	1	< 1.0	2.8	1.0	2.5	< 1.0	< 1.0	< 1.0			
Total Aromatic Hydrocarbons	M	2675	mg/kg	5	< 5.0	54	26	51	< 5.0	< 5.0	< 5.0			
Total Petroleum Hydrocarbons	M	2675	mg/kg	10	< 10	54	26	51	< 10	< 10	< 10			
Naphthalene	M	2700	mg/kg	0.1	< 0.10	0.64	0.59	0.47	< 0.10	0.50	0.50			
Acenaphthylene	M	2700	mg/kg	0.1	< 0.10	0.20	0.15	0.12	< 0.10	0.43	0.43			
Acenaphthene	M	2700	mg/kg	0.1	< 0.10	0.67	0.49	0.27	< 0.10	< 0.10	< 0.10			
Fluorene	M	2700	mg/kg	0.1	< 0.10	0.53	0.40	0.27	< 0.10	0.11	0.11			
Phenanthrene	M	2700	mg/kg	0.1	< 0.10	4.7	3.7	1.8	< 0.10	1.8	1.8			
Anthracene	M	2700	mg/kg	0.1	< 0.10	0.89	0.73	0.35	< 0.10	0.17	0.17			
Fluoranthene	M	2700	mg/kg	0.1	0.16	6.7	4.9	2.2	< 0.10	0.22	0.22			
Pyrene	M	2700	mg/kg	0.1	0.23	6.3	4.8	2.3	< 0.10	0.23	0.23			
Benzo[a]anthracene	M	2700	mg/kg	0.1	< 0.10	2.4	1.6	0.78	< 0.10	< 0.10	< 0.10			
Chrysene	M	2700	mg/kg	0.1	< 0.10	3.3	1.9	1.1	< 0.10	< 0.10	< 0.10			
Benzo[b]fluoranthene	M	2700	mg/kg	0.1	< 0.10	3.1	2.4	0.94	< 0.10	< 0.10	< 0.10			
Benzo[k]fluoranthene	M	2700	mg/kg	0.1	< 0.10	0.98	0.90	0.27	< 0.10	< 0.10	< 0.10			
Benzo[a]pyrene	M	2700	mg/kg	0.1	< 0.10	2.0	1.1	0.77	< 0.10	< 0.10	< 0.10			
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.1	< 0.10	1.4	1.1	0.52	< 0.10	< 0.10	< 0.10			
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.1	< 0.10	0.41	0.14	< 0.10	< 0.10	< 0.10	< 0.10			
Benzo[g,h,i]perylene	M	2700	mg/kg	0.1	< 0.10	1.5	1.1	0.69	< 0.10	< 0.10	< 0.10			
Total Of 16 PAH's	M	2700	mg/kg	2	< 2.0	36	26	13	< 2.0	3.5	3.5			
Dichlorodifluoromethane	N	2760	µg/kg	0.2										
Chloromethane	N	2760	µg/kg	0.2										
Vinyl Chloride	N	2760	µg/kg	0.2										
Bromomethane	N	2760	µg/kg	0.2										
Chloroethane	N	2760	µg/kg	0.2										
Trichlorofluoromethane	N	2760	µg/kg	0.2										

Results Summary - Soil

Project: J2807/14/E- Bury Rd, Radcliffe

Client: Rogers Geotechnical Services Ltd	Chemtest Job No.:				14-11220	14-11220	14-11220	14-11220	14-11220	14-11220	14-11220	14-11220	14-11220
Quotation No.:	Chemtest Sample ID.:				54871	54872	54873	54874	54875	54876	54877	54878	54879
Order No.: 1014-01	Client Sample Ref.:				RGS Suite	RGS Suite	RGS Suite	RGS Suite	RGS Suite	RGS Suite	Asbestos	Asbestos	Asbestos
	Client Sample ID.:				TP1	TP2	TP3	WS1 - C1	WS2 - C1	WS3 - C1	TP1	TP2	TP3
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.60	0.60	0.50	0.50	0.30	0.40	0.60	0.60	0.50
	Bottom Depth(m):												
	Date Sampled:				30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14
Determinand	Accred.	SOP	Units	LOD									
1,1-Dichloroethene	N	2760	µg/kg	0.2									
Trans 1,2-Dichloroethene	N	2760	µg/kg	0.2									
1,1-Dichloroethane	N	2760	µg/kg	0.2									
cis 1,2-Dichloroethene	N	2760	µg/kg	0.2									
Bromochloromethane	N	2760	µg/kg	0.2									
Trichloromethane	N	2760	µg/kg	0.2									
1,1,1-Trichloroethane	N	2760	µg/kg	0.2									
Tetrachloromethane	N	2760	µg/kg	0.2									
1,1-Dichloropropene	N	2760	µg/kg	0.2									
Benzene	N	2760	µg/kg	0.2									
1,2-Dichloroethane	N	2760	µg/kg	0.2									
Trichloroethene	N	2760	µg/kg	0.2									
1,2-Dichloropropane	N	2760	µg/kg	0.2									
Dibromomethane	N	2760	µg/kg	0.2									
Bromodichloromethane	N	2760	µg/kg	0.2									
cis-1,3-Dichloropropene	N	2760	µg/kg	0.2									
Toluene	N	2760	µg/kg	0.2									
Trans-1,3-Dichloropropene	N	2760	µg/kg	0.2									
1,1,2-Trichloroethane	N	2760	µg/kg	0.2									
Tetrachloroethene	N	2760	µg/kg	0.2									
1,3-Dichloropropane	N	2760	µg/kg	0.2									
Dibromochloromethane	N	2760	µg/kg	0.2									
1,2-Dibromoethane	N	2760	µg/kg	0.2									
Chlorobenzene	N	2760	µg/kg	0.2									
1,1,1,2-Tetrachloroethane	N	2760	µg/kg	0.2									
Ethylbenzene	N	2760	µg/kg	0.2									
M & P-Xylene	N	2760	µg/kg	0.2									
O-Xylene	N	2760	µg/kg	0.2									
Styrene	N	2760	µg/kg	0.2									
Tribromomethane	N	2760	µg/kg	0.2									
Isopropylbenzene	N	2760	µg/kg	0.2									
Bromobenzene	N	2760	µg/kg	0.2									
1,2,3-Trichloropropane	N	2760	µg/kg	0.2									

