



Knowsley Council

WINDY ARBOR PLAYING FIELDS CAR PARK

Drainage Strategy





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TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70063452

OUR REF. NO. 70063452-R01

DATE: OCTOBER 2021

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2
Date	20/10/2021		
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Project number	70063452		
Report number	0		
File reference	70063452-R01		

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INTRODUCTION

WSP were commissioned by Knowsley Metropolitan Borough Council (KMBC) to complete a Drainage Strategy (DS) to be submitted as part of a Planning Application for the redevelopment of a car park area in Whiston. The car park will be part of a wider development proposal that encompasses Halshead Park to the south of the site.

The aim of this Drainage Strategy is to present the proposed approach to the drainage of the new car park area. The strategy provides recommendations on how surface water runoff and foul flows from the site will be managed.

The car park is located between Windy Arbor Road and Lickers Lane at the north west of existing playing fields. The car park will include a club house and changing rooms building and will be primarily used by members of the public using the football pitches adjacent to the car park. Whiston Town Council lease and manage the playing fields. To the south of the playing fields lies Mellors Pond.

The objectives in order to satisfy KMBC as the Planning Authority and Lead Local Flood Authority (LLFA) are summarised below:

- Submit a Drainage Strategy as part of the outline planning application;
- Show proposed drainage measures indicatively on a plan;
- Submit a Pre-Planning Application to the water company for a surface water and foul drainage impact assessment.

EXISTING SITE AND PROPOSED DEVELOPMENT

The site, shown in Figure 1, is located in the north west corner of the proposed overall development site, bounded by Windy Arbor Road to the west, Lickers Lane to the north and by grass playing fields (sports pitches) to the south and east. The current car park is informal, and the surfacing material is made of hardcore material / gravel. There is no known surface water drainage system serving the car park area. It is understood that runoff from the car park area part infiltrates into the car park area itself with the excess surface water ponding and running off towards the playing fields.

The grass playing fields extend south of the car park and up to Mellors Pond. There is a land drainage system in place for the playing fields which drains to the south and outfalls into Mellors Pond, however the drains are believed to be in poor condition and cause waterlogging issues on the pitches during and following rainfall events.



Figure 1: Site Location

Figure 2 shows the development proposals for this area. It includes improving the existing car park and sports facilities for the local community. The existing building and track will be removed with new changing facilities provided within the car park area. The boundary wall to the car park will be re-aligned to allow for proposed junction improvements and the car park improved to include 40 parking spaces. The pitches will have improved drainage installed, at present these are shown as a grass surface, although an all-weather option could be included dependent on future funding. The pitches' drainage will connect into Mellors Pond.

Mellors Pond will be redeveloped with clearance of weeds, re-shaping and a better-defined edge using recycled plastic piling. The overflow from Mellors Pond will connect through woodland to Big Water to the south. The existing culverted connection and waterbodies between Mellors Pond and Big Water will be realigned and where possible opened to enhance biodiversity, support wildlife and provide an amenity to be enjoyed by community and visitors.



Figure 2: Indicative car park and playing fields proposals

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Figure 2: Indicative car park and playing fields proposals

DRAINAGE STRATEGY

DESIGN PARAMETERS

The drainage network for the proposed development would need to adhere to the following criteria as set out in the Sewerage Sector Guidance document; SSG Appendix C – Design and Construction Guidance v2.1:

Underground drainage pipes should be designed under pipe full conditions to accept the following design rainfall (i.e. without surcharging above pipe soffit):

- *Sites with average ground slopes greater than 1%, 1 year*
- *Sites with average ground slopes 1% or less, 2 year*
- *Sites where consequences of flooding are severe, 5 year.*

Also, to DEFRA's Non-statutory Technical Standards section S4:

- *To manage the risks associated with the long-term impacts of climate change, the peak rainfall intensity of the rainfall events will be increased by climate change allowances in accordance with the National Planning Policy Framework (NPPF), the accompanying online Planning Practice Guidance (PPG) on Flood Risk and Coastal Change and the CIRIA Sustainable Drainage Systems (SuDS) Manual.*
- *Runoff volume from the development in the 1 in 100-year, 6 hour rainfall event should not exceed the greenfield runoff volume for the same event.*
- *The runoff values for the development are calculated based on the IH124 method using FEH catchment descriptors.*

The use of Sustainable Drainage systems (SuDS) shall be assessed and designed following criteria as set out in the CIRIA report C753 – The SuDS Manual v6.

PROPOSED SURFACE WATER DRAINAGE STRATEGY

The following strategy is recommended for the surface water drainage network:

Best practice for drainage designs on new developments is to prioritise SuDS solutions. The strategy proposed here follows this approach. The SuDS management train as set out in the SuDS Manual (CIRIA C753), is the use of a sequence of component that collectively provide the necessary process to control the runoff and reduce contaminant to acceptable levels. The components used as part of the management train can be split into different elements although some may overlap.

The following elements were considered to design the surface water drainage system for the car park area:

- **Source control and infiltration:** *Slow down runoff at source and allow to infiltrate on site.*
- **Conveyance:** *Transfer runoff across the site and between components.*
- **Retention:** *Provide final storage before discharge into existing network / watercourse.*
- **Treatment:** *Removal of pollutants through the components.*

SOURCE CONTROL AND INFILTRATION

Ground investigations and infiltration tests were carried out in the car park area in August 2020. (Report Ref; GI Windy Arbor / Lickers Lane). The purpose of the investigations were to determine the nature of the underlying soils to enable recommendations to be made with regards to their suitability for infiltration.

The trial pits generally reported made ground to a depth of approximately 0.4 to 0.5m deep. Then a layer of sandy clay to stiff clay and boulder clay with thickness reported to be up to 3.6m.

Data from infiltration tests was collected to assess the potential for infiltration via permeable paving or soakaways across the proposed development area. Results from the infiltration data collected are summarised in Figure 3 and the full Ground Investigation and Infiltration Test report is included in Appendix A.

Pit Dimensions	Trial Hole 1 Attempt 1		Pit Dimensions	Trial Hole 3 Attempt 1		Pit Dimensions	Trial Hole 'SOAKWAY' Attempt 1	
L (m)	1.40		L (m)	1.40		L (m)	1.30	
W (m)	1.20		B (m)	1.20		B (m)	1.20	
D (m)	1.00		D (m)	1.00		D (m)	1.10	
Maximum effective depth	1.00		Maximum effective depth	1.00		Maximum effective depth	1.00	
Effective Storage Depth	1.00		Effective Storage Depth	1.00		Effective Storage Depth	1.00	
25% Effective Depth	0.25		25% Effective Depth	0.250		25% Effective Depth	0.350	
50% Effective Depth	0.50	0.500	50% Effective Depth	0.500	0.500	50% Effective Depth	0.600	0.500
75% Effective Depth	0.75		75% Effective Depth	0.750		75% Effective Depth	0.850	
Time for outflow between 75% and 25% effective depth (Seconds)	59213		Time for outflow between 75% and 25% effective depth	155400	Seconds	Time for outflow between 75% and 25% effective depth	447220	Seconds
Volume outflowing between 75% and 25% effective depth : $V_{p75-25} =$	0.840	m ³	Volume outflowing between 75% and 25% effective depth : $V_{p75-25} =$	0.840	m ³	Volume outflowing between 75% and 25% effective depth : $V_{p75-25} =$	0.780	m ³
The mean surface area through which the out flow occurs, taken to be the pit sides to 50% effective depth and including the base of the pit: ap50 =	4.28	m ²	The mean to 50% effective depth and including the base of the pit: ap50 surface area through which the out flow occurs, taken to be the pit sides =	4.28	m ²	The mean to 50% effective depth and including the base of the pit: ap50 surface area through which the out flow occurs, taken to be the pit sides =	4.06	m ²
From graph, the time for the outflow between 75% and 25% effective depth: $t_{p75-25} =$	59213	Seconds	From graph, the time for the outflow between 75% and 25% effective depth: $t_{p75-25} =$	155400	Seconds	From graph, the time for the outflow between 75% and 25% effective depth: $t_{p75-25} =$	447220	Seconds
Soil infiltration rate, $f =$	3.31E-06	3.31x10⁻⁶	Soil infiltration rate, $f =$	1.26E-06	1.26x 10⁻⁶	Soil infiltration rate, $f =$	4.30E-07	4.30 x 10⁻⁷

Figure 3: Soil Infiltration Rates - Extract from GI Windy Arbor / Lickers Lane Report

Source control should be the preferred option for new developments. By dealing with runoff at source, the volume of water passing downstream is reduced and requires smaller SuDS components downstream. As such permeable paving should be considered for car park areas where rainwater can infiltrate through the surface while providing an area suitable for pedestrian and vehicles. However, due to the impermeable nature of the soils encountered during the investigations and the low infiltrations rates reported by the testing, drainage options relying on infiltration were discounted for this area.

CONVEYANCE AND TREATMENT

The **SuDS management train** include different components to deliver interception, conveyance and treatment of pollution. Components can vary depending on the site, runoff quantity and design criteria.

The pollutant removal strategy for the car park will follow the SuDS management train approach and use different components in series to target a range of particulate-bound and dissolved pollutants.

One SuDS component is already available at the site. This element is Mellors Pond, which is on the current conveyance route and forms part of the existing management train. It is proposed to carry on using Mellors Pond as one of the components in order to provide Secondary and Tertiary Treatment in line with Table 26.7 of the SuDS manual – extract provided in Table 1.

Mellors Pond will also be redeveloped as part of the wider redevelopment to enhance biodiversity, support wildlife and improve amenity.

Mellors Pond, however, cannot provide the Primary treatment stage as required in the Table 26.7 of the SuDS manual (Table 1). The Primary Treatment will need to be provided upstream of the pond. Therefore, another SuDS component is required close to the source of the runoff and the car park area in order to achieve the primary treatment prior to discharging into Mellors Pond.

It is proposed to use a proprietary treatment system after interception to achieve the Primary treatment. A vortex separator has been selected as the best suited proprietary system for the site as its small footprint will allow for it to be integrated within the car park layout proposal. The vortex separator will be located on the south east corner of the car park at the downstream end of the car park drainage system. All surface water runoff flows from the car park area will pass through the vortex separator chamber prior to the flows being passed forward toward Mellors Pond for the Secondary and Tertiary treatments.

Table 1 – Suitability of SuDS Components

TABLE 26.7 Indicative suitability of SuDS components within the Management Train					
SuDS component	Interception ¹	Close to source/ primary treatment	Secondary treatment	Tertiary treatment	
Rainwater harvesting	Y				
Filter strip	Y	Y			
Swale	Y	Y	Y		
Filter drain	Y		Y		
Pervious pavements	Y	Y			
Bioretention	Y	Y	Y		
Green roof	Y	Y			
Detention basin	Y	Y	Y		
Pond	3	Y ²	Y	Y	
Wetland	3	Y ²	Y	Y	
Infiltration system (soakaways/ trenches/ blankets/basins)	Y	Y	Y	Y	
Attenuation storage tanks	Y ⁴				
Proprietary treatment systems		Y ⁵	Y ⁵	Y ⁵	

Notes

- 1 Interception components are also normally also a treatment component (excluding rainwater harvesting which only removes runoff from the system)
- 2 for roof runoff only
- 3 Interception design may be possible in certain scenarios, but would require detailed justification
- 4 if unlined and design performance can be demonstrated (noting the need to protect groundwater)
- 5 where design performance can be demonstrated

In accordance with the simple index approach and as set out within section 26 of the CIRIA SuDS Manual, the **Pollution risks** have been assessed for the SuDS elements proposed, these are:

Step 1: Set Pollution Hazard Indices

To determine the Pollution hazard indices, the land use for the proposed car park is assumed to be in the category “Non-residential car parking with infrequent change” within CIRIA Table 26.2 – extract provided in Table 2.

Table 2 – Pollution Hazard Indices

TABLE 26.2 Pollution hazard indices for different land use classifications				
Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

Step 2: Assess SuDS pollution mitigation indices

To deliver adequate treatment the selected SuDS components should have a total pollution index for each contaminant that equals or exceeds the pollution hazard index.

i.e. ***Total SuDS mitigation index $\geq$ pollution hazard index***

As shown in Table 3, the mitigation indices from Mellors Pond would be sufficient on their own to achieve the necessary pollutant removal in line with the simple index method. However, upon discussion with KMBC and as Mellors Pond will be redeveloped to enhance biodiversity, support wildlife and will also be used by the local fishing community, it was agreed that an additional level of pollution protection should be placed upstream of the discharge into the pond.

Therefore, it is proposed to include a vortex separator within the car park design. A vortex separator will be effective in treating sediments (TSS), gross pollutants, liquid hydrocarbons, sediment bound hydrocarbons and sediment bound heavy metals and nutrients before the flows are discharged into the pond.

Table 3 – Total SuDS Mitigation Indices

	TSS	Metals	Hydrocarbons
SuDS Mitigation indices¹:			
Vortex chamber	0.5*	0.4*	0.5*
Mellors Pond	0.7	0.7	0.5
Total SuDS mitigation index	1.2	1.1	1.0
Pollution hazard indices	0.5	0.4	0.4
Pass / Fail	Pass	Pass	Pass

¹ Mitigation indices for SuDS components taken from the CIRIA SuDS manual - Table 26.3

* Mitigation indices for the vortex chamber based on Hydro International – Downstream Defender Vortex Separator. Values are as reported by manufacturer.

The combined SuDS components proposed in Table 3 have total mitigation indices that are in excess of the pollution hazard indices for each of the contaminants and will therefore deliver an adequate treatment of the surface water runoff volume generated by the car park area.

There is an existing surface water pipe that connects the north part of the playing fields to Mellors Pond. This pipe currently collects flows from the playing pitches drainage and existing roof runoff from the changing rooms. No information is currently available on the capacity or condition of the drain. It is proposed to survey the existing system to assess and confirm suitability. If unsuitable to drain the car park area, a new connection will have to be designed to convey the surface water flows from the vortex chamber outlet to Mellors Pond.

RETENTION

Mellors Pond is currently used as a retention system for surface water runoff volumes generated by the playing pitches and the current car park area.

As part of the new car park design, storage and attenuation should be provided for runoff volumes that cannot be dealt with using upstream drainage components. It is proposed to carry on using Mellors Pond as the storage and attenuation component.

Hydraulic calculations have been carried out to assess how surface water runoff flows from the car park area would impact the water levels at Mellors Pond. Rainfall events have been used for up to a 1 in 100-year + 40% allowance for Climate Change (CC). Calculations extract are included in Appendix B.

The volume of runoff generated by the proposed car park area in the 1 in 100 years + CC is estimated to be approximately 120m³.

The surface area of the pond is approximately 3400m². Assuming that the full runoff volume will reach Mellors Pond and will be fully contained within the pond (i.e. assuming no outgoing flows towards Big Water) this would result in an increase in the water level at the pond of 35mm.

As part of the restoration of the Mellors Pond, a new outlet structure controlling the discharge towards Big Water will be installed. Part of the storm runoff volumes will be passed forward downstream towards the watercourse leading to Big Water, therefore in practice the increase in water level will be less than 35mm due to the constant outflow.

The expected temporary rise in water level during storm conditions is anticipated to be minimal. The existing pond will be able to accommodate these levels and is therefore deemed suitable to provide the attenuation storage required for excess surface water runoff.

Water levels will be dependent on the future flow control system and hydraulic level set at the outlet structure and should be confirmed at design stage. Outflows should not exceed the peak greenfield runoff rates and take into account the total proposed contributing area including the land drainage of the playing pitches.

The current inflow to the Mellors Pond is via land drainage only. Improvement to the car park drainage system as well as the land drainage of the pitches area would also have a beneficial effect on the ponds' ecology by improving the discharge in term of quality and quantity and help to create an adequate flow through the pond ecosystem.

EXCEEDANCE

Drainage exceedance occurs when the rate of surface water runoff exceeds the capacity of the drainage system. For rainfall events above the 1 in 100-year return period, the capacity of the proposed drainage system could be exceeded, and excess water may cause surface water flooding.