Results Summary - Soil

Project: J2807/14/E- Bury Rd, Radcliffe

Client: Rogers Geotechnical Services Ltd	Chemtest Job No.:				14-11220	14-11220	14-11220	14-11220	14-11220	14-11220	14-11220	14-11220	14-11220
Quotation No.:	Chemtest Sample ID.:				54871	54872	54873	54874	54875	54876	54877	54878	54879
Order No.: 1014-01	Client Sample Ref.:				RGS Suite	RGS Suite	RGS Suite	RGS Suite	RGS Suite	RGS Suite	Asbestos	Asbestos	Asbestos
	Client Sample ID.:				TP1	TP2	TP3	WS1 - C1	WS2 - C1	WS3 - C1	TP1	TP2	TP3
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.60	0.60	0.50	0.50	0.30	0.40	0.60	0.60	0.50
	Bottom Depth(m):												
	Date Sampled:				30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14
Determinand	Accred.	SOP	Units	LOD									
2-Chlorotoluene	N	2760	µg/kg	0.2									
1,3,5-Trimethylbenzene	N	2760	µg/kg	0.2									
4-Chlorotoluene	N	2760	µg/kg	0.2									
Tert-Butylbenzene	N	2760	µg/kg	0.2									
1,2,4-Trimethylbenzene	N	2760	µg/kg	0.2									
Sec-Butylbenzene	N	2760	µg/kg	0.2									
1,3-Dichlorobenzene	N	2760	µg/kg	0.2									
4-Isopropyltoluene	N	2760	µg/kg	0.2									
1,4-Dichlorobenzene	N	2760	µg/kg	0.2									
N-Butylbenzene	N	2760	µg/kg	0.2									
1,2-Dichlorobenzene	N	2760	µg/kg	0.2									
1,2-Dibromo-3-Chloropropane	N	2760	µg/kg	0.2									
1,2,4-Trichlorobenzene	N	2760	µg/kg	0.2									
Hexachlorobutadiene	N	2760	µg/kg	0.2									
1,2,3-Trichlorobenzene	N	2760	µg/kg	0.2									
Methyl Tert-Butyl Ether	N	2760	µg/kg	0.2									
N-Nitrosodimethylamine	N	2790	mg/kg	0.05									
Phenol	N	2790	mg/kg	0.05									
2-Chlorophenol	N	2790	mg/kg	0.05									
Bis-(2-Chloroethyl)Ether	N	2790	mg/kg	0.05									
1,3-Dichlorobenzene	N	2790	mg/kg	0.05									
1,4-Dichlorobenzene	N	2790	mg/kg	0.05									
1,2-Dichlorobenzene	N	2790	mg/kg	0.05									
2-Methylphenol	N	2790	mg/kg	0.05									
Bis(2-Chloroisopropyl)Ether	N	2790	mg/kg	0.05									
Hexachloroethane	N	2790	mg/kg	0.05									
N-Nitrosodi-n-propylamine	N	2790	mg/kg	0.05									
4-Methylphenol	N	2790	mg/kg	0.05									
Nitrobenzene	N	2790	mg/kg	0.05									
Isophorone	N	2790	mg/kg	0.05									
2-Nitrophenol	N	2790	mg/kg	0.05									
2,4-Dimethylphenol	N	2790	mg/kg	0.05									
Bis(2-Chloroethoxy)Methane	N	2790	mg/kg	0.05									