Underground conveyance cannot economically or sustainably be built large enough for all types of extreme rainfall, as a result, there will be occasions when surface water runoff will exceed the capacity of the drainage system.

It is recommended that overland flood pathways are considered early on while designing the overall site layout. Flood flows paths will be dependent on the site layout and levels and should be directed along routes where the risk of property flooding and the risk to health and safety is minimal and can be managed.

If the car park drainage system is exceeded. Excess runoff will overflow from the car park on the southern and western edges of the site and onto the playing pitches area.

Some of the excess runoff may be collected by land drainage and passed forward towards Mellors Pond. Additional surface runoff will flow overland by gravity following the fall of the land and towards the pond.

The proposed surface water design strategy is shown on drawing 70063452-WSP-XX-XX-M2-DR-0003 in Appendix C.

PROPOSED FOUL WATER DRAINAGE STRATEGY

The following strategy is recommended for the foul water drainage network:

The sewer records received from United Utilities show a network of foul sewers located within Windy Arbor Road and Lickers Lane to the west and north of the proposed car park (UU foul sewers records are included in Appendix D).

Discussion with KMBC suggested that the foul sewer from the existing changing rooms connects to the UU sewer in Windy Arbor Road. No information is available on the capacity or condition of this sewer. It is proposed to survey the existing foul system to assess whether this can be reused for the relocated changing rooms. If unsuitable a new connection will have to be provided.

If a new system is required to connect the foul flows from relocated changing rooms, it is proposed to use the same UU manhole as the point of connection, as shown in Figure 4.

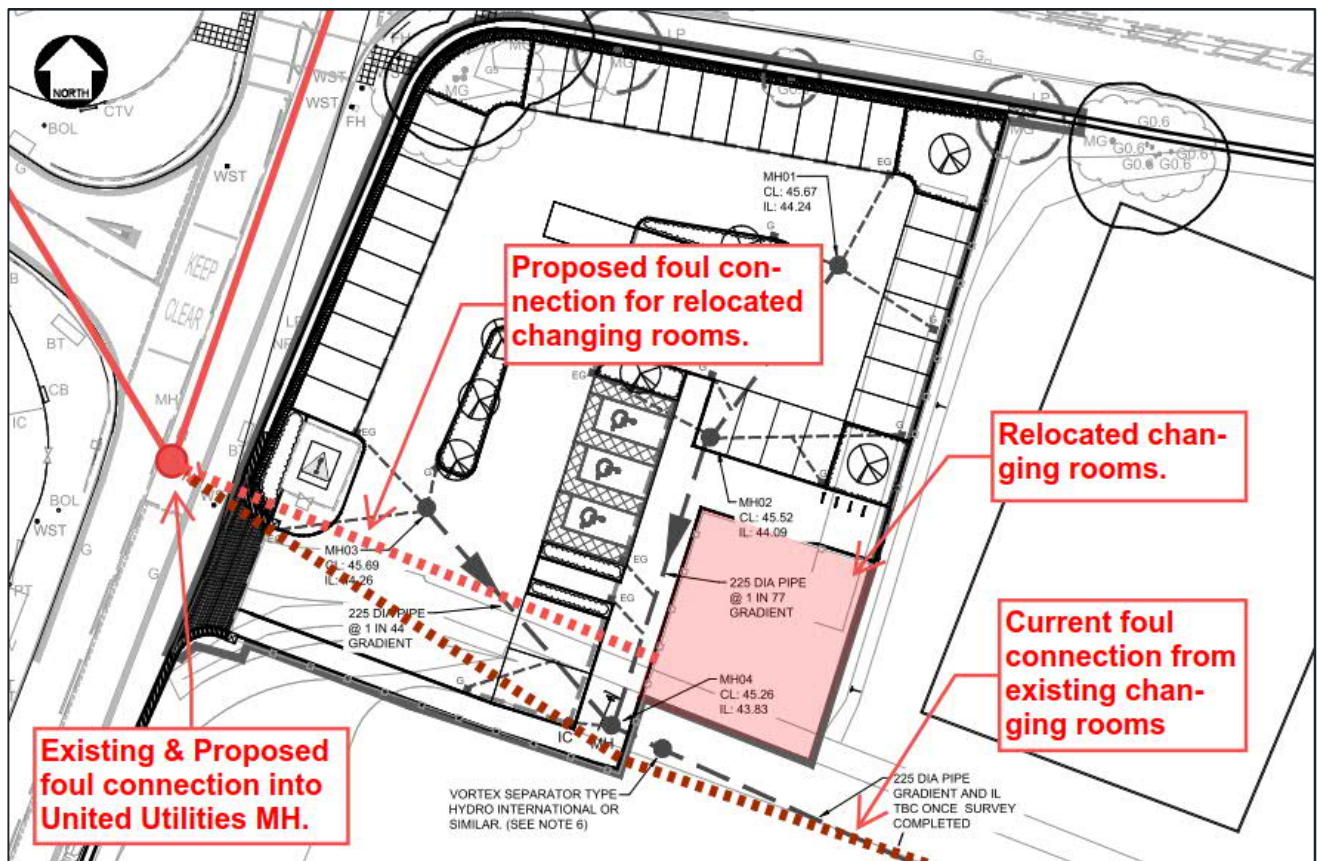


Figure 4: Proposed Foul Water Connection Point

This is believed to be an acceptable proposal for planning application purposes; however, further information such as invert levels and foul flow loads from the changing rooms are required to confirm the viability of the proposed connection.

Once sufficient design information is available the foul strategy and proposed design will need to be confirmed and a United Utilities Pre-Planning Application (PPA) completed and submitted to UU for approval (see PPA below).

Once approved by UU and to proceed with this option, it is recommended that an application is made under Section 106 of the Water Industry Act by the developer. An application form is available on UU web site at: <https://www.unitedutilities.com/globalassets/documents/builders--developers-docs/application-to-connect-to-a-public-sewer-part-1-25-03-20---v2.pdf>

SCHEMATIC DRAINAGE LAYOUT

An indicative layout of the proposed drainage strategy is included in Appendix C.

PRE-PLANNING ASSESSMENT

United Utilities will need to be contacted and a Wastewater pre-development enquiry formally submitted. The Wastewater pre-development enquiry has been initiated for the construction and resurfacing of hardstanding to form 40No. vehicular parking spaces and rebuilding the new changing room facilities based on the preliminary site layout.

For **surface water**; No surface water or highway drainage will drain directly or indirectly to United Utilities surface water or combined sewers. The method of surface water disposal is through the use of the SuDS management train. The final surface water discharge will be to Mellors Pond which is owned by KMBC.

For **foul water**; the Wastewater pre-development enquiry submission assumed that the current UU treatment facility has capacity to treat the foul flows from the proposed new changing rooms building. A direct gravity connection will be proposed in the application based on replicating the current foul arrangement of the existing changing rooms.

Once sufficient design information is available the foul strategy and proposed design will be confirmed and the United Utilities Pre-Planning Application (PPA) completed and submitted to UU for approval.

ASSUMPTIONS AND RISKS

ASSUMPTIONS

- Volumes have been estimated approximately at this stage and should be confirmed prior to detailed design stage.
- It is anticipated that permits to discharge surface water will be agreed with the LLFA during design stages and permissions granted to discharge to Mellors Pond and the subsequent surface water network.

- Discharge rates at the outlet of Mellors Pond shall be set at design stage. Rates should not exceed the peak greenfield runoff rates and take into account the total contributing area including land drainage of the playing pitches.
- It is anticipated that permits to discharge foul flows will be agreed with United Utilities during design stages and that permission will be granted to connect onto the existing foul sewer network.
- Foul flow rates from the relocated changing rooms have been assumed to be similar to the rates from the existing changing rooms.
- Levels of the existing sewer and manhole in Windy Arbor Road are such that a gravity connection from the proposed changing room will be achievable.
- The preliminary drainage system for the car park has been designed in accordance with the Sewerage Sector Guidance document; SSG Appendix C – Design and Construction Guidance v2.1.

RISKS

- The drainage strategy requires that the SuDS components are used in combination to work effectively. If one component is removed or amended the strategy should be reviewed to ensure conveyance, attenuation volume and pollution mitigation requirements are still met.
- Feasibility of connection to the existing foul water network should be assessed by confirming locations, existing invert levels and manhole details at the proposed connection point.
- Foul flow rates from the relocated changing rooms shall be confirmed in order to submit the Pre-Planning Assessment to UU.

CONCLUSIONS AND RECOMMENDATIONS

Surface Water Drainage Strategy:

No surface water will drain directly or indirectly to United Utilities surface water or combined sewers. The method of surface water disposal is through the use of the SuDS management train and surface water discharge will be via Mellors Pond which is a KMBC owned asset.

It is proposed to use a vortex separator and Mellors Pond as a retention pond to treat and attenuate runoff volumes before it enters the surface water network downstream of Mellors Pond. It is estimated that the pond can easily accommodate the required volumes for attenuation for up to a 1 in 100-year return period storm event plus Upper End climate change allowance.

By using these two SuDS components the drainage system will achieve benefits in the four categories referred to as the four pillars of SuDS design (CIRIA C753, fig 2.1), these are:

- **Quality:** By providing treatment of the car park surface water runoff;
- **Quantity:** By managing volumes using Mellors Pond;
- **Amenity:** By improving amenities for local communities;
- **Biodiversity:** By protecting and enhancing natural capital at Mellors Pond;

At this stage, the proposed drainage layout and SuDS components of the drainage strategy are preliminary only and site surveys will need to be carried out to confirm details and locations of existing surface water assets prior to the detailed design stage.

Foul Water Drainage Strategy:

Foul flows are expected from the proposed changing rooms therefore a direct connection to UU foul or combined sewer will be required.

Foul flows from the existing changing rooms currently connect by gravity to the UU sewer in Windy Arbor Road and it is proposed to reuse the same connection point into the UU manhole for the proposed new changing rooms.

Reusing the same connection point is the preferred approach. The volume of foul flows and invert levels of the proposed changing rooms are anticipated to be similar to the existing ones and a new gravity connection to the same manhole point should be achievable. Also, as there will be minimal changes from the existing foul system, this foul strategy is expected to be the most acceptable from a UU perspective.

Further information such as invert levels and foul loads from the changing rooms are required so that the Pre-Planning Application (PPA) can be completed and submitted to UU for approval.

RECOMMENDATIONS

- The foul connection from the existing changing rooms to the UU manhole should be surveyed to confirm connection details and invert levels and whether it can be reused for the new changing rooms.
- The internal layout of the proposed changing rooms should be confirmed in order to assess the volume of foul flow generated.

- The drainage strategies presented, including the SuDS components proposed should be considered and agreed as early as possible in the planning and design process to ensure that they can be integrated into the layout designs.
- All SuDS features to be designed in accordance with the CIRIA C753 SuDS Manual. Health and safety aspects for these features need to adhere to CIRIA RP992 Health and Safety Principles for SuDS.

Once the PPA is approved by UU and to proceed with this option, it is recommended that an application is made under Section 106 of the Water Industry Act by the developer. An application form is available on UU web site at:

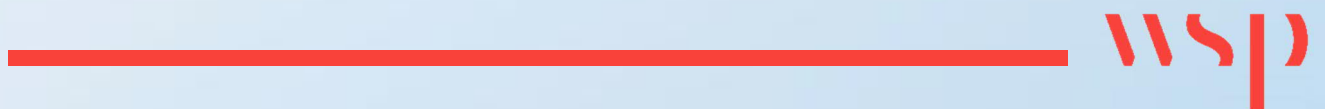
<https://www.unitedutilities.com/globalassets/documents/builders--developers-docs/application-to-connect-to-a-public-sewer-part-1-25-03-20---v2.pdf>.

APPENDICES

Appendix A	Ground Investigation and Infiltration Report
Appendix B	Volume Calculations
Appendix C	Preliminary Drainage Layout Plan
Appendix D	United Utilities – Sewer Records

Appendix A

GROUND INVESTIGATION AND INFILTRATION REPORT



**LABORATORY TEST CERTIFICATE
MATERIALS LABORATORY**



Certificate No: 4633/20

To : Stuart Sidebottom

Client : Knowsley Contractors Ltd
King Construction
1A Prestwood Place, Skelmersdale
Lancashire, WN8 9QE

Date: 18/08/2020

Dear Sirs,

FIELD & LABORATORY TESTING

Introduction

We refer to site testing undertaken on Windy Arbour/ Lickers Lane Playing Field.

Tested By : C. Salmon & K. Bescoby

Sample Reference : N/A

Description : See attached

Date Sampled : N/A

Date Tested : 13th July 2020

Source : N/A

Weather : Sunny

Test Results : Please see attached:
BH & TP Location Plan (from Client)
BH Logs and Core Photos
TP logs and Photo
Dynamic Cone Penetration (DCP) Reports
Soakaway Data and Soil Infiltration information

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
All remaining samples for this project will be disposed of 28 days after issue of this test certificate
When a statement of conformity is requested for a test result against limits set out in a standard or specification (e.g. BS EN ISO, SHW) that already considers measurement uncertainty, MATtest Midlands decision rule is to follow conformity requirements of the applicable standard or specification.
Results reported only relate to the items tested/ received.

Remarks;

Approved for Issue:

Position: Operations Manager

Issuing Office:



Head Office & Central

Unit 5 Draycott Mills, Off Market Street, Draycott, Derby, DE72 3NB

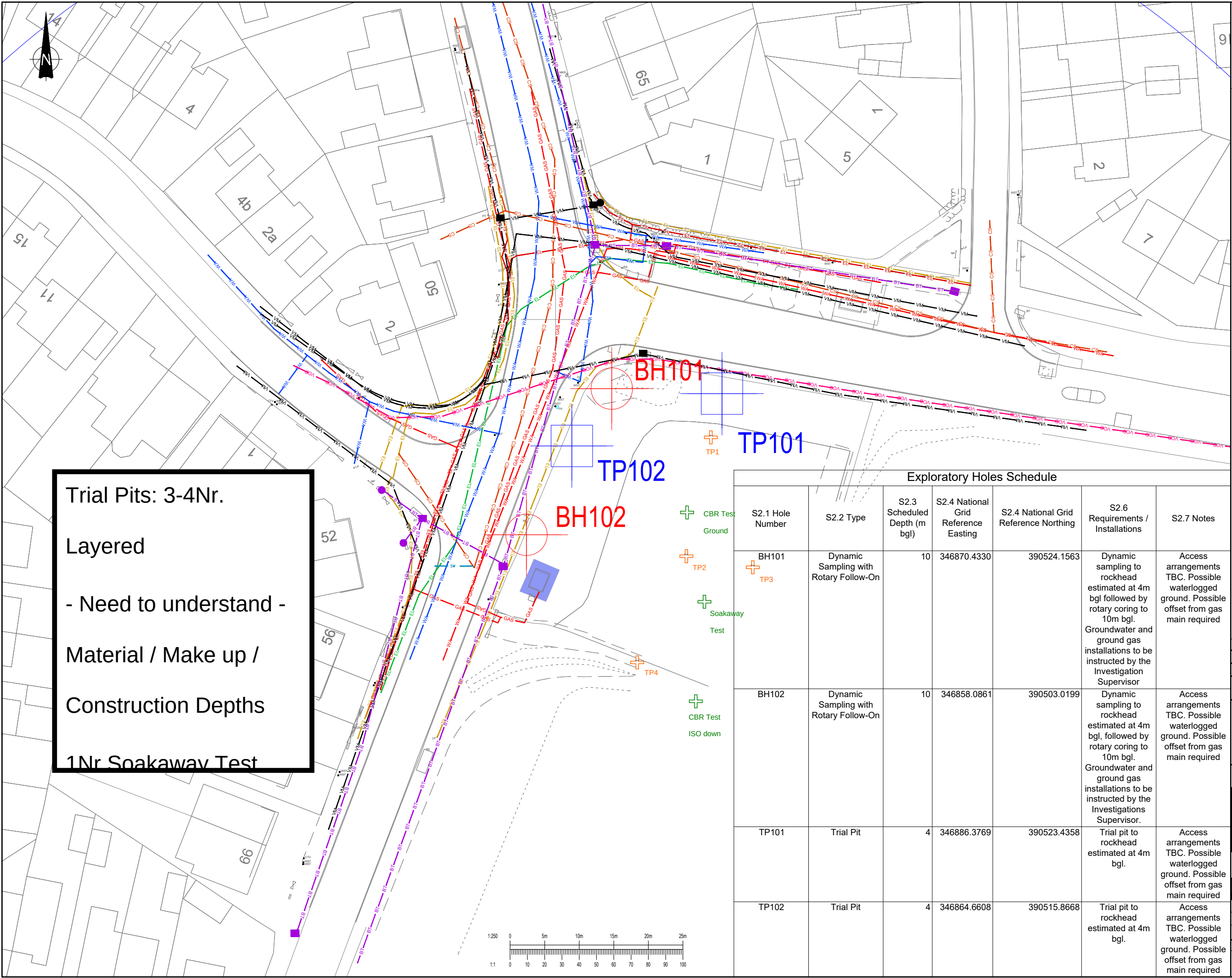


North West

Unit 15 Park Court, Sherdley Business Park, St. Helens, Merseyside, WA9 5GZ

Tel: 03333 202521 Web: www.mattestlaboratories.co.uk





Trial Pits: 3-4Nr.
Layered
- Need to understand -
Material / Make up /
Construction Depths
1Nr Soakaway Test