Results Summary - Soil

Project: J2807/14/E- Bury Rd, Radcliffe

Client: Rogers Geotechnical Services Ltd	Chemtest Job No.:					14-11220	14-11220	14-11220	14-11220	14-11220	14-11220	14-11220	14-11220	14-11220
Quotation No.:	Chemtest Sample ID.:					54871	54872	54873	54874	54875	54876	54877	54878	54879
Order No.: 1014-01	Client Sample Ref.:					RGS Suite	RGS Suite	RGS Suite	RGS Suite	RGS Suite	RGS Suite	Asbestos	Asbestos	Asbestos
	Client Sample ID.:					TP1	TP2	TP3	WS1 - C1	WS2 - C1	WS3 - C1	TP1	TP2	TP3
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.60	0.60	0.50	0.50	0.30	0.40	0.60	0.60	0.50
	Bottom Depth(m):													
	Date Sampled:					30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14
Determinand	Accred.	SOP	Units	LOD										
2,4-Dichlorophenol	N	2790	mg/kg	0.05										
1,2,4-Trichlorobenzene	N	2790	mg/kg	0.05										
Naphthalene	N	2790	mg/kg	0.05										
4-Chloroaniline	N	2790	mg/kg	0.05										
Hexachlorobutadiene	N	2790	mg/kg	0.05										
4-Chloro-3-Methylphenol	N	2790	mg/kg	0.05										
2-Methylnaphthalene	N	2790	mg/kg	0.05										
Hexachlorocyclopentadiene	N	2790	mg/kg	0.05										
2,4,6-Trichlorophenol	N	2790	mg/kg	0.05										
2,4,5-Trichlorophenol	N	2790	mg/kg	0.05										
2-Chloronaphthalene	N	2790	mg/kg	0.05										
2-Nitroaniline	N	2790	mg/kg	0.05										
Acenaphthylene	N	2790	mg/kg	0.05										
Dimethylphthalate	N	2790	mg/kg	0.05										
2,6-Dinitrotoluene	N	2790	mg/kg	0.05										
Acenaphthene	N	2790	mg/kg	0.05										
Dibenzofuran	N	2790	mg/kg	0.05										
4-Chlorophenylphenylether	N	2790	mg/kg	0.05										
2,4-Dinitrotoluene	N	2790	mg/kg	0.05										
Fluorene	N	2790	mg/kg	0.05										
Diethyl Phthalate	N	2790	mg/kg	0.05										
4-Nitroaniline	N	2790	mg/kg	0.05										
2-Methyl-4,6-Dinitrophenol	N	2790	mg/kg	0.05										
Azobenzene	N	2790	mg/kg	0.05										
4-Bromophenylphenyl Ether	N	2790	mg/kg	0.05										
Hexachlorobenzene	N	2790	mg/kg	0.05										
Pentachlorophenol	N	2790	mg/kg	0.05										
Phenanthrene	N	2790	mg/kg	0.05										
Anthracene	N	2790	mg/kg	0.05										
Carbazole	N	2790	mg/kg	0.05										
Di-N-Butyl Phthalate	N	2790	mg/kg	0.05										
Fluoranthene	N	2790	mg/kg	0.05										
Pyrene	N	2790	mg/kg	0.05										

Results Summary - Soil

Project: J2807/14/E- Bury Rd, Radcliffe

Client: Rogers Geotechnical Services Ltd	Chemtest Job No.:					14-11220	14-11220	14-11220	14-11220	14-11220	14-11220	14-11220	14-11220	14-11220
Quotation No.:	Chemtest Sample ID.:					54871	54872	54873	54874	54875	54876	54877	54878	54879
Order No.: 1014-01	Client Sample Ref.:					RGS Suite	RGS Suite	RGS Suite	RGS Suite	RGS Suite	RGS Suite	Asbestos	Asbestos	Asbestos
	Client Sample ID.:					TP1	TP2	TP3	WS1 - C1	WS2 - C1	WS3 - C1	TP1	TP2	TP3
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.60	0.60	0.50	0.50	0.30	0.40	0.60	0.60	0.50
	Bottom Depth(m):													
	Date Sampled:					30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14
Determinand	Accred.	SOP	Units	LOD										
Butylbenzyl Phthalate	N	2790	mg/kg	0.05										
Benzo[a]anthracene	N	2790	mg/kg	0.05										
Chrysene	N	2790	mg/kg	0.05										
Bis(2-Ethylhexyl)Phthalate	N	2790	mg/kg	0.05										
Di-N-Octyl Phthalate	N	2790	mg/kg	0.05										
Benzo[b]fluoranthene	N	2790	mg/kg	0.05										
Benzo[k]fluoranthene	N	2790	mg/kg	0.05										
Benzo[a]pyrene	N	2790	mg/kg	0.05										
Indeno(1,2,3-c,d)Pyrene	N	2790	mg/kg	0.05										
Dibenz(a,h)Anthracene	N	2790	mg/kg	0.05										
Benzo[g,h,i]perylene	N	2790	mg/kg	0.05										
PCB 28	M	2810	mg/kg	0.01										
PCB 52	M	2815	mg/kg	0.01										
PCB 101	M	2815	mg/kg	0.01										
PCB 118	M	2815	mg/kg	0.01										
PCB 153	M	2815	mg/kg	0.01										
PCB 138	M	2815	mg/kg	0.01										
PCB 180	M	2810	mg/kg	0.01										
Total PCBs (7 Congeners)	N	2815	mg/kg	0.1										
Resorcinol	M	2920	mg/kg	0.05										
Phenol	M	2920	mg/kg	0.05										
Cresols	M	2920	mg/kg	0.05										
Xylenols	M	2920	mg/kg	0.05										
1-Naphthol	N	2920	mg/kg	0.05										
Trimethylphenols	M	2920	mg/kg	0.05										
Total Phenols	M	2920	mg/kg	0.3	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30			

Results Summary - Soil

Project: J2807/14/E- Bury Rd, Radcliffe

Client: Rogers Geotechnical Services Ltd	Chemtest Job No.:					14-11220	14-11220	14-11220	14-11220	14-11220	14-11220
Quotation No.:	Chemtest Sample ID.:					54880	54881	54882	54883	54884	54885
Order No.: 1014-01	Client Sample Ref.:					PCB	PCB	PCB	UKWIR	UKWIR	UKWIR
	Client Sample ID.:					TP2	WS1 - C1	WS3 - C1	TP2	TP3	WS2 - C1
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.60	0.60	0.20	0.60	0.50	0.60
	Bottom Depth(m):										
	Date Sampled:					30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14
Determinand	Accred.	SOP	Units	LOD							
ACM Type	U	2192									
Asbestos Identification	U	2192	%	0.001							
Moisture	N	2030	%	0.02	16	17	7.7	15	17	6.8	
Soil Colour	N				brown	brown	brown				
Other Material	N				stones	stones	stones				
Soil Texture	N				sand	sand	sand				
pH	M	2010						6.6	6.1	7.6	
Electrical Conductivity (2:1)	N	2020	µS/cm	1				180	110	240	
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/L	0.01							
Redox Potential	N	2150	mV					160	180	170	
Cyanide (Free)	M	2300	mg/kg	0.5							
Sulphate (Total)	M	2430	%	0.01							
Arsenic	M	2450	mg/kg	1							
Cadmium	M	2450	mg/kg	0.1							
Copper	M	2450	mg/kg	1							
Mercury	M	2450	mg/kg	0.1							
Nickel	M	2450	mg/kg	1							
Lead	M	2450	mg/kg	1							
Selenium	M	2450	mg/kg	0.2							
Vanadium	U	2450	mg/kg	5							
Zinc	M	2450	mg/kg	1							
Chromium (Hexavalent)	N	2490	mg/kg	0.5							
Organic Matter	M	2625	%	0.4							
Aliphatic TPH >C5-C6	N	2675	mg/kg	0.1				< 0.10	< 0.10	< 0.10	
Aliphatic TPH >C6-C8	N	2675	mg/kg	0.1				< 0.10	< 0.10	< 0.10	
Aliphatic TPH >C8-C10	M	2675	mg/kg	0.1				< 0.10	< 0.10	< 0.10	
Aliphatic TPH >C10-C12	M	2675	mg/kg	1				< 1.0	< 1.0	< 1.0	
Aliphatic TPH >C12-C16	M	2675	mg/kg	1				< 1.0	< 1.0	< 1.0	
Aliphatic TPH >C16-C21	M	2675	mg/kg	1				< 1.0	< 1.0	< 1.0	
Aliphatic TPH >C21-C35	M	2675	mg/kg	1				< 1.0	< 1.0	< 1.0	
Aliphatic TPH >C35-C44	M	2675	mg/kg	1				< 1.0	< 1.0	< 1.0	
Total Aliphatic Hydrocarbons	M	2675	mg/kg	5				< 5.0	< 5.0	< 5.0	

Results Summary - Soil

Project: J2807/14/E- Bury Rd, Radcliffe

Client: Rogers Geotechnical Services Ltd	Chemtest Job No.:					14-11220	14-11220	14-11220	14-11220	14-11220	14-11220
Quotation No.:	Chemtest Sample ID.:					54880	54881	54882	54883	54884	54885
Order No.: 1014-01	Client Sample Ref.:					PCB	PCB	PCB	UKWIR	UKWIR	UKWIR
	Client Sample ID.:					TP2	WS1 - C1	WS3 - C1	TP2	TP3	WS2 - C1
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.60	0.60	0.20	0.60	0.50	0.60
	Bottom Depth(m):										
	Date Sampled:					30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14
Determinand	Accred.	SOP	Units	LOD							
Aromatic TPH >C5-C7	N	2675	mg/kg	0.1				< 0.10	< 0.10	< 0.10	
Aromatic TPH >C7-C8	N	2675	mg/kg	0.1				< 0.10	< 0.10	< 0.10	
Aromatic TPH >C8-C10	M	2675	mg/kg	0.1				< 0.10	< 0.10	< 0.10	
Aromatic TPH >C10-C12	M	2675	mg/kg	1				< 1.0	< 1.0	< 1.0	
Aromatic TPH >C12-C16	M	2675	mg/kg	1				3.1	< 1.0	< 1.0	
Aromatic TPH >C16-C21	M	2675	mg/kg	1				20	8.1	< 1.0	
Aromatic TPH >C21-C35	M	2675	mg/kg	1				32	11	< 1.0	
Aromatic TPH >C35-C44	N	2675	mg/kg	1				1.5	< 1.0	< 1.0	
Total Aromatic Hydrocarbons	M	2675	mg/kg	5				57	19	< 5.0	
Total Petroleum Hydrocarbons	M	2675	mg/kg	10				56	19	< 10	
Naphthalene	M	2700	mg/kg	0.1							
Acenaphthylene	M	2700	mg/kg	0.1							
Acenaphthene	M	2700	mg/kg	0.1							
Fluorene	M	2700	mg/kg	0.1							
Phenanthrene	M	2700	mg/kg	0.1							
Anthracene	M	2700	mg/kg	0.1							
Fluoranthene	M	2700	mg/kg	0.1							
Pyrene	M	2700	mg/kg	0.1							
Benzo[a]anthracene	M	2700	mg/kg	0.1							
Chrysene	M	2700	mg/kg	0.1							
Benzo[b]fluoranthene	M	2700	mg/kg	0.1							
Benzo[k]fluoranthene	M	2700	mg/kg	0.1							
Benzo[a]pyrene	M	2700	mg/kg	0.1							
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.1							
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.1							
Benzo[g,h,i]perylene	M	2700	mg/kg	0.1							
Total Of 16 PAH's	M	2700	mg/kg	2							
Dichlorodifluoromethane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20	
Chloromethane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20	
Vinyl Chloride	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20	
Bromomethane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20	
Chloroethane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20	
Trichlorofluoromethane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20	