KEY:

BH
Proposed Bore Hole Location

TP
Proposed Trial Pit Location

Exploratory Holes Schedule						
S2.1 Hole Number	S2.2 Type	S2.3 Scheduled Depth (m bgl)	S2.4 National Grid Reference Easting	S2.4 National Grid Reference Northing	S2.6 Requirements / Installations	S2.7 Notes
BH101 TP3	Dynamic Sampling with Rotary Follow-On	10	346870.4330	390524.1563	Dynamic sampling to rockhead estimated at 4m bgl followed by rotary coring to 10m bgl. Groundwater and ground gas installations to be instructed by the Investigation Supervisor	Access arrangements TBC. Possible waterlogged ground. Possible offset from gas main required
BH102	Dynamic Sampling with Rotary Follow-On	10	346858.0861	390503.0199	Dynamic sampling to rockhead estimated at 4m bgl, followed by rotary coring to 10m bgl. Groundwater and ground gas installations to be instructed by the Investigations Supervisor.	Access arrangements TBC. Possible waterlogged ground. Possible offset from gas main required
TP101	Trial Pit	4	346886.3769	390523.4358	Trial pit to rockhead estimated at 4m bgl.	Access arrangements TBC. Possible waterlogged ground. Possible offset from gas main required
TP102	Trial Pit	4	346864.6608	390515.8668	Trial pit to rockhead estimated at 4m bgl.	Access arrangements TBC. Possible waterlogged ground. Possible offset from gas main required

Rev	Date	Description	By
B01	10.02.20	First Design Issue	JB

Amendments

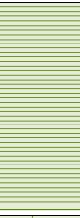
Project	Halsnead Garden Village
Title	Windy Arbor Road / Lickers Lane Exploratory Holes OS Only
Client	Knowsley Council

2nd Floor South Central 11 Peter Street Manchester M2 5GR
T 0161 839 8392 F 0161 839 8394
mail@watermangroup.com www.watermangroup.com

Drawing Status

DESIGN

Designed by	AM	Checked by	RB	Project No	WIE 13628
Drawn by	JB	Date	FEB 2020	Computer File No	
Scales @ A1	work to figured dimensions only	1:250			
Publisher	Zone	Category	Number	Revision	
WIE	0	95	0002EHB	B01	

			Web: www.erda-ltd.co.uk Email: p.devitt@erda-ltd.co.uk Mob: 07531 051197			Date: 13th August 2020			BOREHOLE NO. BH101									
CLIENT MATtest Midlands Ltd						Ground Level:			Sheet No. 1 of 2									
SITE LOCATION Lickers Lane, Whiston						Orientation:			Job No. EAL.17.20									
						Coordinates:												
						Plant: Massenza M13 Rotary Rig												
						Dimensions:												
Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS			SPT Results					N Value	Installation	Core Records			Test Sample Details	
				Depth	No	Type	Seating	Test Drive						TCR	SCR	RQD		
MADE GROUND comprising black sandy gravel. Gravel is fine to coarse sub-angular to angular granite and tarmac fragments. Hardstanding.	0.10		0.10 (0.10)	0.5	1	D												
MADE GROUND comprising dark brown slightly gravelly fine to coarse sand. Gravel is fine to medium sub-angular to angular brick and tarmac.	0.20																	
	0.30																	
	0.40																	
	0.50																	
	0.60																	
	0.70																	
	0.80																	
MADE GROUND comprising dark grey mottled yellow and black slightly gravelly sandy clay. Gravel is fine to coarse sub-angular to angular coal fragments. (Reworked natural).	0.90																	
	1.00																	
	1.10																	
MADE GROUND comprising dark grey mottled yellow and black slightly gravelly sandy clay. Gravel is fine to coarse sub-angular to angular coal fragments. (Reworked natural).	1.20		1.50 (0.50)	1.0 - 1.5	2	B												
	1.30																	
	1.40																	
	1.50																	
Very stiff yellowish brown mottled orange silty sandy CLAY. GLACIAL TILL.	1.60		2.10 (0.60)	1.5 - 2.0	3	B												
	1.70																	
	1.80																	
	1.90																	
	2.00																	
	2.10																	
Extremely weak dark grey MUDSTONE. Recovered as gravelly sand. PENNINE MIDDLE COAL MEASURES.	2.20		2.20 (0.10)	2.2	4	D												
	2.30																	
Borehole continued with rotary coring. No recovery from 2.10m to 2.70mbgl.	2.40		2.70 (0.50)															
	2.50																	
	2.60																	
	2.70																	
	2.80																	
Very weak thinly laminated black MUDSTONE. Extremely closely to very closely spaced horizontal to subhorizontal fractures, undulating, rough, along bedding planes. Weathered to clay penetrating 1mm along fracture planes. Recovered as non intact gravel sized fragments. PENNINE MIDDLE COAL MEASURES.	2.90		3.00 (0.30)															
	3.00																	
	3.10																	
	3.20																	
No recovery from 3.00 to 3.50mbgl.	3.30		3.50 (0.50)															
	3.40																	
	3.50																	
	3.60																	
Very stiff dark grey silty sandy CLAY. Occasional sub-angular to angular mudstone lithorelicts. PENNINE MIDDLE COAL MEASURES.	3.70		3.70 (0.20)															
	3.80																	
Very weak thinly laminated black MUDSTONE. Extremely closely to very closely spaced horizontal to subhorizontal fractures, undulating, rough, along bedding planes. Weathered to clay penetrating 1mm along fracture planes. Recovered as non intact gravel sized fragments. PENNINE MIDDLE COAL MEASURES.	3.90		4.50 (0.80)															
	4.00																	
	4.10																	
	4.20																	
	4.30																	
	4.40																	
	4.50																	
	4.60																	
Very stiff dark grey silty sandy CLAY. Occasional sub-angular to angular mudstone lithorelicts. PENNINE MIDDLE COAL MEASURES.	4.70		5.30 (0.80)															
	4.80																	
	4.90																	
	5.00																	
	5.00																	

Borehole record continued on Page 2

Casing record			Chiselling records								
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
13.08.20	100	9.00									
Remarks: 1. Gas/groundwater monitoring standpipe installed to 10.0m (GL to 1.0m plain/bentonite, 1.0m to 10.0m slotted/gravel). 2. No groundwater encountered. 3. Borehole remained stable throughout drilling.						Logged By:	Checked By:	Date		Scale	
						PD	PD	16.08.20		NTS	



Web: www.erda-ltd.co.uk
Email: p.devitt@erda-ltd.co.uk
Mob: 07531 051197

CLIENT
MATtest Midlands Ltd

SITE LOCATION
Lickers Lane, Whiston

Date: 14th August 2020
Ground Level:
Orientation:
Coordinates:
Plant: Massenza MI3 Rotary Rig
Dimensions:

BOREHOLE NO.
BH101
Sheet No. 2 of 2
Job No.
EAL.17.20

Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS			SPT Results						Core Records			Test Sample Details		
				Depth	No	Type	Seating	Test Drive			N Value	Installation	TCR	SCR	RQD			
				From	To	From	From	To	From	To	From	To	From	To				
... Continued from page 1.	5.10 5.20 5.30		5.30 (0.80)															
Very weak thinly laminated black MUDSTONE. Extremely closely to very closely spaced horizontal to subhorizontal fractures, undulating, rough, along bedding planes. Weathered to clay penetrating 1mm along fracture planes. PENNINE MIDDLE COAL MEASURES.	5.40 5.50 5.60 5.70 5.80 5.90 6.00		6.00 (0.70)												97	29	29	
Very stiff dark grey silty sandy CLAY. Occasional sub-angular to angular mudstone lithorelicts. PENNINE MIDDLE COAL MEASURES.	6.10 6.20 6.30 6.40 6.50		6.50 (0.50)															
No recovery from 6.50m to 7.00mbgl.	6.60 6.70 6.80 6.90 7.00		7.00 (0.50)												44	27	0	
Very stiff dark grey silty sandy CLAY. Occasional sub-angular to angular mudstone lithorelicts. PENNINE MIDDLE COAL MEASURES.	7.10 7.20 7.30 7.40 7.50		7.50 (0.50)															
Very weak thinly laminated black MUDSTONE. Extremely closely to very closely spaced horizontal to subhorizontal fractures, undulating, rough, along bedding planes. Weathered to clay penetrating 1mm along fracture planes. Recovered as non intact gravel sized fragments. PENNINE MIDDLE COAL MEASURES.	7.60 7.70 7.80 7.90 8.00 8.10 8.20 8.30 8.40 8.50 8.60 8.70 8.80 8.90 9.00 9.10 9.20 9.30 9.40 9.50 9.60 9.70 9.80 9.90		9.90 (2.40)												93	11	7	
... 8.30m to 8.40m solid core.																		
Very weak black coal.	10.00		10.0 (0.10)												92	15	0	
Borehole terminated at 10.00mbgl.																		

Casing record			Chiselling records								
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
13.08.20	100	9.00									
Remarks:						Logged By:	Checked By:	Date	Scale		
1. Gas/groundwater monitoring standpipe installed to 10.0m (GL to 1.0m plain/bentonite, 1.0m to 10.0m slotted/gravel).						PD	PD	16.08.20	NTS		
2. No groundwater encountered.											
3. Borehole remained stable throughout drilling.											

 Web: www.erdaltd.co.uk Email: p.devitt@erdaltd.co.uk Mob: 07531 051197				Date: 15th August 2020				BOREHOLE NO. BH102 Sheet No. 1 of 2 Job No. EAL.17.20									
CLIENT MATtest Midlands Ltd				Ground Level:													
SITE LOCATION Lickers Lane, Whiston				Orientation: Coordinates: Plant: Massenza M13 Rotary Rig Dimensions:													
Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS			SPT Results					Core Records			Test Sample Details		
				Depth	No	Type	Seating	Test Drive				N Value	Installation	TCR		SCR	RQD
MADE GROUND comprising dark brown slightly gravelly fine to coarse sand. Gravel is fine to medium sub-angular to angular brick and tarmac.	0.10		0.60 (0.60)														
	0.20																
	0.30																
	0.40																
	0.50																
	0.60																
Very stiff yellowish brown mottled light grey silty sandy CLAY. GLACIAL TILL.	0.70		2.00 (1.40)														
	0.80																
	0.90																
	1.00																
	1.10																
	1.20																
	1.30																
	1.40																
	1.50																
	1.60																
	1.70																
	1.80																
	1.90																
	2.00																
Very weak thinly laminated black MUDSTONE. Extremely closely to very closely spaced horizontal to subhorizontal fractures, undulating, rough, along bedding planes. Weathered to clay and Iron Oxide staining penetrating 1mm along fracture planes. Recovered as non intact gravel sized fragments. PENNINE MIDDLE COAL MEASURES.	2.10		4.00 (2.00)														
	2.20																
	2.30																
	2.40																
	2.50																
	2.60																
	2.70																
	2.80																
	2.90																
	3.00																
	3.10																
	3.20																
	3.30																
	3.40																
	3.50																
	3.60																
Very stiff dark grey silty sandy gravelly CLAY. Gravel is fine to coarse sub-angular to angular mudstone lithorelicts. PENNINE MIDDLE COAL MEASURES.	3.70		4.50 (0.50)														
	3.80																
	3.90																
	4.00																
	4.10																
Very weak thinly laminated dark grey MUDSTONE. Very closely horizontal to sub horizontal fractures, undulating, rough, along bedding planes. Weathered to clay and Iron Oxide staining penetrating 1mm along fracture planes. PENNINE MIDDLE COAL MEASURES.	4.20		4.80 (0.30)														
	4.30																
	4.40																
	4.50																
Very weak thinly laminated dark grey MUDSTONE. Very closely horizontal to sub horizontal fractures, undulating, rough, along bedding planes. Weathered to clay penetrating 1mm along	4.60																
	4.70																
	4.80																
	4.90																
	5.00																
HSV @ 1.60m = 120																	

Casing record			Chiselling records									
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks	
15.08.20	100	9.00										
Remarks:												
1. Gas/groundwater monitoring standpipe installed to 10.0m (GL to 1.0m plain/bentonite, 1.0m to 10.0m slotted/gravel). 2. No groundwater encountered. 3. Borehole remained stable throughout drilling.									Logged By:	Checked By:	Date	Scale
									PD	PD	17.08.20	NTS

 CLIENT MATtest Midlands Ltd				Web: www.erda-ltd.co.uk Email: p.devitt@erda-ltd.co.uk Mob: 07531 051197				Date: 15th August 2020 Ground Level: Orientation: Coordinates: Plant: Massenza M13 Rotary Rig Dimensions:				BOREHOLE NO. BH102 Sheet No. 2 of 2 Job No. EAL.17.20							
SITE LOCATION Lickers Lane, Whiston																			
Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS			SPT Results					N Value	Installation	Core Records			Test Sample Details		
				Depth	No	Type	Seating	Test Drive			TCR			SCR	RQD				
fracture planes. PENNINE MIDDLE COAL MEASURES. ... continued from page 1.	5.10		5.40 (0.60)												84	36	0		
	5.20																		
	5.30																		
	5.40																		
Very stiff dark grey silty sandy gravelly CLAY. Gravel is fine to coarse sub-angular to angular mudstone lithorelicts. PENNINE MIDDLE COAL MEASURES.	5.50		5.90 (0.50)																
	5.60																		
	5.70																		
	5.80																		
Very weak thinly laminated dark grey MUDSTONE. Very closely horizontal to sub horizontal fractures, undulating, rough, along bedding planes. Weathered to clay penetrating 1mm along fracture planes. PENNINE MIDDLE COAL MEASURES.	6.00		6.30 (0.40)												92	37	11		
	6.10																		
	6.20																		
	6.30																		
Very weak black COAL. Closely horizontal to sub horizontal fractures. Sub vertical joints. PENNINE MIDDLE COAL MEASURES.	6.40		6.90 (0.60)																
	6.50																		
	6.60																		
	6.70																		
Very weak thinly laminated dark grey MUDSTONE. Very closely horizontal to sub horizontal fractures, undulating, rough, along bedding planes. Weathered to clay penetrating 1mm along fracture planes. Recovered as non intact gravel sized fragments. PENNINE MIDDLE COAL MEASURES.	6.80		7.50 (0.60)																
	6.90																		
	7.00																		
	7.10																		
	7.20																		
	7.30																		
Very weak thinly laminated dark grey MUDSTONE. Very closely to closely horizontal to sub horizontal fractures, undulating, rough, along bedding planes. Weathered to clay penetrating 1mm along fracture planes. PENNINE MIDDLE COAL MEASURES.	7.40		9.50 (2.00)																
	7.50																		
	7.60																		
	7.70																		
	7.80																		
	7.90																		
	8.00																		
	8.10																		
	8.20																		
	8.30																		
	8.40																		
	8.50																		
	8.60																		
	8.70																		
8.80																			
No recovery from 9.50m to 10.0mbgl.	8.90		10.00 (0.50)																
	9.00																		
	9.10																		
	9.20																		
	9.30																		
	9.40																		
	9.50																		
	9.60																		
	9.70																		
	9.80																		

Borehole terminated at 10.0mbgl.