Results Summary - Soil

Project: J2807/14/E- Bury Rd, Radcliffe

Client: Rogers Geotechnical Services Ltd	Chemtest Job No.:				14-11220	14-11220	14-11220	14-11220	14-11220	14-11220
Quotation No.:	Chemtest Sample ID.:				54880	54881	54882	54883	54884	54885
Order No.: 1014-01	Client Sample Ref.:				PCB	PCB	PCB	UKWIR	UKWIR	UKWIR
	Client Sample ID.:				TP2	WS1 - C1	WS3 - C1	TP2	TP3	WS2 - C1
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.60	0.60	0.20	0.60	0.50	0.60
	Bottom Depth(m):									
	Date Sampled:				30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14
Determinand	Accred.	SOP	Units	LOD						
1,1-Dichloroethene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Trans 1,2-Dichloroethene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
1,1-Dichloroethane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
cis 1,2-Dichloroethene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Bromochloromethane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Trichloromethane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
1,1,1-Trichloroethane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Tetrachloromethane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
1,1-Dichloropropene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Benzene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
1,2-Dichloroethane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Trichloroethene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
1,2-Dichloropropane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Dibromomethane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Bromodichloromethane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
cis-1,3-Dichloropropene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Toluene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Trans-1,3-Dichloropropene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
1,1,2-Trichloroethane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Tetrachloroethene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
1,3-Dichloropropane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Dibromochloromethane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
1,2-Dibromoethane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Chlorobenzene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
1,1,1,2-Tetrachloroethane	N	2760	µg/kg	0.2				0.94	< 0.20	< 0.20
Ethylbenzene	N	2760	µg/kg	0.2				< 0.20	< 0.20	0.56
M & P-Xylene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
O-Xylene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Styrene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Tribromomethane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Isopropylbenzene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Bromobenzene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
1,2,3-Trichloropropane	N	2760	µg/kg	0.2				< 0.20	0.28	< 0.20

Results Summary - Soil

Project: J2807/14/E- Bury Rd, Radcliffe

Client: Rogers Geotechnical Services Ltd	Chemtest Job No.:				14-11220	14-11220	14-11220	14-11220	14-11220	14-11220
Quotation No.:	Chemtest Sample ID.:				54880	54881	54882	54883	54884	54885
Order No.: 1014-01	Client Sample Ref.:				PCB	PCB	PCB	UKWIR	UKWIR	UKWIR
	Client Sample ID.:				TP2	WS1 - C1	WS3 - C1	TP2	TP3	WS2 - C1
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.60	0.60	0.20	0.60	0.50	0.60
	Bottom Depth(m):									
	Date Sampled:				30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14
Determinand	Accred.	SOP	Units	LOD						
2-Chlorotoluene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
1,3,5-Trimethylbenzene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
4-Chlorotoluene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Tert-Butylbenzene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
1,2,4-Trimethylbenzene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Sec-Butylbenzene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
1,3-Dichlorobenzene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
4-Isopropyltoluene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
1,4-Dichlorobenzene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
N-Butylbenzene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
1,2-Dichlorobenzene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
1,2-Dibromo-3-Chloropropane	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
1,2,4-Trichlorobenzene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Hexachlorobutadiene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
1,2,3-Trichlorobenzene	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
Methyl Tert-Butyl Ether	N	2760	µg/kg	0.2				< 0.20	< 0.20	< 0.20
N-Nitrosodimethylamine	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050
Phenol	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050
2-Chlorophenol	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050
Bis-(2-Chloroethyl)Ether	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050
1,3-Dichlorobenzene	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050
1,4-Dichlorobenzene	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050
1,2-Dichlorobenzene	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050
2-Methylphenol	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050
Bis(2-Chloroisopropyl)Ether	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050
Hexachloroethane	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050
N-Nitrosodi-n-propylamine	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050
4-Methylphenol	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050
Nitrobenzene	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050
Isophorone	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050
2-Nitrophenol	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050
2,4-Dimethylphenol	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050
Bis(2-Chloroethoxy)Methane	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050

Results Summary - Soil

Project: J2807/14/E- Bury Rd, Radcliffe

Client: Rogers Geotechnical Services Ltd	Chemtest Job No.:					14-11220	14-11220	14-11220	14-11220	14-11220	14-11220
Quotation No.:	Chemtest Sample ID.:					54880	54881	54882	54883	54884	54885
Order No.: 1014-01	Client Sample Ref.:					PCB	PCB	PCB	UKWIR	UKWIR	UKWIR
	Client Sample ID.:					TP2	WS1 - C1	WS3 - C1	TP2	TP3	WS2 - C1
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.60	0.60	0.20	0.60	0.50	0.60
	Bottom Depth(m):										
	Date Sampled:					30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14
Determinand	Accred.	SOP	Units	LOD							
2,4-Dichlorophenol	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
1,2,4-Trichlorobenzene	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
Naphthalene	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
4-Chloroaniline	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
Hexachlorobutadiene	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
4-Chloro-3-Methylphenol	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
2-Methylnaphthalene	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
Hexachlorocyclopentadiene	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
2,4,6-Trichlorophenol	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
2,4,5-Trichlorophenol	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
2-Chloronaphthalene	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
2-Nitroaniline	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
Acenaphthylene	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
Dimethylphthalate	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
2,6-Dinitrotoluene	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
Acenaphthene	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
Dibenzofuran	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
4-Chlorophenylphenylether	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
2,4-Dinitrotoluene	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
Fluorene	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
Diethyl Phthalate	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
4-Nitroaniline	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
2-Methyl-4,6-Dinitrophenol	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
Azobenzene	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
4-Bromophenylphenyl Ether	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
Hexachlorobenzene	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
Pentachlorophenol	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
Phenanthrene	N	2790	mg/kg	0.05					2.3	< 0.050	< 0.050
Anthracene	N	2790	mg/kg	0.05					0.47	< 0.050	< 0.050
Carbazole	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
Di-N-Butyl Phthalate	N	2790	mg/kg	0.05					< 0.050	< 0.050	< 0.050
Fluoranthene	N	2790	mg/kg	0.05					4.2	0.54	< 0.050
Pyrene	N	2790	mg/kg	0.05					3.4	0.53	< 0.050