Casing record			Chiselling records								
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
15.08.20	100	9.00									
Remarks: 1. Gas/groundwater monitoring standpipe installed to 10.0m (GL to 1.0m plain/bentonite, 1.0m to 10.0m slotted/gravel). 2. No groundwater encountered. 3. Borehole remained stable throughout drilling.								Logged By:	Checked By:	Date	Scale
								PD	PD	17.08.20	NTS

KEY:

DO NOT SCALE



TITLE:

Borehole Core Photos – BH01

PROJECT:

Lickers Lane, Whiston

PROJECT No:

EAL.17.20

DATE:

08/2020

SCALE :

NTS

DRAWN :

PD

DWG No:

Figure 1

Left to right - 2.00m to 3.00m



Left to right - 3.00m to 4.50m

Left to right – 4.50m to 5.50m

KEY:

DO NOT SCALE



TITLE:

Borehole Core Photos – BH01

PROJECT:

Lickers Lane, Whiston

PROJECT No:

EAL.17.20

DATE:

08/2020

SCALE :

NTS

DRAWN :

PD

DWG No:

Figure 1

Left to right - 6.00m to 7.00m



Left to right - 7.00m to 8.00m

Left to right – 8.00m to 9.00m

Left to right - 9.00m to 10.00m



KEY:

DO NOT SCALE



TITLE:

Borehole Core Photos – BH01

PROJECT:

Lickers Lane, Whiston

PROJECT No:

EAL.17.20

DATE:

08/2020

SCALE :

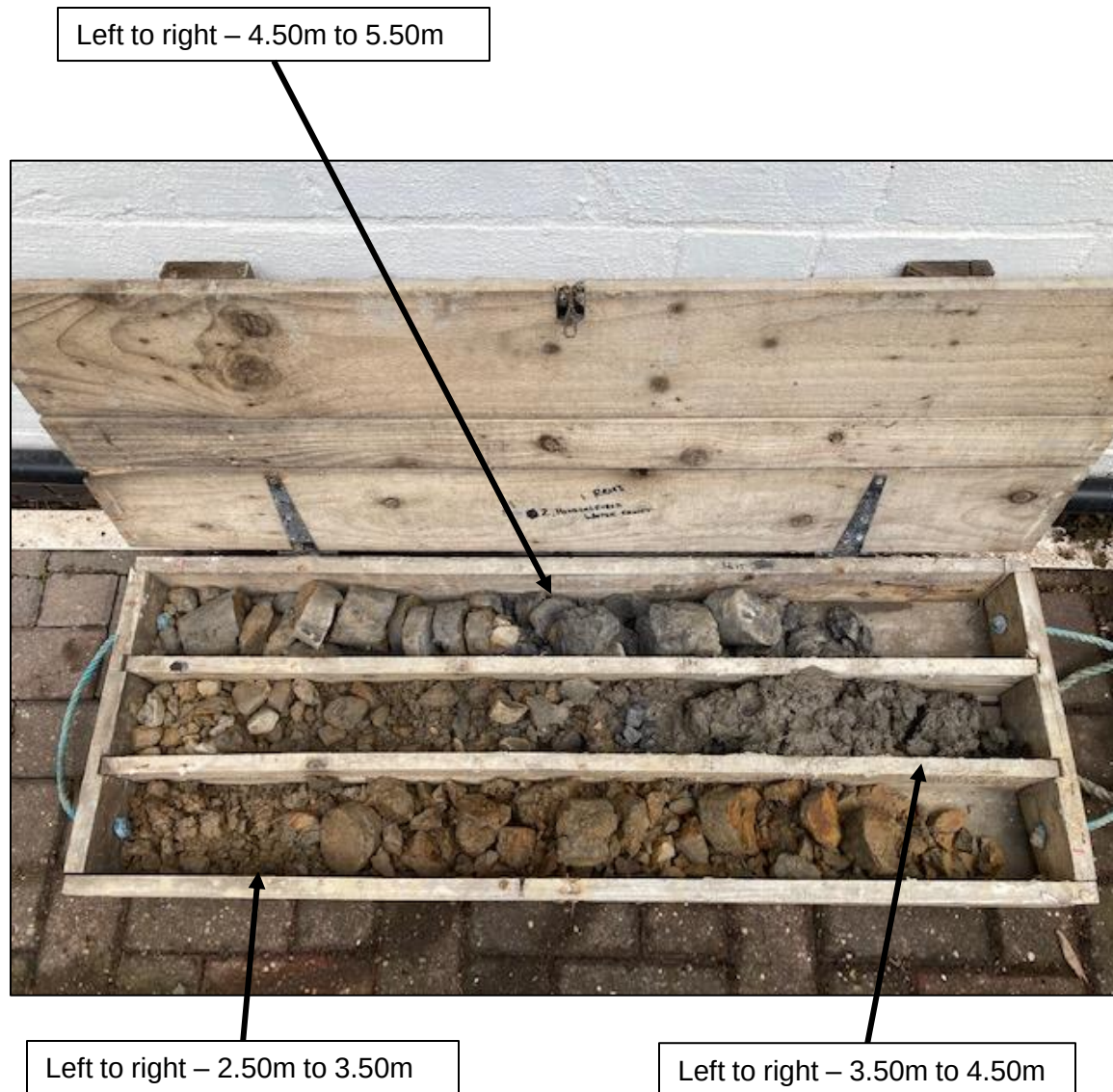
NTS

DRAWN :

PD

DWG No:

Figure 1



KEY:

DO NOT SCALE



TITLE:

Borehole Core Photos – BH02

PROJECT:

Lickers Lane, Whiston

PROJECT No:

EAL.17.20

DATE:

08/2020

SCALE :

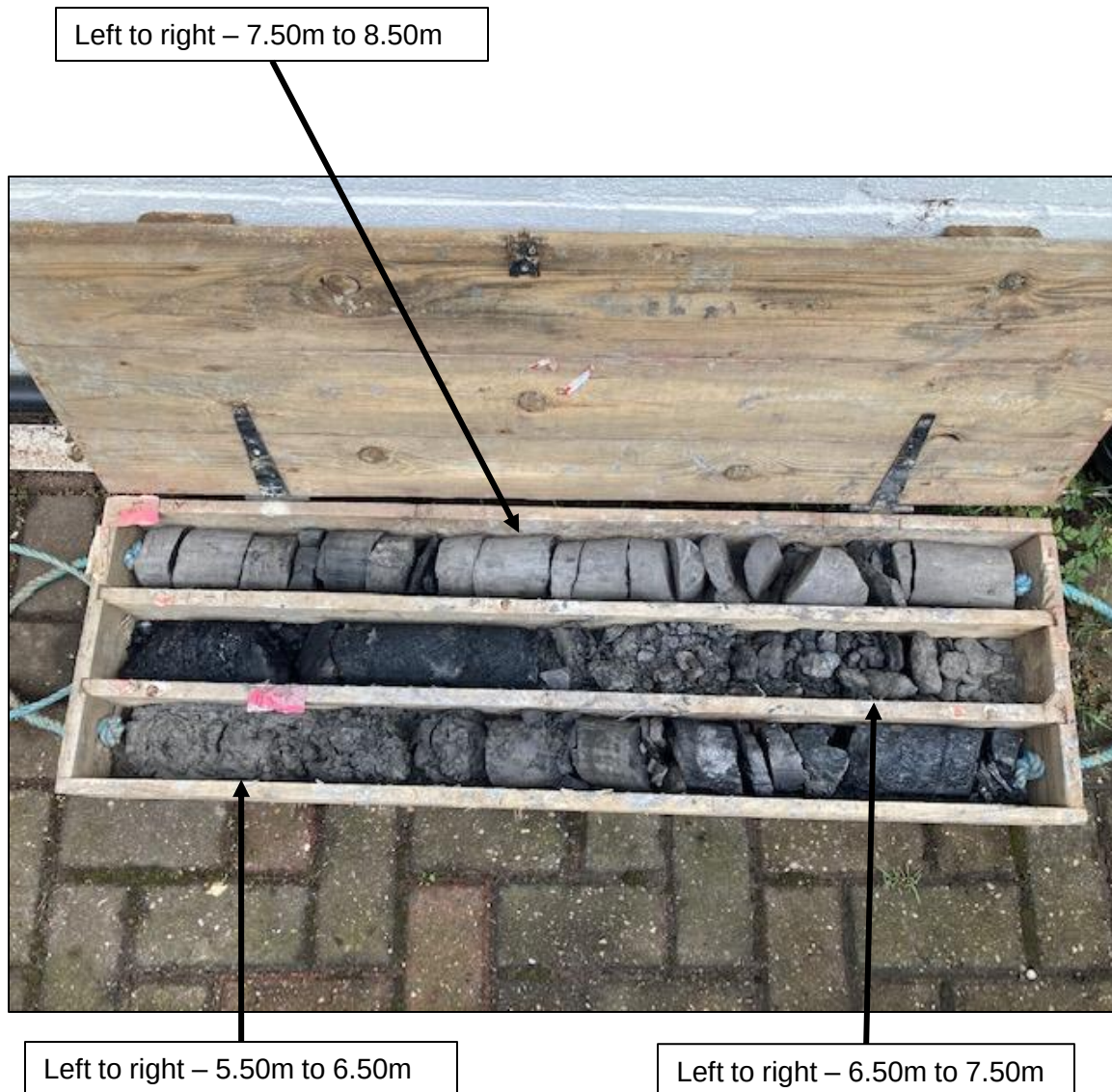
NTS

DRAWN :

PD

DWG No:

Figure 1



KEY:

DO NOT SCALE



TITLE:

Borehole Core Photos – BH02

PROJECT:

Lickers Lane, Whiston

PROJECT No:

EAL.17.20

DATE:

08/2020

SCALE :

NTS

DRAWN :

PD

DWG No:

Figure 1



Left to right – 8.50m to 9.50m

KEY:

DO NOT SCALE



TITLE:

Borehole Core Photos – BH02

PROJECT:

Lickers Lane, Whiston

PROJECT No:

EAL.17.20

DATE:

08/2020

SCALE :

NTS

DRAWN :

PD

DWG No:

Figure 1

BOREHOLE-/ TRIAL PIT LOG

CLIENT **KING CONSTRUCTION**
 JOB REF: **4633/20**
 CONTRACT: **WINDY ARBOR/LICKERS LANE**
(Whiston Juniors Playing Fields)
 LOCATION: **SEE TP LOCATION PLAN**
 PLAN SIZE: **3.00m x 2.20m**

TP REF: **TP101**
 DATE: **13/08/20**
 WEATHER: **SUNNY**
 LOGGED BY: **CS**
 EASTING: **53.40887333**
 NORTHING: **-2.80045152**

Depth (m)	Thickness (m)	Sample No. & Type	Sample Interval	Description	CBR %	MC %	Comments
0.50	0.50	1B 2SB 3D	0.00 to 0.50	Black, sandy, silty, occ gravel, occ cobble of house brick, occ pottery -TOPSOIL/MADE GROUND			See Also DCP Report
1.20	0.70	4B 5SB 6D	0.50 to 1.20	Orangey brown, slightly sandy, sl silty, firm/stiff consistency CLAY/BOULDER CLAY			
2.50	1.30	7B 8SB 9D	1.20 to 2.50	Grey, silty, firm/stiff consistency CLAY/BOULDER CLAY - organic odour at around 2.40m			
4.30	1.80	10B 11SB 12D	2.50 to 4.30	Black, grey, thinly laminated, highly weathered MUDSTONE			
				End of TP at 4.30m bgl			TP DRY

TRIAL PIT PHOTOS

Client:	KING CONSTRUCTION	Date:	13/08/2020
Contract:	WINDY ARBOR/LICKERS LANE (Whiston Juniors Playing Fields) 5DT	Job Ref:	4633/20
Location:	SEE PLAN	Source:	N/A
Trial Pit / Reference:	TP 101		

PHOTO 1 SHOWING GENERAL POSITION



PHOTO 2 SHOWING GENERAL POSITION



TRIAL PIT PHOTOS

Client:	KING CONSTRUCTION	Date:	13/08/2020
Contract:	WINDY ARBOR/LICKERS LANE (Whiston Juniors Playing Fields)	Job Ref:	4633/20
Location:	SEE PLAN	Source:	N/A
Trial Pit / Reference:	TP 101		

PHOTO 3 SHOWING GENERAL SOIL PROFILE



PHOTO 4 SHOWING NATURE OF ARISING



BOREHOLE-/ TRIAL PIT LOG

CLIENT **KING CONSTRUCTION**
 JOB REF: **4633/20**
 CONTRACT: **WINDY ARBOR/LICKERS LANE**
(Whiston Juniors Playing Fields)
 LOCATION: **SEE TP LOCATION PLAN**
 PLAN SIZE: **3.00m x 2.20m**

TP REF: **TP102**
 DATE: **14/08/20**
 WEATHER: **SUNNY**
 LOGGED BY: **CS**
 EASTING: **53.40878998**
 NORTHING: **-2.80077507**

Depth (m)	Thickness (m)	Sample No. & Type	Sample Interval	Description	CBR %	MC %	Comments
0.40	0.40	1B 2SB 3D	0.00 0.40	Black, sandy, silty, occasional gravel, occasional cobble of brick, occasional pottery TOPSOIL/MADE GROUND			See also DCP report
4.00	3.60	4B 5SB 6D	0.40 4.00	Orangey brown, slightly sandy, sl silty, stiff consistency CLAY/BOULDER CLAY localised pockets/lenses of sandy gravel			
4.50	0.50	7B 8SB 9D	4.00 to 4.50	Bluish grey, orangey brown thinly laminated, completely weathered MUDSTONE recovered as fine gravel and cobbles of mudstone with traces of coal 150mm thick			
				End of TP at 4.50m bgl			TP DRY

TRIAL PIT PHOTOS

Client:	KING CONSTRUCTION	Date:	14/02/20
Contract:	WINDY ARBOR/LICKERS LANE (Whiston Juniors Playing Fields) 5DT	Job Ref:	4633/20
Location:	SEE PLAN	Source:	N/A
Trial Pit / Reference:	TP 102		

PHOTO 1 SHOWING GENERAL POSITION



PHOTO 2 SHOWING GENERAL POSITION



TRIAL PIT PHOTOS

Client:	KING CONSTRUCTION	Date:	14/08/2020
Contract:	WINDY ARBOR/LICKERS LANE (Whiston Juniors Playing Fields)	Job Ref:	4633/20
Location:	SEE PLAN	Source:	N/A
Trial Pit / Reference:	TP 102		

PHOTO 3 SHOWING GENERAL SOIL PROFILE



PHOTO 4 SHOWING NATURE OF ARISING



BOREHOLE / TRIAL PIT LOG

CLIENT: **KING CONSTRUCTION**
 JOB REF: **4633/20**
 CONTRACT: **WINDY ARBOR/LICKERS LANE**
(Whiston Juniors Playing Fields)
 LOCATION: **SEE TP LOCATION PLAN**
 PLAN SIZE: **1.40 x 1.20m**

TP REF: **TP1**
 DATE: **13/08/20**
 WEATHER: **SUNNY**
 LOGGED BY: **CS**
 EASTING: **53.40882336**
 NORTHING: **-2.80042838**