Results Summary - Soil

Project: J2807/14/E- Bury Rd, Radcliffe

Client: Rogers Geotechnical Services Ltd	Chemtest Job No.:					14-11220	14-11220	14-11220	14-11220	14-11220	14-11220
Quotation No.:	Chemtest Sample ID.:					54880	54881	54882	54883	54884	54885
Order No.: 1014-01	Client Sample Ref.:					PCB	PCB	PCB	UKWIR	UKWIR	UKWIR
	Client Sample ID.:					TP2	WS1 - C1	WS3 - C1	TP2	TP3	WS2 - C1
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.60	0.60	0.20	0.60	0.50	0.60
	Bottom Depth(m):										
	Date Sampled:					30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14	30-Sep-14
Determinand	Accred.	SOP	Units	LOD							
Butylbenzyl Phthalate	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050	
Benzo[a]anthracene	N	2790	mg/kg	0.05				1.5	0.084	< 0.050	
Chrysene	N	2790	mg/kg	0.05				1.9	0.16	< 0.050	
Bis(2-Ethylhexyl)Phthalate	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050	
Di-N-Octyl Phthalate	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050	
Benzo[b]fluoranthene	N	2790	mg/kg	0.05				2.4	0.26	< 0.050	
Benzo[k]fluoranthene	N	2790	mg/kg	0.05				0.84	0.072	< 0.050	
Benzo[a]pyrene	N	2790	mg/kg	0.05				1.6	< 0.050	< 0.050	
Indeno(1,2,3-c,d)Pyrene	N	2790	mg/kg	0.05				0.50	< 0.050	< 0.050	
Dibenz(a,h)Anthracene	N	2790	mg/kg	0.05				< 0.050	< 0.050	< 0.050	
Benzo[g,h,i]perylene	N	2790	mg/kg	0.05				0.63	< 0.050	< 0.050	
PCB 28	M	2810	mg/kg	0.01	< 0.010	< 0.010	< 0.010				
PCB 52	M	2815	mg/kg	0.01	< 0.010	< 0.010	< 0.010				
PCB 101	M	2815	mg/kg	0.01	< 0.010	< 0.010	< 0.010				
PCB 118	M	2815	mg/kg	0.01	< 0.010	< 0.010	< 0.010				
PCB 153	M	2815	mg/kg	0.01	< 0.010	< 0.010	< 0.010				
PCB 138	M	2815	mg/kg	0.01	< 0.010	< 0.010	< 0.010				
PCB 180	M	2810	mg/kg	0.01	< 0.010	< 0.010	< 0.010				
Total PCBs (7 Congeners)	N	2815	mg/kg	0.1	< 0.10	< 0.10	< 0.10				
Resorcinol	M	2920	mg/kg	0.05				< 0.050	< 0.050	< 0.050	
Phenol	M	2920	mg/kg	0.05				< 0.050	< 0.050	< 0.050	
Cresols	M	2920	mg/kg	0.05				< 0.050	< 0.050	< 0.050	
Xylenols	M	2920	mg/kg	0.05				< 0.050	< 0.050	< 0.050	
1-Naphthol	N	2920	mg/kg	0.05				< 0.050	< 0.050	< 0.050	
Trimethylphenols	M	2920	mg/kg	0.05				< 0.050	< 0.050	< 0.050	
Total Phenols	M	2920	mg/kg	0.3				< 0.30	< 0.30	< 0.30	

Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVCOs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at our Coventry laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers

Sample Retention and Disposal

All soil samples will be retained for a period of 1 month following the date of the test report

All water samples will be retained for 7 days following the date of the test report

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.co.uk



Final Report

Report Number: 14-11740 Issue-1

Initial Date of Issue: 15-Oct-14

Client: Rogers Geotechnical Services Ltd

Client Address: Offices 1 & 2, Barncliffe Business
Near Bank Shelley
Huddersfield
West Yorkshire
HD8 8LU

Contact(s): Imran Sakoor

Project: Bury Road, Radcliffe - J2807/14/E

Quotation No.:		Date Received:	09-Oct-14
Order No.:	1014-06	Date Instructed:	09-Oct-14
No. of Samples:	1	Results Due:	15-Oct-14
Turnaround: (Weekdays)	5		
Date Approved:	15-Oct-14		

Approved By:

Details: Darrell Hall, Laboratory Director

Results Summary - Water

Project: Bury Road, Radcliffe - J2807/14/E

Client: Rogers Geotechnical Services Ltd	Chemtest Job No.: 14-11740				
Quotation No.:	Chemtest Sample ID.: 57301				
Order No.: 1014-06	Client Sample Ref.:				
	Client Sample ID.: WS3				
	Sample Type: WATER				
	Top Depth (m): 3.65				
	Bottom Depth(m):				
	Date Sampled: 07-Oct-14				
Determinand	Accred.	SOP	Units	LOD	
pH	U	1010			6.9
Sulphate	U	1220	mg/l	1	160
Cyanide (Free)	U	1300	mg/l	0.05	< 0.050
Vanadium (Dissolved)	U	1450	µg/l	1	< 1.0
Arsenic (Total)	U	1450	µg/l	1	2.2
Cadmium (Total)	U	1450	µg/l	0.08	< 0.080
Chromium (Total)	U	1450	µg/l	1	< 1.0
Copper (Total)	U	1450	µg/l	1	< 1.0
Mercury (Total)	U	1450	µg/l	0.5	< 0.50
Nickel (Total)	U	1450	µg/l	1	11
Lead (Total)	U	1450	µg/l	1	< 1.0
Selenium (Total)	U	1450	µg/l	1	4.2
Zinc (Total)	U	1450	µg/l	1	18
Chromium (Hexavalent)	U	1490	µg/l	20	< 20
Total Organic Carbon	N	1610	mg/l	1	< 1.0
Aliphatic TPH >C5-C6	N	1675	µg/l	0.1	< 0.10
Aliphatic TPH >C6-C8	N	1675	µg/l	0.1	< 0.10
Aliphatic TPH >C8-C10	N	1675	µg/l	0.1	< 0.10
Aliphatic TPH >C10-C12	N	1675	µg/l	0.1	< 0.10
Aliphatic TPH >C12-C16	N	1675	µg/l	0.1	< 0.10
Aliphatic TPH >C16-C21	N	1675	µg/l	0.1	< 0.10
Aliphatic TPH >C21-C35	N	1675	µg/l	0.1	< 0.10
Aliphatic TPH >C35-C44	N	1675	µg/l	0.1	< 0.10
Total Aliphatic Hydrocarbons	N	1675	µg/l	5	< 5.0
Aromatic TPH >C5-C7	N	1675	µg/l	0.1	< 0.10
Aromatic TPH >C7-C8	N	1675	µg/l	0.1	< 0.10
Aromatic TPH >C8-C10	N	1675	µg/l	0.1	< 0.10
Aromatic TPH >C10-C12	N	1675	µg/l	0.1	< 0.10
Aromatic TPH >C12-C16	N	1675	µg/l	0.1	< 0.10
Aromatic TPH >C16-C21	N	1675	µg/l	0.1	< 0.10
Aromatic TPH >C21-C35	N	1675	µg/l	0.1	< 0.10
Aromatic TPH >C35-C44	N	1675	µg/l	0.1	< 0.10
Total Aromatic Hydrocarbons	N	1675	µg/l	5	< 5.0
Total Petroleum Hydrocarbons	U	1675	µg/l	10	< 10
Naphthalene	U	1700	µg/l	0.1	< 0.10
Acenaphthylene	U	1700	µg/l	0.1	< 0.10