Depth (m)	Thickness (m)	Sample No. & Type	Sample Interval	Description	CBR %	MC %	Comments
0.70	0.70	1B 2SB 3D	0.00 to 0.70	Black, sandy, fmc gravel of ash, clinker, bituminous material, limestone, granite - MADE GROUND			See also soakaway report
1.00	0.30	4B 5SB 6D	0.70 to 1.00	Orangey brown, slightly sandy, sl silty, firm/stiff consistency CLAY/BOULDER CLAY			HAND SHEAR VANE AT 0.90m 94,120,120
1.00				End of TP at 1.00m bgl			TP DRY

TRIAL PIT PHOTOS

Client:	KING CONSTRUCTION	Date:	13/08/2020
Contract:	WINDY ARBOR/LICKERS LANE (Whiston Juniors Playing Fields)	Job Ref:	4633/20
Location:	SEE PLAN	Source:	N/A
Trial Pit / Reference:	TP 1		

PHOTO 1 SHOWING GENERAL POSITION AND NATURE OF ARISING



PHOTO 2 SHOWING GENERAL SOIL PROFILE



TRIAL PIT PHOTOS

Client:	KING CONSTRUCTION	Date:	13/08/2020
Contract:	WINDY ARBOR/LICKERS LANE (Whiston Juniors Playing Fields)	Job Ref:	4633/20
Location:	SEE PLAN	Source:	N/A
Trial Pit / Reference:	TP 1		

PHOTO 3 SHOWING GENERAL SOIL PROFILE



PHOTO 4 SHOWING SOAKAWAY LEVEL AT START OF 2nd DAY



BOREHOLE / TRIAL PIT LOG

CLIENT: **KING CONSTRUCTION**
 JOB REF: **4633/20**
 CONTRACT: **WINDY ARBOR/LICKERS LANE**
(Whiston Juniors Playing Fields)
 LOCATION: **SEE TP LOCATION PLAN**
 PLAN SIZE: **1.20 x 1.10m**

TP REF: **TP2**
 DATE: **13/08/20**
 WEATHER: **SUNNY**
 LOGGED BY: **CS**
 EASTING: **53.40885282**
 NORTHING: **-2.80058831**

Depth (m)	Thickness (m)	Sample No. & Type	Sample Interval	Description	CBR %	MC %	Comments
0.70	0.70	1B 2SB 3D	0.00 to 0.70	Black, sandy, fmc gravel of ash, clinker, bituminous material, limestone, granite - MADE GROUND			See also DCP report
1.10	0.40	4B 5SB 6D	0.70 to 1.00	Orangey brown, slightly sandy, sl silty, firm/stiff consistency CLAY/BOULDER CLAY			
				End of TP at 1.10m bgl			TP DRY

TRIAL PIT PHOTOS

Client:	KING CONSTRUCTION	Date:	13/08/2020
Contract:	WINDY ARBOR/LICKERS LANE (Whiston Juniors Playing Fields)	Job Ref:	4633/20
Location:	SEE PLAN	Source:	N/A
Trial Pit / Reference:	TP 2		

PHOTO 1 SHOWING GENERAL POSITION AND NATURE OF ARISING



PHOTO 2 SHOWING GENERAL SOIL PROFILE



TRIAL PIT PHOTOS

Client:	KING CONSTRUCTION	Date:	13/08/2020
Contract:	WINDY ARBOR/LICKERS LANE (Whiston Juniors Playing Fields)	Job Ref:	4633/20
Location:	SEE PLAN	Source:	N/A
Trial Pit / Reference:	TP 2		

PHOTO 3 SHOWING GENERAL SOIL PROFILE AND POSITION OF DCP



PHOTO 4 SHOWING CLOSE UP OF CLAY MATERIAL



BOREHOLE / TRIAL PIT LOG

CLIENT: **KING CONSTRUCTION**
 JOB REF: **4633/20**
 CONTRACT: **WINDY ARBOR/LICKERS LANE**
(Whiston Juniors Playing Fields)
 LOCATION: **SEE TP LOCATION PLAN**
 PLAN SIZE: **1.40x1.20m**

TP REF: **TP3**
DATE: **13/08/20**
WEATHER: **SUNNY**
LOGGED BY: **CS**
EASTING: **53.40866008**
NORTHING: **-2.8003734**

[illegible]

TRIAL PIT PHOTOS

Client:	KING CONSTRUCTION	Date:	13/08/2020
Contract:	WINDY ARBOR/LICKERS LANE (Whiston Juniors Playing Fields)	Job Ref:	4633/20
Location:	SEE PLAN	Source:	N/A
Trial Pit / Reference:	TP 3		

PHOTO 1 SHOWING GENERAL POSITION AND NATURE OF ARISING



PHOTO 2 SHOWING GENERAL SOIL PROFILE



TRIAL PIT PHOTOS

Client:	KING CONSTRUCTION	Date:	13/08/2020
Contract:	WINDY ARBOR/LICKERS LANE (Whiston Juniors Playing Fields)	Job Ref:	4633/20
Location:	SEE PLAN	Source:	N/A
Trial Pit / Reference:	TP 3		

PHOTO 3 SHOWING CLOSE UP OF MADE GROUND MATERIAL



PHOTO 4 SHOWING CLOSE UP OF CLAY MATERIAL



TRIAL PIT PHOTOS

Client:	KING CONSTRUCTION	Date:	13/08/2020
Contract:	WINDY ARBOR/LICKERS LANE (Whiston Juniors Playing Fields)	Job Ref:	4633/20
Location:	SEE PLAN	Source:	N/A
Trial Pit / Reference:	TP 3		

PHOTO 5 SHOWING GENERAL SOIL PROFILE AND POSITION OF DCP



PHOTO 6 SHOWING SOAKAWAY LEVEL ON 2nd DAY



BOREHOLE / TRIAL PIT LOG

CLIENT: **KING CONSTRUCTION**
 JOB REF: **4633/20**
 CONTRACT: **WINDY ARBOR/LICKERS LANE**
(Whiston Juniors Playing Fields)
 LOCATION: **SEE TP LOCATION PLAN**
 PLAN SIZE: **1.40x1.30m**

TP REF: **TP4**
 DATE: **13/08/20**
 WEATHER: **SUNNY**
 LOGGED BY: **CS**
 EASTING: **53.40851498**
 NORTHING: **-2.80060507**

Depth (m)	Thickness (m)	Sample No. & Type	Sample Interval	Description	CBR %	MC %	Comments
0.50	0.50	1B 2SB 3D	0.00 to 0.50	Black, sandy, fmc gravel of ash, clinker, bituminous material, limestone, granite occasional cobble of brick - MADE GROUND			
1.00	0.50	4B 5SB 6D	0.50 to 1.00	Orangey brown, blackish grey in part, slightly sandy, sl silty, firm/stiff consistency CLAY/BOULDER CLAY			
1.00				End of TP at 1.00m bgl			TP DRY

TRIAL PIT PHOTOS

Client:	KING CONSTRUCTION	Date:	13/08/2020
Contract:	WINDY ARBOR/LICKERS LANE (Whiston Juniors Playing Fields)	Job Ref:	4633/20
Location:	SEE PLAN	Source:	N/A
Trial Pit / Reference:	TP 4		

PHOTO 1 SHOWING GENERAL POSITION AND NATURE OF ARISING



PHOTO 2 SHOWING GENERAL SOIL PROFILE



TRIAL PIT PHOTOS

Client:	KING CONSTRUCTION	Date:	13/08/2020
Contract:	WINDY ARBOR/LICKERS LANE (Whiston Juniors Playing Fields)	Job Ref:	4633/20
Location:	SEE PLAN	Source:	N/A
Trial Pit / Reference:	TP 4		

PHOTO 3 SHOWING CLOSE UP OF MADE GROUND MATERIAL



PHOTO 4 SHOWING CLOSE UP OF CLAY MATERIAL



~~BOREHOLE~~ / TRIAL PIT LOG

CLIENT: **KING CONSTRUCTION**
 JOB REF: **4633/20**
 CONTRACT: **WINDY ARBOR/LICKERS LANE**
(Whiston Juniors Playing Fields)
 LOCATION: **SEE TP LOCATION PLAN**
 PLAN SIZE: **1.30x1.10m**

TP REF: **TP 'CBR'**
DATE: **13/08/20**
WEATHER: **SUNNY**
LOGGED BY: **PD**
EASTING: **53.40860671**
NORTHING: **-2.80050986**

[illegible]

CLIENT	KING CONSTRUCTION
JOB REF:	4633/20
CONTRACT:	WINDY ARBOR/LICKERS LANE (Whiston Juniors Playing Fields)
LOCATION:	SEE TP LOCATION PLAN
PLAN SIZE:	1.30x1.20m

TP REF: **TP 'SOAKAWAY'**
DATE: **13/08/20**
WEATHER: **SUNNY**
LOGGED BY: **CS**
EASTING: **53.40855835**
NORTHING: **-2.80048672**

[illegible]

**LABORATORY TEST CERTIFICATE
MATERIALS LABORATORY**



Certificate No: 4633/20

To : Stuart Sidebottom

Client : Knowsley Contractors Ltd
King Construction
1A Prestwood Place, Skelmersdale
Lancashire, WN8 9QE

Date: 18/08/2020

Dear Sirs,

FIELD & LABORATORY TESTING

Introduction

We refer to site testing undertaken on Windy Arbour/ Lickers Lane Playing Field.

Tested By : C. Salmon & K. Bescoby

Sample Reference : N/A

Description : See attached

Date Sampled : N/A

Date Tested : 13th July 2020

Source : N/A

Weather : N/A

Test Results;

Please see attached

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This report should not be reproduced except in full without the written approval of the laboratory
All remaining samples for this project will be disposed of 28 days after issue of this test certificate
When a statement of conformity is requested for a test result against limits set out in a standard or specification (e.g. BS EN ISO, SHW) that already considers measurement uncertainty, MATtest Midlands decision rule is to follow conformity requirements of the applicable standard or specification.
Results reported only relate to the items tested/ received.

Remarks;

Approved for Issue:

Position: Operations Manager

Issuing Office:



Head Office & Central

Unit 5 Draycott Mills, Off Market Street, Draycott, Derby, DE72 3NB

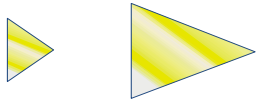


North West

Unit 15 Park Court, Sherdley Business Park, St. Helens, Merseyside, WA9 5GZ

Tel: 03333 202521 Web: www.mattestlaboratories.co.uk





DYNAMIC CONE PENETROMETER TESTING (DCP)

Windy Arbour/ Lickers Lane Playing Field

Test Ref : 1

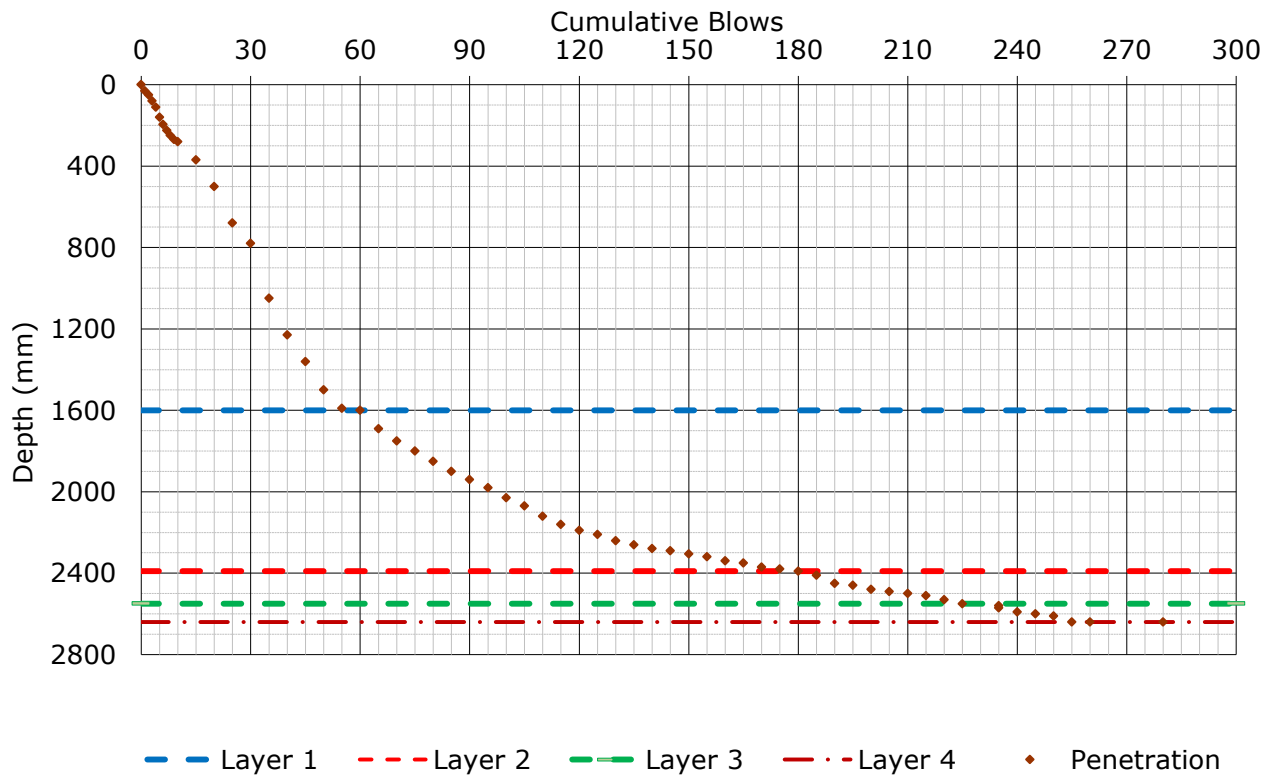
Date Tested : 13/08/2020

Job Ref : 4633/20

Location : TP 101

Description : TP Log 101

GRAPH DETAILING RESULTS



SUMMARY OF RESULTS

Layer	No. of Blows	Cumulative No. of Blows	CBR (%)	Layer Thickness (mm)	Total Depth (mm)
1	60	60	9	1600	1600
2	120	180	41	790	2390
3	45	225	79	160	2550
4	55	280	>100	90	2640

COMMENTS

NOTES

Test Procedure:

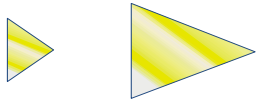
In House Method for Highways, based upon TRL Road Note 8

Interpretative Method :

TRL Equation : $\text{Log}_{10}(\text{CBR}) = 2.480 - 1.057 \times \text{Log}_{10}(\text{Strength})$

TEST CERTIFICATE

Form Ref MTM-REP 019



DYNAMIC CONE PENETROMETER TESTING (DCP)

Windy Arbour/ Lickers Lane Playing Field

Test Ref : 2

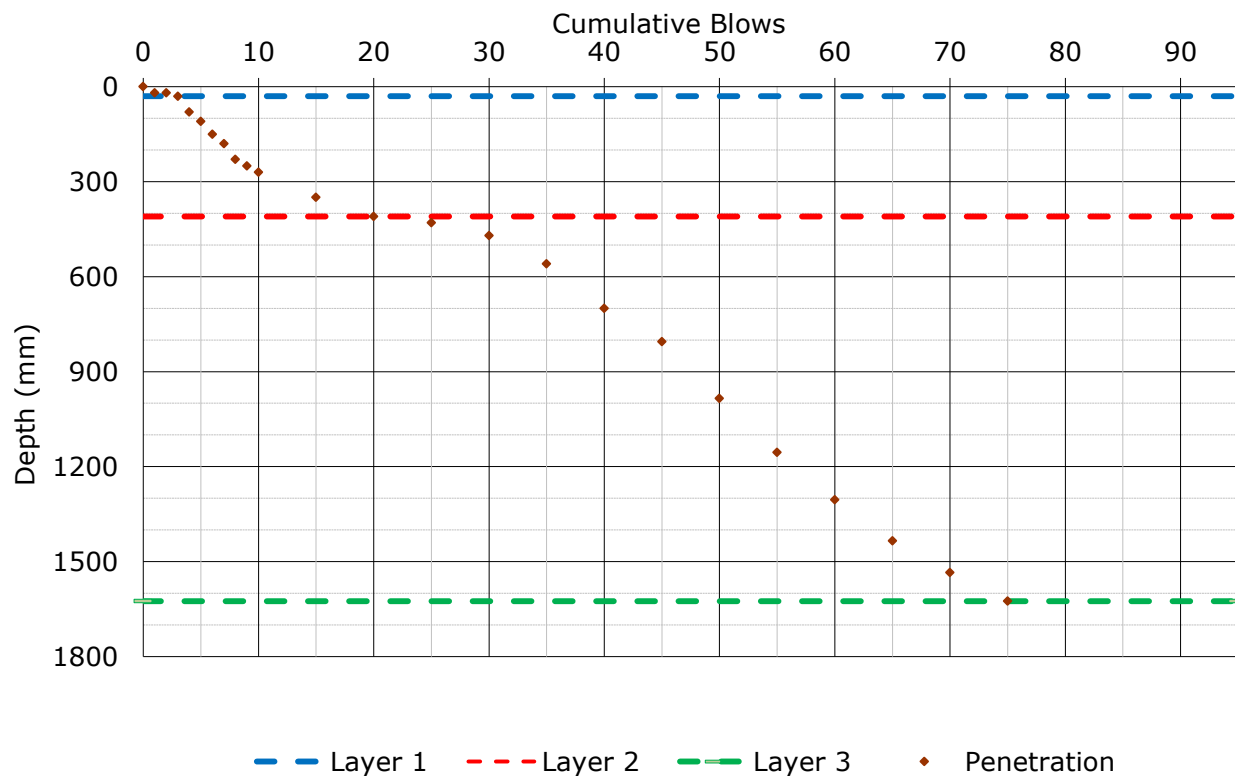
Date Tested : 13/08/2020

Job Ref : 4633/20

Location : TP 102

Description : TP Log 102

GRAPH DETAILING RESULTS



SUMMARY OF RESULTS

Layer	No. of Blows	Cumulative No. of Blows	CBR (%)	Layer Thickness (mm)	Total Depth (mm)
1	3	3	26	30	30
2	17	20	11	380	410
3	55	75	11	1215	1625

COMMENTS

NOTES

Test Procedure:

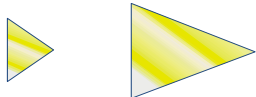
In House Method for Highways, based upon TRL Road Note 8

Interpretative Method :

TRL Equation : $\text{Log}_{10}(\text{CBR}) = 2.480 - 1.057 \times \text{Log}_{10}(\text{Strength})$

TEST CERTIFICATE

Form Ref MTM-REP 019



DYNAMIC CONE PENETROMETER TESTING (DCP)

Windy Arbour/ Lickers Lane Playing Field

Test Ref : 3

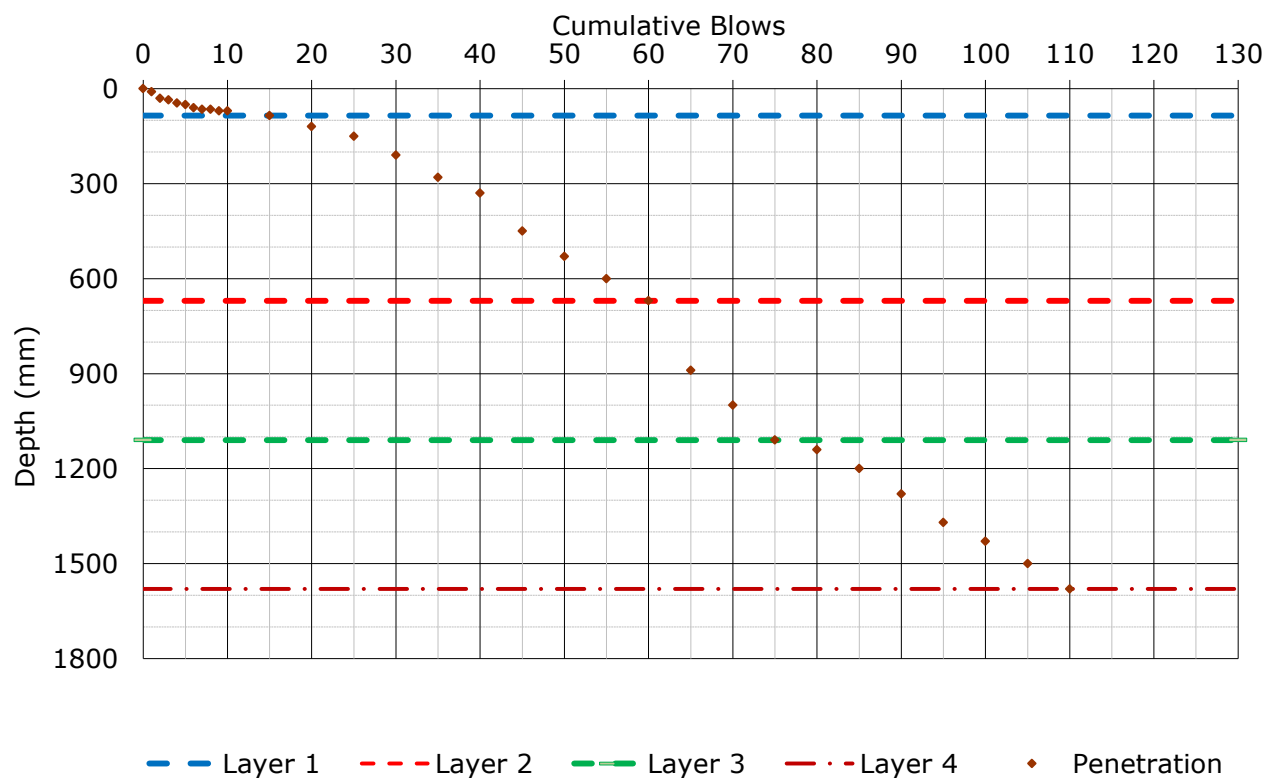
Date Tested : 13/08/2020

Job Ref : 4633/20

Location : TP 102

Description : TP Log 102

GRAPH DETAILING RESULTS



SUMMARY OF RESULTS

Layer	No. of Blows	Cumulative No. of Blows	CBR (%)	Layer Thickness (mm)	Total Depth (mm)
1	15	15	48	85	85
2	45	60	20	585	670
3	15	75	8	440	1110
4	35	110	19	470	1580

COMMENTS

NOTES

Test Procedure:

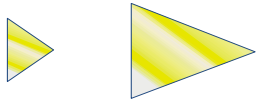
In House Method for Highways, based upon TRL Road Note 8

Interpretative Method :

TRL Equation : $\text{Log}_{10}(\text{CBR}) = 2.480 - 1.057 \times \text{Log}_{10}(\text{Strength})$

TEST CERTIFICATE

Form Ref MTM-REP 019



DYNAMIC CONE PENETROMETER TESTING (DCP)

Windy Arbour/ Lickers Lane Playing Field

Test Ref : 4

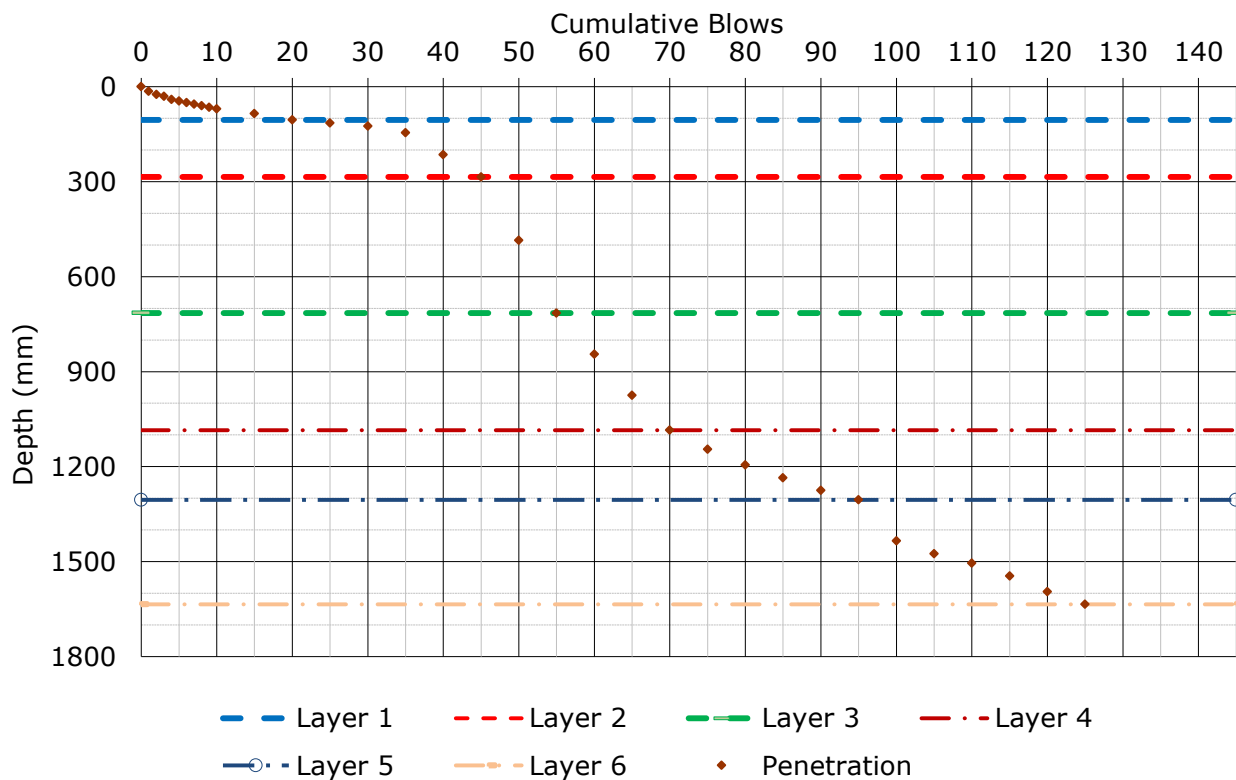
Date Tested : 13/08/2020

Job Ref : 4633/20

Location : TP 103

Description : TP Log 103

GRAPH DETAILING RESULTS



SUMMARY OF RESULTS

Layer	No. of Blows	Cumulative No. of Blows	CBR (%)	Layer Thickness (mm)	Total Depth (mm)
1	20	20	52	105	105
2	25	45	37	180	285
3	10	55	6	430	715
4	15	70	10	370	1085
5	25	95	30	220	1305
6	30	125	24	330	1635

COMMENTS

NOTES

Test Procedure:

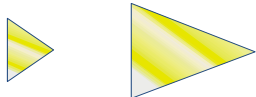
In House Method for Highways, based upon TRL Road Note 8

Interpretative Method :

TRL Equation : $\text{Log}_{10}(\text{CBR}) = 2.480 - 1.057 \times \text{Log}_{10}(\text{Strength})$

TEST CERTIFICATE

Form Ref MTM-REP 019



DYNAMIC CONE PENETROMETER TESTING (DCP)

Windy Arbour/ Lickers Lane Playing Field

Test Ref : 5

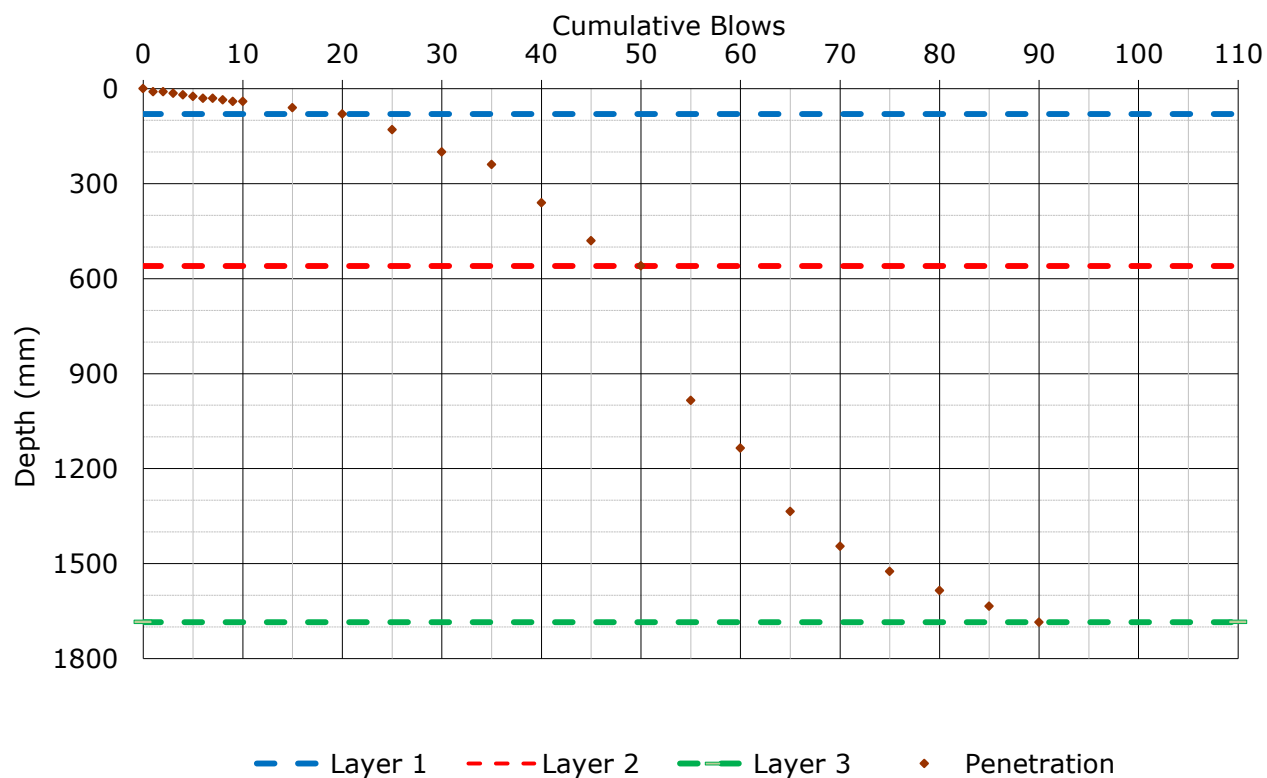
Date Tested : 13/08/2020

Job Ref : 4633/20

Location : DCP extra at TP CBR

Description : TP CBR Log

GRAPH DETAILING RESULTS



SUMMARY OF RESULTS

Layer	No. of Blows	Cumulative No. of Blows	CBR (%)	Layer Thickness (mm)	Total Depth (mm)
1	20	20	70	80	80
2	30	50	16	480	560
3	40	90	9	1125	1685

COMMENTS

NOTES

Test Procedure:

In House Method for Highways, based upon TRL Road Note 8

Interpretative Method :

TRL Equation : $\text{Log}_{10}(\text{CBR}) = 2.480 - 1.057 \times \text{Log}_{10}(\text{Strength})$

TEST CERTIFICATE

Form Ref MTM-REP 019

**LABORATORY TEST CERTIFICATE
MATERIALS LABORATORY**



Certificate No: 4633/20

To : Stuart Sidebottom

Client : Knowsley Contractors Ltd
King Construction
1A Prestwood Place, Skelmersdale
Lancashire, WN8 9QE

Date: 18/08/2020

Dear Sirs,

FIELD & LABORATORY TESTING

Introduction

We refer to site testing undertaken on Windy Arbour/ Lickers Lane Playing Field.

Tested By : C. Salmon & K. Bescoby

Sample Reference : N/A

Description : See attached

Date Sampled : N/A

Date Tested : 13th July 2020

Source : N/A

Weather : Sunny

Test Results : Please see attached Soakaway and Soil infiltration Data

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This report should not be reproduced except in full without the written approval of the laboratory
All remaining samples for this project will be disposed of 28 days after issue of this test certificate
When a statement of conformity is requested for a test result against limits set out in a standard or specification (e.g. BS EN ISO, SHW) that already considers measurement uncertainty, MATtest Midlands decision rule is to follow conformity requirements of the applicable standard or specification.
Results reported only relate to the items tested/ received.