Results Summary - Water

Project: Bury Road, Radcliffe - J2807/14/E

Client: Rogers Geotechnical Services Ltd	Chemtest Job No.: 14-11740				
Quotation No.:	Chemtest Sample ID.: 57301				
Order No.: 1014-06	Client Sample Ref.:				
	Client Sample ID.: WS3				
	Sample Type: WATER				
	Top Depth (m): 3.65				
	Bottom Depth(m):				
	Date Sampled: 07-Oct-14				
Determinand	Accred.	SOP	Units	LOD	
Acenaphthene	U	1700	µg/l	0.1	< 0.10
Fluorene	U	1700	µg/l	0.1	< 0.10
Phenanthrene	U	1700	µg/l	0.1	< 0.10
Anthracene	U	1700	µg/l	0.1	< 0.10
Fluoranthene	U	1700	µg/l	0.1	< 0.10
Pyrene	U	1700	µg/l	0.1	< 0.10
Benzo[a]anthracene	U	1700	µg/l	0.1	< 0.10
Chrysene	U	1700	µg/l	0.1	< 0.10
Benzo[b]fluoranthene	U	1700	µg/l	0.1	< 0.10
Benzo[k]fluoranthene	U	1700	µg/l	0.1	< 0.10
Benzo[a]pyrene	U	1700	µg/l	0.1	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	µg/l	0.1	< 0.10
Dibenz(a,h)Anthracene	U	1700	µg/l	0.1	< 0.10
Benzo[g,h,i]perylene	U	1700	µg/l	0.1	< 0.10
Total Of 16 PAH's	U	1700	µg/l	2	< 2.0
Total Phenols	U	1920	mg/l	0.03	< 0.030

Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVCOs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at our Coventry laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers

Sample Retention and Disposal

All soil samples will be retained for a period of 1 month following the date of the test report

All water samples will be retained for 7 days following the date of the test report

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.co.uk

SUMMARY OF CONTAMINATION ANALYSIS - including Atkins ATRISK SSVs

Job Number: J2807/14/E
Date: 21.10.14

Tox Data Report No.	Compound	Range of Values Found (mg/kg)		Residential with Homegrown Produce Landuse (mg/kg)		Reference
	<i>Metals</i>	<i>Min</i>	<i>Max</i>			
3	Cadmium	0.15	0.86	10		A
4	Chromium	<0.5	<0.5	14.7		A
	Copper	26	150	4020		A
7	Mercury	0.13	0.82	1.00		A
8	Nickel	17	25	130		A
	Lead	70	210	168		A
	Zinc	45	220	17200		A
	Vanadium	23	46	115		A
	<i>Semi and Non Metals</i>					
1	Arsenic	8.5	45	32		A
10	Selenium	0.71	1.5	350		A
	Free Cyanide	<0.5	<0.5	34		A
9	Phenols (total)	<0.3	<0.3	420		A
	<i>Poly Aromatic Hydrocarbons</i>			ATRISK	CLEA	
20	Napthalene	<1	0.64	8.71		A
	Acenaphthene	<0.1	0.67	937	2130	A
	Fluorene	<0.1	0.53	746	1930	A
	Anthracene	<0.1	0.89	20.9	18300	A
	Fluoranthene	<0.1	4.9	113	2160	A
	Pyrene	<0.1	6.3	13.2	1550	A
	Benzo(a)anthracene	<0.1	2.4	8.54		A
2	Chrysene	<0.1	3.3	2.64	927	A
2	Benzo(b)fluoranthene	<0.1	3.1	7.29	9.86	A
2	Benzo(k)fluoranthene	<0.1	0.98	4.12	100	A
2	Benzo(a)pyrene	<0.1	2	0.998		A
2	Dibenzo(a,h)anthracene	<0.1	0.41	0.0236	1	A
2	Indeno(1,2,3-cd)pyrene	<0.1	1.4	0.368	9.75	A
2	Benzo(g,h,i)perylene	<0.1	1.5	0.112	103	A
	<i>Petroleum Hydrocarbons</i>					
	Aliphatic C5-C6	<0.1	<0.1	26.1		A
	Aliphatic C6-C8	<0.1	<0.1	87.8		A
	Aliphatic C8-C10	<0.1	<0.1	14.5		A
	Aliphatic C10-C12	<1	<1	87.7		A
	Aliphatic C12-C16	<1	<1	126		A
	Aliphatic C16-C21	<1	<1	88200		A
	Aliphatic C21-C35	<1	<1	88200		A
	Aromatic C5-C7 (Benzene)	<0.1	<0.1	0.33		A*
	Aromatic C7-C8 (Toluene)	<0.1	<0.1	610		A
	Aromatic C8-C10	<0.1	<0.1	23.7		A
	Aromatic C10-C12	<1	<1	132		A
	Aromatic C12-C16	<1	5.1	452		A
	Aromatic C16-C21	<1	14	804		A
	Aromatic C21-C35	<1	33	1220		A
	<i>Others</i>					
	pH	6	8.3	-		-
	Organic Content (%)	1.3	11	-		-
	Soluble Sulphate (g/l)	0.018	0.15	-		-
	Total Sulphate (%)	0.058	0.76	-		-
A = WS ATKINS PLC, ATRISK SOIL SCREENING VALUES BASED ON 6% SOIL ORGANIC MATTER						
For PAHs ATRISK assumes free product is available whilst CLEA assumes no free product						
A* Atrisk's SSV is lower than Chemtest's detectable limit for this compound.						