Remarks;

Approved for Issue:

Position: Operations Manager

Issuing Office:



Head Office & Central

Unit 5 Draycott Mills, Off Market Street, Draycott, Derby, DE72 3NB



North West

Unit 15 Park Court, Sherdley Business Park, St. Helens, Merseyside, WA9 5GZ

Tel: 03333 202521 Web: www.mattestlaboratories.co.uk



Job Ref: 4633/20
 Client: KING CONSTRUCTION
 Scheme: WINDY ARBOR/LICKERS LANE (Whiston Juniors Playing Fields)
 Date: 13/08/2020 TO 15/08/20

SOAKAWAY TEST DATA

Trial Pit Ref:	TP1
Pit Dimensions:	
L (mm):	1400
W (mm):	1200
D (mm):	1000
TOP OF WATER mmbgl	260
WATER DEPTH mm	740
75% FULL mmbgl =	445
50% FULL mmbgl =	630
25% FULL mmbgl =	815
TIME (at start of test):	14:00:00
DATE (at start of test):	13/08/2020
SOIL DESCRIPTION	DEPTH INTERVAL (m)
MADE GROUND	0.00-0.70m
CLAY	0.70-1.00
TOP OF WATER mmbgl	Time In Seconds
260	0
260	94
260	176
270	330
280	479
290	840
300	1338
320	1989
340	2576
350	3325
390	5400
410	6600
445	8175
490	10200
630	37428
780	66600
815	67388
820	67500
START TEST	13/08/2020 14:00
END TEST	14/08/2020 08:45
DURATION (HR/MINS)	18hrs 45mins
DURATION (Sec's)	67500

Trial Pit Ref:	TP3
Pit Dimensions:	
L (mm):	1400
W (mm):	1200
D (mm):	1000
TOP OF WATER mmbgl	200
WATER DEPTH mm	800
75% FULL mmbgl =	400
50% FULL mmbgl =	600
25% FULL mmbgl =	800
TIME (at start of test):	10:25:00
DATE (at start of test):	14/08/2020
SOIL DESCRIPTION	DEPTH INTERVAL (m)
MADE GROUND	0.00-0.40
CLAY	0.40-1.00
TOP OF WATER mmbgl	Time In Seconds
200	0
210	600
220	1200
230	2400
250	5700
270	9300
280	12900
290	16500
400	77700
600	155400
800	233100
START TEST	14/08/2020 10:25
END TEST	15/08/2020 08:00
DURATION (HR/MINS)	21hrs 35mins
DURATION (Sec's)	77700

Trial Pit Ref:	TP 'SOAKAWAY'
Pit Dimensions:	
L (mm):	1300
W (mm):	1200
D (mm):	1100
TOP OF WATER mmbgl	370
WATER DEPTH mm	730
75% FULL mmbgl =	553
50% FULL mmbgl =	735
25% FULL mmbgl =	918
TIME (at start of test):	08:50:00
DATE (at start of test):	14/08/2020
SOIL DESCRIPTION	DEPTH INTERVAL (m)
MADE GROUND	0.00-0.40
CLAY	0.40-1.10
TOP OF WATER mmbgl	Time In Seconds
370	0
400	1200
420	2100
430	3000
440	3600
450	4200
460	4800
460	6000
470	6900
480	8100
500	11400
510	15000
510	18600
510	22200
510	83400
553	115994
735	286544
918	563214
START TEST	14/08/2020 08:50
END TEST	15/08/2020 08:00
DURATION (HR/MINS)	23hrs 10mins
DURATION (Sec's)	83400

NOTE: VALUES IN GREEN ITALICS ARE EXTRAPOLATED/PROJECTED BETWEEN POINTS

Job Ref: 4633/20
 Client: KING CONSTRUCTION
 Scheme: WINDY ARBOR/LICKERS LANE (Whiston Juniors Playing Fields)
 Date: 13/08/2020 TO 15/08/20

SOIL INFILTRATION RATES FOR SOAKAWAY TEST AREAS

Trial Hole 1 Attempt 1			Trial Hole 3 Attempt 1			Trial Hole 'SOAKWAY' Attempt 1		
Pit Dimensions			Pit Dimensions			Pit Dimensions		
L (m)	1.40		L (m)	1.40		L (m)	1.30	
W (m)	1.20		B (m)	1.20		B (m)	1.20	
D (m)	1.00		D (m)	1.00		D (m)	1.10	
Maximum effective depth	1.00		Maximum effective depth	1.00		Maximum effective depth	1.00	
Effective Storage Depth	1.00		Effective Storage Depth	1.00		Effective Storage Depth	1.00	
25% Effective Depth	0.25		25% Effective Depth	0.250		25% Effective Depth	0.350	
50% Effective Depth	0.50	0.500	50% Effective Depth	0.500	0.500	50% Effective Depth	0.600	0.500
75% Effective Depth	0.75		75% Effective Depth	0.750		75% Effective Depth	0.850	
Time for outflow between 75% and 25% effective depth (Seconds)	59213		Time for outflow between 75% and 25% effective depth	155400	Seconds	Time for outflow between 75% and 25% effective depth	447220	Seconds
Volume outflowing between 75% and 25% effective depth : $V_{p75-25} =$	0.840	m ³	Volume outflowing between 75% and 25% effective depth : $V_{p75-25} =$	0.840	m ³	Volume outflowing between 75% and 25% effective depth : $V_{p75-25} =$	0.780	m ³
The mean surface area through which the out flow occurs, taken to be the pit sides to 50% effective depth and including the base of the pit: $a_{p50} =$	4.28	m ²	The mean to 50% effective depth and including the base of the pit: a_{p50} surface area through which the out flow occurs, taken to be the pit sides =	4.28	m ²	The mean to 50% effective depth and including the base of the pit: a_{p50} surface area through which the out flow occurs, taken to be the pit sides =	4.06	m ²
From graph, the time for the outflow between 75% and 25% effective depth: $t_{p75-25} =$	59213	Seconds	From graph, the time for the outflow between 75% and 25% effective depth: $t_{p75-25} =$	155400	Seconds	From graph, the time for the outflow between 75% and 25% effective depth: $t_{p75-25} =$	447220	Seconds
Soil infiltration rate, $f =$	3.31E-06	3.31x10⁻⁶	Soil infiltration rate, $f =$	1.26E-06	1.26x 10⁻⁶	Soil infiltration rate, $f =$	4.30E-07	4.30 x 10⁻⁷

NOTE: VALUES IN **GREEN** ITALICS ARE EXTRAPOLATED/PROJECTED BETWEEN POINTS

Appendix B

VOLUME CALCULATIONS



Project Title
Whiston Car Park

Job Number	
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Version	v1.01
File Path	

Produced by	PV	Date	12/10/2021
Checked by	SG	Date	12/10/2021

INPUTS

Surface type	Area (h)		Runoff Coefficient (Cv)
	Existing	Proposed	
Greenfield Open Space	0.20	0.00	N/A
Roof	0.00	0.00	0.85
Road / Paving	0.00	0.20	0.90
Total	0.20	0.20	

Runoff restriction (l/s)	0.00
--------------------------	------

OUTPUTS

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Qbar (l/s/ha)	0.00
Qbar (l/s)	0.00

Return period	Greenfield runoff l/s	Post-development runoff l/s*	Additional runoff due to development*
2	1.2	2.5	1.3
10	1.8	3.8	2.0
30	2.2	4.8	2.6
100	2.7	6.4	3.7
100+CC Central	3.4	7.7	4.3
100+CC Upper End	3.8	8.9	5.2

*360 minute rainfall duration

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Return period	Maximum required storage volume across all rainfall durations m ³	Storage volume for 360 minute rainfall duration m ³	Precautionary volume to use in FRA m ³
2	20	15	25
10	39	35	35
30	54	52	55
100	79	78	80
100+CC Central	99	99	100
100+CC Upper End	121	121	125

Project Title
Whiston Car Park

Job Number 0

Version v1.01

File Path 0

Produced by PV **Date** 12/10/2021

Checked by SG **Date** 12/10/2021

Rainfall Data NGR SJ 46000 91000

Return Period		2	10	30	100	100 + CC Central	100 + CC Upper End
Duration (mins)	Duration (hrs)						
60	1	12.40	22.40	29.57	39.30	47.16	55.02
120	2	16.00	26.70	34.63	46.10	55.32	64.54
240	4	20.10	31.60	40.50	54.00	64.80	75.60
360	6	22.90	34.90	44.28	58.90	70.68	82.46
480	8	25.04	37.40	47.15	62.45	74.94	87.43
600	10	26.83	39.48	49.51	65.26	78.31	91.36
840	14	29.85	42.97	53.33	69.60	83.52	97.44
1440	24	35.60	49.60	60.43	77.30	92.76	108.22
2880	48	45.40	60.70	72.12	89.10	106.92	124.74

Notes

Rainfall data sourced from FEH Web Service using depth duration frequency (DDF) model. Should be in millimetres (mm).

Rainfall data at return periods less than 1 in 2 years are not considered reliable and should not be used in detailed design calculations.

Climate change rainfall intensities are based on Environment Agency guidance published 19/02/16 (<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>) and assume a development design life of 30 years (i.e. rainfall increase of both Central 10% and Upper End 20%). It may be necessary to increase/decrease the climate change allowance depending upon the development design life.

Project Title
Whiston Car Park

Job Number	0		
Version	v1.01		
File Path	0		
Produced by	PV	Date	12/10/2021
Checked by	SG	Date	12/10/2021

Calculation of Greenfield Runoff Rates - Institute of Hydrology Report 124 FSR 3-parameter equation

Site name	AREA (km2)	SPRHOST (%)	SAAR (mm)	SOIL (index)	QBAR (m³/s)
Whiston Car Park	0.50	31.49%	897	0.47	0.323

For Small Catchments $QBAR(rural) = 0.00108 * AREA^{0.89} * SAAR^{1.17} * SOIL^{2.17}$
--

Growth curve factor from FSE Growth Region Map	Return Period
	2 10 30 100
10	0.93 1.38 1.70 2.08

Greenfield runoff in m3/s	QBAR	Return Period	2	10	30	100	100 + CC Central 0 + CC Upper End
	0.323		0.300	0.445	0.548	0.671	0.839
							0.940

Greenfield runoff in l/s	QBAR	Return Period	2	10	30	100	100 + CC Central 0 + CC Upper End
	322.65		300.06	445.25	548.50	671.10	838.88
							939.55

Greenfield runoff in l/s/ha	QBAR	Return Period	2	10	30	100	100 + CC Central 0 + CC Upper End
	6.45		6.00	8.91	10.97	13.42	16.78
							18.79

Existing total discharge from site (l/s)	QBAR	Return Period	2	10	30	100	100 + CC Central 0 + CC Upper End
	1.29		1.20	1.78	2.19	2.68	3.36
							3.76
Runoff restriction			1.20	1.29	1.29	1.29	1.29

Notes
REFERENCES
SuDS Manual (2015) CIRIA. This documents provides guidelines for the calculation of Greenfield runoff, Chapter 24, Section 24.3.2 (pg 513). Based on guidance from the National SuDS Working Group (2004) the IOH 124 method only applies to catchments of 50ha and above and for smaller catchment should be linearly interpolated from a 50ha area. (Equation 24.3 of SuDS Manual).
Technical Report W5-074/ATR1 Revision D (2005) - Preliminary Rainfall Runoff Management for Developments The 1 in 1 year return period event is defined as the highest probability event to be specifically considered to ensure that flows to the watercourse are tightly controlled for these more frequent events.
For SOIL Index: Flood Studies Report (FSR) Vol. 1 Pg 303 and 312.
For small catchments: IoH Report No. 124, Institute of Hydrology, 1994.
For Growth Curve Factors: Flood Studies Supplementary Report (FSSR) 14, UK Hydrological Growth Curve Regions
SOIL INDEX
SOIL type 1 is sandy highly permeable material with permeability reducing as the SOIL value increases. SOIL type 4 is heavy clay and 5 (which is rarely applied) is exposed rock. For each of these categories there is a value of SPR which is used in the IH124 equation. These were 0.1, 0.3, 0.4, 0.47, 0.53 respectively. Classification is determined from the Winter Rain Soil Acceptance (WRAP) map. Site investigation results (borehole data) can also be used for reference where available.
The SPRHOST values used in this tool (http://geoservergisweb2.hrwallingford.co.uk/uksgd/greenfieldrunoff_js.htm) are constrained to the same range as SOIL (0.1 - 0.53) as this is the range over which the IH124 equation was developed.
RIVER BASIN DISTRICT

Project Title
Whiston Car Park

Job Number 0

Version v1.01
File Path 0

Produced by PV **Date** 12/10/2021
Checked by SG **Date** 12/10/2021

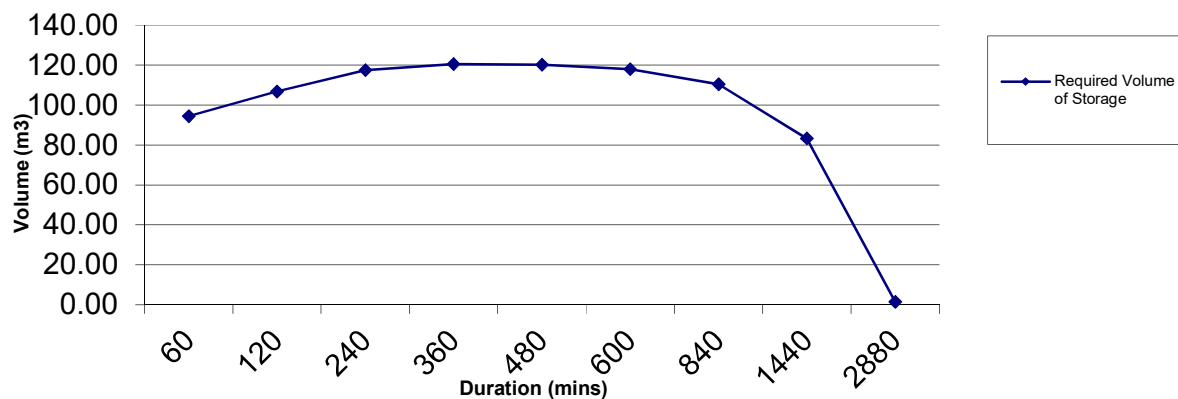
Calculation of TOTAL Post Development Peak Runoffs and Volumes and Required Storage

Return Period 1 in 100 + CC Central **Year**

Storm Duration (minutes)	Existing or Permitted Discharge Runoff Rate m³/s	Post-Development Runoff Rate m³/s	Existing or Permitted Outflow Volume (Greenfield) m³	Post-Development Runoff Volume m³	Storage, Inflow - Outflow m³
60	0.0013	0.036	4.65	99.04	94.39
120	0.0013	0.021	9.29	116.17	106.88
240	0.0013	0.012	18.58	136.08	117.50
360	0.0013	0.009	27.88	148.43	120.55
480	0.0013	0.007	37.17	157.37	120.21
600	0.0013	0.006	46.46	164.46	117.99
840	0.0013	0.005	65.05	175.39	110.35
1440	0.0013	0.003	111.51	194.80	83.29
2880	0.0013	0.002	223.01	224.53	1.52

Required Storage 120.55 m³

Required Volume of Storage



Notes

Post-Development runoff volumes are a combination of runoff volumes from impermeable areas and runoff volumes from greenfield areas.