Rogers Geotechnical Services Ltd.

SUMMARY OF CONTAMINATION ANALYSIS

Client: Southdale Ltd and Great Cube Places Ltd
Site: Land adjacent to Bury Road, Radcliffe

Job Number: J2807/14/E
Date: 21.10.14

	Compound	Range of Values Found (mg/l)		Water Sample Values (mg/l)	Reference
		Min	Max		
	<i>Metals</i>				
	Cadmium	<0.00008		0.05	A
	Chromium	<0.001		0.5	A
	Copper	<0.001		2	A
	Mercury	<0.005		0.01	A
	Nickel	0.011		0.2	A
	Lead	<0.001		0.25*	A
	Zinc	0.018		5	A
	<i>Semi and Non Metals</i>				
	Arsenic	0.0022		0.1	A
	Selenium	0.042		0.1	A
	Free Cyanide	<0.050		0.5	A
	Phenols (total)	<0.03		0.005	A
	<i>Poly Aromatic Hydrocarbons</i>				
	Napthalene	<0.0001		0.952	B
	Acenaphthene	<0.0001		375	B
	Fluorene	<0.0001			
	Anthracene	<0.0001			
	Fluoranthene	<0.0001		0.001	A
	Pyrene	<0.0001			
	Benzo(a)anthracene	<0.0001		0.0536	B
	Chrysene	<0.0001			
	Benzo(b)fluoranthene	<0.0001			
	Benzo(k)fluoranthene	<0.0001			
	Benzo(a)pyrene	<0.0001		0.0638	B
	Dibenzo(a,h)anthracene	<0.0001		0.0237	B
	Indeno(1,2,3-cd)pyrene	<0.0001			
	Benzo(g,h,i)perylene	<0.0001			
	<i>Petroleum Hydrocarbons</i>				
	Aliphatic C5-C6	<0.0001		1.93	B
	Aliphatic C6-C8	<0.001		1.4	B
	Aliphatic C8-C10	<0.0001		0.0296	B
	Aliphatic C10-C12	<0.0001		0.0228	B
	Aliphatic C12-C16	<0.0001		0.00547	B
	Aromatic C5-C7 (Benzene)	<0.0001		0.0888	B
	Aromatic C7-C8 (Toluene)	<0.0001		96.4	B
	Aromatic C8-C10	<0.0001		0.985	B
	Aromatic C10-C12	<0.0001		3.87	B
	Aromatic C12-C16	<0.0001		10.5	B
	<i>Others</i>				
	pH	6.9		-	-
	Organic Content (%)			-	-
	Soluble Sulphate (g/l)	0.16		-	-
	Total Sulphate (%)			-	-

A = 10 x acceptable drinking water criteria in the *Water Supply (Water Quality) Regulations (2000)* for England Wales and Scotland

* For drinking water the maximum concentration is 25mg/l until 24th December 2013 reducing to 10mg/l from 25th December 2013

B = Atkins WSV. Only inhalation exposure pathways are considered as presented within the input parameters. The potential presence of free product should be assessed to ensure no further risk assessment is required. TPH >C16 are not considered to be volatile according to TPHCWG. Consequently no WSV have been derived.

Rogers Geotechnical Services Ltd.

SUMMARY OF CONTAMINATION ANALYSIS - including Atkins ATRISK SSVs

Client: Southdale Ltd and Cube Great Places Ltd
Site: Land adjacent to Bury Road, Radcliffe

Job Number: J2807/14/E
Date: 23.10.14

[illegible]

Based across the UK with offices in
Manchester, Liverpool, Swindon and Glasgow.

Manchester (Head Office)

Unit 29
Eton Business Park
Eton Hill Rd, Radcliffe
M26 2ZS

t: 0161 763 7200
e: info@thelkgroup.com

Swindon

39 Bowman House Business Centre
Bowman Court
Whitehill Lane
Royal Wootton Bassett
Swindon
SN4 7DB

t : 01793 987 390
e : info@thelkgroup.com

Glasgow

Wright Business Centre
1 Lonmay Road
Glasgow
G33 4EL

t: 0141 773 6269
e: info@thelkgroup.com

Liverpool

Unit 10
12 Jordan Street
Baltic Triangle
Liverpool
L1 0BP

t: 0161 763 7200
e: info@thelkgroup.com



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