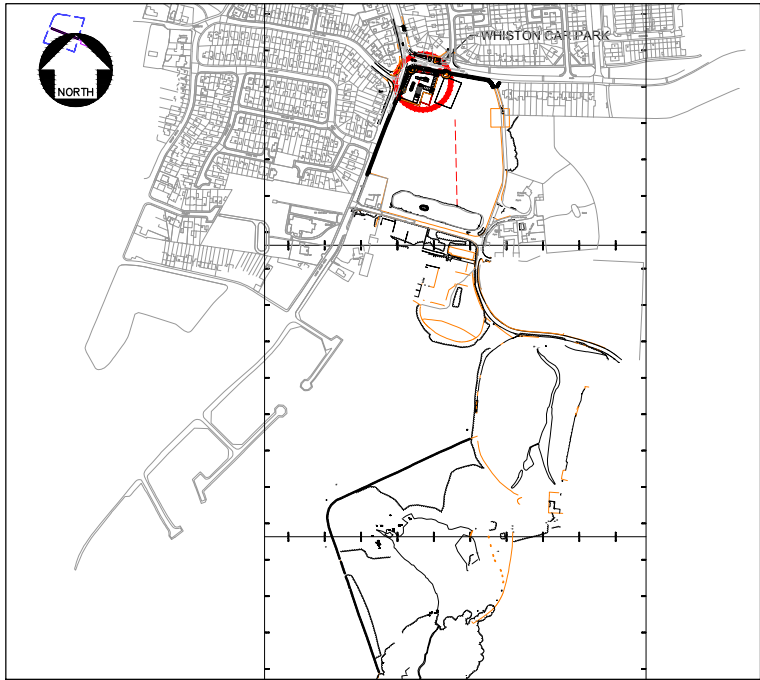
Greenfield runoff rates are not duration dependent using the IoH124 method, however greenfield runoff volumes have been calculated for the storm durations above and added to the duration dependent volumes from the impermeable areas (which use the Modified Rational Method)

Appendix C

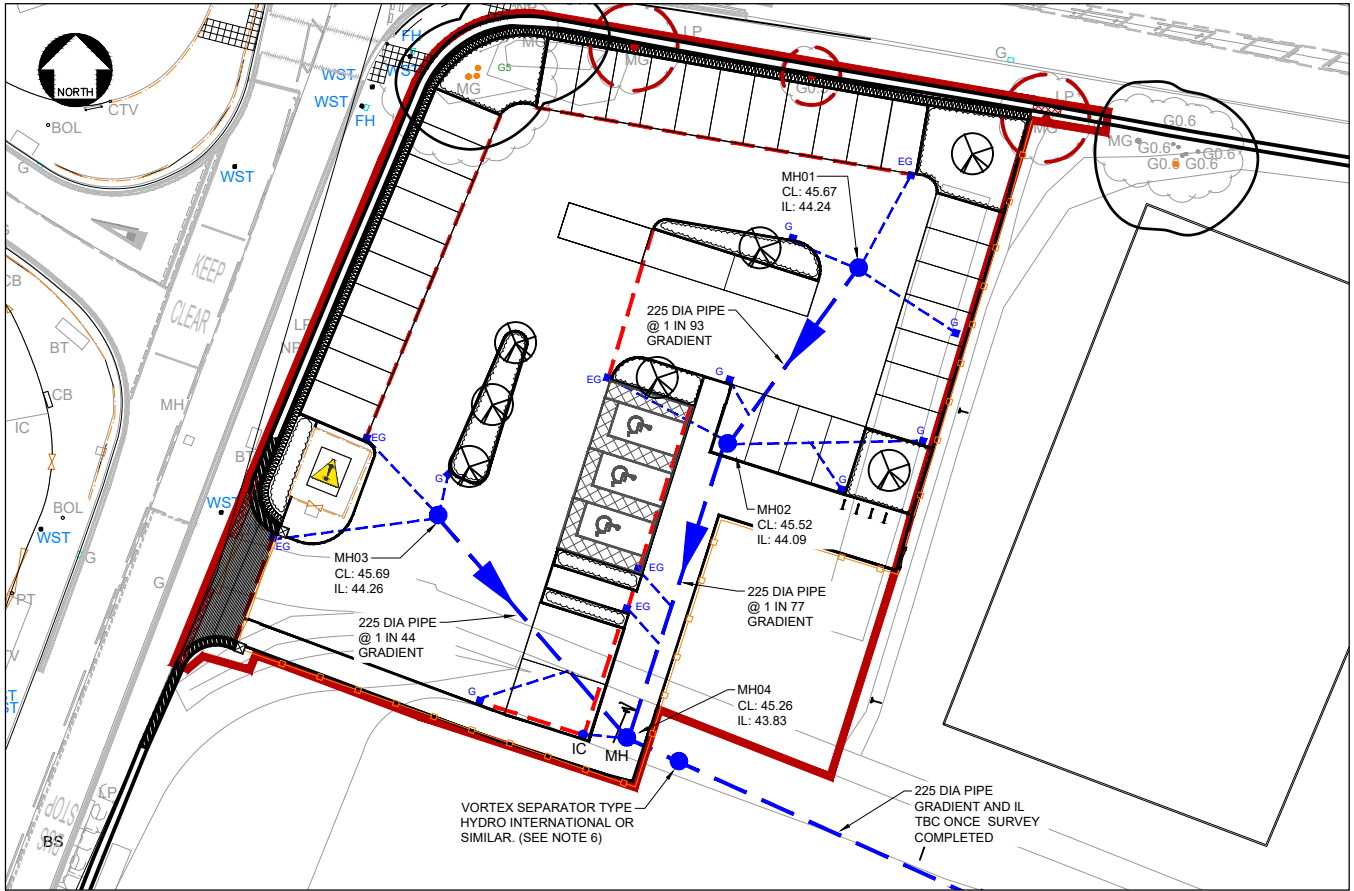
PRELIMINARY DRAINAGE LAYOUT PLAN



File name: \\UK\WSP\GROUP\COMMON\CENTRAL DATA\PROJECTS\70063452-WSP-XX-XX-M2-DR-0003.DWG, printed on 28 August 2021 15:40:01, by vandaveort, Piers



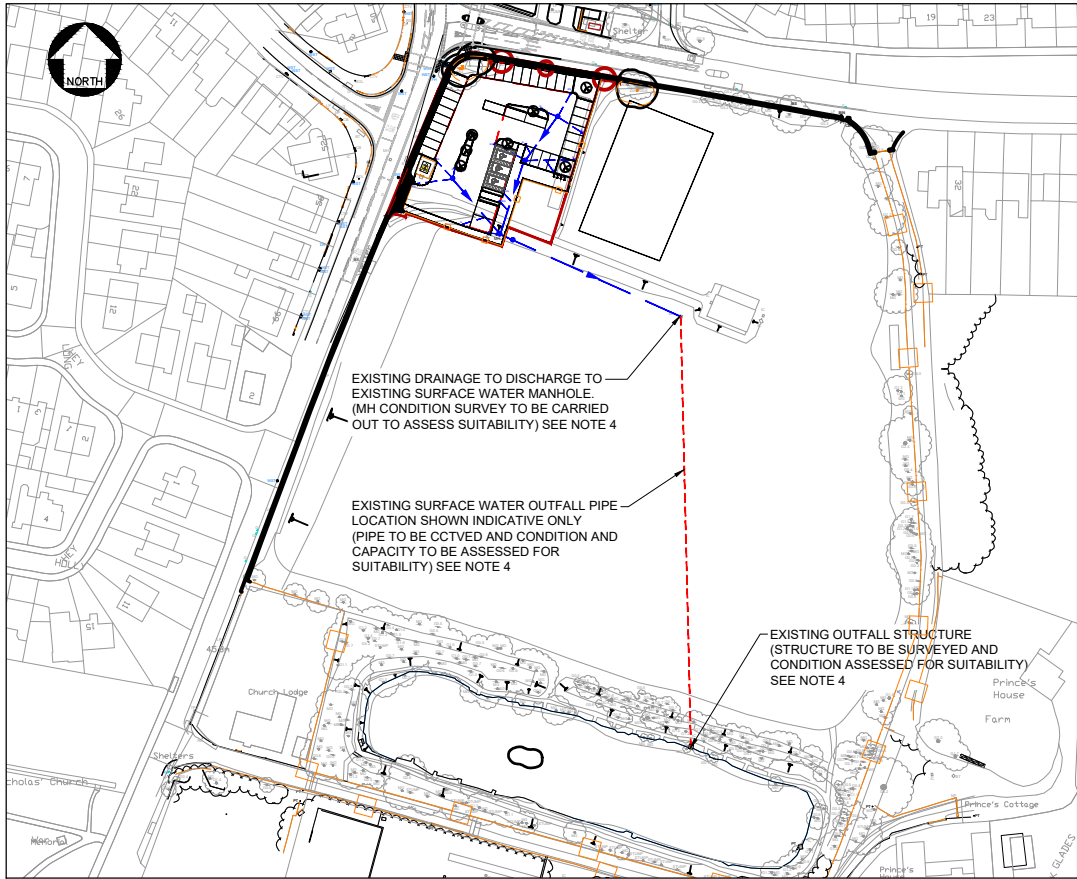
LOCATION PLAN
Scale - 1:5000



DETAILS
Scale - 1:250

DRAINAGE LAYOUT SHOWN INDICATIVE ONLY.
PRELIMINARY DESIGN, NOT FOR CONSTRUCTION.

SURFACE WATER DRAINS, SURFACES FALLS,
GULLIES LOCATIONS TO BE CONFIRMED AT
DETAILED DESIGN STAGE.



OUTFALL PIPE TO MELLOR'S POND
Scale - 1:1000

DO NOT SCALE

NOTES

- ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS ARE IN METRES RELATED TO ORDINANCE DATUM UNLESS STATED OTHERWISE.
- THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS AND SPECIFICATIONS.
- UNDERGROUND SERVICES MAY BE PRESENT OR PLANNED IN THE AREA OF THE PROPOSED WORKS AND MAY IMPACT ON THE PROPOSED DESIGN. SERVICE LOCATIONS SHOULD BE DETERMINED PRIOR TO DETAIL DESIGN AND PRIOR TO CONSTRUCTION.
- CONDITION AND CAPACITY OF EXISTING OUTFALL TO MELLOR'S POND UNKNOWN. SYSTEM TO BE FULLY SURVEYED TO ASSESS SUITABILITY. UPON ASSESSMENT EXISTING ASSETS MAY NEED TO BE REHABILITATED/REPLACED.
- LINEAR DRAINS TO BE 100mm BORE AND TO BE LAID TO FALL TOWARDS END GULLIES. LOAD CLASS TO BE C250.
- VORTEX SEPARATOR TO BE TYPE HYDRO INTERNATIONAL DOWNSTREAM DEFENDER 1.2m DIAMETER, OR SIMILAR. VORTEX SEPARATOR TO SUIT PEAK FLOW RATE OF 40L/S AND DRAINAGE AREA OF 2000M². MAINTENANCE ALARM SYSTEM TO BE FITTED. POWER DUCT ROUTE TBC ON SITE.

LEGEND

- SURFACE WATER DRAIN
- EXISTING SURFACE WATER OUTFALL PIPE
- GULLIES
- END GULLIES OF LINEAR DRAINAGE
- INSPECTION CHAMBER
- LINEAR DRAINAGE CHANNEL TYPE ACO DRAIN OR SIMILAR (SEE NOTE 5)
- XXX
- PROPOSED PETROL / OIL SEPARATORS

P01.01	10/12/2020			PV	SC
REV	DATE			CHK	APP

DRAWING STATUS: D2 - FOR TENDER

wsp

1st Floor Station House, Exchange Station, Tithebarn Street,
Liverpool, L2 2QP
TEL: +44(0) 0151 600 5500
wsp.com

CLIENT: KNOWSLEY METROPOLITAN BOROUGH COUNCIL

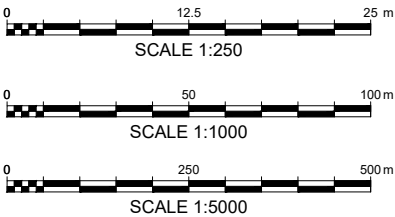
SITE/PROJECT: HALSNEAD GARDEN VILLAGE

TITLE: WHISTON PLAYING FIELDS CAR PARK DRAINAGE LAYOUT

SCALE @ A1: AS SHOWN	CHECKED: PV	APPROVED: -
PROJECT NO: 70063452	DESIGNED: PV	DRAWN: CLW
		DATE: July 21

DRAWING NO: 70063452-WSP-XX-XX-M2-DR-0003	REV: P01.06
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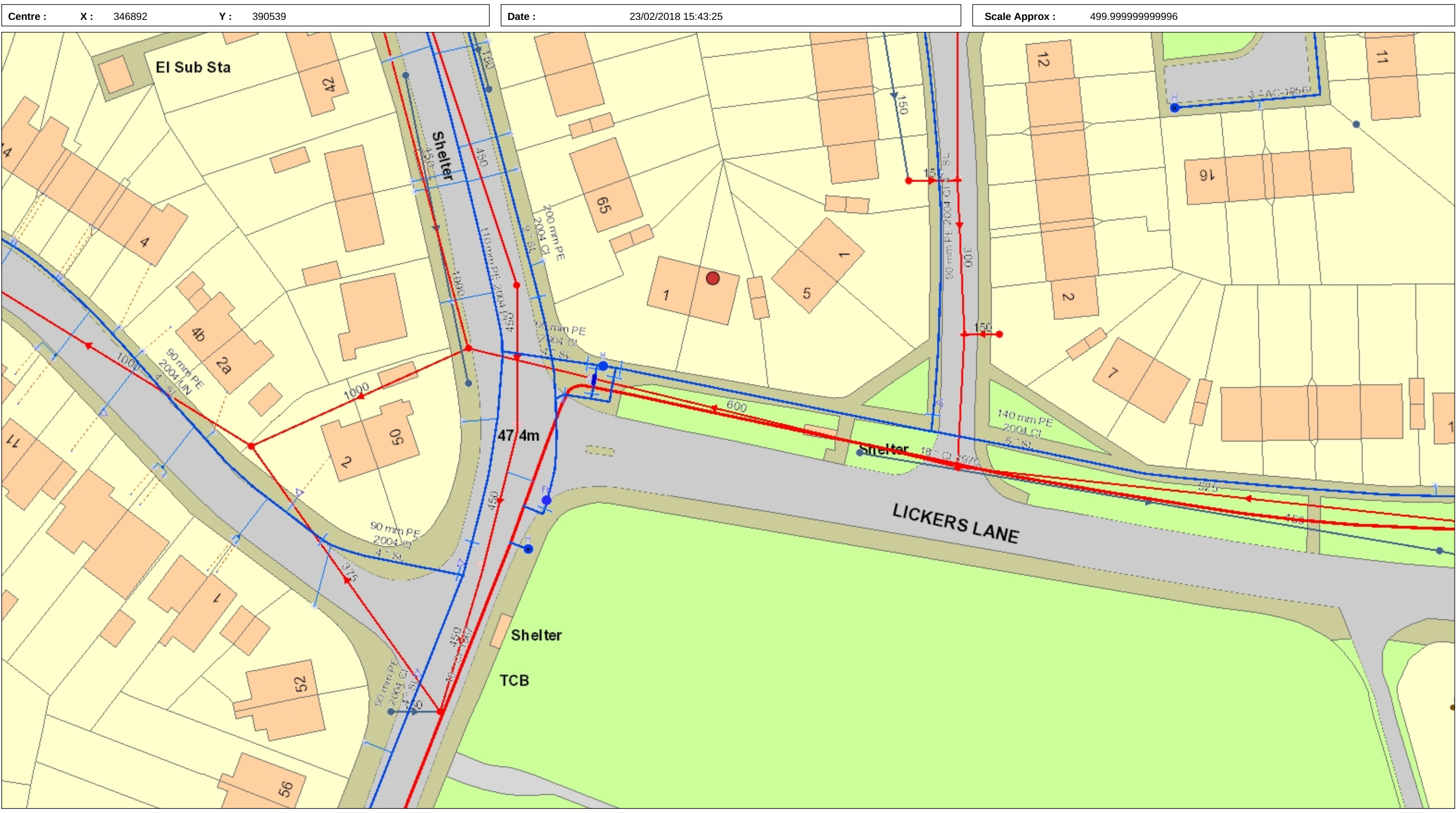


Appendix D

UNITED UTILITIES – SEWER
RECORDS



United Utilities Maps for SafeDig



Extract from maps of United Utilities' Underground Assets



1st Floor Station House
Tithebarn Street, Exchange Station
Liverpool
L2 2QP

wsp.com
